

Flora of India
Series - 2

FLORA OF WEST BENGAL

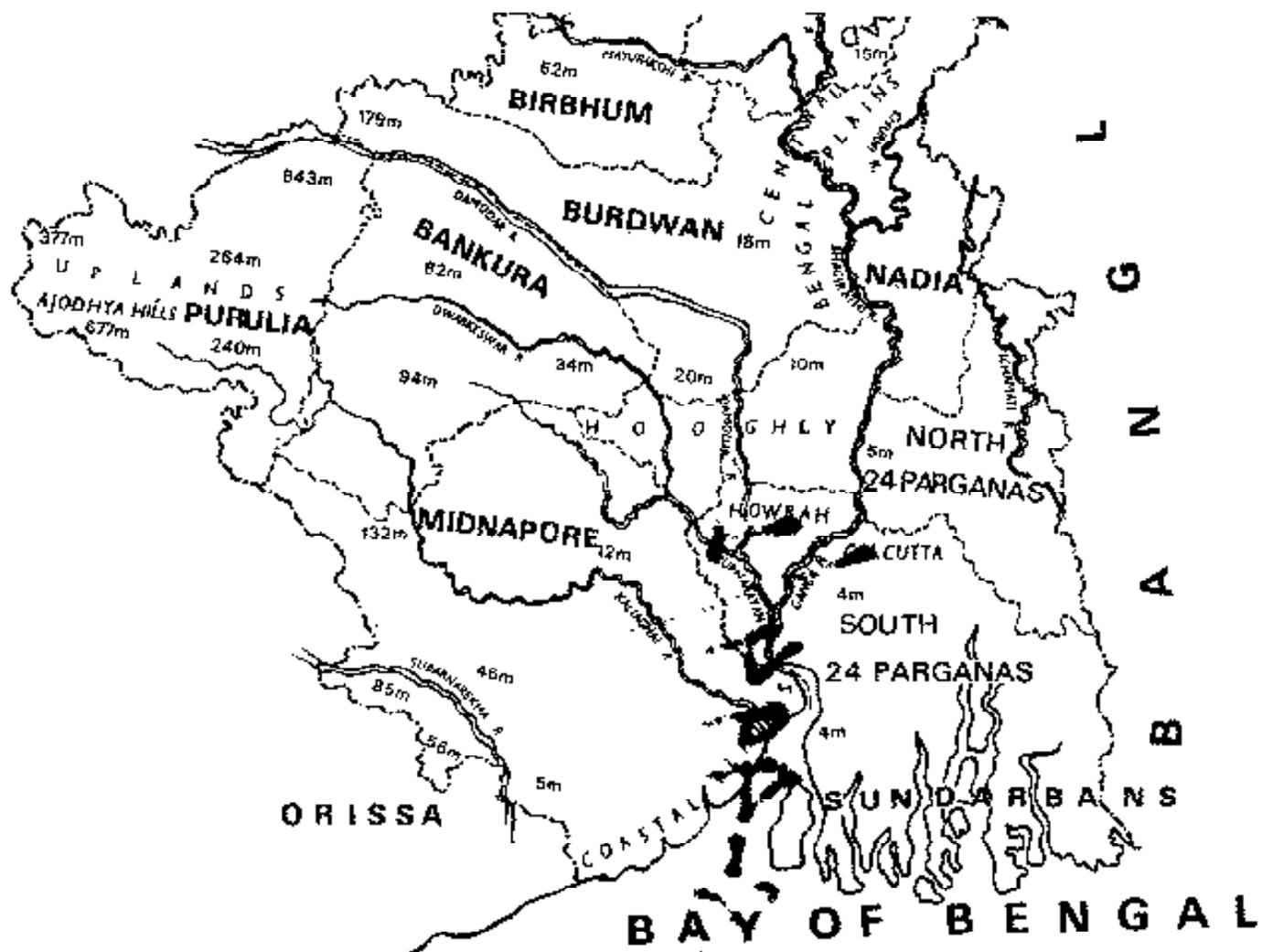
Volume 1

RANUNCULACEAE TO MORINGACEAE



भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

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Volume 1

RANUNCULACEAE TO MORINGACEAE



BOTANICAL SURVEY OF INDIA

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FOREWORD

Botanical Survey of India has launched a programme to publish the accounts of plants under different series like a) National Flora, b) State Flora, c) District Flora, d) Flora of Fragile Ecosystem, e) Flora of Biosphere Reserve and National Park etc.

So far 6 volumes of National Flora out of planned 32 volumes, State Floras of Rajasthan, Tamil Nadu, Karnataka, Himachal Pradesh, Madhya Pradesh, Goa, Diu, Daman, Dadra & Nagarhaveli, Maharashtra, Arunachal Pradesh, Sikkim etc. and several district floras have been published. The State Flora of West Bengal is unique as it covers different altitudinal regions from sea-coast to alpine Himalayas. Since the establishment of Botanical Survey of India in 1890 at Calcutta in the Presidency of Bengal, the Flora of the State attracted the attention of many Botanists and state was fairly well explored. Based on all available collections at Calcutta Herbarium, surveys and field explorations, Dr. David Prain published the Flora of erstwhile Bengal as Bengal Plants in 1903. This flora in addition to West Bengal included parts of Bihar, Orissa and Bangladesh but excluded Darjeeling Himalayas. Despite fairly thorough survey of plant wealth of this state of West Bengal with changed political boundaries, no modern flora is available, except for a few district floras. The Botanical Survey of India realised the need for publication of the State Flora and the First Volume of Flora of West Bengal State is the outcome of sincere efforts of all Scientists of Botanical Survey of India.

It gives me a great pleasure to thank all the contributors and authors of different chapters and families in the volume.

I like to thank Sri Utpal Chatterjee, Samiran Roy and other staff members in Publication Unit of Botanical Survey of India without whose sincere efforts it would not have been possible to publish this Flora. I am sure this long awaited publication will cater to the needs of all those who are interested in knowing the plants of the State.

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Consolida ambigua (L.) Ball. & Heywood



Dillenia indica L.



Michelia cathcartii Hook. f. & Thoms.



Stephania japonica (Thunb.) Miers var. *discolor* (Bl.) Forman



Mahonia acanthifolia G. Don



Nelumbo nucifera Gaertn.



Argemone mexicana L.



Crateva religiosa Forst. f.



Cochlospermum religiosum (L.) Alston.



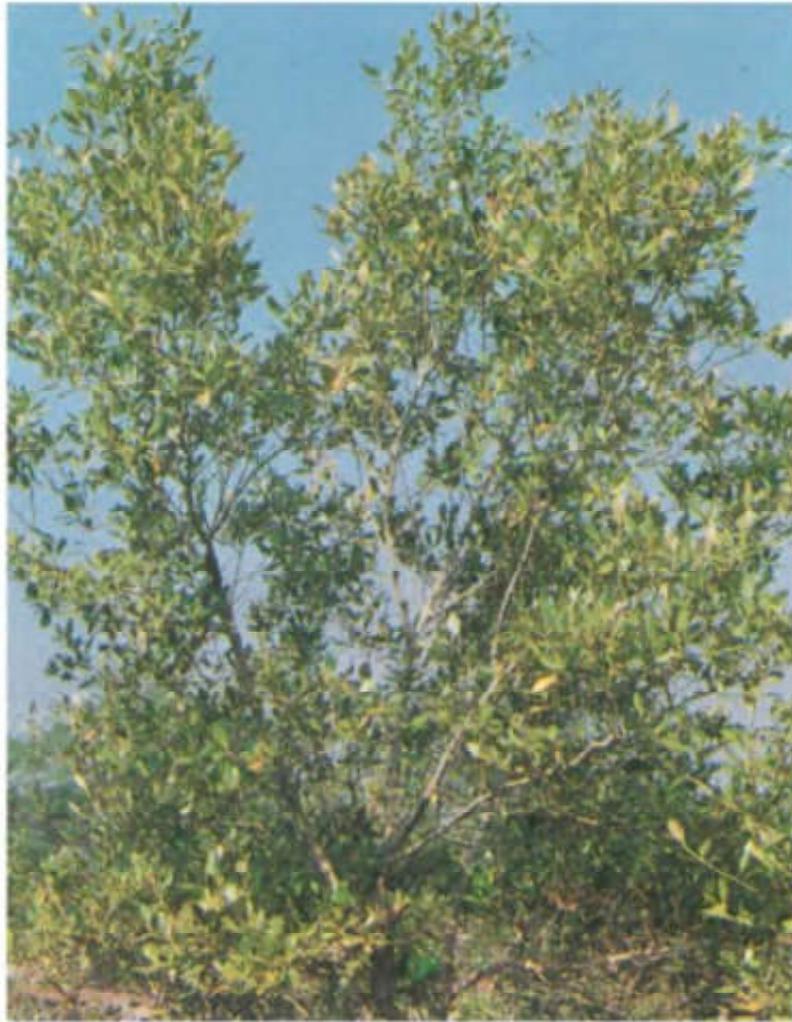
Polygala arillata Buch.-Ham. ex D. Don



Sida acuta Burm. f.



Abroma augusta (L.) L. f.



Heritiera fomes Buch.-Ham.



Elaeocarpus serratus L.



Oxalis martiana Zucc.



Averrhoa carambola L.



Anacardium occidentale L.



A panoramic view of Mangrove vegetation of Sundarbans.



Leea macrophylla Roxb. ex Hornem



Cardiospermum halicacabum L.

INTRODUCTION

(U.C. Bhattacharyya)

Stretching between the high Himalayan territory in the northern limit and the Bay of Bengal in the south, the present political boundary of the state of West Bengal enjoys a unique landmark from floristic point of view. It is the only state in India which for its geographical location is endowed with a flora ranging right from the most impressive littoral forest of the Sundarbans to the luxuriant forests of the Himalayan foothills and the vegetation upwards culminating to the temperate and alpine zone in the district of Darjeeling. Excepting the spurs of western hilly tract of the bordering states of Bihar and Orissa, the major landmass of West Bengal can be divided into two natural geographical divisions viz. the Northern Himalayan and the Plains Divisions. The latter, as a part of the massive Gangetic delta, extends from West Dinajpur in the north to the intricate deltaic system of creeks of the South 24-Parganas (Randhwa, Mitra and Mehta, 1964). The main features of vegetation of this plain, though broadly outlined by Prain (1903a) under various profiles, have been specified under four botanical divisions (Basak & Guha Bakshi, 1977) : (1) West Bengal Proper lying between the river Bhagirathi-Hooghly and the Chhotonagpur Plateau. (2) A part of the North Bengal covering the land north of Bhagirathi. (3) The strip of land lying east of Bhagirathi and (4) The western part of Sundarbans mainly occupied by the district of South 24-Parganas. The mountainous district of Darjeeling excluding the Siliguri sub-division being wholly Himalayan, the flora of this district is exceptionally different from the rest of the areas of West Bengal Plains. In order to reduce the volume of the Flora, Prain (*l.c.*) had purposefully omitted the plants of the Darjeeling district and proposed a separate account for it. Though collections have been gathered and sufficient information is available about the rich flora of this hilly district (Hooker, 1848, 1849, 1850; Clarke, 1876, 1885; Gamble, 1878, 1896; Biswas, 1966; Mathew, 1966, 1969, 1971; Hara, 1966, 1971, 1975; Yonzon, 1984; Das & Chandra, 1987) yet a complete workable Flora is still wanting. Considering the various aspects of socio-economic development in different parts of the state together with the prospect of rational exploitation of natural resources, inclusion of Himalayan Flora has been thought essential to prepare an updated Flora of West Bengal. Keeping these aspects in view, plants of Darjeeling have also been included in preparing this State Flora.

Revision of Floras for all practical purposes is not only a responsibility of the botanists but also it is an obligation to the nation for utilization, development and conservation of the natural plant resources. Particularly a state like West Bengal after independence has been subjected to so much population pressure

by massive influx of uprooted migrants from Bangladesh that the very land use pattern is drastically changing. Botanical diversities associated with pre-existing forests, vast natural water bodies and natural vegetational tracts are being engulfed by developmental programmes. More than thirty percent of the luxuriant forests of Sundarbans have been depleted due to human habitation and cultivation during the last two centuries and trees of Sundri (*Heritiera minor*) which dominated as a major forest component for coining the name of the forest are remaining only in small localized pockets (Naskar and Guha Bakshi, 1987). Industrial developments in the western part have also destroyed considerable forested areas where *Shorea robusta* had flourished and exotic trees of commercial forestry have replaced much of the natural forests in the northern hilly tracts. Biotic interference followed by partition of the erstwhile Bengal has been so drastic that not only the area of the state has been reduced to less than one third but also some of the fascinating areas with unique floristic composition as given in the account of the Prain's (*i.e.*) Bengal Plants do not exist in the present West Bengal. However, for the purpose of first hand information Prain's contribution had been the only comprehensive account of vascular plants of the plains of West Bengal, including that of Sundarbans, during the first half of the present century. Though most of the plants of lower Gangetic plains had been meticulously included in his Flora yet the absence of highly interesting flora of the northern Himalayan section makes the provincial flora incomplete in accounting the total plant wealth of the state. Incorporation of the plants of Darjeeling district and providing precise descriptive account of individual species with their suitable identification keys have been a major step in preparation of the present Flora of West Bengal. Further, from utilitarian point of view, some other important and related aspects of botany have also been included in the present approach.

During the second half of the century the wealth of botanical information on West Bengal have accumulated to a remarkable extent due to active participation of a highly interested group of workers, and their contributions will be dealt with elsewhere. On account of extensive and intensive explorations not only a number of new species have been added to the existing flora but also the records of additional findings have accumulated a voluminous amount of material (Basak, 1973) for incorporation in an updated Flora of the state.

1.1 POSITION AND GEOGRAPHY

Overlooked by the magnificent Himalayan Peak of Kanchen Jungha in the northern extremity and washed by the waves of the rolling ocean in the south, the small state of West Bengal lies between 21°45' and 27°16' North latitude and 85°55' and 89°56' East longitude. Following independence of India in 1947 the state came into existence as the western part of the erstwhile Bengal and

area of the state was reduced to c. 87,676 sq. km or about one third of the prepartitioned Bengal. Partition by arbitrary demarcation rendered the state almost isolated from the northern three districts viz. Darjeeling, Jalpaiguri and Cooch Behar excepting a narrow corridor through West Dinajpur.

At present the state on the north is bounded by Sikkim and Bhutan, on the east by Assam and Bangladesh, the Bay of Bengal forms the southern boundary and on the west it is bounded by Orissa, Bihar and Nepal. The hilly district Purulia which belonged to Manbhum district of Bihar, became a part of West Bengal during the reorganisation of the states in 1955. A thin strip of Bihar was also included to the narrow corridor of West Dinajpur for facilitating better communication and management of border area.

Till the end of the seventies the state had 16 administrative districts grouped under three divisions. The districts Bankura, Birbhum, Burdwan, Hooghly, Midnapore came under Burdwan Division, where as Calcutta, Howrah, Murshidabad, Nadia and 24-Parganas remained in the Presidency Division and Cooch Behar, Darjeeling, Jalpaiguri, West Dinajpur and Malda were kept under Jalpaiguri Division. In order to facilitate administrative control the district 24-Parganas with high density of population and having an international boundary with Bangladesh has been divided into two more districts as North and South 24-Parganas during recent years and in 1992 West Dinajpur has been further divided into South and North with their respective Hqrs. at Balurghat and Raiganj. Due to a steady increase of density of population with more than 400/sq. km the state is under a severe threat of land use pattern and eventually the land and water bodies supporting natural vegetation are being brought under human habitation and related activities. It is, therefore, obvious that due to such intense biotic factors a good deal of natural habitats for plants are getting extinct.

1.2 GEOLOGY AND SOIL

1.2.1 Geology : Excepting the Himalayan sector of Darjeeling district and spurs of the mountains penetrating to the south and the marginal areas of the Western boundary, the major landmass of West Bengal plain is principally a thick alluvium deposition forming almost a trough along the Bhagirathi basin (Basak and Guha Bakshi, 1977). The plain, 40-80 km wide along the course of the Bhagirathi, is solely of alluvial origin with varying depth and is supposed to be not more than 400 m deep (Chatterjee, 1965). Hooker (1854) and Theohald (1881) are of the opinion that the present West Bengal plain was originally an estuary, which after receiving the drainage from the young folded mountains in the north got filled up in the post Tertiary period. Deep drilling in the Bengal basin has recently substantiated the continuity of the complete tertiary flora of Rajmahal formations from Bihar to Assam below the massive alluvial deposition

in the Central West Bengal. According to Oldham (1893) the development of this plain particularly the deltaic region is supposed to be a product of fluvial action and the platform for this action was initiated through the tectonic activities associated with the early tertiary epoch, giving rise to the formation of the Trans Eurasian lofty mountain chains. The rise of the Himalayas due to upheaval of Tethys created a trough on to its south while the movement of the Arakan-Yama-Andaman-Sumatra has helped in the formation of the Bay of Bengal (Singh, 1971). Under the two tensional forces *i.e.* one from the Sindhu-Ganga trough in the north and the downwrapping of the Bay of Bengal in the south the pre-existing narrow neck of the Peninsular landmass had a rupture resulting in the formation of the Rajmahal Gap, through which the flow of the northern rivers found a drainage into the Bay of Bengal. Thus the huge silt of the original run off and subsequent erosion of the Himalayas by the rivers in the north had been responsible for contributing to the major landmass of the state. The recent Pleistocene alluvium deposition in the deltaic West Bengal and the absence of older alluvium in the strata of the plain is a significant proof in support of its origin through drainage, where as white lateritic deposition is remarkably extensive on the northern plains derived from the older basin. This accidental tectonic movement considerably influenced the riverine action of the tributaries flowing from the Himalayas and physical landscape also got very much re-oriented owing to the instability introduced in the river flow system. Due to such significant geological events there were also considerable disturbances in the isostatic equilibrium on the earth surface that affected the topography due to repeated subsidence, alluviations and diversion of rivers responsible for reshaping the deltaic region to its present state. Further, the presence of well developed beds with erect roots of *Heritiera* and massive peats occurring at about 6-11 m, and 150 m below the sea level is a clear indication and evidence of regular subsidence of the deltaic region (Singh, *l.c.*).

The western marginal land of the state on the other hand is variously rocky and covered by laterites and Gondwana formation, the latter, however, is prominently exposed in the Ranigunj area of the Damodar Basin in Burdwan district. Other western districts of Birbhum, Bankura, Burdwan and West Midnapur bordering the states of Bihar and Orissa show more of Archaean rocks in the geological formation along with Gondwana system. These areas are projected from the western table land and got intermingled or replaced by laterite or alluvium towards the eastern basin. The archaean rocks in those areas consist mainly of gneiss, and crystalline schist. However, the relative proportion of gneiss is considerably high in such rock formation. The rock, principally belonging to Bengal Gneiss is remarkable for its varied composition, consisting of successive bands of intermixed granite, granalitic and dioritic gneisses and micaceous chloritic, hornblendic schists with alminated or foliated granitic intrusions. Stray distribution of conical hills are not uncommon in some of the bordering districts which are mainly composed of porphyritic or dome gneiss.

1.2.2 Soil : The soil of the plains of West Bengal have been studied and described in details by different workers. In a number of district Floras and floristic accounts (Basak and Guha Bakshi, 1977) published in recent years, information about soil at micro level have been enriched our knowledge. In order to differentiate the main recognizable soil types of the overall area of the state, Singh (1971) has grouped them under (i) Alluvial soil, (ii) Laterite, (iii) Red earth, (iv) Terai soil and (v) Tidal soil. The nature and quality of the soil of West Bengal have been studied in detail by Chatterjee and Chatterjee (1957) where as stress on the general character of the soil of the state has been given while dealing with the distribution of forest types in the state by Champion and Seth (1968). General soil types of the state have also been outlined by Basak and Guha Bakshi (*l.c.*) while reviewing the floristic studies of West Bengal.

Among all the soil types described by various workers the Ganga alluvium covering the largest area of the plain of West Bengal (28,921.3 sq. km.) is considered most important. The major deltaic landmass of West Bengal is composed of this soil which originated mainly due to the activities of the river Ganga and its tributaries from late geological history. The soil of this kind is remarkably fertile due to richness in mineral contents and organic matter and have been found to be most suitable for agricultural purposes. This soil being alkaline in nature (pH 7.0-6.9) has also facilitated cultivation of various kinds of crops and fruit trees. Depending upon the source of alluvium origin the quality of the soil also varies considerably. Soils in the narrow alluvial strip bordering the laterite and red soil beds in parts of Murshidabad, Bankura, Burdwan, Hooghly and Midnapur are very much different in texture and quality. The bulk of this soil type constitutes the riverine tract of the Damodar and the Kansai river and their tributaries bringing silt from the western plateau and laterite deposits. Such soil profiles are characterized by alternating sand beds and irregular stratification.

The other important type of soil is represented by laterite which occupy an area next to alluvium. Lateritic soils are poor in water holding capacity and are mainly spread along the undulating stretches of well drained land of the western districts bordering the Chhotanagpur Plateau and also in some of the areas in northern part of the state. Rocky lattices in this region holding such soils are rather acidic in nature and devoid of organic matters. This kind of soil with scanty water content supports a low grade Sal forest and other sparse deciduous types of forests. These soil beds are gradually thicker towards east.

The kind of soil transported from the laterites towards the eastern flanks of the districts under Burdwan Division, excluding Howrah and Hooghly, are known as Red Earth or Red Soil and are physically nothing but laterite alluvium. Considerable area under Rarh Plain and the Barind tract of Malda and West Dinajpur has such deposition of Red Earth. Such soil beds are sometimes mixed with lime of shallow depths and often mixed with morum and feldspar. These areas after deforestation are now converted to cultivated lands which on the other hand has considerably accelerated the process of soil erosion.

The soils of nonspecific composition deposited at the foothills of Darjeeling Himalaya particularly in Siliguri tahsil and Jalpaiguri district are classified as Terai Soil. This kind of soil is acidic in nature and poor in plant nutrients and organic matter.

The coastal soils in the state are restricted in the districts of Midnapur, South 24-Parganas and in some parts of Howrah. The whole of Sundarbans soil in 24-Parganas come under this type of soil. The origin of this kind of soil is primarily due to interaction of the rivers and tides. These are saline and markedly alkaline and contain rich deposits of Ca and Mg along with semidecomposed organic matters. The true saline soils are considered as physiologically dry and marks the true habitat of halophytes or mangroves. The Coastal soils with increasing distance from the tidal action is also considerably changed in its character. Consequently the character of the halophytes is also changed.

1.3 PHYSICAL FEATURES AND DRAINAGE

Major land area of West Bengal is a flat alluvial plain and its central and southern regions are solely derived from the silt depositions of the Ganga. The state has gradual slope from the north to the south and also from the western side to the east. The lowest height of the western boundary is marked by the point of entry of the river Ganga after rounding the Rajmahal hills between Murshidabad and Malda districts of the main flow after bifurcating near Dhulia in Murshidabad, one turns to the south as Bhagirathi and the other flows to Bangladesh. The Bhagirathi, after demarcating the two main divisions *viz.* Burdwan and Presidency divisions of West Bengal, finally confluences at Bay of Bengal under the name Hooghly. The origin of the plain along the course of the Bhagirathi is associated with a long history of geological events and have been variously interpreted (Spate, 1957 ; Ahmed, 1959). The lowland lying in the south of Midnapur and stretching towards west of the river Bhagirathi-Hooghly though not a part of the delta proper is also flat (Chatterjee, *l.c.*) with a gentle elevation towards the west. The major part of the plain covering the lower Ganga plain in West Bengal can be broadly divided under (i) The northern paradelta of the Ganga and the *Barind* tract in West Dinajpur and Malda districts. (ii) The western part of the state consisting mainly of laterite plain and of Red earth (the *Rarh* areas) and the Contai Coastal strip of the land. The latter along the sea coast is characterized by frequent sand dunes and salt marshes mingled with each other (Ghosh, 1976). The marshes are formed behind well developed sand bars; shifting sand dunes of great dimensions have a tendency to blow landwards with high velocity wind and encroach upon the lands under cultivation. It is not uncommon also to witness the coastline being eroded by the action of sea waves. (iii) The even and extensive plain of the proper Ganga delta having a span of 40-80 km on both sides of the river

Bhagirathi is further subdivided into *Meribund* area of Murshidabad, Nadia, Hooghly and Howrah. The plains in the northern half of 24-Parganas and Howrah marks the formation of *Matured delta* and *active sections* constitute the South Sunderbans and new islands amidst the creeks. Great thickness of alluvium in most of the plain districts of West Bengal has also been mentioned by others (Randhawa, Mitra and Mehta, *l.c.*).

The physical feature of the western part of Rarh Plain in the districts of Midnapore, Purulia, Bankura, Burdwan and Birbhum show undulated rocky terrain of Archaean Gneiss and other metamorphic rocks as well as coal belts of Gondwana specially in Burdwan district. Laterite soil together with red alluvium and gravels get interspersed due to penetration of the spurs of the Chhotanagpur Plateau and low hilly areas bring a marked change of the topographical view in the districts of Purulia and Bankura. Laterite fringe and laterite debris are also noticed at the Goghat Thana of Hooghly district (Basak and Guha Bakshi, 1977).

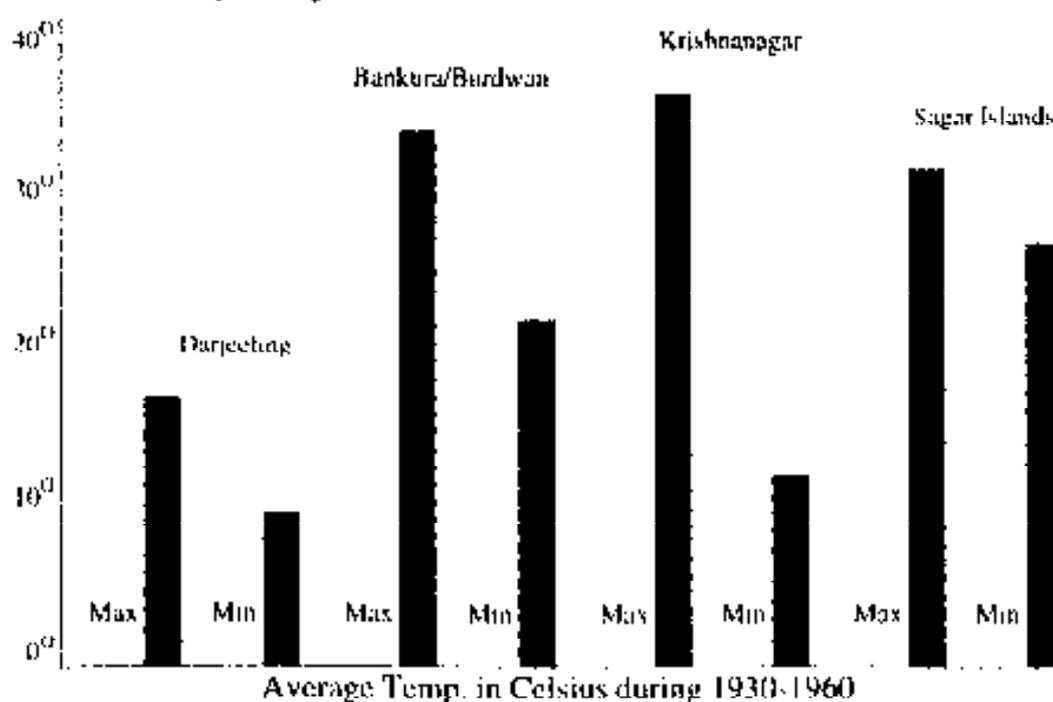
The northern extremity of the state terminates in the district Darjeeling where excepting the Siliguri sub-division being plain the rest of the area is covered by the extension of the high Singalila range of the Himalaya from the Nepal side. The plains of Siliguri with a gradual elevation towards north gives rise to the low thickly forested mountains of the outer range and gradually higher mountains rise up to 3900 m where almost alpine conditions prevail in Sandakphoo & Phaloot. Among the four subdivisions of the district Darjeeling has the highest altitude from 1800 - 3900 m where as Kurseong and Kalimpong are within 1000 m to 1600 m.

The entire land area to the west of the Bhagirathi being gradually elevated towards west all the rivers in Burdwan divisions have a course of their flow from west to east or south-east, where as all the rivers east of the Bhagirathi flow north to south with a minor slant towards the east except the Jalangi and Churni in Nadia which have their flow westwards into the Bhagirathi Basin. The western region of the state is flanked by the coalesed fans of seasonal flashy torrent tributaries of the Ajay, Damodar, Mayurakshi, Kangsabati, Rupnarayan, Anandpur and Haldi, all of which fall to a dead delta zone along the Hooghly river bank (Singh, *l.c.* and Basak & Guha Bakshi, *l.c.*). The physiography of the changing rivers like the Ganga, Damodar and others, explains the mode of formation of the surface of the plain in the southern part of West Bengal (Sen, 1968). The rivers in the north of the state have their origin from the Himalayas which after flowing through a short distance within the districts north of Bhagirathi-Padma enter Bangladesh. The Teesta, Jaldhaka, Mahananda, Nagar, Torsa, Atrai, Punarbhaba are some of the notable rivers which drain out massive water during rainy season from their catchment in the Himalayas causing devastating floods in Jalpaiguri, Cooh Behar, Malda and West Dinajpur districts. Many dry riverbeds with boulders, pebbles and sand is a common

feature in the northern part carrying thin flow of water in dry summer and which come into spate during monsoon. Indication of the remnants of old river beds is not uncommon in some of the districts of central West Bengal which form long stretches of marshes and small lakes. These are commonly known as *Jheels* and *Bils* and most of them are gradually utilized for temporary seasonal cultivation. Distributaries of the old river system occurring in the district of South 24-Parganas have converted the famous part of Sunderbans into an intricate network of tidal water system towards the sea. However, the salinity in the Hooghly river has been considerably reduced since the Bhagirathi is being fed by freshwater after constructing a barrage at Farakka between Murshidabad and Malda.

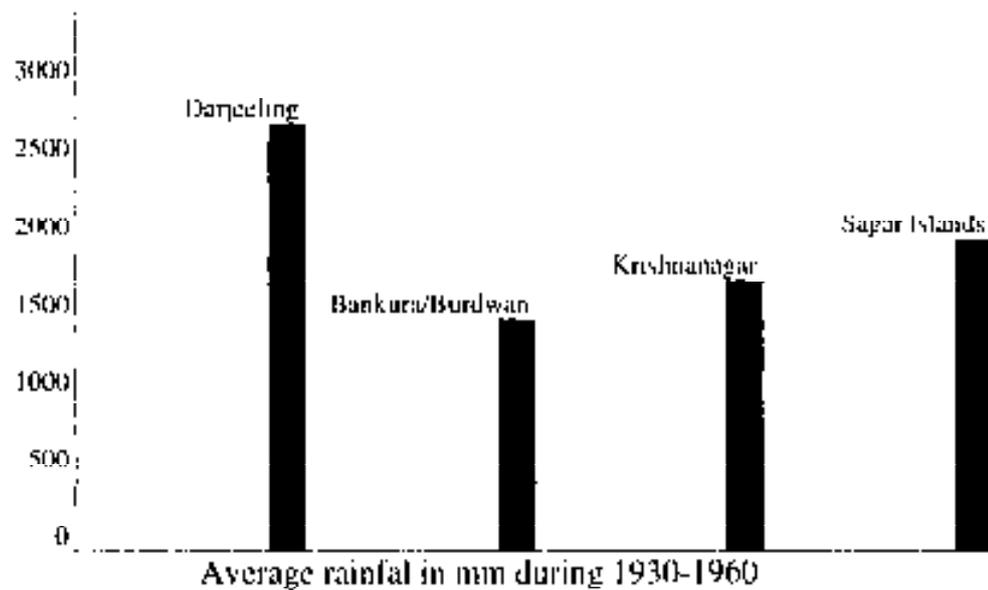
14. CLIMATE

The climate of West Bengal is principally tropical. Tropic of Cancer passes through the northern part of the districts of Purulia, Bankura and Nadia and hot summer prevails in major part of the state. Except for a short duration of 3-4 months from late November to the end of February, winter is very mild and pleasant in the state. However, the mountainous region in the northern district of Darjeeling is cold throughout the year due to altitude. But on account of high percentage of atmospheric humidity feeling of cold is more. According to classical traditions there are six seasons—Summer, Rainy, Autumn, Mild Winter, Severe Winter and Spring. Practically only four clearly well marked seasons with a brief pause of Spring are observed namely the Hot season (April to June), the Rainy season (July to August), the post monsoon season (September to November) corresponding to Autumn and the cold season (December to March).



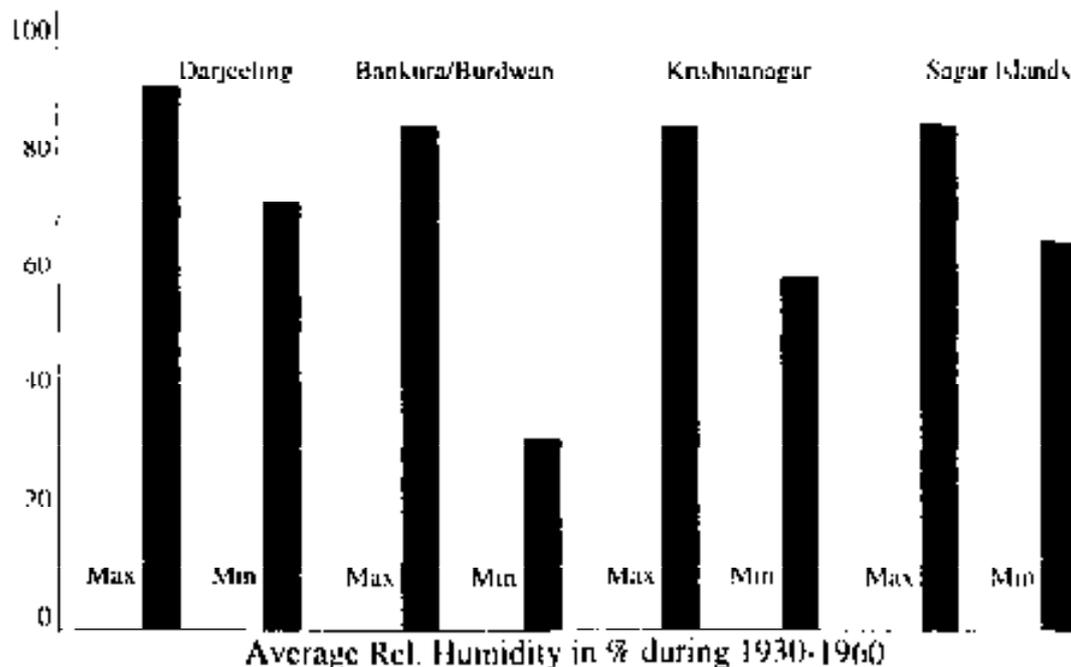
In West Bengal though broadly four seasons have been taken into consideration as major climatic periods (Ghosh, *l.c.*) the Spring is remarkably pronounced with onset of Southern Wind from the Bay of Bengal. The flow of this wind is very strong near coastal region in hot summer and causes the formation of shifting sand dunes. Following such hot spell, the water laden monsoon clouds reach the state generally by the second week of June. The hot season continues from March to June with the day temperature fluctuating from 38°C to 45°C in different parts of the state. The highest temperature with comparatively low humidity is recorded in the fringes of the plateau extended within West Bengal particularly in Purulia, Bankura and the Durgapur-Asansol industrial belt which is also extremely dry due to complete deforestation for developmental activities. The nights, however, bring pleasant relief with the cool sea breeze and flowing with moisture from the Bay of Bengal. As a result of high temperature often troughs of low pressure are formed on the plains causing sudden and forceful storms accompanied by lightning and thunder showers and are locally named as *Kalbaisakhi*, which often cause damage to the ripening fruits during the months of May to July. Though such storms bring heavy loss but at the same time they are beneficial to agricultural operations and also help the summer fruits to receive adequate sap for better development. The rains also help in ploughing land in preparation for the main monsoon crop of paddy and Jute and also in ripening of the early *Aus* paddy crop. The Darjeeling district due to its altitude (1900 m) is comfortably cool during summer, the higher reaches however, often get enveloped in dense fog and help in the growth of luxuriant and rich temperate flora of the district.

The monsoon in West Bengal approaches with gorgeous preparation accompanied by cohorts of dense blue-black clouds generally by the middle of June. However, flash rains, pouring flooding water before the onset of true monsoon are also experienced. The short spells of rains start arriving before the major break of monsoon rains about a fortnight ahead and brings down the heat of summer with a pleasant break. The rains in West Bengal are solely caused by the current of South West Wind which bring the heavy moisture laden clouds from the Bay of Bengal. The rain bearing clouds after moving northward get obstructed by the high barrier of Himalayas and pour down heavily on the mountains and the foothill areas of Duars. As such the average rainfall in the state being about 125 cm during the year, the mountains receive more than 1780 mm. The seasonal rainfall in Darjeeling area is generally above 3500 mm where as Duars receives about 3000 mm. In the western plateau fringes the rainfall is less than 1500 mm per year. Particularly during winter months the atmospheric humidity in these districts also comes down to very low and extreme dryness prevails from November to March when rainfall is only 1.0 mm to 25 mm. Particularly the districts of Bankura and Purulia are in a permanent state of extreme drought condition and the only way of improving the agricultural crop is through irrigation.



Monsoon in West Bengal sometimes shows some interesting features of variability and sudden breaks in rainfall is not uncommon and flooding heavy downpour is also experienced during the end of the monsoon. The states bordering the northern part of the Bay of Bengal, including Bangladesh, are prone to worst and devastating cyclonic conditions during September to November. Very often the low pressures created in the Bay of Bengal during those months develop into furious cyclonic storms accompanied by heavy rains and slashes the life and property of the coastal states including the districts in the southern part of the state.

Winter sets in the state following the flow of air current from the north across the Himalayas and becomes apparent when smoke from chimnies starts moving towards south.



The winter is mild over the plains and lasts for about three months when average temperature does not drop below 15°C. The season is accompanied by a cold and dry northern wind which appreciably causes lowering of the humidity level. However, short spell of smart rains with cloudy days are experienced during the end of December and in the 1st week of January due to incursion of the western monsoon coming all the way from the Arabian Sea. The weather becomes warmer by the middle of February which marks the welcome arrival of a short period of spring in the state and a fresh greenery with new foliage proclaims the end of the dormancy in the winter months. Most remarkable flowers noticed in this season are *Bombax ceiba* (Simul), *Saraca asoka* (Ashoke), *Butea monosperma* (Palas), *Erythrina indica* (Mathar), *Crataeva nurvula* (Barun) etc. Sweet smell of blooming *Mangifera indica* (Aam), *Citrus* sp., *Michelia champaka* (Champa), *Jasminum* spp., abounds under cultivation in the gardens and forests. But the mellow season is too short and summer heat sets in from April, and seasonal cycle rolls once again. A summerised normal climatic data during 1930-1960 as recorded by the Meteorological Department at Alipore observatory is diagrammatically represented from four climatic regional stations of West Bengal.

1.5 HISTORY OF BOTANICAL ACTIVITY IN WEST BENGAL

Botanical activity in West Bengal owes its initiation in Calcutta as early as in 1784 when W. Jones founded the Asiatic Society of Bengal to study various aspects of natural history and their relation with man and nature in the oriental countries. The year 1787 marks a glorious period in the history of Botanical studies in Bengal when Robert Kyd founded the Botanic Garden on the bank of the river Hooghly near Calcutta. Since its establishment some of the most important economic plants like Tea, Jute, Cinchona, Teak and Mahogany were introduced for cultivation and development through this garden specially in Bengal. Such introduction had a remarkable effect on the local people in the awareness and utilization of those plants in practical life and gradually towards industry and also in plant life (Basak and Guha Bakshi, 1977). The earlier account of the economic plants of Bengal mainly centering round the Calcutta Botanic Garden were published by J. Fleming, W. Jones, W. Roxburgh, Buchanon-Hamilton and others (Santapau, 1958).

No major early work on the Botany of Bengal had been published by anybody prior to W. Roxburgh. His excellent contribution towards Indian botany have been duly recognized by faming him as the Father of Indian Botany. His eminence and great interest in plant life prompted him to collect plants, writing descriptions and correspond liberally about the plants of this area. From the letters written by Buchanon-Hamilton it is apparent that the manuscript copies of Roxburgh's *Flora Indica* were available for use at least by some of his friends

(Prain, 1905) and possibly helped in preparing descriptive account of plants of the surrounding areas of Calcutta and Madras. The Hortus Bengalensis was published by Roxburgh (1814) which incorporated an interesting catalogue of 3500 species of plants under cultivation in the Botanic Garden at Calcutta. Roxburgh had a batch of eminent staff to help him in gathering plants as he could not move freely out of Calcutta for the interest of the garden. He prepared more than 2533 excellent coloured illustrations in 35 volumes (1776-1815) where many plants have been represented from the present political boundary of the state. Several of these illustrations serve as lectotypes as per rules of International Code of Botanical Nomenclature. Subsequently an attempt was made to redraw those specimens and some 148 illustrations were separately published in six fascicles each containing 24-28 drawings during 1964-1973 (c.f. Icones Roxburghianae 1964, 1968, 1970, 1971 and 1973). The Flora Indica of Roxburgh came out in two volumes which were edited in part by Carey and Wallich (1820 and 1824) after including many of the latter's own collections. Carey at the request of Roxburgh's sons edited and published another edition of the Flora Indica in 3 volumes in 1832.

Contributions of two contemporary botanists viz. W. Carey and Buchanan-Hamilton in early Botanical and Horticultural research are of great significance to West Bengal (Ghosh, 1947; Srinivasan, 1961; Burkill, 1965; Basak, *l.c.*). Both of them actively helped Roxburgh to gather plants from Central Bengal and Sunderbans (Prain, *l.c.* a). The Hortus Suburbanus Calcuttensis by Voigt (1945) enlisted the plants grown in the Botanic Garden of Calcutta and that of Carey's Garden at Serampore up to 1841. It also included the plants which were entered in Master's incomplete Calcutta Flora (1839-40). The well known French botanist Jacquemont on his way for exploring in the N.W. India, travelled across the plains of Hooghly, Chandannagar, Burdwan and Raniganj in West Bengal in 1829 and threw some light on his botanical experience along his route (Jacquemont 1841). Most of his collections are now preserved in the Paris Herbarium (Stacton, 1945).

The history of Botanical researches in West Bengal and growing interest of local people in plants have a close link with the establishment of the Calcutta Herbarium (CAL). The nucleus of the Herbarium was founded by Roxburgh sometime in 1800 and excellent materials were gradually deposited by world fame botanists. Valuable collections and/or type specimens were contributed by Buchanan-Hamilton, Wallich, Hooker, Thomson, Griffith, McClelland, Clarke, Kurz, Prain and others from the Botanic Garden of Calcutta and different localities of W. Bengal. The utility of an authentic herbarium was realised by Griffith for identification of local plants and hence developed. A general herbarium as well as extensive series of local ones, so valuable for understanding botanical geography and vegetable statistics of each part of British India (Mukherjee, 1959) with better knowledge about plants were established.

Gradually interest was focussed on the medicinal plant resources of Bengal which included areas in the present West Bengal as well. A garden depicting the useful plants of lower Bengal and medicinal plants labelled in Bengali was developed by Griffith for students of medical science (Burkill *l.c.*). Among the collections catalogued by T. Thomson (1856) the following are worth mentioning : A complete set of specimens gathered and dried in the Botanic Garden, Calcutta and labelled by N. Wallich, collections made by Hooker and Thomson till 1851 and a set of specimens from Jessore. Extensive collections were made by Hooker from erstwhile Bengal and specially from Darjeeling and Sundarbans. The botanical findings during his travels have been systematically recorded by him (Hooker, 1848; 1849 a,b; 1850; 1852; 1854 a,b; 1904; 1907; Hooker and Thomson, 1855; Hooker *et al.* 1872-1897).

A few important publications brought out during the mid-nineteenth century by Long (1857-59) are on indigenous plants of Bengal, on plants of Calcutta by Anderson (1862) and on the Flora of Manbhum (Purulia in W. Bengal) by Bal (1869).

Clarke showed much interest and paid serious attention to the herbaceous weeds in rice fields in the plains of Bengal specially on the families like Cyperaceae, Commelinaceae and herbaceous members of Scrophulariaceae (Clarke, 1871, 1874, 1875, 1885, 1898). His intimate knowledge about the topography and vegetation of the Sunderbans prompted him to address of the subject to the learned body of the Linnean Society (Clarke, 1896).

Gamble joined his services in North Bengal in 1872 and was exceedingly fascinated with the luxuriant and most varied forests in Terai and the Himalayan district of Darjeeling and described its forest types (Gamble, 1875). He made rich collections from Darjeeling and foothill areas of Jalpaiguri. A first hand list of Himalayan woody plants including climbers under various forest zones (Gamble, *l.c.*) of Darjeeling with lucid notes and phenological data were enumerated by him (Gamble, 1878, 2nd ed. 1896). It is interesting to note that Clarke also made thorough collections from the district and made a critical study of the plants and vegetation of the botanically rich valleys and prepared valuable notes [Clarke, 1875(-1876), 1885]. Clarke's entire set of collections was utilized in preparing the useful catalogue by Gamble (*l.c.*). Kurz accumulated a very rich collection from the plains of Bengal and desired to publish a Flora of Bengal but he had to move from Bengal to Burma (Burkill, *l.c.*) leaving behind the collections. Various parts of North Bengal and Duars were subsequently explored also by King and Haines (1896, 1906) and Prain (1903 a).

Publication of the monumental Flora of British India by J.D. Hooker (1872-1897) switched on a new era in the History of Indian Botany. This excellent work paved a smooth way and gave a lot of impetus to prepare several Regional Floras by eminent botanists engaged in forest and other government

services. Prain published the Flora of the Plains of Bengal as "Bengal Plants" (1903 a). This work stands out as the only comprehensive and useful Flora of the erstwhile Bengal with workable keys for identification of different taxa with vernacular names. In the introductory chapter Prain mainly dealt with the varied physical features and broad outline of the vegetation and its associated forest types in the state and discussed their relationship with different phytogeographical regions of India and that of Malayan type. (He, however, admitted his work on Bengal Plants as provisional and suggested a more critical study of the collections to bring out a standard Flora of erstwhile Bengal.) Prain added further knowledge of floras of localized areas and published Flora of Sunderbans (Prain 1903 b) and the Flora of Howrah, Hooghly and 24-Parganas (Prain, 1905). He recorded 1316 species from these areas and isolated a precious collection of Bengal Plants which became an asset for Calcutta Herbarium (Basak, 1977).

Botanical researches on Bengal plants till 1920 or near about period were confined mostly to the Government departments like the Botanical Survey of India, The Agriculture and Forest departments. Thereafter this interest started spreading among the workers in various botanical research institutes, different universities and colleges and even in a number of individual workers (Bose, 1920; Burkill, 1920, 1922, 1926; Banerjee, 1934; Ara, 1954; Ghosh, 1960; Dutta and Ganguly, 1967; Guha, 1968, 1971 and others). Masterly work for the Calcutta Herbarium by Prain (i.e.) and his valuable contributions through literature imparted excellent knowledge about the plants mainly of the plains of erstwhile Bengal including the adjoining areas of the states of Bihar and Orissa. The interesting flora of the Chittagong hill tracts and the districts bordering the floristically rich eastern states are now in Bangladesh and out of the purview while preparing the present Flora of West Bengal. Botanists and students of the premier colleges and of the universities in the state were no doubt very much benefitted by Prain's floras but felt the dearth of Himalayan flora of Darjeeling district to a great extent. (However, in comparison to other branches of botany, research in taxonomy was neglected in W. Bengal particularly during the two decades between the World Wars I & II (Basak and Guha Bakshi, 1977).

(Reorganization of the Botanical Survey of India under the dynamic abilities of Janaki Ammal in 1953-54 triggered a fresh outlook and revival of taxonomic research in India particularly at the Headquarters in Calcutta) and in the four important Regional Circles, viz. Shillong, Dehra Dun, Pune and Coimbatore. Exploratory activities were remarkably augmented and as a result of intensive and extensive search, botanical information considerably accumulated, specially for the state of West Bengal. Taxonomists and botanical researchers in different universities, colleges, research institutions and various branches of forestry, agricultural and medicinal plant services became more interested in the plants of West Bengal and published their observations and findings in a large number

of publications (Basak, 1973; Basak and Guha Bakshi, 1977). With the revival of such botanical activities there were ample opportunities for taxonomic and floristic research centering around Calcutta with valuable collections and information added to the Central National Herbarium. As an outcome of such studies Flora of Howrah district was published by Bonnet (1979). Similarly, Flora of Murshidabad district in central West Bengal was published by Guha Bakshi (1984). Apart from these two complete district floras a number of workers made thorough collections in different districts and floristically interesting areas in W. Bengal after the sixties of the present century and published their findings or submitted dissertations of their research for the award of doctoral degree, although publication of these accounts is still awaited. Other floristic accounts of such studies include contribution to the Flora of Purulia district by Malick (1966), Herbaceous Flora of Jalpaiguri district excluding Cyperaceae, Poaceae, and Pteridophytes by Sikdar and Samanta (1983), vegetation of Malda district by Krishna & Dutta (1983), enumeration of the plants of Burdwan district including the pteridophytic flora by Bhattacharyya (1986).

Floristic studies on interesting botanical zones and taxonomical contributions on various groups of plants include several publications such as by Chakraborty (1951) on the genus *Corchorus*; Mitra (1952, 1958) on the family Commelinaceae & Monocotyledons of eastern India; Majumdar (1956, 1962) on grasses and weed flora of 24-Parganas; Mukherjee (1965) on Jalpaiguri district; Biswas (1967) on plants of Darjeeling district; Guha (1968) on floristic survey of Birbhum district; Datta and Majumdar (1966) on Flora of Calcutta and its vicinity; Basak (1968) on distribution of several new plants for W. Bengal from Birbhum district; Banerjee (1968) on grasses of Burdwan; Banerjee & Pal (1974) enlisting the grasses of Indian Botanic Garden; Chaudhuri (1960) on grasses and sedges of Darjeeling; Maji and Sikdar (1983) enumerating the sedges and grasses of Bankura district; Sanyal (1974) dealing with the sedges and grasses of Bankura district; grasses new to W. Bengal and others. Apart from the aforesaid publications on floristics and vegetation brought out after fifties, dissertations on two district floras by Das on Nadia district in 1968 and Sen on Hooghly district in 1972 were submitted but not yet published. Similarly Mitra worked on Tollygunge and adjoining areas and Vuppuluri Sharma on the weed flora of the Indian Botanic Garden, both in the year 1970.

After publication of the Flora of British India by Hooker (*l.c.*) and Bengal Plants by Prain (*l.c.*) there have been reports of large number of new species and several new distributional records for the state of West Bengal. Calder, Narayanaswami and Ramaswami (1926) and Razi (1959) compiled two useful lists of such plants which included several taxa also from West Bengal. Other species, hitherto known from different parts of Indian subcontinent and many exotic species found to be growing wild in West Bengal have been published by various authors (Culshaw, 1952; Srinivasan and Agrawal, 1963; Maheshwari, 1964; Bennet, 1965 a,b,c, 1966, 1967, 1971; Rao and Mukherjee, 1965; Banerjee, 1966; Ghosh, 1966 a, b; Jain, 1966 a, b, c, 1968; Chandra,

1966 ; Chandra and Bhattacharyya, 1966 ; Datta and Majumdar, 1966 ; Santapau and Korlahali, 1967 ; Mitra, 1967, 1969, 1971 ; Guha Bakshi and Naskar, 1966, 1967; Rao and Shanware, 1966; Jain and Banerjee, 1967; Korlahali, 1967; Rao, Mukherjee and Banerjee, 1967; Basak, 1968 a, b; Mukherjee and Banerjee, 1968; Jain and Pal, 1968; Guha Bakshi, 1969; Banerjee, 1969; Das, 1969; Mukherjee, 1969 a; Vuppuluri Sharma, 1969 a,b ; Banerjee and Pal, 1970; Yonzon, Babu and Das, 1970; Banerjee 1971 a; Ghosh, Guha Bakshi, Mukherjee and Mondal, 1971; Banerjee and Babu, 1971 ; Mitra and Roy, 1971; Krishna and Dutta, 1979; Krishna and Das, 1984).

In spite of poor representation of endemic taxa in the Indo-gangetic Floristic Region (Chatterjee, 1939, 1962), a number of new species and varieties have been described in recent years from West Bengal including the northern hilly areas, such as *Cardanthera uliginosa* Buch.-Ham. var. *birbhumensis* Guha (1967) from Birbhum district; *Peristrophe bicalyculata* (Retz.) Nees var. *subaequibracteata* Bennet (1969) from Howrah district; *Cuscuta sharnanum* Mukherjee & Bhattacharyya (1970) from Midnapore district; *Hydrocotyle himalaica* Mukherjee (1969 b) from Darjeeling district; *Hypericum assamicum* Biswas (1971) from Assam and Darjeeling district; *Dalbergia duarensis* Thothathri (1975) from Alipurduar, North Bengal and *Panax assamicum* Banerjee (1968) from Darjeeling and Assam. It is worth mentioning that *Adiantum indicum*—a new species of pteridophyte has also been collected by Ghatak (1963) from Calcutta.

1.6 VEGETATION AND FOREST TYPES OF WEST BENGAL

The varied and unique physical features in the state have given rise to 5 well defined phyto-ecological zones to support corresponding typical vegetational layout including the forest types. These are: 1. *The Himalayan zone of Darjeeling, between 500-3800 m.* 2. *Sub-montane Terai region and the adjacent plain.* 3. *Vast alluvial plain on both sides of the Bhagirathi and its northern and western tributaries.* 4. *The Western dry flanks of Chhotanagpur plateau,* and 5. *Mangrove forest of Sunderbans* mainly restricted to South 24-Parganas. In the broad outline of the areas mentioned above certain subdivisions of forest types and vegetational patterns have been further classified after critical analysis by the ecologists and plant sociologists (Champion and Seth, 1968; Naskar and Guha Bakshi, 1987; Malick, 1966; Gamble, 1875 etc.). However, the present picture of the vegetational pattern and forest types in the whole state is not the same as in the past and has undergone considerable modification due to continuous stress of intense bio-edaphic factors (Basak & Guha Bakshi 1977) which have been operative markedly during the last 50 to 60 years. Apart from those mentioned above the other typical plant groups belonging to the aquatic members, weed elements, horticultural and cereal crops along with components of forestry development also have markedly changed the vegetation in terms of quality and quantity and the details are treated under separate headings.

The past vegetational pattern of West Bengal particularly that of the Lower Ganga Plain has been worked out and revealed quite interesting features (Chaudhuri, Mallik and Sen, 1962; Basak and Guha Bakshi *l.c.*). Anatomical studies of the excavated wood from deep core have indicated the existence of a dominating mangrove forest which at present has migrated only to the southern part of the 24-Parganas (Ghosh, 1941; Ghosh and Neogi, 1958). The analysis of pollen flora from the river mud of estuarine region and also from some of the fresh water tanks showed the presence of pollens of the mangrove flora, the forests of which have shifted to the southern extremity of the Sunderbans (Das, 1961).

A thick deposition of peat around Calcutta and neighbouring regions with several metres of depth has shown no trace of mangrove pollens. Such peats under several vast swamps also indicate complete absence of mangrove elements and reveal the occurrence of *Suaeda maritima*—a halophytic plant at different strata of the peat, suggesting that the origin of the flora of the peat has been due to riverine translocation of elements and not growing *in situ*. It is apparent that the stumps of *Heritiera fomes*, and many others which had contributed a dominant forest *in situ* and located just beneath the peat had no role in the formation of the peat layer in Calcutta and surrounding area. Drifting of plant and other materials through riverine action is postulated to be responsible for the origin of Calcutta peat (Ghosh, 1964).

The vast coal basin of Raniganj area in the western part of the state is an outcome from the upper series of the Gondwana system and show remarkable prevalence of ferns, cycads and conifers whereas the lower series of Gondwana predominates with *Glossopteris*, *Equisetaceous* elements and *Cordaitean* stems (Randhawa, Mitra and Mehta, 1964). It may be worth mentioning that apart from the past geological history of the forests and vegetation mentioned above there are reports and evidences of thickly wooded areas in large tracts of West Bengal even up to the end of the nineteenth century. Such forests were specially predominant in the districts of West Dinajpur and Malda, in large areas of the districts on the south western part of the state, particularly bordering Chhotanagpur plateau of Bihar and in the Sunderbans (Basak and Guha Bakshi, *l.c.*). Presence of dense forest stands in other parts of the plains were mainly near the fringes of the confluencing rivers and in the vast marshes and depressions. Formation of such forests were in the areas between the rivers Mahananda and Kalindi and between Punarbhava and Tangon in Malda, around the *Hijal* and *Kalantar* bits in Murshidabad; in the marshes between the Damodar and Bhagirathi in Hooghly district; between the Damodar and Saraswati in Howrah, in the marshy areas between Kalighai and Rupnarayan in Midnapore and the extensive saline marshes to the south east of Calcutta extending towards the fringes of the bay in the south. Reclamation of marshy lands for cultivation and habitation and continuous destruction of forests during the last one hundred

years have completely changed the whole face of the forest cover in W. Bengal and reveals an uncontrolled denudation of the forests and plant cover in wet and saline lands. The percentage of forest area to geographical area in the plain is about 11% and it varies from 3% in Birbhum to nearly 20% in Bankura and not less than 31% in Sunderbans (Anon., 1966; Basak and Guha Bakshi, *l.c.*).

It has already been emphasized that the geographical features and the plant life in relation to such conditions are more diverse in West Bengal than those of any state of India of comparable size. Apart from the Himalayan elements the flora of the plains of West Bengal falls into two sub-provinces, *Bengal Proper* and *Sunderbans*, as described by Hooker (1904) under his 4th botanical province of the Gangetic Plain. According to Champion and Seth (1968), the forests may be grouped under following types: 1) Subtropical to temperate forests of northern Himalayan region in Darjeeling; 2) Northern tropical dry deciduous Peninsular Sal forests; 3) Tropical seasonal swamp forest; 4) Dry deciduous scrub and 5) Littoral and swamp forest. Concise account with salient features of these forest types and their main components are described below:

1.6.1 Subtropical to temperate forests of northern Himalayan region in Darjeeling: A comprehensive travelogue through the dense and magnificent forests and vegetation for the district of Darjeeling is rather difficult to conceive due to the nature of the Himalayan terrain and the intricacy of the plant cover comparable to almost that of the tropical rain forests in some of the river valleys. However, much of our knowledge about the forests and plant wealth owes to the pioneering efforts of eminent botanists and forest officers of the last century (Basak, 1973). In spite of having a thorough knowledge of the life forms there is every possibility of missing the herbaceous elements which do not appear every year due to combination of various climatic and edaphic factors associated with the physiological behaviour of plants as it is noticeable in *Strobilanthes*, *Lagotis*, *Lilies* and many genera of Orchids. At the same time the richness of plant wealth with which the district flourished in the past has been considerably changed with the introduction of commercial and several exotic species and also due to large scale exploitation of the forest resources by the local inhabitants. Our knowledge about the species diversity in the district is almost complete, yet due to very interesting phytogeography along with the assemblage of so many species within this small section of the Himalaya it will be always a paradise for botanical explorations.

In introducing the forest types of Darjeeling district Gamble (1875) had expressed his views by saying that "The forests of Darjeeling district not those under the forest department, although it possesses specimens of most kind but the forests, are more varied probably than those of any other district in India". Further while presenting the distribution pattern of the various forest types within the district his impressions are vividly expressed in his remarks "deep valleys filled with strange vegetable forms, serpent like lianas, trees of monstrous size

and shape, perhaps clothed with the fairy blossoms of epiphytic orchids or the delicate tracery of pendent ferns mount thence upwinding paths through dark forests whose only colour is that of the mossy hangings of the gigantic stems or the occasional flower of the scented *Magnolia* to the regions of winter snow where masses of *Rhododendron* cover with their gorgeous tincts the slopes of the upper hills and twist in every conceivable shape their wonderfully coloured limbs."

Most congenial condition for development of unique forest types and a flourishing growth of the forest cover is due to the fact that the heavy moisture laden clouds travelling northwards with the onset of monsoon get an easy passage into the Teesta river valley within the district and strike first on the rugged precipices on either side of the basin and also those of the smaller valleys of the rivers Balsan, Mahananda, Cheil and Jaldhaka in the neighbouring areas and pour heavy rains and cling to the forest cover with a blanket of moisture. By dropping the burden of water as they travel upwards and penetrate into the lattice of higher valleys it provides most favourable condition for the lush growth of all kinds of plant life of the forest composition. An approach from the plains to the mountainous zone of Darjeeling district and gradually to the higher reaches and ultimately to cold subalpine to alpine summits of Tonglo and Sandakphoo, for any botanist is a unique and thrilling experience.

During his historical journey through Darjeeling to Sikkim, Hooker (1849) prepared an excellent narrative about the Himalayan vegetation right from its commencement at the foothills to the highest limit at Tonglo in the Singalila range. In his observation the vegetational zones were mainly dealt from the plains to 1600 m under tropical zone and beyond this and up to 3600 m under temperate zone. Clarke (1877, 1886) also made interesting botanical trips following Hooker's route and narrated his collections mostly from the temperate zones of Darjeeling to Tonglo and further up towards Sandakphoo. More than four hundred species enumerated by him include also an interesting list of nearly hundred species of ferns. Gamble (1896) as a master forest botanist did an excellent job by preparing an exhaustive and very critical list of more than 800 species of trees, shrubs and woody climbers from the district. Apart from his own rich collections the collections of other contemporary botanists helped him in preparing a very useful contribution with valuable information on forestry and botany along with critical phenological data. In order to describe the plants within specific forest community he classified the forests broadly under five categories viz. 1. Sal Forests (*Shorea robusta* up to 750 m) ; 2. Khair-Sissoo Forests (*Acacia catechu* & *Dalbergia sissoo*) ; 3. Savannah Forests; 4. Mixed Forests (with 3 subdivisions) ; 5. Temperate Forests (with 3 subdivisions). Cowan & Cowan (1929a) while revising Gamble's (*l.c.*) list added a large number of herbaceous species while dealing with the ecological aspect of distribution of forests in Darjeeling particularly of Kalimpong sub-division and recognised 3 broad zones viz. *Tropical zone* (upto 900 m); *Sub-Tropical zone* (900-2000 m)

and *Temperate zone* (2000-3500 m) or *Upper Hill zone*. Biswas in his flora also described species from the district and vegetational succession according to altitude following the pattern of Cowan. Hara (1966) in his Flora of the Eastern Himalaya included considerable collections from Darjeeling district and described the forest types under (i) *Rain Green Deciduous Forest* between 700-900 m with *Shorea robusta* as the dominating tree; (ii) *Mixed Broad Leaved Forest* between 1500-1700 m, where *Castanopsis indica* and *Schinus wallichii* are flourishing elements; (iii) *Evergreen Oak Forest* with *Quercus lamellosa*, *Q. pachyphylla* and others between 2500-2800 m and indicative species along with *Quercus* have been marked by *Euglenardia gardneri* and *Acer campbellii*. Trees, shrubby and other herbaceous associates in these forest types have also been mentioned. Banerjee (Anon, 1966) while preparing a short account of the forests of Darjeeling broadly treated the forests under I. *Plain Forests* and II. *Hill Forests*. The latter however, has been subdivided into three categories under Lower, Middle and Upper Hill Forests following Gamble's outlook.

The forested areas of the Darjeeling district are mainly under the control of the Directorate of Forests, Government of West Bengal and are maintained as Reserve Forests or Protected Forests. The different categories of forests and their respective areas recorded in 1966 under 3 sub-divisions (Anon, 1980) are summarised in the following Table :

Name of Forest Division	Reserve Forest (Acres)	Protected Forest (Acres)	Unclassified state forests and land for afforestation	Forest area under corporate bodies & Private individuals	Grand Total (Area as on 31.3.1966)
Darjeeling	72,936	3,297	470	10,958	87,661
Kurseong	71,815	593	2,051	10,475	84,934
Kulinpong	1,43,957	285	1,870	—	1,46,112

Presently forests in this district are classified broadly under two groups : the plain forest and the hill forest as done by Banerjee (*l.c.*). Such plains with sandy soil mainly adjoining the rivers are replaced by loamy soil with drifts from the river and the nature of forests are also changed. The main components in the forest composition both in the plains as well as in the hills as depicted under the classification by Gamble (1896) are mentioned below :

I. *Acacia catechu - Dalbergia sissoo forest of the Tropical Plains (Khair Sissoo Forest)* : The forests of this kind with *Acacia catechu* and *Dalbergia sissoo* as predominating species are found on sandy soil and characteristically prevalent on the river beds of the perennial and seasonal rivers, viz., Teesta, Sevak, Mahananda, Rakti, Balsan, Mechi, Chel and others. *Dalbergia sissoo*, however, is in smaller number in comparison to almost pure stands of *Acacia catechu* and other commonly associated species are rather widely spaced which mainly include, *Acacia concinna*, *A. stipulata*, *Albizia procera*, *Bambax ceiba*, *Bridelia stipularis*, *B. tomentosa*, *Capparis olucifolia*, *Cassia tora*, *Coffea bengalensis*, *Cordia dichotoma*, *Crataeva magna*, *Croton caudatus*, *Dalbergia*

hirca, *D. lanceolaria*, *D. stipulacea*, *Deeringia amaranthoides*, *Erythrina indica*, *Flueggea microcarpa*, *Gmelina arborea*, *Grewia laevigata*, *Lannea coromandelica*, *Milletia auriculata*, *Natsiatum herpeticum*, *Premna latifolia*, *Pueraria tuberosa*, *Tinospora cordifolia*, *Toona ciliata*, and *Trewia nudiflora*.

II. *Savannah Forest in the Tropical Plains of Darjeeling* : Savannah type of Forest with tall grass cover though not very extensive in the district yet are chiefly found in Western Terai. Such grassy tracts with occasional trees or light forests are neither rich in *Shorea robusta*, nor in *Dalbergia sissoo*. These grasslands when dry and well grazed differ markedly from those under protection in composition and extent of growth form. Following their ecological characteristics Chaudhuri (1960) classified them under five types and common grasses growing in such forests excluding those in strict aquatic habitat include, *Saccharum spontaneum*, *S. procerum*, *S. bengalense*, *Narenga porphyrocoma*, *Themeda arundinacea*, *Seterostachya fusca*, *Themeda villosa*, *Vetiveria zizanioides*, *Cymbopogon claudensinus*, *Erianthus longisetosus*, *Desmostachya bipinnata*, *Atundo domax*, *Phragmites karka* (generally in marshy areas), *Arundinella bengalensis*, *Imperata cylindrica*, *Paspalum conjugatum*, *Eleusine indica*, *Cynodon dactylon*, *Paspalidium flavidum*, *Setaria glauca*, *Leersia hexandra*, *Panicum repens* and several others.

Along with the grasses of varying compositions a number of woody elements and trees commonly occurring and characteristically associated in this grass land are : *Acacia ferruginea*, *Adina cordifolia*, *Bauhinia malabarica*, *B. variegata*, *Butea monosperma*, *Careya arborea*, *C. indicum*, *Clerodendrum serratum*, *Crotalaria stricta*, *C. sericea*, *Dalbergia latifolia*, *Eugenia operculata*, *Grewia sapida*, *Leea alata*, *L. crispa*, *L. macrophylla*, *Milletia auriculata*, *Mimosa rubicaulis*, *Ochna pumila*, *Oroxylum indicum*, *Osbeckia rostrata*, *Premna herbacea*, *Randia dimetorum*, *R. uliginosa*, *Wendlandia exerta*, and *Ziziphus rugosa*.

The grassland of Terai region are mostly interspersed with *Shorea robusta* and other trees. Such sparsely wooded forest lands have been covered by planting *Tectona grandis*, *Shorea robusta*, *Eucalyptus globulus*, *E. leucoxylon* and other species of *Eucalyptus* under commercial plantation by forest department. Conversion of such lands for extensive Tea (*Thea sinensis*) or Pineapple (*Ananas comosus*) cultivation is a common feature of the district in the present days.

III. *Mixed Plain Forest of the Tropical Plain* : The flora in the mixed plain forest of Terai exhibits a rich growth of trees which are mainly of tropical evergreen type. Some of the deciduous species also take a prominent role in their composition. They also occur in the hill forests up to an elevation of 900m and associate with the predominating forest of *Shorea robusta*. From Dalka Jhar in the west to the whole of eastern Terai these forests are spread and occasional patches are found at the bases of the ridges. Common trees and woody climbers

dominating the composition of the forest are : *Acacia ferruginea*, *A. intsia*, *A. pennata*, *A. procera*, *A. sinuata*, *A. stipulata*, *Actinodaphne obovata*, *Adina cordifolia*, *Aesculus assamica*, *Alstonia scholaris*, *Anthocephalus chinensis*, *Antidesma acuminatum*, *Aporosa octandra*, *Artocarpus chama*, *Bauhinia anguinea*, *B. malabarica*, *B. purpurea*, *B. vahlii*, *B. variegata*, *Beaumontia grandiflora*, *Bridelia retusa*, *B. stipularis*, *B. tomentosa*, *Byttneria grandifolia*, *Calamus flagellum*, *C. lutifolius*, *Callicarpa arborea*, *Carallia brachiata*, *Careya arborea*, *Cassia fistula*, *Catnaregam spinosa*, *Chisocheton paniculatus*, *C. cecicodaphne*, *Cinnamomum tamala*, *Cissus repanda*, *Clerodendrum indicum*, *C. serratum*, *Cochinocarpus sterculiaceus*, *Coffea bengalensis*, *Combretum roxburghii*, *Concephalus suaveolens*, *Crateva magna*, *Croton caudatus*, *C. roxburghii*, *Daemonorops jenkinsianus*, *Dalbergia foliosa*, *D. latifolia*, *D. pinnata*, *D. stipulacea*, *Desmodium gyroides*, *D. motorium*, *D. pulchellum*, *Dillenia indica*, *D. pentagyna*, *Duabanga grandiflora*, *Dysoxylum hamiltonii*, *Embelia ribes*, *E. robusta*, *Entada pursaetha* ssp. *siatimalensis*, *Eranthemum pulchellum*, *Ficus altissima*, *F. chama*, *F. curtipes*, *F. cyrtophylla*, *F. infectoria*, *F. oligodon*, *F. retusa*, *F. rumphii*, *F. semicordata*, *F. subincisa*, *Flemingia macrophylla*, *F. strobilifera*, *Garuga pinnata*, *Glochidion gamblei*, *Glycosmis arborea*, *Gmelina arborea*, *Grewia disperma*, *Holarthra antidysenterica*, *Hymenodictyon exelsum*, *Ixora undulata*, *Knema lirifolia*, *Lagerstroemia parviflora*, *Lannea coromandelica*, *Leen acuminata*, *Lettsomia atropurpurea*, *L. strigosa*, *Litsea lacta*, *L. monopetala*, *L. salicifolia*, *Macaranga indica*, *M. gamblei*, *Macrosolen cochinchinensis*, *Mallotus philippensis*, *Mangifera sylvatica*, *Meliosma simplicifolia*, *Mezoneurum cucullatum*, *Micromelum minutum*, *Mimosa rubicaulis*, *Milletia auriculata*, *Morinda angustifolia*, *Mucuna nigricans*, *M. monosperma*, *Murraya exotica*, *Myxopyrum simplicifolius*, *Olea dioica*, *Oroxylum indicum*, *Pandanus minor*, *Phlogacanthus pubinervis*, *P. thyrsoformis*, *Phoebe lauceolata*, *Pinanga gracilis*, *Premna corymbosa*, *P. scandens*, *Pueraria nuberosa*, *Psychotria culocarpa*, *P. erratica*, *Sapium baccatum*, *Semecarpus anacardium*, *Spatholobus parviflorus*, *Stereospermum chelonoides*, *Tabernaemontana divaricata*, *Terminalia bellirica*, *T. chebula*, *Tetrameles nudiflora*, *Toona ciliata*, *Trewia nudiflora*, *Turpinia nepalensis*, *Wendlandia coriacea*, *W. wallichii*, *Wrightia arborea*, *Ziziphus mauritiana* and *Z. rugosa*.

IV. *Tropical Sal Forest (Shorea robusta) of the plains of Darjeeling* : Most impressive forests of *Shorea robusta* occupy the well drained areas of the district and occur on the plains with deep loamy soils of W. Terai and go up to 700 m from the Machi river on the west to the Chel river at Dalingkote. This type flourishes also along the valleys of Teesta, Rangeet and Rungu on both sides and extend continuously from the plains to the frontier of Sikkim (Gamble l.c.). Though *Shorea robusta* is the dominant component a number of other tree species grow with varying density mixed with several shrubby and herbaceous elements such as *Acacia ferruginea*, *A. pennata*, *Alstonia scholaris*, *Aphananixis*

polystachya, *Barleria cristata*, *Bauhinia malabarica*, *B. vahlii*, *Bridelia retusa*, *Caesalpinia bonduc*, *Calamus tenuis*, *Callicarpa arborea*, *Careya arborea*, *C. herbacea*, *Chukrasia tabularis*, *Cissus repanda*, *C. indicum*, *Clerodendrum viscosum*, *C. serratum*, *Coffea bengalensis*, *Combretum roxburghii*, *Crotalaria sericea*, *Colebrookea oppositifolia*, *Cycas pectinata*, *Daedalacanthus splendens*, *Desmodium cephalotes*, *D. confertum*, *D. gyroides*, *D. latifolium*, *D. motorium*, *D. pulchellum*, *Dillenia pentagyna*, *Duabanga grandiflora*, *Embelia robusta*, *Flemingia stricta*, *F. strobilifera*, *Garuga pinnata*, *Grewia sapida*, *G. sclerophylla*, *Heteropanax fragrans*, *Holarthra antidiysenterica*, *Indigofera pulchella*, *Lannea coromandelica*, *Leca alata*, *L. crispa*, *L. macrophylla*, *Litsea monopetala*, *Macrosolen cochinchinensis*, *Mallotus philippensis*, *Milletia auriculata*, *Mimosa rubicaulis*, *Morinda angustifolia*, *M. citrifolia*, *Oroxylum indicum*, *Pavetta crassicaulis*, *Phoenix acaulis*, *Premna herbacea*, *Rivea ornata*, *Schinus wallichii*, *Semecarpus anacardium*, *Spatholobus roxburghii*, *Spermatocytum suaveolens*, *Stereospermum chelonoides*, *Syzygium cerasoides*, *S. cumini*, *Terminalia bellirica*, *T. chebula*, *T. tomentosa*, *Wendlandia wallichii*, *Woodfordia fruticosa* and *Ziziphus rugosa*.

V. *Tropical Lower Hill Forests of Darjeeling and their vegetational composition*: The vegetation of the lower hill forests of Darjeeling shows some characteristic features and has considerable density and diversity of species. The trees with high biomass and lofty trunks cover the lower slopes and the basins of the river valleys and support dense growth of lianoid climbers belonging to different families like Vitaceae, Fabaceae, Apocynaceae and Arecaceae. The forests within this zone are frequently impregnated with Sal (*Shorea robusta*) no doubt but this is occasional in comparison to the predominance of other lofty tree species belonging to different tropical families like Sterculiaceae, Meliaceae, Burseraceae, Celastraceae, Tiliaceae, Rutaceae, Datisceae, Rubiaceae, Combretaceae, Sapotaceae, Lauraceae, Euphorbiaceae, Urticaceae, Juglandaceae and others. Some of the families like Rubiaceae, Euphorbiaceae, Verbenaceae, Moraceae and Lauraceae show a marked dominance in these forests in respect of number of genera and species. The following woody elements (Gamble *l.c.*) are well represented in this zone : *Abrus precatorius*, *Acacia intsia*, *A. torta*, *Acrocarpus fraxinifolius*, *Acutenosperma claviflorum*, *Actinodaphne obovata*, *Adhatoda zeylanica*, *Adina cordifolia*, *Aescidus assamica*, *Aglatia edulis*, *Albizia chinensis*, *A. lehbeck*, *A. lucidior*, *A. procera*, *Allophyllus zeylanicus*, *Alchornea tiliifolia*, *Alstonia scholaris*, *Anthocephalus chinensis*, *Antidesma acuminatum*, *A. humias*, *A. diandrum*, *Aplasia rubra*, *Aporosa roxburghii*, *Ardisia involucreata*, *A. solanacea*, *Aristolochia roxburghiana*, *Artocarpus chama*, *Argyreia hookeri*, *A. nazirii*, *A. wallichii*, *Arundinaria hookeriana*, *A. intermedia*, *Aspidopterys indica*, *A. nutans*, *Baccaurea sapida*, *Bambusa nutans*, *Barleria cristata*, *Bassia butyracea*, *Bauhinia malabarica*, *B. purpurea*, *B. scandens*, *B. horsfieldii* var. *vahlii*, *B. variegata*, *B. wallichii*, *Beaumontia grandiflora*, *Bischofia javanica*, *Boehmeria rugulosa*, *Bombax ceiba*, *Bridelia retusa*, *B. stipularis*, *B. tomentosa*, *Brucea mollis*, *Buddleja asiatica*, *Butea butejformis*, *B. parviflora*, *Hytneria pilosa*, *Calamus erectus*, *C. flagellum*, *C. latifolius*, *C. leptospadix*, *C. tenuis*,

Callicarpa arborea, *C. macrophylla*, *C. rubella*, *C. vestita*, *Canarium sikkimense*,
Canthium dicoccum, *Capparis acutifolia*, *C. cantoniensis*, *C. multiflora*, *C.*
olacifolia, *Carallia brachiata*, *Careya arborea*, *Carvota urens*, *Caryopteris*
wallichiana, *Casearia graveolens*, *C. vareca*, *Cassia fistula*, *Cassine glauca*,
Cannaregam nutans, *Cayratia pedata*, *C. tenuifolia*, *C. trifolia*, *Celtis*
cinnamomea, *C. tetrandra*, *Cephalostachyum capitatum*, *Cephalanthus*
tetrandra, *Chasalia ophioxylodes*, *Chisocheton cumingianus* ssp. *holauae*,
Chromolaena odorata, *Cinnamomum cecicodaphne*, *C. tamala*, *Cissampelos*
pariera, *Cissus adnata*, *C. glauca*, *C. javana*, *Clerodendrum bracteatum*, *C.*
indicum, *C. kaempferi*, *C. serratum*, *C. wallichii*, *Cloidion javanicum*,
Combretum roxburghii, *C. squamosum*, *C. wallichii*, *Cordia dichotoma*, *C.*
grandis, *Cratogeomys magna*, *Crotalaria tetragona*, *Croton oblongifolius*,
Cryptocarya amygdalina, *Cyclostemon lancifolius*, *Daedalacanthus nervosus*, *D.*
splendens, *Dalbergia latifolia*, *D. pinnata*, *D. sericea*, *D. stipulacea*, *Deeringia*
celocoides, *Dendrocalamus hamiltonii*, *Derris microptera*, *Desmodium*
cephalotes, *D. gyroides*, *D. heterocarpon*, *Desmodium motorium*, *D. velutinum*,
Dittoceras andersoni, *Dualbanga grandiflora*, *Dysoxylum alliarium*, *Ehretia*
acuminata, *Embelia ribes*, *E. robusta*, *Eriolaena wallichii*, *Erythrina variegata*,
Erythropalum vagum, *Euonymus bullatus*, *Fagerlindia fasciculata*, *Ficus*
altissima, *F. beughalensis*, *F. conglobata*, *F. curtipes*, *F. cyrtophylla*, *F.*
drupacea var. *puseons*, *F. elastica*, *F. fistulosa*, *F. fruticosa*, *F. hookeriana*, *F.*
laevis, *F. macrophylla*, *F. microcarpa*, *F. obovata*, *F. oligodon*, *F. prostrata*, *F.*
racemosa, *F. rigida*, *F. ruuphii*, *F. semicordata*, *F. sikkimensis*, *F. squamosa*,
F. subincisa, *F. virens*, *Firmania fulgens*, *Flemingia macrophylla*, *Fragraea*
obovata, *Garuga pinnata*, *Glochidion assamicum*, *G. lanceolatum*, *G. thomsoni*,
G. velutinum, *Gmelina arborea*, *Grewia abutilifolia*, *G. excelsa*, *G. laevigata*,
G. sterculiaceus, *G. vestita*, *Gymnema tingens*, *Heteropanax fragrans*, *Hiptage*
beughalensis, *Holarrhena antidysenterica*, *Holmskioldia sanguinea*,
Hyptianthera stride, *Itea macrophylla*, *Ixora acuminata*, *I. undulata*, *Jasminum*
multiflorum, *J. nepalense*, *Kuemia linifolia*, *Kydia calycina*, *K. jujubifolia*, *Lannea*
coromandelica, *Lasiococca symphilliaefolia*, *Lettsomia strigosa*, *Leea*
acuminata, *L. aequata*, *L. bracteata*, *L. herbacea*, *L. robusta*, *L. sumbuwina*,
Lepimurus oblongifolius, *Leptobaea multiflora*, *Licuala peltata*, *Litsea lacta*, *L.*
salicifolia, *Livistona jenkinsiana*, *Lophopetalum wightianum*, *Loranthus*
involutus, *L. ligustrinus*, *L. pulverulentus*, *L. scurrilla*, *Macaranga indica*,
M. pustulata, *Persea gamblei*, *P. villosa*, *Muesa macrophylla*, *Mallotus*
ferruginea, *M. philippensis*, *M. roxburghianus*, *Mangifera sylvatica*, *Marsdenia*
roylei, *M. tinctoria*, *Meyua spinosa*, *Micropteris discolor*, *Miliasma pinnata*, *M.*
simplicifolia, *Mitusa roxburghiana*, *Milletia cinerea*, *M. extensa*, *M.*
patchycarpa, *Morinda citrifolia*, *M. angustifolia*, *Morus australis*, *M. macrocarpa*,
Mucuna monosperma, *M. pruriens*, *Munronia pinnata*, *Murraya koenigii*, *M.*
paniculata, *Mussaenda glabra*, *M. roxburghii*, *Mycetta oblongifolia*, *Myrsine*
capitellata, *Ormosia glauca*, *Ougeima ougeimensis*, *Oroxylum indicum*, *Paderia*
foenida, *Pandanus nepalensis*, *Parabauera sagitata*, *Paranympha monophylla*,
Pavetta crassicaulis, *Phoenix rupicola*, *Pinanga gracilis*, *Pithecellobium*

angulatum, *P. bigeminum*, *Platea latifolia*, *Plecosperrum spinosum*, *Porana paniculata*, *P. racemosa*, *Pouzolzia viminea*, *Psychotria calocarpa*, *Pterospermum acerifolium*, *Pueraria tuberosa*, *P. wallichii*, *Randia sikkimensis*, *R. wallichii*, *Rauwolfia serpentina*, *Rhamnus nepalensis*, *Rinora bengalensis*, *Sabia paniculata*, *Sapium baccatum*, *Sarcosperma arboreum*, *Sauropus androgynus*, *Semecarpus anacardium*, *Shorea robusta*, *Sloanea sterculiacea*, *Solanum erianthum*, *Spermatidictyon suaveolens*, *Spondius pinnata*, *Sterculia hamiltonii*, *S. roxburghii*, *S. villosa*, *Syzygium cumini*, *S. formosum*, *S. operculatum*, *S. ramosissimum*, *S. toddalioides*, *S. wallichii*, *Stereospermum chelonoides*, *Tabernaemontana divaricata*, *Terminalia bellirica*, *T. chebula*, *T. tomentosa*, *Thespesia lampas*, *Thunbergia grandiflora*, *Tetrameles nudiflora*, *Tephrosia candida*, *Trevesia palmata*, *Trewia nudiflora*, *Trema orientalis*, *T. politaria*, *Turpinia nepalensis*, *Ulmus lancifolius*, *Uncaria scandens*, *U. sessilifructus*, *Vernonia talaumifolia*, *V. volkammeriaefolia*, *Villebrunia frutescens*, *V. integrifolia*, *Wallichia densiflora*, *Wendlandia coriacea*, *W. heynei*, *W. wallichii*, *Woodfordia fruticosa*, *Wrightia arborea* and *W. sikkimensis*.

VI. *Subtropical Middle Hill Forests of Darjeeling and their composition* :
 The forests in the Middle Hill zone of the district are mainly distributed in the west of the Teesta River and preserve most valuable tree species of forestry interest. The whole of Darjeeling forest division is occupied by this forest components and the species gradually show more of temperate type towards the upper limit whereas many species of the upper limit of the lower hills merge with those in the middle hill forest. The principal species in the forests of this division are *Alnus nepalensis*, *Juglans regia*, *Betula alnoides*, *Machilus odoratissima*, *M. gammieana*, *Symingtonia populnea*, *Engelhardtia spicata*, *Phoebe lanceolata*, *Michelia cathcartii*, *M. excelsa*, *Eurya japonica*, *Schima wallichii*, *Miliusa macrocarpa*, *Saurauja griffithii*, *Pittosporum floribundum*, *Echinocarpus dasycarpus*, *Acronychia laurifolia*, *Celastrus paniculatus*, *Rhamnus virgata*, *Acer thomsoni*, *Rhus semialata* and some of the gigantic climbing legumes are represented by *Milletia monticola* and *Mucuna macrocarpa*. *Acrocarpus fraxinifolius* in blazing flowers is also an attractive species in these forests. Many other well represented species include *Eriobotrya dubia*, *Dichroa febrifuga*, *Oxyspora paniculata*, *Brasstopsis mitis*, *Maesa indica*, *Embelia floribunda*, *Chonemorpha macrophylla*, a gigantic climber, *Clerodendrum colebrookianum* and others. The undergrowth in these forests though not very thick yet presents large number of herbaceous and shrubby species like *Astilbe rivularis*, *Daphne papyracea*, *Aechmanthera tomentosa*, *Helicia erratica*, *Ardisia macrocarpa*, *Arundinaria aristata*, *Lastrea dissecta*, *Maesa chisia*, *Neillia thyrsoflora*, *Plectocomia himalayana*, *Reinwardtia trigyna*, *Ranunculus diffusus*, *Draba gracillina*, *Viola serpens*, *Stellaria patens*, *Skinimia laureola*, *Piptanthus nepalensis*, *Spiraea bella*, *Primula rotundifolia*, *Veronica cana*, *Ajuga lobata* and many others. The ferns make a dominant cover in these forests along with others. In Kurseong division the middle hill forest also abounds with many tree species which are common also in Darjeeling division. Common species in this division are *Alnus nepalensis*, *Terminalia myriocarpa*,

Schima wallichii, *Syningtonia populnea*, *Lithocarpus fenestrata*, *Betula alnoides*, *Erythrina arborescens*, and *Phoebe lanceolata*. Because of comparatively low altitude some of the species of the lower hills like *Toona ciliata*, *Adina cordifolia*, *Cinnamomum tamala*, *Engelhardtia spicata* and others are represented in very large number in the forests of middle hills in the district. Most characteristic feature of the trees is exhibited by their magnificent size both in height and girth. Some of the common tree-ferns like *Hemitelia brunoniana*, *Alsophila glauca*, *A. glabra*, *A. latebrosa* are represented in large numbers in these forests apart from *Angiopteris erecta* and thick masses of *Gleichenia glauca* and *G. linearis* growing on shady moist rocks and forest slopes.

The Middle Hill Forests in the Kalimpong Division are spread within an altitudinal limit of 750-1700 m with soil rich in sandy loam derived from the Daling series. The quality of the soil has been responsible for the development of magnificent forests abounding in evergreen trees with dense canopies, mainly represented by species like *Castanopsis tribuloides*, *C. indica*, *Schima wallichii*, *Phoebe lanceolata*, *Eurya cavineris*, *Betula cylindrostachys*, *Nyssa javanica*, *Alcimandra cathcartii* and large climbers like *Actinidia callosa*, *Pentapanax racemosum*, *Mucuna macrocarpa* and *Rubus moluccanus* of which the latter commonly grow with in a great altitudinal amplitude of 400 m to 3300 m. *Ostodes paniculata* represents a major associate in the Middle Hill Forests of Darjeeling amidst a thick herbaceous growth and common shrubby members are *Rubus ellipticus*, *R. niveus*, *Viburnum colebrookianum*, *Sambucus hookeri*, *Strobilanthes wallichii*, etc. In comparatively moist areas the tree fern *Cyathea spinulosa* is fairly common. Apart from the magnificent forest cover, large hilly areas within the Middle Hill Forest have been cleared from time to time for extensive cultivation of Tea (*Camellia sinensis*).

Plants of woody habit commonly represented in the Middle Hill Forests of Darjeeling are : *Acer oblongum*, *A. thomsoni*, *Acrucarpus fraxinifolius*, *Acronychia aurifolia*, *Actinidia callosa*, *Actinodaphne sikkimensis*, *Agapetes saligna*, *Alcornea tiliacifolia*, *Alnus nepalensis*, *Aralia montana*, *Ardisia thyrsoiflora*, *Aphananixis polystachya*, *Aristolochia planifolia*, *A. saccata*, *Beilsmedea sikkimensis*, *Berchemia floribunda*, *Betula alnoides*, *Boehmeria hamiltoniana*, *B. platyphylla*, *Brassiopsis mitis*, *B. speciosa*, *Buddleja macrostachya*, *Callicarpa vestita*, *Camellia sinensis*, *Caryopteris paniculata*, *Casearia glomerata*, *Castanopsis indica*, *C. lanceaefolia*, *Celastrus acuminata*, *C. monosperma*, *C. paniculatus*, *Chasalia curviflora* var. *ophioxylodes*, *Chonemorpha macrophylla*, *Cinnamomum bejolghota*, *C. impressinervium*, *Clausena willdenovii*, *Clematis acuminata*, *C. grewiaefolia*, *C. munroiana*, *Clerodendron colebrookianum*, *Cornus capitata*, *C. controversa*, *Cryptomeria japonica*, *Debregeasia velutina*, *D. wallichiana*, *Dicroa febrifuga*, *Dillenia pentagyna*, *Dobinaea vulgaris*, *Drimycarpus racemosus*, *Dysoxylum procerum*, *Dendrophthoe falcata*, *Ehretia wallichiana*, *Elaeocarpus serratus*, *E. sikkimensis*, *Eleagnus latifolia*, *Embelia floribunda*, *E. nagushia*, *Engelhardtia spicata*, *Eriobotrya dubia*, *Erycibe schimidti*, *Erythrina arborescens*, *Eurya cerasifolia*,

E. japonica, *Ficus cyrtophylla*, *F. hookeriana*, *F. sarmentosa*, *Glochidion nubigenum*, *Gonania tiliaefolia*, *Hedyotis scandens*, *Holboellia latifolia*, *Holostemma ada-kodien*, *Hymenopogon parasiticus*, *Jasminum nepalense*, *Kadsura heteroclita*, *Lonicera glabrata*, *L. macrantha*, *Loranthus psilanthus*, *Luculia gratissima*, *Lyonia formosa*, *Macaranga denticulata*, *Machilus odoratissima*, *Maesa indica*, *M. rugosa*, *Magnolia hodgsoni*, *Mallotus nepalensis*, *Medinilla erythrophylla*, *Melastoma malabathricum*, *Melia dubia*, *Meliosma dillenigefolia*, *M. pinnata* var. *barbulata*, *Michelia excelsa*, *M. lanuginosa*, *Microtropis discolor*, *Miliusa macrocarpa*, *Murraya koenigii*, *Mussaenda macrophylla*, *Myrsine capitellata*, *Microchites elliptica*, *Osbeckia stellata*, *Oxyspora paniculata*, *Periploca calophylla*, *Podocarpus neriifolia*, *Populus ciliata*, *Pyrularia edulis*, *Quercus acuminata*, *Reevesia pubescens*, *Reinwardtia trigyna*, *Rhamnus virgata*, *Rhus semialata*, *Sabia leptandra*, *S. parviflora*, *Saurauja fasciculata*, *S. griffithii*, *S. napaulensis*, *Stephania elegans*, *S. glabra*, *Symplocos cochinchinensis*, *Thunbergia coccinea*, *Toddalia asiatica*, *Trachelospermum axillare*, *T. fragrans*, *Turpinia nepalensis*, *Zanthoxylum acanthopodium* and *Z. armatum*.

VII. *Temperate Upper Hill Forest and vegetation of Darjeeling district* : The characteristic North Temperate Upper Hill Forests, dominated by several species of age stricken *Quercus* and many interesting species of *Rhododendron* with different hues are distributed in the greater part of Darjeeling division. In the other two divisions viz. Kurseong and Kalimpong, members of the family Lauraceae and Aceraceae are represented markedly in higher densities. A number of exotic species like *Eucalyptus tereticornis*, *E. globosus*, *E. obliqua*, *Cedrus deodara*, *Cupressus torulosa* etc. with profuse undergrowth mainly represented by species like *Rubus ellipticus*, *R. niveus*, *R. moluccanus*, *Strobilanthes wallichii*, *S. pentastemonoides* and common ferns like *Arthromeris himalayensis*, *Asplenium ensiforme*, *Athyrium asperum*, *Crypsinus malacodon*, *Dryopteris filix-mos* and many others make the general forest composition of the Upper Hilly belt of Kurseong division above 1700 m. Where as in Kalimpong division in the lower limit between 1700m to 1900 m high concentration of *Engelhardtia spicata* forms a special feature of the forest. In higher succession above 1800 m the common tree elements of the forests include *Persea fructifera*, *Phoebe lanceolata*, *Lindera pulcherrima*, *Alcimandra cathcartii* and others. Trees of comparatively lesser frequency are represented by *Litsaea elongata*, *Engelhardtia spicata*, *Castanopsis tribuloides*, *Schima wallichii*, *Brassiopsis hispida* etc. On the southern aspects however, *Macaranga pustulata*, *Betula alnoides*, *Brassiopsis hookeri* etc. are not uncommon specially on lands which have been left after cultivation. *Quercus lamellosa* forms the dominant composition of the upper hill forests of both Darjeeling and Kalimpong divisions between 1900 to 2400 m which is followed by *Persea gammieana*, *Acer campbellii*, *Litsaea elongata*, *Michelia kisopa*, *Alcimandra cathcartii* and others. High level Oak forest dominating on Singalila range is mainly represented by *Lithocarpus pachyphylla* with which *Quercus lamellosa* is a common associate.

The Upper Hill forests in Darjeeling division comprise a fascinating temperate vegetation predominated by *Quercus lamellosa*, *Q. lineata* and *Lithocarpus pachyphylla*. Its common associates include *Castanopsis purpurella*, *Magnolia campbellii*, *M. globosa*, *Michelia excelsa*, *Eurya acuminata*, *Ilex dipyrrena*, *I. fragilis*, *Eumyrmus frigidus*, *Symplocos theaeifolia*, and others. Temperate herbs and shrubs common within these forests have a large number of typical plants belonging to the families of Rosaceae, Ranunculaceae, Acanthaceae, Berberidaceae, Grossulariaceae, Ericaceae, Primulaceae, Saxifragaceae etc. One of the common bamboos in this forest zone is represented by *Aruundinaria racemosa*. Apart from different species of *Rhododendron* which commonly occur in the high altitude forests the Conifers make a dominating vegetation in the higher limits. Though *Cryptomeria japonica* has been extensively planted in this division after its first introduction from Japan during later part of the 19th century yet it is flourishing more at the lower heights. The species however, does not thrive well above 1600 m. The temperate conifers mainly restricted to Singalila range include *Abies pindrow*, *Larix griffithii*, *Tsuga brunoniana* and *Pinus roxburghii*; the latter is found only in dry inner valleys.

In addition to the general outline of the temperate or high hill forest vegetation and woody species of Darjeeling district given above, the other typical plants in the same altitudinal range above 1800 m are : *Acer campbellii*, *A. caudatum*, *A. hookeri*, *A. laevigatum*, *A. sikkimense*, *Actinidia strigosa*, *Aucuba himalaica*, *Berberis angulosa*, *B. chitria*, *B. concinna*, *B. insignis*, *B. nepalensis*, *B. umbellata*, *Betula alnoides*, *B. utilis*, *Brassiopsis hookeri*, *Buddleja colvillei*, *Castanopsis purpurilla*, *Celastrus stylosus*, *Clematis buchananiana*, *C. montana*, *Cornus cupitata*, *Cotoneaster microphyllus*, *Daphne papyracea*, *Derris monticola*, *Ilex dipyrrena*, *I. fragilis*, *I. hookeri*, *I. insignis*, *I. sikkimensis*, *Jasminum dispernum*, *Juniperus recurva*, *Lasianthus hiermanni*, *Leucoseprum canum*, *Lindera assamica*, *L. heterophylla*, *L. pulcherrima*, *L. elegans*, *Litsaea cubeba*, *L. elongata*, *L. sericea*, *Lonicera acuminata*, *Lyonia villosa*, *Meliosma dillenuefolia*, *M. pinnata* var. *barbulata*, *Mycetia longifolia*, *Osmanthus fragrans*, *O. suavis*, *Pentapanax leschenaultiana*, *Piptanthus nepalensis*, *Pittosporum floribundum*, *Potentilla fruticosa* var. *rigida*, *Prunus nepalensis*, *P. rufa*, *P. undulata*, *Pyrus foliolosa*, *P. lanata*, *P. microphylla*, *P. rhamnoides*, *Rhododendron arboreum*, *R. barbatum*, *R. cinnabarinum*, *R. dalhousiae*, *R. edgeworthii*, *R. fulgens*, *R. grande*, *R. hodgsoni*, *R. lepidatum*, *R. vuccinoides*, *Rhus acuminata*, *R. hookeri*, *Ribes acuminatum*, *Rosa sericea*, *Rubus andersoni*, *R. calycinus*, *R. hookeri*, *R. paniculatus*, *R. thomsoni*, *R. treutleri*, *R. macilentus*, *Sabia limoniacea*, *Sambucus adnata*, *S. hookeri*, *Sarcococca saligna*, *Schizandra grandiflora*, *Skinimia laureola*, *Sloanea dasycarpa*, *Spiraea bella*, *Stachyurus himalaicus*, *Stryax hookeri*, *S. serrulatum*, *Symplocos dryophylla*, *S. lucida*, *S. phyllocalyx*, *Taxus baccata*, *Vaccinium nummularia*, *V. retusum*, *Viburnum erubescens*, *V. mullaha*, *V. nervosum*, *Viscum album*, *V. articulatum*, and *Zanthoxylum nitidum*.

A journey to the higher reaches from Darjeeling to Tongloo and further up to the highest point of Singalila range not only offers an interesting succession and impressive composition of typical forests of temperate Eastern Himalaya but also abounds with fascinating herbaceous undergrowth with many temperate and alpine species of flowering herbs and handsome ferns. Some common flowering plants including orchids are : *Herminium angustifolium*, *Aconitum palmatum*, *Aeschynanthus bracteata*, *Agrostis alba*, *A. nervosa*, *A. vulgaris*, *Ainsliaea pteropoda*, *Ajuga lobata*, *Anaphalis adnata*, *A. araneosa*, *A. cinnamomea*, *A. contorta*, *A. triplinervis*, *Anemone obtusiloba*, *Ancilema thomsoni*, *Anisadenia saxatilis*, *Anthogonium gracile*, *Aralia pseudogensing*, *Arisaema costatum*, *A. erubescens*, *A. griffithii*, *A. jacquemontii*, *A. nepanthoides*, *A. speciosum*, *A. tortuosum*, *Avena alpestris*, *Balanophora dioica*, *Begonia cathcartii*, *B. josephi*, *B. gemmipara*, *Bidens pilosa*, *Boenninghausenia albiflora*, *Bromus himalaicus*, *Calceolaria mexicana*, *Campanula colorata*, *Cardamine trifoliata*, *C. bengalensis*, *Carex daltonii*, *C. decora*, *C. filicina*, *C. foliosa*, *C. fusiformis*, *C. indica*, *C. nepalensis*, *C. nubigena*, *C. pellucida*, *C. phacota*, *C. polycephala*, *C. remota*, *C. vesiculosa*, *Carpesium abrotanoides*, *C. cernuum*, *Chamabainia cuspidata*, *Chirita macrophylla*, *C. urticifolia*, *Chloopsis canescens*, *Chrysosplenium lanuginosum*, *C. nepalense*, *Clinopodium umbrosum*, *Clintonia alpina*, *Codonopsis inflata*, *Coelogyne corymbosa*, *C. praecox*, *Commelina maculata*, *Corydalis chaerophylla*, *C. sibirica*, *Crawfordia luteoviridis*, *Craniotome versicolor*, *Cynoglossum zeylanicum*, *Cyrtosia lindleyana*, *Dicentra thalictrifolia*, *Dichrocephala latifolia*, *Didymocarpus aromaticus*, *D. albicalyx*, *Disporum cantoniense*, *Draba gracillima*, *Edgaria darjeelingensis*, *Elatostemma dissectum*, *E. surculosum*, *E. hookerianum*, *E. ficoides*, *E. nasutum*, *E. obtusum*, *E. sessile*, *E. sikkimense*, *Elsholtzia flava*, *E. strobilifera*, *Epilobium roseum*, *Fragaria daltoniana*, *F. vesca*, *Fritillaria cirrosa*, *Galium mollugo*, *G. rotundifolium*, *G. hirtiflorum*, *Gentiana capitata*, *G. pedicellata*, *Geranium nepalense*, *G. polyanthes*, *Girardinia heterophylla*, *Gnaphalium luteo-album*, *Gynura angulosa*, *Habenaria pectinata*, *Hackelia uncinata*, *Hemiphragma heterophyllum*, *Herminium congestum*, *Herpetospermum pedunculatum*, *Holcus lanatus*, *Hymenopogon parasiticus*, *Hypoxis aurea*, *Impatiens arguta*, *I. longipes*, *I. puberula*, *I. racemosa*, *I. radiata*, *I. stenantha*, *Iris decora*, *Isachne miliacea*, *Isopyrum adiantifolium*, *Juncus bufonius*, *J. himalensis*, *J. concinnus*, *Kobresia hookeri*, *Lapportea evittata*, *Lecanthus peduncularis*, *Lindenbergia indica*, *Liparis nepulensis*, *Lobelia pyramidalis*, *Lysimachia Japonica*, *L. prolifera*, *L. ramosa*, *Lysionotus ternifolia*, *Malaxis acuminata*, *Mazus dentatus*, *M. surculosus*, *Meconopsis robusta*, *Melissa parviflora*, *Muehlenbergia duthieana*, *Myriactis nepalensis*, *M. wallichii*, *Notochaete hamosa*, *Ophiopogon wallichianus*, *Osbeckia criuita*, *Ophiorrhiza mungos*, *O. nutans*, *O. thomsoni*, *Oplismenus compositus*, *Origanum vulgare*, *Oxalis griffithii*, *Paris polyphylla*, *Pedicularis gracilis*, *Pentapterygium serpens*, *Pentaptyxis stipulata*, *Peperomia reflexa*, *Perilla ocimoides*, *Perncarpa carnosia*, *Pilea anisophylla*, *P. bracteosa*, *P. scripta*, *P. smilacifolia*, *P. symmeria*, *P. ternifolia*, *P. umbrosa*, *Poa alpina*, *P. annua*, *P. subsecunda*, *Polygonatum*

cirrifolium, *P. oppositifolium*, *P. punctatum*, *P. verticillatum*, *Polygonum amplexicaule*, *P. capitatum*, *P. chinense*, *P. filicaule*, *P. molle*, *P. runcinatum*, *P. perforatum*, *Potentilla nepalensis*, *Pouzolzia indica*, *Pratia begoniifolia*, *Prinuda petiolaris*, *P. rotundifolia*, *Prinella vulgaris*, *Ranunculus cymbatariae*, *R. diffusus*, *R. hirtellus*, *Rorippa montana*, *Rubia monjith*, *Rumex acetosa*, *R. nepalensis*, *Sarcopyramis nepalensis*, *Satyrium nepalense*, *Saussurea deltoidea*, *Saxifraga purpurescens*, *Scrophularia elatior*, *S. urticifolia*, *Senecio alatus*, *S. chrysanthemoides*, *S. tetranthus*, *S. wallichii*, *Siegesbeckia orientalis*, *Smilacina oleracea*, *S. purpurea*, *Smilax ferox*, *S. menispermoidea*, *Spiranthes sinensis*, *Stellaria bulbosa*, *S. crispata*, *S. longissima*, *S. sikkimensis*, *Streptolirion volubile*, *Strobilanthes attenuatus*, *S. divaricatus*, *S. wallichii*, *Swertia himaculata*, *S. chiravita*, *S. paniculata*, *Thalictrum chelidonii*, *Thladiantha calcarata*, *Thunbergia coccinea*, *T. lutea*, *Tiarella polyphylla*, *Trillium govanianum*, *Urtica parviflora*, *Utricularia multicaulis*, *U. orbiculata*, *Valeriana hardwickii*, *Veronica cuna*, *Vitis capriolata*, *V. tenuifolia*.

The temperate forest zone of Darjeeling shows also a characteristic distribution of scrub forest communities generally on the sites of abandoned shifting cultivation and specially in the areas which are excessively overgrazed or where trees have been ruthlessly lopped. Such secondary forests are mainly composed of dwarf conifers, mostly represented by the introduced trees of *Pinus griffithii* or saplings of *Quercus lamellosa*, *Lithocarpus pachyphylla*, *Quercus lineata* etc. These forests are easily recognized by their appearance on terraced lands which due to constant biotic interference are unable to establish and attain their climax formation. On the other hand where the valleys are deep, the soil in these forests is more moist due to seepage of water with minerals and help in the formation of mixed and mesophyllous communities which require adequate moisture and soil rich in nutrients.

VIII. The Conifer-Rhododendron Forests : This type is predominant in the highest limit of the district, mainly in Darjeeling and to lesser extent in Kalimpong Division. This zone however, is not represented in Kurseong Division. The dominating element in this forest is *Arundinaria racemosa* which is found to grow as a pure crop or as an element in the undergrowth of these high forests. It is stated (Banerjee, 1966) that greater part of this forest zone in Darjeeling Division had suffered great damage from serious forest fires in 1876, 1879, 1882, 1903, 1909 and 1939. Charred and blackened stems of crooked *Rhododendron* and *Quercus* succeeding above pure stands of bamboo zone still represent the ravages of the past fire and give an indication of the nature of well grown forest and mode of invasion of the dwarf bamboos within the gutted forests in the past. The forests of this zone are chiefly represented by *Arundinaria racemosa*, different species of *Rhododendron* or with patches of conifers and scattered growth of *Lithocarpus pachyphylla*, *Quercus spicata*, *Acer campbellii* and *Magnolia campbellii* towards the lower heights. Among the conifers, *Taxus baccata* is scatteredly distributed at higher elevations of the Tonglu Range. But

further upwards towards Phaloot *Taxus* is replaced to a large extent by *Tsuga dumosa* between 2400 m to 2800 m and thence higher up merge with *Abies spectabilis*. Ultimately this is replaced by *Rhododendron* of higher distribution and by *Betula utilis* in the highest limit. Pure forests of *Rhododendron arboreum* are not uncommon at the higher altitudes and sometimes Pasture lands are come across on the boundary of Nepal & West Bengal (Banerjee, *l.c.*)

A small area in Kalimpong Division is occupied by the kind of forest visible in Darjeeling above 2700 m where patches of conifers flourish with the main species being *Tsuga dumosa*, *Larix griffithiana* and *Taxus baccata*. Above 2800 m the entire ground is mostly covered with *Arundinaria racemosa* where occasional patches of *Rhododendron arboreum*, *R. grande* and the handsome *R. falconeri* are come across.

1.6.2: Vegetation of North Bengal : Out of the five vegetational zones of West Bengal mentioned earlier, the forest types and floristic composition of the mountainous Darjeeling district including its plain areas being greatly influenced by the Himalayan elements, its vegetation has been dealt with separately in the preceding part of this chapter, though it is situated in North Bengal.

The forests and vegetation of North Bengal show much resemblance with that of the mixed plain forests of Darjeeling. These needed special attention in isolation of other tracts of the state in view of its excellent climatic and edaphic factors, supporting most luxuriant growth of the forests along with rich bio-diversity of tropical evergreen forests. Due to the density and development of various kinds of forests including excellent Savanna type of thick grasslands in moist and swampy belt located in long stretch of Jalpaiguri district, the terrain has been favoured with the development of three wild life sanctuaries, *viz.* Jaldapara in Buxa forest division, Garumara and Chapramari, of rather smaller dimensions, located in the north-eastern part of the district under Lower Tandu, Upper Tandu and Daina forest ranges. Apart from 13 kinds of mammals and 12 kinds of birds which are represented in large numbers, these game sanctuaries are preserving one of the most precious animals of the country, the single horned Rhinoceros in sizeable numbers. In order to protect such an important habitat and to understand its direct relationship with the famous and rich fauna of this submontane forest, the knowledge of the main biological component *viz.* the flora and vegetation of North Bengal need thorough investigation. Moreover, after declaration of Buxaduar as a tiger reserve in the same district, the flora of North Bengal require special attention to maintain the forest habitat favourable for the sustenance of the fauna. Keeping such ideas in view, the Botanical Survey of India had already launched research programmes to study the flora and vegetation of those areas. Mukerjee (1965) after studying the vegetation of Jalpaiguri prepared an account to sketch the main forest types and their major components to throw light on the interesting flora of the district. The fascinating orchid flora of the plains of North Bengal also attracted his attention and an

account on this interesting group of plants were published (Mukerjee 1975). In addition to such observations, he worked out the fern flora of Jalpaiguri district which provides an ideal condition in the forest floor for regeneration and a rich growth of other herbaceous members. The works mentioned above also created interest in subsequent workers and Sikdar (1984) published an account on the Baikunthapur forest division of Jalpaiguri district. Based on the composition and distribution of the major floristic elements, he described five forest types and their typical components, as under:

I. *Semi-evergreen forests* : Common species like *Alstonia scholaris*, *Bauhinia variegata*, *Castanopsis tribuloides*, *Cinnamomum obtusifolium*, *Eugenia formosa*, *Litsea salicifolia*, *Meliosma simplicifolia*, *Syzygium cumini* etc. Forests of such types are found in small patches near the rivers or streams. Other commonly occurring species in such forests are *Mesua ferrea*, *Aphania rubra*, *Achronychia pedunculata*, *Mucaranga denticulata*, *Phoebe pallida*, *Viburnum colebrookianum* and species like *Osbeckia nepalensis*, *Mussaenda frondosa* etc.

II. *Moist deciduous forest* : The forests of this kind are described under moist tropical forest type and are categorised under Sub-Himalayan secondary wet mixed forest. The principal genera found in these forests are *Elaeocarpus*, *Eugenia*, *Dysoxylum*, *Litsea*, *Machilus* and others. Extensively growing climbers of Vitaceae are frequently found to grow on these trees and make an entangled lattice of climbers. Some of the well represent trees, and other associated shrubby elements are *Aphananixis polystachya*, *Callicarpa arborea*, *Casearia vareca*, *Phlogacanthus thyrsoiflorus*, *Aporosa roxburghii*, *Maesa indica*, *Styrax serrulatum*, *Symplocos laurina*, *Thubergia coccinea*, *Coffea bengalensis*. In wet localities *Carallia brachiata* is sometimes found to occur on the forest margins. Along with several herbaceous members like *Duchesnea indica*, *Lepidagathis incurva*, *Pseudobruxsiopsis polycantha* and large climbers of *Trichosanthes bracteata* with attractive red fruits are quite common. Some of the well represented grasses in these forests are *Setaria palmaefolia*, *Gentotheca lappacea*, *Eragrostis unioides*, *Pogonatherum panicum*, *Oplismenus compositus* etc.

III. *Dry deciduous forests* : The vegetation in this forest type according to Champion and Seth (1968) is recognised as East Himalayan moist mixed deciduous forest where *Shorea robusta* is frequently come across along with various other trees and shrubby elements and the floor is densely covered with grasses following burning of ground cover. Along with dominating *Shorea robusta* other commonly growing species are *Lagerstroemia parviflora*, *Stereospermum personatum*, *Wrightia tomentosa*, *Stercutia villosa*, *Mallotus philippensis*, *Erythrina stricta*, *Bridelia stipularis*, *Ziziphus rugosa* and straggling shrubs like *Holmskioldia sanguinea*, *Celastrus paniculatus* etc. Some of the common herbaceous species in the undergrowth of the forests are *Dicliptera roxburghiana*, *Blumen lacera*, *Lepidagathis hyalina*, *Ludwigia octovalvis*,

Elephantopus scaber, *Solanum indicum*, *Urena lobata* and *Cissampelos pariera*, the latter is found frequently climbing on different shrubby species. The grasses commonly growing on these forest floors are *Pogonatherum paniceum*, *Panicum sarmentosum*, *Eragrostis unioloides*, *Neyraudea* and others. Sometimes ferns like *Lygodium flexuosum*, *Asplenium alternans* are come across in the forest undergrowth.

IV. *Sal forest* : The forests of *Shorea robusta* in the aforesaid division and in general are of plantations by the state forest department and found in most of the ranges. Common associates of this type of forests are : *Lagerstroemia parviflora*, *Sterculia villosa*, *Morinda angustifolia*, *Maesa indica*, *Terminalia bellirica*, *Schima wallichii*, *Aphananixis polystachya*, *Eranthemum splendens*, *Strobilanthes capitatus* and others. Few small shrubs like *Ochna pumila*, *Coffea bengalensis* along with climbing *Asparagus racemosus* are also found to grow in these forests mixed with grasses like *Cantotheca lappacea*, *Microstegium ciliatum* etc. Parasites frequently growing on *Shorea robusta* are *Dendrophthoe fulcata* and *Mucrosolen cochinchinensis*.

V. *Grass lands* : Impressive grassy terrains are found mainly along the river banks, which in presence of moist habitat in low lying areas support luxuriant and thick grasses belonging to the species like *Saccharum spontaneum*, *S. procerum*, *Phragmites karka*, *Erianthus elephantinus*, *Themeda villosa*, and *Antheistaria gigantea* with scattered trees like *Albizia procera*, *Bombax ceiba*, *Butea monosperma*, *Bischofia javanica* and others. Sometimes these grasslands are replaced by a typical mixed deciduous forest of *Dillenia pentagyna*, *Careya arborea*, *Toona ciliata* along with *Shorea robusta*. In the riverine alluvium, however, *Dalbergia sissoo* predominates.

Some of the common and characteristic species in open situations in this division are *Melastoma malabathricum*, *Xeromphis uliginosa*, *Mussaenda frondosa*, *Clerodendrum viscosum*, *Buddleia asiatica* together with tender herbs like *Scoparia dulcis*, *Tridax procumbens*, *Blumea lacera*, *Trichodesma indicum* etc.

While the vegetation in part of North Bengal has been outlined from Baikunthapur forest division (Sikdar *l.c.*), our knowledge about the forests and vegetation of the whole of Jalpaiguri district is mainly due to the first hand information furnished by Mukerjee (1965). Recently Banerjee (1993) made an intensive ecological study of the Jaldapara Game Sanctuary to explore the habitat of Rhinoceros and contributed details on the flora of this limited area.

With a rectangular outline, the district Jalpaiguri stretches more in the east-west direction and provides greater land area for the rivers from the northern Himalayan region to flow through the district. As a result the major rivers like Mahananda, Teesta, Torsa, Jaldhaka, Sankosh and their tributaries interact extensive tracts of forest lands both in the plains as well as in the hilly areas and help in subtending various kinds of magnificent tropical forests and

grasslands. Annual rainfall between 3100 mm to 5400 mm together with range of temperature between 31^oC to 40^oC provide ideal conditions for the development of four major kinds of forests, viz. 1. Tropical Semi-evergreen forests, 2. Moist Sal forests, 3. Riverain Khair-Sissoo forest and 4. Savannah forests. Under the aforesaid warm damp climatic condition though wet evergreen forests are likely to develop, yet such forests are located in restricted pockets only due to other edaphic factors. Two types of Savannahs, one in low lying areas and the other at high levels have been recognised in the foot hill forests by Troup (1921). In the moist low lying terrain, the most densely growing tall grasses are *Erianthus elephantinus*, *Themeda gigantea*, *Phragmites kurka*, *Saccharum spontaneum*, *S. procerum*. Some notable trees characteristically marking their presence in these grasslands with sparse distribution are *Albizia procera*, *Bombax ceiba*, *Bischoffia javanica*, *Butea monosperma*, *Syzygium sericeoides*, etc., whereas in riverain alluvium *Dalbergia sissoo* predominates in such grass cover. The high level Savannahs are mostly formed in well drained submontane soil where *Narenga porphyrocoma* is a dominating species. Other commonly growing grasses in these forests include *Arundinella decempedalis*, *Eulalia fastigiata*, *Imperata cylindrica*, *Cymbopogon nardus* and *Saccharum arundinaceum*. Excessive silt deposition by riverine action renders the high savannah forests a congenial ground to develop deciduous forests in succession after the grass cover is burnt by forest fire. In such areas *Shorea robusta* becomes the dominant component along with other plants like *Dillenia pentagyna*, *Wrightia tomentosa*, *Sterculia villosa*, *Terminalia crenulata* and a number of fire resistant species like *Careya arborea*, *Callicarpa arborea*, *Macaranga denticulata*, *Gmelina arborea*, *Lagerstrœmia parviflora*, *Terminalia bellirica*, *Litsea polyantha*, *Toona ciliata* etc. which gradually invade the grassland to enrich the composition of the deciduous forests mixing with the dominating *Shorea robusta*.

Due to very high moisture content of the soil in the submontane plains the deciduous forests are gradually replaced by lofty trees of evergreen mixed forests with dense vegetational coverage. The common trees of notable dimensions include : *Aphanamixis semiserrata*, *A. spectabilis*, *Actionodaphne obovata*, *A. angustifolia*, *Cinnamomum obtusifolium*, *C. cecicodaphne*, *Chisocheton paniculatus*, *Chukrasia tabularis*, *Cryptocarya amygdalina*, *C. floribunda*, *C. griffithiana*, *Dysoxylum binectiferum*, *D. hamiltonii*, *D. procerum*, *Casearia kurzii*, *Elaeocarpus robustus*, *E. varunna*, *Elaeodendron glaucum*, *Ehretia acuminata*, *Kurrimia pulcherrima*, *Lophopetalum fimbriatum*, *Meliosma pinnata*, *Litsea sepifera*, *L. citrata*, *Phoebe lanceolata*, *Pithecellobium angulatum*, *Polyalthia simiarum*, *Pygeum acuminatum*, *Kuema longifolia*, *Sarcopetalum longiflorum*, *Symplocos spicata*, *S. caudata*, *S. ramosissima*, *Tetrameles nudiflora*, *Vatica lancifolia*, *Vitex heterophylla*, *Walsura tabulata* and others. A number of shrubby species are also visible in the undergrowth of this forest and are represented by *Phlogacanthus thyrsoiflorus*, *Morinda angustifolia*, *Casearia vareca*, *Micrometum pubescens*, *Coffea bengalensis*, *Clerodendrum serratum*, *C. viscosum*, different species of *Leea*, *Ixora*, *Desmodium* and *Phyllanthus* with

flourishing growth of ferns. All these enrich the forest floor with dense greenery. Some of the extensively growing climbing shrubs like *Mucuna macrocarpa*, *Mezoneurum cuculiatum*, *Millettia auriculata*, *Croton caudatus*, *Spathobolus roxburghii* and several others belonging to genera like *Cissus*, *Ampelocissus*, *Smilax* and *Dioscorea* jointly make the canopy almost impenetrable for the sunlight.

On the submontane gentle slopes a special type of vegetation dominated by the members of Convolvulaceae has been recognised by Cowan (1929) which he termed as "Convolvulus mictim" and this was also noticed by Gamble (*l.c.* 1895) which he called as greater jungle. In this vegetational layout large trees like *Michelia champaca*, *Amoora wallichii*, and *Duabanga grandiflora* and the magnificent *Acrocaupus fraxinifolius* and few others grow wide apart. Herbaceous or subwoody climbers entangling beneath such lofty trees include species of *Argyreia*, *Ipomoea*, *Porana*, *Rivea*, *Dioscorea*, *Millettia*, *Smilax*, *Paederia* and others. These are now being contested by the menacing *Mikania cordata* which is gradually spreading in overwhelming rapidity to encroach the trees and shrubs of all dimensions in these open forest-land. A number of climbing shrubs and notable shrubs and trees of low height in such vegetation include *Holmskioldia sanguinea*, *Capparis zeylanica*, *Dalbergia stipulacea*, *Ziziphus apetala*, *Munromia wallichii*, *Melastoma malabathricum*, *Premna mucronata*, *Trema orientalis*, *Callicarpa arborea* and different species of *Glochidion* and *Bridelia*. Due to several congenial factors the low trees grow in profusion but are short lived and easily give place for the large and long lived magnificent trees to replace them in course of time. In wet undisturbed areas of the aforesaid vegetation different species of *Aroids*, *Musa*, *Pandanus* and extensively growing *Calamus guruba* and *C. tenuis* give a typical coverage on the ground where *Asplenium esculentum* is found to be a pre-dominating fern. But due to more economic and commercial forest development programmes, such lands are often being utilised now for plantation of Teak and Sal. Otherwise the stability of the natural adventive forest is reported to be controlled by the aggressiveness of the infesting climbers.

The evergreen types of forests in the north-eastern part of Jalpaiguri district are having rattan brakes as a conspicuous vegetational set up, specially in swampy situation, which is also not uncommon in Darjeeling and the well represented species are *Calamus inermis*, *C. jagglam*, *C. leptospadix*, *C. guruba* and *C. tenuis*. A comparatively stouter plant of the same group of canes viz. *Daemonorops jenkinsianus* is also common in such forests. In some of the moist localities a graceful palm *Pinanga gracilis* is not uncommon and presents elegant patches in the forest. Few wild palms also found to be growing in the district are *Caryota urens* and *Phoenix sylvestris*, while *Areca catechu* is extensively planted in villages and towns. Among the wild species of bamboos *Dendrocalamus bassiltonii* is very common and others growing in the forest include *Cephalostachyum capitatum*, *Pseudostachyum polymorphum*, *Bambusa*

pallida, *B. tulda* and *B. vulgaris*. Groves of bamboos commonly found around villages include *Bambusa balcooa*, *B. tulda* and *B. vulgaris*. Apart from the general aspect of wild forest vegetation of North Bengal specially that of Jalpaiguri district the cultivated fruit trees and others represent almost the same characteristics as it is found in almost all the plain districts of West Bengal. Also the weeds and aquatic vegetation in both Jalpaiguri and Coochbehar together with herbaceous and shrubby elements including crop cultivation show the same feature of the other plain districts.

However, the more important aspect of North Bengal vegetation may be attributed to the tea gardens. These gardens occupy a major area of Jalpaiguri district and about 1,33,696.5 acres are under tea plantation. Tall trees of different species of *Albizia* are scatteredly planted in order to provide partial shade to the tea plantation gardens to avoid direct heat of the sun to the tea crop. Trees most commonly used for such purpose are *Albizia chinensis*, *A. procera*, *A. lebbeck*, *A. moluccana* and *Dalbergia assamica*. *Crotalaria amagyroides*, an exotic shrubby legume, is often grown to enrich the soil of tea gardens. *Tephrosia candida* and *Cajanus cajan* are also planted in tea gardens for mini lac purpose. In order to produce varnish oil, two species of *Aleurites* viz. *A. fordii* and *A. montana* are also grown in some of the gardens along the margin of the roads.

1.6.3: Vegetational Outline of West Bengal Plains : The main landmass of West Bengal plains (excluding the northern Himalayan and Sub-Himalayan tract and the drier projections of the Bihar plateau in the western boundary) and the southern estuarian forest of the Sundarbans is derived from the Gangetic Delta and alluvial deposits of the tributaries of the Ganga and the Brahmaputra where cultivated lands dotted with villages having varieties of plantations form the main feature of the vegetation. With improved methods of agriculture and irrigation the fields of late are producing rice almost throughout the year and other crops and vegetables render the plains with soothing greenery. Wheat, sugarcane, jute and pulses are also some of the important products of agriculture which take part in the layout of vegetation in much lesser area of this plain. In recent years several district floras and floristic accounts (*vide* Chapter 1:5) have contributed significant knowledge about the vegetation of this plain area in critical details. Different aspects of this vegetation and the constituent elements in the vegetation and their controlling factors are narrated hereunder.

Influence of biotic factors on vegetation : The villages being distributed throughout plains in the state, vegetation is greatly influenced in selecting crops and other plants to cater the necessity of the rural life. As such the vegetation fails to come up in its natural course. Many plants grown for meeting the needs of the villagers are sometimes naturalized or running wild. Even the crops are rotated at intervals with plants of very different characters to fulfil the choice and interest of the local people. In the cultivated fields the undesirable weeds are removed or normal thickets coming up along roadside, canal banks, railway tracks are drastically weeded in summer when they flourish with the onset of

rains, resulting in loss of such natural vegetation. The fate of vast marshy lands or aquatic bodies are under threat of extinction with their conversion for habitation. The impact of huge migrating population since independence has also been very drastic to alter the original state of vegetation in the plains of West Bengal. At the same time plants of very different types have been selected for introduction to suit the requirements, thus the normal vegetational set up has been remarkably changed. In this respect specially the Coconut (*Cocos nucifera*) has taken a dominant role in changing the rural vegetation, specially in the southern part of the state since the middle of this century.

Vegetational change due to seasonal variation : In comparison to the biotic influence the seasonal changes are rather more widespread and act as natural factors in manifestation of vegetational composition. This is caused through a marked change of climatic and edaphic factors in the sustaining soil and local conditions, influenced by light, temperature and water. A combination of such binding climatic and edaphic factors play a distinct role for facilitating a particular group of plants to come up and flourish. Thus the plants of summer and winter are distinguished to suit their advantageous growing season to complete their growth and life cycle. Though summer heat appears to be rather high for the plant life in southern West Bengal but practically it is the most vital season for tropical species to rejuvenate with availability of water in the supporting soil. When the summer is followed by rains in quick succession all the nooks and corners of the plain abound in green carpet of herbaceous species. At the same time many seasonal plants are forced to survive under adverse condition but as soon as the climate changes in favour, they revive to start for a new life. Though the rainy season is most suitable condition for majority of the tropical species in the plains, sometimes irrigational water also help a number of uncommon species to grow in profusion.

In addition to trees and shrubby elements, a number of common plants generally take a prominent role to provide a green cover with grasses or other herbaceous species throughout the plain areas of the state. Though rainy season provides most ideal condition in favour of their existence yet many such plants are found to come up extensively in different habitats. Some of the well represented species of this category are : *Achyranthes aspera*, *Alternanthera sessilis*, *Blumea lacera*, *Boerhavia repens*, *Cynodon dactylon*, *Cyperus rotundus*, *Eclipta prostrata*, *Eleusine indica*, *Eragrostis tenella*, *E. diarrhena*, *Euphorbia hirta*, *E. microphylla*, *Glinus lotoides*, *Hemigraphis hirta*, *Hygrophila difformis*, *Oxalis corniculata*, *Parthenium hysterophorus*, *Phyla nodiflora*, *Sporobolus tremulus*, *Tridax procumbens*, *Vernonia cinerea* and many others.

Vegetation of rainy season : With the onset of monsoon the whole plain gives a lushgreen appearance in which plants of all categories take part with vigorous growth and new foliage. In low lying areas *Xanthium indicum* gives a dense coverage just after the first shower and start growing fast. The thickets of *Ipomoea carnea* ssp. *fistulosa* struggling for water in similar situation takes a

new shape with profusion of leaves and lilac flowers. Before the puddles, ponds and low-lying areas accumulate water most of the semi-dry basins are found to be covered with common aquatics like *Eichhornia crassipes*, *Jussiaea repens*, *Alternanthera philoxeroides* whereas in the margins *Polygonum hydropiper*, *P. barbatum*, *P. orientale* make dense patches. Many other hydrophytic members which remain dormant in the drying soil completely cover the surface of the water when such localities receive more water. Along with grasses and sedges most successful members of aquatic deposits are the Aroids specially the *Colocasia esculenta*. In comparatively elevated grounds many subwoody species start coming up soon after a few showers of rains. Some of the common species in such areas are *Acalypha indica*, *Croton bonplandianum*, *Cassia tora*, *Parthenium hysterophorus*, *Chrozophora taitleri*. Members of the families of Poaceae and Cyperaceae appear in profusion both in low-lying and elevated situations and most congenial localities are cultivated lands and their marginal grounds. Some of the common species are *Imperata cylindrica*, *Chrysopogon aciculatus*, *Eleusine indica*, *Paspalidium flavidum*, *Saccharum spontaneum*, *Cynodon dactylon*, *Cyperus rotundus*, *Fimbristylis dichotoma*, *Schoenoplectus articulatus* and several others. A number of shrubby members abounding alongside roads, railway tracks, village outskirts, canal banks and fruit orchards are : *Lantana camara* var. *aculeata*, *Calotropis gigantea*, *Chromolaena odorata*, *Glycosmis arborea*, *Clerodendrum viscosum*, *Cassia angustifolia*, *Solanum torvum*, *S. sisymbriifolium*, and many others. Other flourishing herbaceous species of monsoon season may be named as : *Alternanthera paronychioides*, *Anaranthus viridis*, *A. spinosus*, *Cayratia trifolia*, *Chloris barbata*, *Cleome viscosa*, *Cyperus iria*, *Achyranthes aspera*, *Alocasia formicata*, *Amorphophallus bulbifer*, *A. campanulatus*, *Argemone mexicana*, *Borreria articularis*, *Cardiospermum halicacabum*, *Cassia occidentalis*, *Chenopodium ambrosioides*, *Clitoria ternatea*, *Coccinea cordifolia*, *Commelina benghalensis*, *Corchorus aestuans*, *Crimon asiaticum*, *C. defixum*, *Crotalaria pullida*, *Cryptolepis buchanani*, *Curculigo archioides*, *Cyperus compressus*, *C. distans*, *C. iria*, *C. triceps*, *Datura metel*, *Deutella repens*, *Desmodium triflorum*, *Digitaria adscendens*, *Dioscorea bulbifera*, *D. esculenta*, *D. hispida*, *D. pentaphylla*, *Dipteracanthus prostratus*, *Chromolaena odorata*, *Euphorbia serpens*, *E. thymifolia*, *Fimbristylis ovata*, *F. polytrichoides*, *Hibiscus vitifolius*, *Ipomoea cairica*, *I. mauritiana*, *I. obscura*, *I. pestigridis*, *Kyllinga nemokalix*, *Laportea interrupta*, *Leptochloa panicea*, *Lindernia crustacea*, *Lindenbergia indica*, *Murdannia nudiflora*, *Passiflora foetida*, *P. subrosa*, *Pergularia daemia*, *Phaseolus trilobatus*, *Phyllanthus amarus*, *P. fraternus*, *Pilea microphylla*, *Polygala arvensis*, *Portulaca oleracea*, *P. quadrifida*, *Pouzolzia indica*, *Scoparia dulcis*, *Solanum surattense*, *Tephrosia purpurea*, *Tragia hispida*, *Trichosanthes anguinea*, *Typha angustata*, *Typhonium trilobatum*, *Urochloa panicoides*, *Trianthema portulacastrum* and many others.

A sudden downpour during the onset of summer help in the sprouting of a number of quick growing herbaceous members like *Acalypha indica*, *Cleome viscosa*, *Deutella repens*, *Enilia sanchifolia*, *Evolvulus nummularius*,

Fimbristylis barbata, *Phyllanthus amarus*, *Portulaca oleracea*, *P. quadrifida*, *Salanum nigrum*, *Synedrella nudiflora*, *Trianthema portulacastrum* and few others. With the availability of favourable conditions these can survive for a long period but dry up if sunny days prolong.

Post monsoon vegetation : Most of the flowering plants of the summer and rainy season complete their optimum vegetative growth and flowering and fruiting with the approach of autumn in West Bengal but continue to survive to contribute also to a major vegetational cover till the middle of November. As such, excepting a set of some typical winter elements, the plants of the cold months are practically a mixture of species of both the seasons. They occur almost in the same areas in the village surrounding, along roadsides, railway tracks, fallow lands along with the typical plain plants of winter season. Due to excessive rains in the catchment areas, the major rivers bring sudden floods and inundate a number of districts in the north as well as in central districts along the Bhagirathi basin thereby resulting in premature death of many plants of temporary helophytic vegetation. While this water starts receding, the members of Cyperaceae again gets an ideal condition to flourish for some time but are dominated by the members of dicots belonging to the genera like *Ipomoea* and *Polygonum*. Many aquatic flowering species of *Nymphaea* and *Nelumbo* present pleasing landscapes with showy flowers in undisturbed water bodies, whereas *Eichhornia crassipes*, *Monachoria hastata*, *Alisma plantago*, gives hues of blue and white with their bunches of flowering inflorescences. On both sides of railway tracks and highways the vegetational features of adventive weeds and shrubby components include a number of widely distributed species like *Lantana camara* var. *aculeata*, *Chromolaena odorata*, several species of *Cassia*, *Cestrum diurnum*, *Carissa ophaca*, *Calotropis gigantea*, *Jatropha gossypifolia*. In the aquatic habitats *Nymphaea nouchali*, *Ipomoea aquatica*, *Nymphoides cristatum*, *Nelumbo nucifera*, are widespread in the State along with cultivated *Trapa bispinosa* and members of Aponogetonaceae and Hydrocharitaceae bearing white or pinkish white spikes projecting above water. The nature of aquatic vegetation of the plains has been elaborately dealt with separately to cover many other species.

Some of the typical plants indicative of seasonal change as winter plants are found to appear in waste places, along roadsides and cultivated fields and complete their life cycle generally during the cold season. A few plants of this category are: *Amischophacelus axillaris*, *Anagallis arvensis*, *Andrographis paniculata*, *Argemone mexicana*, *Bergia annuanioides*, *Biophytum sensitivum*, *Blumea mollis*, *Commelina benghalensis*, *Crotalaria spectabilis*, *Drosera burmanni*, *D. indica*, *Fissendocarpa linifolia*, *Fumaria indica*, *G. polycanthon*, *Hedyotis pumila*, *H. corymbosa*, *Hydrolea zeylanica*, *Launnea asplenifolia*, *Lindenbergia indica* (on walls), *Medicago lupulina*, *Melilotus alba*, *M. indica*, *Murdannia spiralis*, *Oxalis corniculata*, *Phyllanthus urinaria*, *Rotala densiflora*, *Rumex dentatus*, *Sonchus asper*, *S. brachyotus*, *S. oleraceus*, *Veriveria zizanioides* and many others.

After their flourishing growth during rainy season a number of typical plants of summer prolong their existence in winter and contribute a major part of vegetation till the middle of cold months or even up to the approach of next summer depending upon the availability of moisture in the ground. A sizable number of species belonging to this kind of plants in winter season are : *Aerva lanata*, *Alysicarpus monilifer*, *Bacopa monnieri*, *Blumea lacera*, *B. laciniata*, *Brachiaria ramosa*, *Cardiospermum helicacabum*, *Cassia sophera*, *Centella asiatica*, *Centipeda minima*, *Chenopodium ambrosioides*, *Coldenia procumbens*, *Commelina diffusa*, *C. longifolia*, *Cyperus michelianus* var. *pygmaeus*, *Digitaria adscendens*, *Echinochloa colomum*, *Eragrostis diarrhena*, *E. tenella*, *Erigeron asteroides*, *Eriochloa procera*, *Chromolaena odorata*, *Fimbristylis aestivalis*, *Gomphrena serrata*, *Gruisea maderaspatana*, *Heliotropium indicum*, *H. ovalifolium*, *Hemigraphis hirta*, *Hygrophila polysperma*, *Leonurus sibiricus*, *Leucas lavendulaefolia*, *L. aspera*, *Malvastrum coromandelianum*, *Nelsonia canescens*, *Paspaladium flavidum*, *Pentstemon capensis*, *Peristrophe bicalyculata*, *Polygonum plebejum*, *Rorippa indica*, *Rungia pectinata*, *Sessile diffusum*, *Setaria intermedia*, *Sida rhombifolia*, *Sporobolus tremulus*, *Tephrosia purpurea*, *Tridax procumbens*, *Turnera ulmifolia*, *Wedelia chinensis*, *Xanthium indicum* and others.

Vegetational Strata : With continuous expansion of human habitation in the plains of the State, the nature of vegetation is changing fast. Though the vegetation is of open type both in the villages and in urbanised localities yet in absence of protection of habitat in large cities the members of herbaceous elements are very much reduced. In this regard the rural areas and undisturbed lands alongside highways, railways, canal banks, burial grounds etc. offer better situations for the appearance of different strata of vegetation. In general the vegetational components of the latter can be divided into three following strata as has been preferred by Bennett (l.c.) (a) *Tree Stratum* (Top layer), (b) *Shrub Stratum* (Middle layer), (c) *Herb Stratum* (Lowest layer).

(a) *Tree Stratum* : In this stratum the trees are generally exotic and planted as avenue trees, garden materials or stray components in various localities. Many of such trees with self-sowing capacities spread automatically and come up through human protection or by chance if biotic factors are not much operative. In this respect two adventives viz., *Ficus hispida* and *Trema orientalis* need special mention due to their profusion and surprising success in invading any fallow land in city metropolis of the State. It may also be interesting to note that in the villages of the plains the cultivation of different species of Bamboos specially *Bambusa tulda*, *B. balcooa* and *B. vulgaris* is a constant feature of tree stratum along with some of the common trees like *Syzygium cumini*, *Tamarindus indica*, *Artocarpus heterophyllus*, *Ficus religiosa*, *Ficus benghalensis*, *Azadirachta indica*, *Mungifera indica* etc. The general tree stratum comprising various useful purposes or growing uncared throughout the plains are : *Acacia nilotica* ssp. *indica*, *Acacia auriculiformis*, *Aegle marmelos*, *Alangium salvifolium*, *Albizia lebbek*, *Alstonia scholaris*, *Anacardium occidentale*, *Anonu*

reticulata, *A. squamosa*, *Anthocephalus chinensis*, *Aphanamysis polystachya*, *Areca catechu*, *Artocarpus heterophyllus*, *A. lakoocha*, *Azadirachta indica*, *Bambusa tulda*, *B. vulgaris*, *Barringtonia acutangula*, *Bombax ceiba*, *Borassus flabellifer*, *Butea monosperma*, *Carica papaya*, *Casuarina tomentosa*, *Cassia fistula*, *C. siamea*, *Casuarina equisetifolia*, *Cocos nucifera*, *Cordia obliqua*, *Dalbergia lanceolaria*, *D. sissoo*, *Derris indica*, *Dillenia indica*, *Diospyros malabarica*, *D. peregrina*, *Drypetes roxburghii*, *Erioglossum rubiginosum*, *Erythrina variegata*, *Eucalyptus citriodora*, *E. rostrata*, *E. tereticornis*, *E. viminalis*, *Euphoria longana*, *Excoecaria agalocha*, *Ficus benghalensis*, *F. hispida*, *F. infectoria*, *F. religiosa*, *F. rumphii*, *Garuga pinnata*, *Grewia subinaequalis*, *Guazuma ulmifolia*, *Hibiscus tiliaceus*, *Holarrhena pubescens*, *Lagerstroemia speciosa*, *Lanea coromandelica*, *Leucaena latifolia*, *Limonia acidissima*, *Litchi chinensis*, *Litsea glutinosa*, *Livistona australis*, *L. chinensis*, *Mangifera indica*, *Melia azedarach*, *Michelia champaca*, *Millingtonia hortensis*, *Mimusops elengi*, *Mitragyna parvifolia*, *Morinda bracteata*, *M. citrifolia*, *Moringa oleifera*, *Murraya koenigii*, *M. paniculata*, *Nyctanthes arbor-tristis*, *Oroxylum indicum*, *Phoenix sylvestris*, *Pithecellobium dulce*, *Polyalthia longifolia* and its var. *pendula*, *Premna corymbosa*, *Psidium guajava*, *Punica granatum*, *Samanea saman*, *Sapium indicum*, *S. sebiferum*, *Sesbania grandiflora*, *Spathodea campanulata*, *Spondias pinnata*, *Streblus asper*, *Sterculia foetida*, *Syzygium cumini*, *S. samarangense*; *Tamarindus indica*, *Thespesia populnea*, *Toona ciliata*, *Trema orientalis*, *Trewia nudiflora*, *Ziziphus mauritiana* and many others.

(b) *Shrub Stratum* : Multitude of habitats specially along highways, railway tracks, fallow lands and village outskirts have provided a sizable number of shrubby species along with large number of ornamentals which are grown in recent years within private gardens and parks. A good deal of shrubby elements are also good materials for providing ornamental or protecting hedge. Some of the typical species often utilised for the purpose of fencing are: *Acalypha hispida*, *Allophyllus serratus*, *Cereus hexagonus*, *Barleria prionitis*, *Clerodendrum inerme*, *Duranta repens*, *Erythrina variegata*, *Euphorbia antiquorum*, *E. tirucalli*, *Jatropha curcas*, *J. tanjorensis*, *Lawsonia inermis*, *Lantana camara* var. *aculeata*, *Pandanus foetidus*, *Pithecellobium dulce*, *Pedilanthus pithymaloides*, *Pluchea indica* and few others.

The common species constituting shrubby stratum of vegetation in the plains of the State apart from those mentioned above are : *Acacia farnesiana*, *Acacia nilotica* ssp. *indica*, *Acanthus ilicifolius*, *Allophyllus serratus*, *A. triphyllus*, *Azima tetraacantha*, *Baliospermum montanum*, *Barleria cristata*, *Bauhinia acuminata*, *Breynia rhamnoides*, *Calotropis gigantea*, *Capsicum frutescens*, *Carissa carandus*, *Cassia sophera*, *Clerodendrum fragrans*, *C. indicum*, *C. viscosum*, *Codeium variegatum*, *Cordia obliqua*, *Desmodium gangeticum*, *Datura metel*, *Duranta repens*, *Euphorbia antiquorum*, *E. tirucalli*, *Excoecaria bicolor*, *Ficus heterophylla*, *Flacourtia indica*, *Glycosmis arborea*, *Hibiscus*

rosa-sinensis, *H. mutabilis*, *Holarrhena pubescens*, *Ixora coccinea*, *I. undulata*, *Jatropha gossypifolia*, *J. pendurifolia*, *Justicia adhatoda*, *J. gendarussa*, *Kirganalia reticulata*, *Lantana camara* var. *aculeata*, *Leea aspera*, *Leucaena latisiliqua*, *Lippia javanica*, *Mallotus repandus*, *Meyna spinosa*, *Mimosa rubicaulis*, *Morinda bracteata*, *M. citrifolia*, *Murraya koenigii*, *M. paniculata*, *Nerium indicum*, *Ocimum gratissimum*, *O. sanctum*, *Opuntia dilleani*, *O. vulgaris*, *Pavetta indica*, *Polyalthia suberosa*, *Premna corymbosa*, *Rauvolfia serpentina*, *R. tetraphylla*, *Ricinus communis*, *Securinega virosa*, *Solanum sisymbriifolium*, *S. torvum*, *S. viarum*, *Tabernaemontana divaricata*, *Thevetia peruviana*, *Weddlia biflora*, *Vitex negundo*, *Ziziphus uenoplia* and many others.

(c) *Herb Stratum* : Herbaceous elements constitute a major part of the flora in the Herb Stratum in respect of coverage on the land and water surface of the plains and cultivated fields along with crops, pulses, oil seeds, spices and medicinal plants contributing for green coverage in largest areas. The crops in general include *Oryza sativa*, *Triticum aestivum*, *Zea maize*, *Saccharum officinarum*, while fibre yielding plants are mostly two species of *Corchorus* viz. *C. olitorius* and *C. capsularis*. Pulses and oil seed plants occupy limited areas in comparison to the crops and fibre plants, however, *Brassica nigra*, *Helianthus annuus*, *Arachis hypogea* produce oils and *Cicer arietinum*, *Pisum sativum*, *Lens culineris* are pulse producing species grown in very limited areas.

Herbs due to their distinctive habits can be isolated under three types of plants viz., (Bennett *l.c.*) - (i) *The prostrate species forming the mat vegetation*, (ii) *Diffuse to erect herbs*, (iii) *The undershrubs*.

(i) The common plants of mat vegetation are : *Alternanthera sessilis*, *A. patroychioides*, *Bacopa nanuicri*, *Centipeda minima*, *Chrysopogon aciculatus*, *Coldenia procumbens*, *Commelina benghalensis*, *Cynodon dactylon*, *Dentella repens*, *Desmodium triflorum*, *Eriochloa proceru*, *Euphorbia serpens*, *E. thymifolia*, *Evolvulus nummularius*, *Glinus lotoides*, *Grangea maderaspatana*, *Gomphrena celosioides*, *Heliotropium strigosum*, *Justicia Japponica*, *Mazus rugosus*, *Oplismenus burmannii*, *Oxalis corniculata*, *Phyla nodiflora*, *Polycarpon prostratum*, *Polygonum plebejum*, *Portulaca quadrifida*, *Rangia repens*, *Sessile diffusum*, *Sphaeranthus indicus*, *Sporobolus tremulus*, *Trianthema portulacastrum* and several others.

(ii) Some of the common diffuse to erect herbs are : *Acalypha indica*, *Achyranthes aspera*, *Ageratum conyzoides*, *Alocasia fornicata*, *Amaranthus spinosus*, *A. tenuifolius*, *A. viridis*, *Blumea lavera*, *B. laciniata*, *B. mollis*, *B. oxydonta*, *Borreria articularis*, *Canscora decussata*, *Catharanthus roseus*, *Canscora diffusa*, *Centaurium roxburghii*, *Chrozophora rotleri*, *Cleome gynandra*, *C. rutidosperma* (limited mostly within S. 24-Parganas), *C. viscosa*, *Colocasia esculenta*, *Commelina longifolia*, *C. peludosa*, *Corchorus aestivus*, *Crotalaria muricata*, *Croton hooplandianum*, *Curculigo orchoides*, *Digera*

muricata, *Dipteracanthus dejectus*, *Elephantopus scabar*, *Euphorbia hirta*, *Heliotropium indicum*, *H. ovalifolium*, *Imperata cylindrica*, *Leucas aspera*, *Leonurus sibiricus*, *Lobelia alsinoides*, *Malachra capitata*, *Melilotus alba*, *M. indica*, *Murdannia nudiflora*, *Nicotiana plumbaginifolia*, *Peperomia pellucida*, *Parthenium hysterophorus*, *Phaulopsis imbricata*, *Phyllanthus amarus*, *P. virgatus*, *Physalis minima*, *Polygala arvensis*, *Polygonum hydropiper*, *P. minus*, *Portulaca oleracea*, *Psoralea corylifolia*, *Scoparia dulcis*, *Solanum nigrum*, *Sonchus brachyotus*, *S. oleraceus*, *Synedrella nodiflora*, *Tridax procumbens*, *Typhonium flagelliforme*, *T. trilobatum* and others belonging to Cyperaceae and Gramineae.

(iii) Along with the herbaceous species of the aforesaid type a number of subwoody perennial or bi-annual herbs constitute an interesting vegetational component in the Herbs Stratum represented by common species like *Abutilon hirtum*, *A. indicum*, *Aerva lanata*, *A. sanguinolenta*, *Anisomeles indica*, *Cassia occidentalis*, *C. sophora*, *C. tora*, *Hibiscus vitifolius*, *Jatropha gossypifolia*, *Malvastrum coromandelianum*, *Mimosa pudica*, *Sida acuta*, *S. cordifolia*, *S. rhomboidea*, *Solanum indicum*, *S. torvum*, *S. trilobatum*, *Tephrosia purpurea*, *Triumfetta rhomboidea*, *Urena lobata*, *U. sinuata* and many others.

(d) *Climbers and Twiners* : Climbers and twiners are important part of vegetation in the plains of W. Bengal growing with various devices like hooks, tendrils, prickles, which are helpful for their climbing habit and growing over other plants or reaching to desired height or direction. Some of the families like Cucurbitaceae, Passifloraceae, Vitaceae, Cuscutaceae, have all the species climbing with the help of tendrils, some genera under Convolvulaceae, Asclepiadaceae and Apocynaceae being twinners are easily recognisable by their habit. Climbers and twiners have representative species in all the vegetational strata and some of the common species distributed in the plains of W. Bengal are : *Abrus precatorius*, *Aganosma caryophyllata*, *Ampelocissus latifolia*, *Antigonon leptopus*, *Argyreia nervosa*, *Aristolochia indica*, *Bougainvillea spectabilis*, *B. glabra*, *Caesalpinia bonduc*, *C. crista*, *Canavalia cathartica*, *Capparis sepiarea*, *C. zeylanica*, *Cardiospermum halicacabum*, *Cayratia pedata*, *C. trifolia*, *Cissampelos parieri*, *Cissus adnata*, *C. quadrangularis*, *Clerodendrum splendens*, *Clitoria ternatea*, *Coccinea grandis*, *Cocculus hirsutus*, *Cryptolepis buchmanii*, *Cucurbita maxima*, *Derris scandens*, *D. trifoliata*, *Dioscorea bulbifera*, *D. esculenta*, *D. glabra*, *D. hispida*, *D. pentaphylla*, *Diptocyclos palmata*, *Dregea volubilis*, *Flagellaria indica*, *Gloriosa superba*, *Gouania tiliaefolia*, *Hemidesmus indicus*, *Ichnocarpus frutescens*, *Ipomoea cairica*, *I. mauritiana*, *I. nil*, *I. obscura*, *I. palmata*, *I. sepiaria*, *Jasminum sambac*, *J. acuminatum*, *Lagenaria ciceraria*, *Luffa aegyptiaca*, *L. acutangula*, *Melothria maderaspatana*, *Merremia hederacea*, *Mikania micrantha*, *Momordica charantia*, *M. cochinchinensis*, *Operculina turpethum*, *Passiflora foetida*, *P. suberosa*, *Pentatropis capensis*, *Pergularia daenia*, *P.*

pallida, *Porana paniculata*, *Quamoclit coccinea*, *Quisqualis indica*, *Sarcolobus carinatus*, *Sarcostemma secumone*, *Smitax perfoliata*, *S. zeylanica*, *Stephania japonica*, *Stictocardia tillifolia*, *Teramnus mollis*, *Thunbergia grandiflora*, *Tiliacora acuminata*, *Tinospora cordifolia*, *Tytophoru indica*, *Trichosanthes anguinea*, *T. bracteata*, *T. cucumerina*, *T. dioica*, *Ziziphus oenoplia* and many others.

In addition to the list of plants added to represent a general profile of the vegetational composition of the plains of W. Bengal, there are hundreds of species distributed in the area in different categories. Specially the number of horticultural species which have become a permanent entity of the flora need proper mention for general awareness and will be suitably noted while describing such species in the text. Apart from those mentioned above some characteristic plants which draw special attention are the parasites, epiphytes, saprophytes, insectivorous plants and rare, threatened and endangered species.

A few representative species of aforesaid categories may be named as :

Parasitic plants : *Cassytha filiformis*, *Cuscuta reflexa*, *C. chinense*, *Dendrophthoe falcata*, *Loranthus philippensis*, *Macrosolan capitellatus*, *M. cochinchinensis*, *Viscum album*, *V. orientale*.

Epiphytic species : *Hoya parasitica*, *Dischidia benghalensis*, *D. nummularia*, *Aerides multiflorum*, *Rhynchostylis retusa*, *Vanda tessellata*.

Saprophytic species : *Aeginetia indica*, *Didymoplexis pallens*.

Insectivorous species : *Drosera indica*, *D. burmanni*, *Aldrovanda vesiculosa*, *Utricularia stellaris*, *U. flexuosa*, *U. exoleta*.

1.6.4: Vegetation of the Western Periphery of W. Bengal : Due to extension of the floristically rich hilly plateau of Bihar and Orissa along the western boundary of W. Bengal, the vegetation in these areas of the bordering districts viz. Birbhum, Burdwan, Bankura, Purulia and Midnapur represents a distinct type of flora related to the adjoining drier areas of the two States. Moreover, the undulated stretch of submontane topography drained by the rivers from western origin has provided congenial areas with rich laterite for the distribution and establishment of plants uncommon for the Lower Ganga Plain. Many species of Peninsular and Terai Himalayan distribution occurring in this strip have rendered the vegetation quite interesting for studying the phytomigratory influence on the distribution of species in the marginal areas. The eastern and south-eastern part of land of the districts with a gentle slope have gradually merged in the Gangetic Plain of alluvium and here the flora is similar to the plain of West Bengal.

Excepting a few heavy showers during the monsoon these bordering districts specially in Burdwan division are considerably drier and hot spell of summer with high temperature has allowed in the development of only one kind of forest

under Tropical Sub-humid Deciduous type dominated by *Shorea robusta* (Sal). But continuous biotic influences have considerably changed its character at different places in this border area, and quality and density of such forests are very different than what these were in the past. Continuity of these forests in this stretch has been broken by the rivers and topographical features and finally by human interference. These are generally in patches and unlike the sub-Himalayan belt, the forests are considerably degraded due to massive industrialisation and mining operation as well as arid climatic condition of the belt.

The projections of Bihar plateau being more exposed in the districts of Purulia and Bankura, the forests occupy more areas than in those parts in other districts in the border. Thick patches are also visible in Midnapur around Jhargram and Purulia and at the same time mixed type of forests with both deciduous and evergreen species like *Mallotus philippensis*, *Etioglossum rubiginosum*, *Alstonia scholaris*, *Lagerstroemia parviflora*, *Canthium dicoccum* together with deciduous *Terminalia bellirica*, *Holoptelea integrifolia*, *Holarrhena antidysenterica* compose interesting vegetational pockets. Though majority of the species in the mixed forests of *Shorea robusta* have an identical composition of Terai but penetration of some of the typical peninsular elements like *Pterospermum xylocarpum*, *Boswellia serrata* etc. make an assemblage of different regional flora in the peripheral vegetation. In rest of the districts there are signs of considerable depletion of the Sal forests and scrub jungles have appeared at various places specially in the districts of Malda and W. Dinajpur. With complete removal of *Shorea robusta* the invasion of *Madhuca indica* in such land is sometimes a common vegetational feature in Purulia, Bankura and Birbhum districts. The fate of similar Sal forests in Burdwan district is rather very poor due to much exploitation and vast areas with fairly thick forests have been disturbed by massive industrial development and mining operation in Durgapur-Asansol belt and also in other areas including the coal-belt areas. However, remnants of the previous forest are still visible in some restricted pockets around Durgapur and along the Saraswati river basin.

Prain (*l.c.*) in his Bengal Plants, very meticulously included most of the plants of the bordering districts, but a large number of them have been referred to areas now in Bihar. After independence considerable explorations conducted by Maji (*l.c.*), Malik (*l.c.*), Bhattacharyya (1990), Sanyal (1970), Guha (1968), Basak (1977) have provided more critical assessment of the vegetational composition of the border areas and contributed to present botanical knowledge. Mention may be made about a number of species like *Acanipe pruemorsa*, *Desmodium benthamii*, *Drosera indica*, *Hedyotis umbellata*, *Jatropha heynei*, *Mitrasacme pygmaea* var. *malaccansis*, *Rotala verticillaris*, *Rhyncospora longisetis*, *Pseudarthria viscida*, *Sphaeromorphaea russeliana*, *Utricularia minutissima* which have been recorded (Basak 1969, 1977) from Birbhum showing the extension of some of the typical Central and Peninsular Indian species in the

bordering districts. At the same time, several Himalayan species extending through North Bengal and Bihar have been observed from the distribution of *Hypericum japonicum*, *Atylosia volubilis*, *Vallisneria spiralis*, *Uvaria hamiltonii* and others from Birbhum southwards. A number of interesting species of Pteridophytes like *Helminthostachys zeylanica*, *Lygodium japonicum*, *Hemionitis fulva*, *Ophioglossum nudicaule* var. *macrorrhizum*, *Selaginella repanda* etc., make the vegetational set-up very much impressive from botanical point of view as well as show resemblance to the flora of Rajmahal hills of eastern Bihar (Panigrahi 1966). Out of 94 species of plants of aquatic and semi-aquatic distribution in W. Bengal (Deb 1976) as many as 29 species have been recorded only from Purulia district which, however, are common in the Lower Gangetic Plain also. The herbaceous or other woody species in the waste land and marshy and swampy situations of this vegetational zone are enumerated later.

The most characteristic elements of partial arid vegetation associated with the semi-deciduous forests of *Shorea robusta* and also in the hills and isolated pockets of Sal are : *Acacia catechu*, *Aegentia indica*, *Alangium salvifolium*, *Ahizia lebeck*, *Anogeissus latifolia*, *Antidesma acidum*, *Apluda nutica*, *Ardisia solanacea*, *Azadirachta indica*, *Bauhinia vahlii*, *Bombax ceiba*, *Borassus flabellifer*, *Boswellia serrata*, *Breynia vitisidaea*, *Buchanania lanzan*, *Butea monosperma*, *B. superba*, *Carissa carandus*, *C. opaca*, *Cayratia trifolia*, *C. pedata*, *Casuarina elliptica*, *Cassia fistula*, *Celastrus paniculata*, *Cleistanthus collinus*, *Clodendrum viscosum*, *Cochlospermum religiosum*, *Combretum roxburghii*, *Dendrophthoe falcata*, *Dioscorea bulbifera*, *D. hispida*, *Diospyros esculpta*, *Emblica officinalis*, *Erycibe paniculata*, *Eulaliopsis binata*, *Ficus benghalensis*, *F. religiosa*, *F. virens*, *Flacourtia indica*, *Flemingia chappar*, *Gardenia latifolia*, *Garuga pinnata*, *Gloriosa superba*, *Habenaria marginata*, *H. platyphylla*, *Helicteres isora*, *Holarrhena pubescens*, *Holoptilea integrifolia*, *Justicia adhaeda*, *Lannea coromandelica*, *Lantana camara* var. *aculeata*, *Madhua indica*, *Millettia tomentosa*, *M. velutina*, *Naravalia plicata*, *Nyctanthes arbor-tristis*, *Phoenix sylvestris*, *Pothos scandens*, *Sapindus emarginatus*, *Schleichera oleosa*, *Semecarpus anacardium*, *Shorea robusta*, *Smitax zeylanica*, *Solanum surattense*, *Syzygium cumini*, *Tacca leontopetaloides*, *Tamurindus indica*, *Terminalia arjuna*, *T. bellirica*, *T. chebula*, *T. crenulata*, *Trichosanthes tricuspidatus*, *Ventilago denticulata*, *Viscum album*, *Wendlandia exerta*, *Wrightia tomentosa*, *Xylia xylocarpa*, *Ziziphus mauritiana*, *Z. oenophia*, *Z. xylopyrus* and many others.

In addition to the notable species associated with forested lands the elements found in waste lands, grass lands and in the scrub jungle represent a characteristic feature of the flora in these marginal district and some of the plants worth-mentioning in the waste lands are : *Acanthospermum hispidum*, *Achyranthes aspera*, *Aerva lanata*, *Argemone mexicana*, *Calotropis gigantea*, *Croton bonplandianum*, *Datura metel*, *Digitaria sanguinolenta*, *Echinops echinatus*, *Euphorbia hirta*, *Evolvulus alsinoides*, *Ficus hispida*, *Glycosmis mauritiana*, *Jatropha gossypifolia*, *Hyptis suaveolens*, *Leucas cephalotes*,

Martynia annua, *Panicum psilopodium*, *Pennisetum orientale*, *Saccharum spontaneum*, *Scoparia dulcis*, *Strebilus asper*, *Tephrosia purpurea* etc. whereas dominating species in grassland vegetation are *Brachiaria reptans*, *Chrysopogon aciculatus*, *Cyperus niveus*, *Dactyloctenium aegypticum*, *Euphorbia thymifolia*, *Hackelochloa granularis*, *Hybanthus ennaespermus*, *Heteropogon contortus*, *Imperata cylindrica*, *Ischaemum laxum*, *Perotis indica*, *Setaria glauca* and others.

Development of scrub jungle in these bordering districts are mainly found on dry hill-slopes or in mining areas where biotic agencies have been operative either for deforestation or excessive exploitation of fire wood. *Lantana camara* var. *aculeata* has been the most successful invader in such lands and other common species in such areas are : *Acacia nilotica*, *A. torta*, *Caesalpinia bonduc*, *Capparis sepriaria*, *Carissa carandus*, *C. opaca*, *Flacourtia indica*, *Glycosmis mauritiana*, *Ichnocarpus frutescens*, *Rottboelia exaltata*, *Woodfordia fruticosa*, *Ziziphus mauritiana*, *Z. oenoplia*, and a few others.

During the post monsoon period the low lying areas accumulate water for a short period of time and ponds also help in the development of a rich and interesting aquatic vegetation from August to October. Before complete drying up of shallow water logged areas the cultivated fields and other water bodies also take part in sheltering a number of marshy and swampy species and composition of such vegetation is almost the same as in Lower Ganga Plain. Aquatic and marshy plants of different habits include *Alternanthera sessilis*, *Ammannia baccifera*, *Aponogeton natans*, *Azolla pinnata*, *Blyxa octandra*, *Cyperus haspan*, *Eclipta prostrata*, *Eichhornia crassipes*, *Eriocaulon cinereum*, *E. quinquangulare*, *Fimbristylis miliacea*, *Fuirena ciliaris*, *Heliotropium indicum*, *Hydrilla verticillata*, *Hydrolea zeylanica*, *Hygroryza aristata*, *Lemma perpusilla*, *Lindernia parviflora*, *Limnophila sessiliflora*, *Lobelia alsinoides*, *Marsilia minuta*, *Monochoria hastata*, *M. vaginalis*, *Nelumbo nucifera*, *Nymphaea pubescens*, *Nymphoides cristata*, *Ottelia alismoides*, *Nechamandra alternifolia*, *Najas indica*, *Pistia stratiotes*, *Polygonum barbatum*, *P. hydropiper*, *P. plebejum*, *Potamogeton nodosus*, *Rumex dentatus*, *Sagittaria sagittifolia*, *Salvinia natans*, *Schoenoplectus articulatus*, *Scleria levis*, *Spirodella polyrrhiza*, *Trapa natans* var. *bispinosa*, *Typha angustata*, *Vallisneria spiralis*, *Wolfia arrhiza*, and few others.

1.6.5: Vegetation of the Mangrove Forests of the Sundarbans : The most impressive and interesting forest vegetation with which West Bengal has been endowed is the Mangrove vegetation of the Sundarbans. The area of this fascinating forest which the state is retaining at present is only about one-tenth of the gorgeous forest occupying the estuarine creeks and islands of the world's largest delta of erstwhile Bengal. Some of the most ideal conditions have rendered this forest a congenial habitat for harnessing the world fame Royal Bengal Tiger in the littoral forest and a Tiger Reserve has been declared by the Govt. for protecting this rare race in the Sajnakhali Block of the Sundarbans.

The Mangrove Forests of the Sundarbans attracted attention of the pioneer Botanists of the Royal Botanic Garden (Indian Botanic Garden, Howrah) since the early period of 19th. century when Roxburgh with the help of Buchanan Hamilton and William Carey gathered many interesting plants from this locality to include in his well accounted *Hortus Bengalensis* (1814). Subsequent important collections from this area were brought by Griffith and Falconer which enriched the mangrove materials of the Calcutta Herbarium (CAL). Kurz made several collections from the Sundarbans during the period of Anderson and reported the existence of the queen of insectivorous plant, *Aldrovanda vexiculosa* from the saline lakes of this area. Clarke paid special attention to the mangrove flora of the Sundarbans and presented a comprehensive account of this flora in his presidential address at the Linnean Society, London in 1895. Sir George King and Gamble also contributed a few new species to this list. Ellis gathered two interesting species viz., *Kleinhovia hospita* and *Porteresia coarctata* (Roxb.) Tak Coka (*Oryza coarctata* Roxb.) and deposited them to CAL. Brace also worked on the flora of the Sundarbans. A working flora of this wonderful forest was prepared by Heining who made a thorough collection of specimens of the mangrove to facilitate the task of publication of the 'Flora of Sundarbans' by David Prain (1930b). Apart from his rich gatherings Heining also studied about the vegetational cover and different aspects of topography and ecological factors operative in this region.

The wealth of information on various botanical, ecological and forestry aspects have accumulated to a vast extent since independence in 1947. A number of workers Anonymous (1957), S. K. Mukerjee (1960, '66), R. P. Patil (1961), S. K. Choudhury, N. Mallick & J. Sen (1962), A. K. Banerjee (1965), D. N. Guhabakshi & S. Sen (1969), A. K. Mukherjee (1975), C. Blasco (1975), S. Chanda (1977), A. K. Mahapatra & R. K. Chakraverty (1978), B. B. Mukherjee & J. Mukherjee (1978), R. L. Mitra & I. K. Banerjee (1979), K. R. Naskar (1981, 1983, 1984, 1985b), K. R. Naskar & D. N. Guhabakshi (1982, 1983a, 1983b, 1984, 1985) worked and published many papers and books on various aspects of the mangrove forests of the Sundarbans.

The halophytic vegetation in the forests of the Sundarbans of W. Bengal cover large tracts of swampy land in the district of South 24-Parganas and is only a small part of the vast gangetic delta encroached by sea-coast and all the time fringed with muddy salt water, creeks, lagoon and estuaries. Mangrove forests in India has been variously defined by Puri (1960), Rao (1973) and Blasco *et al.* (1975) and the formations have been broadly classified (Aubreville 1970, Blasco 1975) into (1) *Swampy mangrove* situated below the high-tide level and submerged by sea-water, twice in 24 hrs. (2) *Tidal mangrove* submerged only during spring tide and cyclones and exceptionally by tide (Qureshi 1959). The plants in the first type are true mangrove, whereas those in the others correspond to back mangroves mostly dominated by herbaceous plants belonging to the families Chenopodiaceae and Aizoaceae. About 40-50 species have been

included under mangroves in India (Blasco 1975). However, the number mentioned for W. Bengal by Rao & Sastry (1974) is 42 spp. belonging to 32 genera. However, among the typical plants of the mangrove of Sundarbans about 80 species suggested by others are also supposed to be doubtful (Naskar & Guhabakshi). The unique forest developing in such condition is characteristically different in various aspects and covers with dense mass of impenetrable trees of low height having almost a uniform canopy and supported by intricate system of arched aerial roots and pinnacles of numerous pneumatophores. The trees are in most cases gregarious in habit due to their typical mode of fruiting and germination behaviours. These forests are developed only within zone which is flooded daily during high tides. Out of the 50 true mangrove species of the world, Sundarbans alone contain nearly 35 typical species in addition to 28 associated members and 7 obligate mangroves under 29 families and 49 genera. Among those 30 are arborescent and shrubby and herbaceous species are represented by 20 for each. With the continuous process of tidal activity the silting pattern gradually changes to stabilise the soil and in the pace of time the land is transformed to support only the mesophytic vegetation. According to the distribution pattern of mangrove forests and other associated trees, the Sundarbans have been divided under five zones (Naskar & Guhabakshi 1990) and small part of the vast deltaic forest within W. Bengal is the area lying in the West of Raimangal river (Prain 1905). It has been pointed out that salinity in the soil is harmful for growth of larger trees as such the forest in the eastern Sundarbans grow faster than those in the western part because of differential salinity (Basak & Guhabakshi 1977). According to the composition of the forest vegetation the littoral forest has been described under two types viz., (1) Low mangrove type and (2) Salt water-*Heritiera* type. The forests of these kinds are associated with the *char* and flooded areas. Champion and Seth (*l.c.*) recognised the following forest types in the estuarian plain of W. Bengal, viz., (1) Littoral forests on sandy beaches and dunes facing the sea (Type : 4A/LI), (2) Mangrove scrub or Salt water forest (Type : 4B/TS1), (3) Mangrove forests (Type : 4B/TS2), (4) Salt water mixed forest of *Heritiera* (Type : 4B/TS3), (5) Brakish water forest (Type : 4B/TS4) and (6) Palm swamp (Type : 4B/EI). The typical woody genera represented in the mangrove forests of Sundarbans are : *Aegiceras* (Myrsinaceae), *Avicennia* (Avicenniaceae), *Amoora* (Meliaceae), *Bruguiera* (Rhizophoraceae), *Ceriops* (Rhizophoraceae), *Excoecaria* (Euphorbiaceae), *Heritiera* (Sterculiaceae), *Rhizophora* (Rhizophoraceae), *Sonneratia* (Sonneratiaceae) and *Xylocarpus* (Meliaceae). The mixed forest of *Heritiera* is quite dense and spread in fairly large area in the saline water. The highest canopy in this forest is occupied by *Heritiera fomes*, *Excoecaria agallocha*, *Ceriops decandra*, *Xylocarpus granatum* and others. Some of the typical mangroves of moderate height are *Avicennia alba*, *Ceriops tagal*, *Xylocarpus moluccensis*, *Excoecaria agallocha*, where some of the bushy shrubs like *Acanthus ilicifolius*, *Dalbergia spinosa*, *Derris scandens*, *Desmodium umbellatum*, *Clerodendrum inerme* are found to form dense patches along the muddy flat lands of the river banks. The mangrove scrub of salt water is of very low height and occupy

extensive areas in the Western Sundarbans. The brackish water mixed forests are of poor quality due to high salinity of the water. The two palms common in the mangrove forests are gregarious and much depleted due to long exploitation by human agencies. Of these *Nypa fruticans* is a stemless palm with leaves more than 9 m long is receding fast and occupying smaller areas than the other species *Phoenix paludosa* with 2-3 m stem and with a crown of leaves 1.5 to 2 m diam. Few important grasses exclusive of the mangrove forest are *Myriostachya wightiana*, *Paspalum disticum*, *Porteresia disticha*, *Zoysia matrella* and others.

Due to physiochemical action of the sea with the silt carrying rivers, the deposition of mud in the estuarine region is a continuous process from time immemorial and the process is still in operation resulting in the formation of the *chars*. These in the long run are giving rise to islands. It is interesting to note that in such small *chars* the most common invaders forming colonised growths are *Leersia hexandra*, *Porteresia coarctata*, and *Sesuvium portulacastrum* (Basak & Guhabakshi, *l.c.*). These are generally followed by trees like *Avicennia alba*, *A. marina*, *Agiceras corniculatum* and after a moderate stabilization of the soil the common species intruding for the formation of the forest are *Ceriops decandra*, *Excoecaria agallocha* and a sparse growth of *Bruguiera gymnorrhiza*, *Heritiera fomes* and *Xylacarpus granatum* (Banerjee, *l.c.*).

Naskar and Guhabakshi (*l.c.*) while dealing with different aspects of vegetation pattern of Sundarbans not only dealt taxonomic treatment of the flora in details but also worked out the features of the forest types of the Sundarbans delta. After reviewing the various forest types described by Prain (*l.c.*), Curtis (1836), Champion (1936), Puri (1960), Champion and Seth (1968), Rao and Sastry (1972), Blasco (1975), the characteristic vegetational layout of the mangrove forests has been critically examined. Based on the various groupings of the forest types by the above authors the Sundarbans tidal forests have been divided under following vegetational patterns by Naskar, 1983 : (a) The sea-face or beach forests, (b) The flora of formative islands, (c) The flora of reclaimed low-lying zones, (d) The flora of the river-banks and (e) and The swamp forests. Apart from describing the vegetational types under six/five different zones, the mode of phytosuccession has been narrated in five phases *vic.*, (i) Swampy mangroves of intertidal mangrove zone, (ii) Tidal mangroves (Ridge forests), (iii) True mangrove decline, (iv) Colonisation of non-littoral species and (v) Non-mangrove and dry evergreen forests.

Floristic composition in swampy mangrove of Sundarbans includes :
Aegialitis rotundifolia, *Aegiceras corniculatum*, *Amoora cucullata*, *Avicennia alba*, *A. marina*, *A. officinalis*, *Bruguiera cylindrica*, *B. gymnorrhiza*, *B. parviflora*, *B. sexangula*, **Ceriops decandra*, **C. tagal*, *Cynometra ramiflora*, *Excoecaria agallocha*, **Heritiera fomes*, *Kandelia candel*, **Nypa fruticans*.

Phoenix paludosa, **Rhizophora apiculata*, **R. mucronata*, *Sonneratia apetala*, *S. caseolaris*, *Xylocarpus granatum*.

In view of their excessive exploitation the plants marked above with asterisk (*) have been categorised as endangered species.

Floristic elements in Non-halophytic mangrove forests : Few interesting shrubby species associated with the mangrove forest are found to grow in large patches either on the banks of creeks or in the open muddy areas within or around the forests, the characteristic species of such type are *Acanthus ilicifolius* (this spiny element, however, has well adaptability also in fresh water and have spread far and wide along the Hooghly river basin), *A. volubilis*, *Caesalpinia crista*, *C. nuga*, *Clerodendrum inerme*, *Dalbergia spinosa*, *Derris scandens*, *D. trifoliata*, *Desmodium umbellatum*, *Sarcobolus carinatus*, *Tamarix dioica*, *T. ericoides*, *T. indica* and a few others. A number of climbers twining or spreading on such shrubby members are *Canavalia cathartica*, *C. lineata*, *Desmodium umbellatum*, *Finlaysonia obovata*, *Flagellaria indica*, *Pentstemon capensis*, *Salicaria chinensis*, *Sarcobolus carinatus*, *Solanum surattense*, *S. trilobatum*, *Tylophora tenuis*. The herbaceous species including grasses and sedges growing along with shrubby members or in isolation are comparatively less salt tolerant than the typical halophytic species and prefer more the raised land outside the characteristic halophytic zone. However, some of these are capable of withstanding moderate to rich salinity and others can survive even if they are occasionally getting submerged under salt-water. A number of herbaceous species standing or stabilizing with mangrove vegetation are : *Aeluropus lagopoides*, *Aerva lanata*, *Ammannia baccifera*, *A. salicifolia*, *Coryza semi-pinnatifida*, *Cyperus exaltatus*, *C. kyllingia*, *C. procerus*, *Diplachne fusca*, *Eragrostis tenella*, *Heliotropium curassavicum*, *Imperata cylindrica*, *Ipomoea pes-carpa*, *Launea sarmentosa*, *Leersia hexandra*, *Leptochloa chinensis*, *Myriostachya wightiana*, *Phragmites karka*, *Pluchea indica*, *Portersia coarctata*, *Rotula rotundifolia*, *Salicornia brachiata*, *Sarcobolus globosus*, *Schoenoplectus articulatus*, *Suaeda maritima*, *S. nudiflora* and several others.

A number of non-littoral tree species are found to grow and take part in the formation of halophytic ecosystem. In view of their close relationship with the mangroves, these have been designated as mangrove associates (Naskar & Guhabakshi, 1987) and the species under such category are : *Barringtonia acutangula*, *B. racemosa*, *Brownlowia lanceolata*, *Cerbera odallum*, *Crataeva roxburghii*, *Derris indica*, *Dolichandrone spathaceum*, *Hibiscus tiliaceus*, *Holarrhena antidysenterica*, *Kleinhovia hospita*, *Lumintzera racemosa*, *Nerium indicum*, *Pandanus fascicularis*, *P. foetida*, *Premna corymbosa*, *P. mucronata*, *Sapium indicum*, *Syzygium muscifolium*, *Thespesia lampas*, *T. populneoides*, *Trewia nudiflora* and many others.

Due to high atmospheric humidity and associated temperature during day and soothing air flow during night, the conditions have also allowed some parasites and epiphytes to grow in these mangrove forests where the common host tree

is *Excoecaria agallocha*. The well represented parasites are *Cassytha filiformis*, *Dendrophthoe falcata*, *Macrosolen cochinchinensis*, *Viscum monoicum*, *V. orientale* and as epiphytes *Dischidia nummularis* and *Hoya parasitica* are worth mentioning.

In addition to the true mangroves the account by Naskar & Guhabakshi (*l.c.*) also reviewed the remaining mesophytic flora of the Sundarbans which are not true halophytes but definitely form a major part of the complete flora of the Sundarbans. Out of 96 species of flowering plants and few ferns enlisted in the treatment, the following species not mentioned earlier are enumerated hereunder :

Abutilon graveolens var. *hirsutum*, *Acacia intsia*, *Achrosticum aureum*, *Alpinia allughas*, *Alternanthera polygonoides*, *Apluda nutica*, *Arthrocnemum indicum*, *Asplenium falcatum*, *Azima tetraantha*, *Bergia ammanoides*, *B. capensis*, *Calotropis gigantea*, *Capparis sepiaria*, *Casuarina equisetifolia*, *Cissus trifolia*, *Crinum defixum*, *Crotalaria pallida*, *Cyperus imbricatus*, *C. javanicus*, *C. malaccensis*, *C. tegetiformis*, *Dalbergia candenstensis*, *Eleocharis spiralis*, *Eragrostis diarrhena*, *E. unioloides*, *Fimbristylis complanata*, *F. polytrichoides* var. *halophila*, *Flacourtia indica*, *Gnaphalium polycaulon*, *Hemidesmus indicus*, *Hibiscus tetraphyllus*, *Hygrophila phlomisoides*, *Ipomoea macrautha*, *Lantana aspleniifolia*, *Merremia gangetica*, *M. hederacea*, *Morinda bracteata*, *Mucuna gigantea*, *Murdannia nudiflora*, *Pandanus tectorius*, *Parkinsonia acutangula*, *Parsonsia spiralis*, *Polycarpaea corymbosa*, *Pseudoraphis brunoniana*, *Prosopis chilensis*, *Pteris longifolia*, *Pulicaria crispa*, *Ruppia maritima*, *Saccharum spontaneum*, *Sapium indicum*, *Scirpus littoralis*, *S. tuberosus*, *Seseli diffusum*, *Spinifex littoralis*, *Sporobolus tenuis*, *Stictocardia tiliifolia*, *Syzygium ruscifolium*, *Teramnus flexilis*, *Trianthema portulacastrum*, *T. triquetra*, *Tribulus terrestris*, *Tylophora fasciculata*, *Vicia vestita*, *Vigna luteola*, *Vittaria elongata*, *Wedelia biflora*, *Xeromphis spinosa*, *Zoysia matrella* and few others.

1.7 : AQUATIC VEGETATION OF W. BENGAL

Due to riverain origin of the major landmass of the erstwhile Bengal of which W. Bengal is only the western part, the aquatic vegetation forms an important and interesting composition of its flora. The aquatic situations, both natural and artificial, in this state are of various kinds in respect of quality and extension. Broadly the aquatic vegetation of the area may be classified under freshwater and halophytic vegetation. The latter being a highly specialized kind and unique for the estuarian terrain, has been dealt with in the previous chapter the former is being narrated here in brief. On account of extensive urbanisation and changing landuse pattern for settlement of massive migratory population after partition in 1947, the water bodies of different sizes have disappeared and filled up with transported soil and many kinds of aquatic vegetation are vanishing,

which otherwise were common and widespread earlier in the state. Moreover, due to extensive commercial utilization of the water resources for piscicultural practices during the last few decades both the planktonic and submerged common aquatics are disappearing fast from the state.

Hooker (*l.c.*) in his monumental flora of the whole country included almost all the aquatic plants which are distributed also in W. Bengal but it is from Prain's (*l.c.*) comprehensive account we owe our precise knowledge about the water plants of the state. Biswas (1927a, 1927b) described the flora of Salt Lakes which are now occupied by the vast satellite township of Calcutta and also for other areas to work out the oxygen output of the aquatic vegetations. Calder's (1936) account of the fresh water and marsh plants of India and Burma also added further knowledge towards hydrophytic flora of this state. Being fascinated by these interesting group of plants several publications on aquatic vegetation covering river valleys (Kachroo 1956, 1959) and for other areas at microlevel added more information about water plants of such localities (Majumdar, 1956; Mitra *et al.*, 1971; Mukhopadhyay, 1987). Several workers dealing with the district floras or with the weed flora of different localities also provided much knowledge about the areas under their study (Guhakshi, *l.c.*; Bennett, *l.c.*; Malick, *l.c.* etc.) and there is enough information available about the aquatic vegetation of W. Bengal.

Freshwater Hydrophytes under different categories and belonging to angiosperms and pteridophytes may be enumerated as noted hereunder. These are common or occasional in W. Bengal according to localities and some of them are extremely rare.

I. Free floating aquatics (Plankton) : *Azolla pinnata*, *Salvinia cucullata*, *Spirodela polyrrhiza*, *Wolffia arrhiza*, *Lemma paucicostata*, *L. minor*, *L. trisulca*, *Pistia stratiotes*, *Eichhornia crassipes*, *Hygroryza aristata*.

II. Submerged suspended aquatics (Pleuston) : *Myriophyllum indicum*, *M. tuberculatum*, *Ceratophyllum demersum*, *Utricularia inflexa* var. *stellaris*, *U. flexuosa*, *U. exoleta*, *Aldrovanda vesiculosa*.

III. Anchored aquatics with floating leaves (Benthos) : (a) *Nelumbo nucifera*, *Nymphaea pubescens*, *N. nouchali*, *N. rubra*, *Nymphoides hydrophylla*, *N. indica*, *Monochoria vaginalis*, *Sagittaria guayanensis* ssp. *lappula*; *Caldesia parnassifolia*, *Trapa bispinosa*, *Aponogeton natans*, *A. crispum*, *A. monostachyon*, *Limnophyton obtusifolium*, *Teuagocharis latifolia*, *Potamogeton nodosus*, *Marsilea minuta*, *Mimulus orbicularis*, *Ipomoea aquatica*.

IV. Anchored submerged aquatics (Benthos) : (b) *Myriophyllum oliganthum*, *Blyxa Aubertii*, *B. octandra*, *Hydrilla verticellata*, *Vallisneria natans*, *Nechamandra alternifolia*, *Ottelia ulismoides*, *Potamogeton pectinatus*, *P. crispus*, *P. mucronatus*, *Ruppia rostellata*, *Najas graminea*, *N. foveolata*, *N. minor*.

V. Semi-Aquatic or Emergent amphibious Hydrophytes : *Aeschynomene aspera*, *A. indica*, *Ammania baccifera*, *Limnophila indica*, *L. sessiliflora*, *Rotala densiflora*, *Typha angustata*, *T. elephantina*, *Alternanthera philoxeroides*, *Bacopa monnieri*, *Hygrophila auriculata*, *Monochoria hastifolia*, *Cardanthera difformis*, *Polygonum orientale*, *Acanthus ilicifolius*, *Hydrolea zeylanica*, *Caesulia axillaris*, *Enhydra fluctuans*, *Acorus calamus*, *Monochoria vaginalis*, *Oenanthe benghalensis*, *Neptunia oleracea*, *Ceratopteris thalictroides*.

VI. Marshland and Hydrophytic weeds : *Hygrophila polysperma*, *Phyla nodiflora*, *Polygonum orientale*, *P. hydropiper*, *P. glabrum*, *P. minus*, *Commelina salicifolia*, *Murdannia nudiflora*, *Colocasia antiquorum*, *Eriocaulon sexangulare*, *E. quinquangulare*, *Crinum defixum*, *Cyperus cephalotes*, *C. exultans*, *C. compressus*, *C. hastatus*, *C. iria*, *Schoenoplectus articulatus*, *Scirpus grossus*, *S. erectus*, *S. supinus*, *S. squarrosus*, *Fimbristylis dichotoma*, *F. monostachya*, *F. diphylla*, *F. complanata*, *F. miliacea*, *Vetiveria zizanioides*, *Eragrostis diarrhena*, *E. unioloides*, *Leptochloa capillacea*, *Leersia hexandra*, *Sacciolepis indica*, *Echinochloa colonum*, *Eriochloa procer*, *Setaria glauca*, *Paspalidium flavidum*, *Paspalum serobiculatum*, *Brachiaria nutica*, *B. reptans*, *Phragmites karka*, *Coix aquatica*, *Cryptocoryne ciliata*, *Lasia aculeata*.

Among the aquatics enumerated above special mention may be made about two interesting species viz., *Aldrovanda vesiculosa* of Droseraceae, a submerged aquatic in Salt Lakes, appears to be lost or gone to localities where it is very rare to locate. The plant after its single collection during the thirties of the last century has not been collected again from the areas under W. Bengal at present. The other species *Mimulus orbicularis* of Scrophulariaceae may be considered as a flash immigrant collected only in the coastal districts of W. Bengal in recent years from flooded ricefields in menacing profusion, but rarely spreading in subsequent years. The species mainly of Burmese distribution was described once from Orissa coast so far in India.

1.8. WEED FLORA OF W. BENGAL.

The regular arrival of European ships to India at Goa and other southern ports via Brazil and also through Cape of Good Hope dates back to the end of 15th century AD. These brought large number of exotic plants for commercial purposes including weeds which could easily make their way in India under selective climatic condition and many reached Bengal in no time. At the same time the Calcutta Port had been an extremely important centre for receiving many kinds of Agricultural and Industrial products through merchant vessels and other transport agencies. The grain bags, containers and foreign commodities were in all probability the best agencies for the arrival and subsequent distribution of a large number of weed seeds in W. Bengal and neighbouring states. Sir David Prain (1903) in his Bengal Plants included many of such exotic plants along with other weeds of indigenous origin. Gradually the interest on

such plants by botanists resulted in large number of publication on weeds during the present century.

Spontaneous growth and quick establishment of uncared plants and weeds in a state like W. Bengal have been possible due to wide range of congenial habitats and favourable climatic conditions. Such plants constitute a significant part of the flora of an area and are directly or indirectly associated with the environmental and human interest. Weeds of different kinds are distributed in agricultural fields, aquatic bodies, fruit or other plantation orchards, waste places, on walls and fallow lands. Due to their very easy and effective means of propagation either by air or water many weeds have the capacity to invade in vast areas within a short period of time and successfully complete their life cycle for better establishment in new areas. *Parthenium hysterophorus* is an ideal example of the said kind of weed which is extensively spreading along the railway tracks and highways in W. Bengal & elsewhere by their airborne fruits.

As a part of fascinating botanical and ecological study there are sizable literature available on this subject particularly for W. Bengal. As early as 1934 Biswas made an attempt to throw light on the invasion of some of the major exotic weeds and their distribution in India and Burma. These included large number of species which are also common for W. Bengal. P. Brühl (1908) prepared an exhaustive list of more than 234 species of exotic plants, many of which represent notable weeds of this state. Chakraborty (1957) made an interesting observation on the weed flora of the paddy fields of W. Bengal which included many common species of grasses and sedges and other members of aquatic & semi-aquatic habitat. Studies on weed flora of local areas gradually attracted attention of a number of workers and reports on such observations were published as enumeration of species with interesting ecological notes. Datta (1954) dealt with some common weeds of Darjeeling and discussed on their mode of control. Paul and Bhattacharyya (1959) studied the weed flora of the paddy fields of the State Agricultural Farm at Chinsurah and Majumdar (1962) conducted similar studies on the paddy fields of 24-Parganas and Datta and Maity (1963) studied the same for Midnapur district. In recent years Maity and Guhabakshi (1981) made an interesting assessment of the mode of invasion of the exotic weeds in W. Bengal since 1903 and of late an All India Co-ordinated Research Project on weed control, major weed flora under various niches of West Bengal from seven agroclimatic zones have been published by Hore and Tripathi (1985). Recently Panda *et al.* (1989) worked out the nature of interesting plant colonization on walls of Calcutta and the weed flora of such specific distribution has been highlighted.

A concise list of major weed flora of the state indigenous to various countries and year of their first report from W. Bengal in parenthesis is enumerated here under :

I. North America : *Alternanthera pingens* (1966); *Calceolaria mexicana* (1954); *Cassia corymbosa* (1966); *Cassia laevigata* (1966); *Centrosema virginianum* (1970); *Eleutheranthera ruderalis* (1966); *Eupatorium adenophorum* (1966); *E. erythropappum* (1976); *E. ligustrinum* (1970); *Gnaphalium purpureum* (1881); *Hyptis pectinata* (1940); *Melichia pyramidata* (1969); *Notholaerva brachiata* (1966); *Oxalis latifolia* (1870); *O. maritima* (1969); *Parthenium hysterophorus* (1978); *Petiviera alliacea* (1961); *Pseudo-elephantopus spicatus* (1961); *Solanum glaucum* (1905); *Tithonia diversifolia* (1966); *Bromus unioloides* (1975); *Setaria paniculifera* (1970); *Argemone mexicana* (1903); *Malvastrum coromandelianum* (1903); *Malachra capitata* (1903); *Passiflora suberosa* (1903); *P. foetida* (1903); *Melochia pyramidata* (1969); *Erigeron karvinskianus* (1966); *Opuntia dillenii* (1903); *Neptunia plena* (1903).

II. South America : *Alternanthera ficoidea* (1964); *Boerhavia erecta* (1978); *Croton bonplandianum* (1905); *Gomphrena celosioides* (1966); *Ipomoea carnea* (1978); *I. congesta* (1969); *I. fistulosa* (1966); *Melochia pyramidata* (1969); *Solanum viarum* (1970); *Spermacoce latifolia* (1976); *Turnera subulata* (1969); *Echinochloa crusgavonia* (1970); *Eichornia crassipes* (1928); *Paspalum dilatatum* (1976).

III. Africa : *Cleome rutidosperma* (1969); *Grossocephalum crepidioides* (1976); *Euphorbia chamaesyce* (1969); *Gisekia pharnacioides* (1976); *Hibiscus micranthus* (1966); *Indigofera spicata* (1969); *Ludwigia erecta* (1969); *L. hyssopifolia* (1966); *Micrococca mercurialis* (1966); *Mitracarpus verticillatus* (1979); *Brachiaria nutica* (1976); *Melinis minutiflora* (1970); *Rhynchelytrum villosum* (1980).

IV. Europe : *Chrysanthemum leucanthemum* (1970); *Convolvulus arvensis* (1969); *Cuscuta campestris* (1966); *Lepidium ruderale* (1970); *Rumex acetosella* (1969); *Senecio vulgaris* (1980); *Anthoxanthum odoratum* (1966); *Phalaris minor* (1975); *Lathyrus aphaca* (1903); *Vicia sativa* (1903); *Senebiera pinnatifida* (1903); *Alyssum maritimum* (1903); *Lepidium sativum* (1903).

V. Malasia & Australia : *Cotula australis* (1969); *Dentella serpyllifolia* (1968); *Eryngium foetidum* (1979); *Ipomoea quinata* (1979); *Lobelia radicans* (1960); *Pseudarthria viscida* (1979); *Rothia trifoliata* (1966); *Digitaria adscendens* (1966); *D. preslii* (1960); *Polytrias amaura* (1960).

VI. China & Japan : *Hydrangia macrophylla* (1966); *Viola thomsonii* (1916); *Primula malacoides* (1966).

VII. Western Asia : *Euphorbia helioscopia* (1978); *Aeluropus lagopoides* (1965); *Capsella bursa-pastoris* (1903).

19. PLANTS OF MEDICINAL AND ETHNOBOTANICAL
INTEREST IN W BENGAL

West Bengal preserves a rich source of medicinal plants but due to its massive population and small size of the state the problem of their free exploitation from natural condition is rather a common practice. However, from time immemorial utilization of natural plant resources by the tribals and crude drug dealers is going on. This may be a matter of serious concern for their progressive depletion or complete loss from the areas of their abundance at present. With a view to record the distribution of plants used by the tribals either for medicinal or other economical purposes, considerable works have been carried out under the scientific projects of the Botanical Survey of India and reports of such findings have been published.

(During the last few decades the study on Ethnobotany as well as medicinal plants received much attention in W. Bengal particularly the former, due to concerted efforts of Jain and De (1966), Jain (1981), Raichaudhuri *et al.* (1979, 1982, 1984), Pal (1989) and others. Recently a dictionary of Indian folk medicines and ethnobotany by Jain (1991) has provided almost an up to date and comprehensive account of plants relating to tribal use. (A review of the literature reveals that there are more than 35 different tribal communities in W. Bengal specially along the bordering districts, which is relatively high in comparison to the size of the state. It was therefore, thought desirable to incorporate some relevant information on ethnobotany in the Flora of W. Bengal to facilitate further search of plants of non-conventional medicines and other economic utility.)

(Some of the common and well known tribal communities like Santal, Munda, Oraon, Bishore, Toda, Lodha, Bhumij etc. are found to be considerably high in W. Bengal from whom valuable information on plants of ethnobotanical interest have been gathered in recent years. Due to continuous bio-edaphic changes two important tribes *viz.* Lodha and Toda are on the verge of extinction. (Purulia, Midnapur, Bankura, Birbhum, Malda and W. Dinajpur districts, adjoining the states of Bihar and Orissa have a large representative of the aforesaid tribals.) (As such the works carried out on those districts (Jain & De *l.c.*, Raichaudhuri *et al. l.c.* & Pal *l.c.*) and also in Santal Pargana (Goel *et al.*) adjoining W. Bengal have contributed a rich wealth of ethnobotanical information specially of medicinal plants of the bordering districts. An active group of workers from Botanical Survey of India are also engaged in covering most of the districts in the northern area of which report on Jalpaiguri is already published (Raichaudhuri *l.c.*).

From the published accounts on ethnobotany of W. Bengal more than 550 species are found to be used by the tribals either medicinally or for other economic purposes. Out of these, 350 species are reported to be of medicinal importance or used as wild food-plants. A good number of such plants are also useful for veterinary treatment and as many as 55 species are of fodder value.

Plants or their products which have been recorded as ethno-botanically important can be categorized broadly under following headings : (1) Oilseeds, (2) Narcotics, (3) Vegetables/Edible fruits, (4) Medicinal, (5) House building, (6) Drink/Beverage, (7) Agricultural implements, (8) Hunting/Fishing/ Trapping, (9) Cart construction, (10) Musical instruments, (11) Personal adornments, (12) Decorative purposes, (13) Cooking and other domestic materials, (14) Cultural materials, (15) Worship and rituals, (16) Magico religious belief, (17) Conservation of vegetation, (18) Conservation of individual species, (19) Craft and tribal industry, (20) Insect repellent and piscicides/Fish poisoning or stupifying plants, (21) Fibre and Cordage, (22) Dye yielding plants etc.

A list of some common plants of medicinal and ethnobotanical interest with their available common names in Bengali, under different usage are presented below -

Medicinal Plants : *Abelmoschus moschatus* (Mushakdana), *Abrus precatorius* (Kunch), *Adhatoda zeylanica* (Vasaka), *Acorus calamus* (Bach), *Adina cordifolia* (Khetkadam), *Aloe barbadensis* (Ghritakumari), *Alstonia scholaris* (Chhatim), *Andrographis paniculata* (Kalomegh), *Aristolochia indica* (Ishermul), *Artemisia nilagirica* (Hindi-Dona), *Argemone mexicana* (Shulkanta), *Abutilon indicum* (Petari), *Aegle marmelos* (Bael), *Azadirachta indica* (Neem), *Ampelocissus tomentosa* (Ghora lata), *Atylosia scarabaeoides* (Bankullhi), *Anisomeles indica*, *Achyranthes aspera* (Apang), *Butea monosperma* (Palas), *Bacopa monnieri* (Brahmi), *Bauhinia purpurea* (Kanchan), *Boerhavia repens* (Punarnaba), *Cannabis sativa* (Bhang), *Culotropis v. antea* (Akanda), *Cupparis zeylanica*, *Cipadessa fruticosa*, *Cissampelos pariera*, *Celastrus paniculatus* (Kijri), *Crotalaria prostrata*, *C. alata*, *Cassia fistula* (Bandar lathi), *Cassia tora*, *Caesalpinia crista* (Nata), *Centella asiatica* (Thankuni), *Cryptolepis buchanani* (Dudhi lata), *Cordia dichotoma* (Boch), *Cuscuta reflexa* (Swarnalata), *Clerodendrum viscosum* (Ghentu), *Croton oblongifolium*, *Costus speciosus* (Kowa), *Curcuma domestica* (Halud), *Datura metel* (Dhatro), *Erythrina variegata* var. *orientalis* (Kanda Mathar), *Eugenia heyniana* (Khudijam), *Eclipta prostrata* (Keshut), *Elephantopus scaber* (Majorjhuti), *Erycibe paniculata*, *Evolvulus alsinoides*, *Gardenia latifolia* (Barabhutra), *Glossogyne pinnatifida*, *Gloriosa superba* (Ulat Chandal), *Hemidesmum indicus* (Ananiamul), *Helicteres isora* (Antmachra), *Holarrhena antidysenterica* (Kurchi), *Ipomoea pes-tigridis*, *Mucuna prurita* (Alkushi), *Melothria heterophylla*, *Martynia annua* (Bagh Nokh), *Mallotus philippensis*, *Melanthesa turbinata* (Jirul), *Ochna pumila*, *Nyctanthes arbor-tristis* (Shiuli), *Phyllanthus emblica* (Amlaki), *Pterocarpus marsupium* (Piasal), *Piper longum* (Peepul), *Ricinus communis* (Reri), *Rouvoftia serpentina* (Sarpagandha), *Scoparia dulcis*, *Scurrula philippensis*, *Streblus asper* (Shaora), *Terminalia arjuna* (Arjun), *T. bellirica* (Bahera), *T. chebula* (Haritaki), *Tinospora cordifolia* (Gulanha), *Uraria lagopoides* (Isharjata), *Vanda roxburghii* (Rasna), *Viscum orientale*, *Vitex negundo* (Nishinde), *Ventilago calyculata*, *Ziziphus xylopyrus*.

Food Plants : *Aegle marmelos* (Bael), *Allium cepa* (Peany), *A. sativum* (Rasoon), *Alternanthera sessilis* (Sechi), *A. philoxeroides*, *Amaranthus gangeticus* (Danta), *A. dubias* (Notey), *A. spinosus* (Kanta notey), *Alocasia indica* (Man kachu), *A. viridis* (Notey), *Ammania pentandra*, *Amorphophalus campanulatus* (Ol), *Antidesma diandra*, *A. ghaesembilloa*, *Anona squamosa* (Ata), *Artocarpus lakoocha* (Dahu), *Basella alba* (Puin), *B. rubra* (Puin), *Bauhinia purpurea* (Rakta kanchan), *B. vahlii*, *Bombax ceiba* (Shimool), *Boswellia serrata* (Shalga), *Brassica campestris* (Sorshey), *B. nigra* (Sorshey), *Canavalia virosa* (Makhan sheem), *Coccinea grandis* (Telakuch), *Cochlospermum religiosum* (Galpal), *Colocasia antiquorum* (Kachu), *Cucurbita maxima* (Kumro), *Dillenia indica* (Chalta), *D. pentagyna*, *Dioscorea bulbifera* (Chupri Alu), *D. helophylla* (Chupri Alu), *D. pentaphylla* (Chupri Alu), *Diospyros malabarica* (Gaab), *D. tomentosa* (Gaab), *Dentella repens*, *Dolichos trilobus* (Sheem), *Echinochloa crusgalli*, *Eleusine coracana*, *Ethydra fluctuens* (Hinche), *Ficus glomerata* (Jajnadamur), *F. hispida* (Khaskhase Dumur), *F. semicordata*, *F. virens*, *Flacourtia indica* (Bainchi), *Gardenia gummifera*, *G. latifolia* (Barabhutra), *Garuga pinnata*, *Grewia asiatica* (Phalsa), *Holoptelea integrifolia*, *Holostemma annularis*, *Ipomoea aquatica* (Kalmi), *I. batata* (Ranga Alu), *Labiab purpureus* (Sheem), *Lagenaria siceraria* (Lau), *Lasia spinosa*, *Lepidium sativum*, *Leucas cephalotes* (Drona), *Limonia acidissima* (Kathbel), *Lycopersicum esculentum* (Tomato), *Madhuca indica* (Mohua), *Marselia minuta* (Sushni), *Maytenus emarginata*, *Melothria purpusilla* (Bankundri), *Momordica charantia* (Karala, Uehhe), *M. dioica* (Ban Karala), *Musa paradisiaca* (Kancha Kala), *M. sapientum* (Kantali Kala), *Nymphaea nouchali* (Shapla), *N. rubra* (Lal Shapla), *Olax scandens*, *Oryza rufipogon* (Dhan), *O. sativa* (Dhan), *Oxalis corniculata* (Amrool), *Pachyrrhizus erosus* (Sankalu), *Panicum miliare*, *Pennisetum hypoides* (Bajra), *Portulaca oleracea* (Nunia), *Randia uliginosa*, *Rivea hypocrateriformis*, *Schleichera oleosa* (Kusum), *Semecarpus anacardiun* (Bhela), *Sesbania grandiflora* (Bak Phool), *Setaria glauca*, *Solanum melangena* (Begun), *S. tuberosum* (Alu), *Sorghum hulpense* (Jowar), *S. vulgare* (Jowar), *Spondias pinnata* (Amra), *Syzygium cumini* (Kalajam), *Tamarindus indica* (Tentul), *Trianthema portulacastrum*, *Trichosanthes dioica* (Patol), *Vigna capensis* (Bangaugra), *V. mungiculata* (Ghangra), *Xeromphis spinosa* (Gurman), *Zea mays* (Bhutta), *Ziziphus mauritiana* (Kul), *Z. oenoplia* (Shiakul).

Oil Yielding Plants : *Azadirachta indica* (Neem), *Brassica campestris* (Sorshey), *Celastrus paniculatus*, *Guizotia abyssinica*, *Holoptelea integrifolia*, *Linum usitatissimum* (Teeshi), *Madhuca indica* (Mohua), *Prinsepia utilis*, *Ricinus communis* (Reri), *Schleichera oleosa* (Kusum), *Sesamum indicum* (Teel), *Shorea robusta* (Sal).

Plants used for Narcotics and Beverages : *Artemisia nilagirica*, *Borassus flabellifer* (Tal), *Buchanania lanzan*, *Caryota urens*, *Ceropegia hirsuta*, *Cannabis sativa* (Bhang), *Madhuca indica* (Mohua), *Nicotiana tabacum* (Tamak), *Oryza sativa* (Dhan for Rice Beer), *Phoenix sylvestris* (Khejur), *Terminalia crenulata* (Asan.).

Plants for House Building : *Acacia nilotica* (Babla), *Bambusa tulda* (Bans), *B. balcooa* (Bans), *B. arundinacea*, *Borussus flabellifer* (Tal), *Cleistanthus collinus*, *Dalbergia sissoo* (Sissam), *Dendrocalamus strictus* (Bans), *Firmania colorata*, *Gmelina arborea* (Gamar), *Heteropogon contortus*, *Hymenodictyon excelsum* (Bhorkud), *Imperata cylindrica* (Shar), *Lagerstroemia parviflora* (Jarul), *Lannea coromandelica* (Jiol), *Limonia acidissima* (Kathel), *Panicum miliare*, *Saccharum spontaneum* (Kush), *Shorea robusta* (Sal), *Sorghum vulgatum* (Jowar), *Terminalia arjuna* (Arjun), *T. bellirica* (Bahera), *T. chebula* (Haritaki), *Tectona grandis* (Shegun).

Plants for Household Articles & Agricultural Implements : *Acacia nilotica* timber-variously used; *Adina cordifolia* (Khetkadam) -agricultural implements, comb; *Agave cantata* (Sisal)-cordage from leaf fibre; *Anogeissus latifolia* cart making; *Azadirachta indica* (Neem) timber variously used; *Bauhinia vahlii* leaf for dish umbrella, stem for cordage; *Bombax ceiba* (Shimul)-pillow cotton, box, bats; *Buchanania lanzan* furniture; *Dendrocalamus strictus* - stick, handle, fencing; *Diospyros tomentosa* (Kend) furniture and Biri from leaf; *Helicteris isora* cordage; *Jatropha curcas* (Varenda)- fencing; *Kydia calycina* stick; *Lannea coromandelica* (Jiol)-cart, door making; *Mallotus philippensis* thatching; *Morinda tinctoria* furniture; *Ougeinia ougeinensis* cart and furniture; *Phoenix sylvestris*- broom, hat, mat; *Pterocarpus marsupium* (Piasal) household article; *Sesbania aegyptica* (Dhancha) fencing; *Shorea robusta* several wooden articles; *Spatholobus roxburghii* window from timber, cordage from bark.

Lac Host Plants : *Butea monosperma*, *B. stuperba*, *Croton oblongifolium*, *Dalbergia paniculata*, *Ficus semicordata*, *F. virens*, *Ziziphus mauritiana*.

Fish Poisoning Plants : *Casuarina tomentosa* (Churchu) fruits; *Careya arborea* roots; *Engelhardtia spicata* leaves; *Hedyotis scandens* -leaves, roots; *Mimosa rubicaulis* bark; *Rhododendron arboreum* leaves; *Xeromphis spinosa* (Gurman) crushed fruits.

Fodder Plants : *Artocarpus heterophyllus* (Kanthal), *A. lakoocha* (Dehu), *Bauhinia variegata* (Kanchan), *B. purpurea* (Rakta, Kanchan), *Dalichos biflorus*, *Echinochloa colona*, *Ficus benghalensis* (Bat), *F. religiosa* (Ashwaththa), *Imperata cylindrica*, *Milletia auriculata* (Hebel), *Oryza sativa* (Dhan), *Paspaladium flavidum*, *Quercas leucotrichofera* (Oak) etc.

Plants of Other uses : *Acacia catechu* (Khayer)-source of Catechal of commerce; *Alangium salvifolium* rubbing of dry wood used for lighting fire; *Boswellia serrata* (Shalga) resin used as insence, wood for gun powder charcoal; *Carissa opaca* (Ban karamcha) roots for curing Simla disease of cattle and insect repellent; *Cleistanthus collinus* bark juice for tanning; *Curcuma domestica* powder used in sprain and decorating limbs; *Diospyros malabarica* (Gaab) fruit, gum used for tanning and painting fishing net; *Eclipta prostrata* (Keshut)-leaf juice for curing swelling of cattle ears; *Erycibe paniculata* - stem and leaf decoction for curing sprains of cattle; *Lantana camara*

(Chotra) dried twigs for ignition by friction and charcoal for gunpowder; *Lawsonia inermis* (Mahendi) crushed leaves along with lime for hand decoration; *Shorea robusta* (Sal) - leaves for dish and cup making; *Thysanolaena maxima* (Phooljharit) panicle for broom.

Medicinal Plants of Darjeeling : The medicinal plants of the plains of W. Bengal have been enumerated while dealing with the ethnobotanical uses of some of the common plants. But for the plants of Himalayan distribution some of the interesting species have been enlisted by Yonzon *et al.* (1984) with their phenology and medicinal uses. The plants not enumerated under ethnobotany chapter above are enumerated below with part used :

Abeis pindrow (Leaves), *Achyranthes bidentata* (Stem, Roots), *Aconitum ferox* (Root), *A. laciniatum* (Root), *A. spicatum* (Root), *Acorus calamus* (Rhizome), *Agrimonia eupatoria* (Root Leaves), *Artemisia nilagirica* (Whole plant), *Asparagus racemosus* (Root), *Astilbe rivularis* (Rhizome), *Berberis chitria* (Root), *B. insignis*, *Bergenia ligulata* (Root), *Cephalis ipicacuanha* (Root), *Cinchona calisaya* (Bark), *C. ledegarium* (Bark), *C. officinalis* (Bark), *C. robusta* (Bark), *C. succirubra* (Bark), *Cymbopogon flexuosus* (Whole plant), *Datura stramonium* (Fruits), *Dichroa febrifuga* (Root), *Digitalis purpurea* (Leaves), *D. lanata* (Leaves), *Dioscorea composita* (Tuber), *D. floribunda* (Tuber), *D. prazeri* (Tuber), *Drymeria cordata* (Whole plant), *D. villosa* (Whole plant), *Entada phaxeoloides* (Seed), *Eupatorium adenophorum* (Whole plant), *Fagopyrum cynosutum* (Seeds), *F. tataricum* (Seeds), *Gynocardia odorata* (Seeds), *Hedera nepalensis* (Leaves, Seeds), *Hedyochium spicatum* (Root stalk), *Hydrocotyl javanica* (Whole plant), *Hedyotis scandens* (Leaves, Roots), *Heracleum nepalense* (Root), *Hyoscyamus nigr* (Leaves), *Imperata arundinacea* (Root), *Mahonia nepalense* (Berries), *Mentha arvensis* (Whole plant), *M. spicata* (Whole plant), *Ocimum sanctum* (Leaves), *Paederia foetida* (Leaves), *Pelargonium graveolens* (Whole plant), *Polygala arillata* (Root), *Rauwolfia serpentina* (Root), *R. tetraphylla* (Root), *Rhododendron arboreum* (Flower), *Rubia manjith* (Root), *Rubus ellipticus* (Root), *Solanum vitarum* (Fruit), *Thysanolaena maxima* (Root), *Valeriana hardwickii* (Root), *Viscum articulatum* (Whole plant), *Xanthoxylum hamiltonianum* (Fruits), *Zingiber officinale* (Rhizome).

110 FRUITS, VEGETABLES AND ORNAMENTALS IN WEST BENGAL

Horticultural activities in W. Bengal coincides almost with the establishment of the East India Company's Royal Botanic Garden at Shihpore in 1787 by Robert Kyd. With profound knowledge in horticultural practices William Carey of the Serampore Missionaries took leading role in establishing the wellknown Agri- Horticultural Society's Garden at Alipore in 1820 and a detailed list of interesting garden plants growing in the Calcutta Botanic Garden at Shihpore and Serampore Garden was enumerated by Voigt in 1845.

With an excellent treasure of live collections of economical as well as ornamental plants those gardens started accumulating great wealth of botanical and horticultural plants in the twin cities of Calcutta and Howrah. At the same time ornamental and fruit trees disseminating from two aforesaid gardens enriched several nurseries to develop horticultural interest among people and private land owners far and wide in the state.

Fruits : Fruit trees as one of the major sections of horticulture received much attention from early historic period in the state without much scientific background. After establishment of the Agricultural Universities at Kalyani and Calcutta in the 50s the subject found a sound footing to impart good knowledge and Mitra & Bose (1985) made efforts to highlight the horticultural status of 28 major fruit yielding plants of India including those of W. Bengal. Horticultural aspects of some of the common fruits largely grown in W. Bengal for commercial exploitation and mainly marketed in ripe state are summarised below:

Mango : Cultivation of Mango as a major fruit growing tree had been in practice in Bengal even before 15th century and specially with the patronization of the Nawabs and Zamindars large orchards in Murshidabad, Malda, Nadia and other districts were preserving exceptionally good varieties like Himsagar (Misribhog), Fajli, Brindabani, Bombai, Gopalbhog, Kishenbhog, Saiderpasand, Karpuri, Jalibandha, Mohanbhog, Bhaduri and others. Specially some of the late fruiting and a number of Kachamitha (sweet in green condition) varieties are exclusively nurtured as quality Mangoes of the state. After independence about 1,80,776 acres of land area has an annual production of 9.5 thousand quintals of mangoes. In view of increasing demands of this fruit the scope of its development in W. Bengal need special attention. Air layering and grafting has been practised almost everywhere in the country for its successful propagation.

Banana : Banana as a fruit is considered to be second in importance in India, and peninsular India is the largest producing area. In W. Bengal there are four well known varieties namely Kabuli, Martaman, Amritsagar & Champa. Out of these, Martaman is the most favoured and highly priced variety but productivity is low. The highest yielding variety is Kabuli and is cultivated throughout the state. Champa variety is grown extensively along the plain districts by the side of the Bhagirathi particularly in Hooghly and Nadia. The well known green banana is one of the best green vegetables of great demand in W. Bengal market. It is sporadically grown throughout the state. About 11.5 ha. of land area of the state yields nearly 100.7 tones per year. Sword Suckers are the best source of material for their propagation and plantation is generally done after the winter months and before the onset of rain. For W. Bengal suitable period of planting is between February and August.

Orange : The hill district of Darjeeling produces one of the best quality of sweet orange (*Citrus reticulata*), having a good commercial market in the state.

In comparison to its high demand the productivity of the fruit could not be increased due to limited area being available for its cultivation. The other species of *Citrus* commonly grown include *Citrus grandis*. It is the large size Shaddock available throughout the state in private gardens. A large number of other species and varieties are mostly used in green condition to add taste and flavour to various food-stuff and are represented by *C. limon*, *C. medica*, *C. aurantifolia*. Nearly 1250 ha. of northern hill area of W. Bengal produces about 6250 tones of the sweet oranges. Air layering and even cutting are common methods for general propagation, but budding is generally done for maintaining better quality of most of the commercial species of *Citrus*.

Guava : *Psidium guajava* as an important fruit tree is grown largely in Northern India and occupies 4th position in relation to its productivity and land area under cultivation. It is a native of Mexico to Peru and was introduced in India during the 17th century and is extensively grown in Uttar Pradesh. In W. Bengal the Baruipur variety is one of the most important commercial variety, largely grown in South 24-Parganas and commonly in other districts. Seed germination and transplantation are usually used for growing the plant. However, for commercial plantation, Air layering and Cutting are also suitable methods for propagation.

Sapota : Sapota (*Achras zapota*) is a native of Mexico and Central America. Exact date of its introduction in India is not known. Though major area of its cultivation is in the Peninsular India, yet it is gradually receiving horticultural attention also in the Northern states. It was cultivated for the first time in Maharashtra in 1898. In W. Bengal this fruit tree is now being grown in some of the central and southern districts, specially in 24-parganas and receiving considerable commercial importance for its great demand due to its rich iron content, delicacy and nourishing properties. Air layering of coveted varieties is the most effective method for its propagation, however, Grafting and Budding are also important horticultural practices for growing this plant.

Pine Apple : Pine Apple (*Ananas comosus*) is regarded as one of the most favourite tropical fruits. It is a native of Tropical America and the species probably had its distribution along Panama-Paraguay River Drainage (Sen in Mitra and Bose *l.c.*). It is said to be introduced in India in mid 16th century. In W. Bengal the Giant Kew variety has now occupied a very favourable place under cultivation in sandy and loamy well drained soil having moderate rain fall (170 cm). It is grown in large quantities in the sub-montane northern districts of Darjeeling and Jalpaiguri and also in some of the southern districts of the state. Vegetative propagation through Shoot Suckers gives the best productive crop, however, Ground Suckers, Crown, Slips and Stumps are also utilized as propagating materials.

Coconut : Coconut (*Cocos nucifera*) tree for its unique fruit of great utility and high commercial demand is regarded as the tree of the Heavens. Every part

of the tree including the fruits have several industrial use. Oil, Food and Coir are the three main products of its fruits and stiff Brooms are prepared from the leaves. On the basis of shape, size, colour and productivity of fruit and size of the tree, several well known varieties have been recognised (Thongoraj, Muthuswami in Mitra and Bose *l.c.*). Coconut is a valuable tree for planting in the garden and is extensively grown in southern part of W. Bengal, almost in every house. The area under cultivation of coconut has been considerably increased in the state following migration of people from Bangladesh after independence. About 6% of land area produces 22 million nuts annually, however, the consumption of green coconut being highest in W. Bengal, other fruit based industries have not yet flourished.

Papaya : Papaya (*Carica papaya*) is one of the most important fruit trees in the present days in India. The fruits both in green and ripe condition have great demand as vegetable and delicious fruit. The plant is a native of Tropical America and was introduced in India during 16th century. A large number of improved varieties like Pusa Giant, Pusa 1-45 V, Pusa Majesty, Pusa 22-3, Honey Dew, Co. 2 and several others have been evolved at IARI and TNAU and are largely cultivated in different parts of the country as well as in W. Bengal. However, the Ranchi variety has been found to be very successful in productivity and quality of the fruit in W. Bengal. Lower and Central area of the Lower Ganga Plains are ideal lands for its cultivation. Propagation of Papaya is mainly done by seeds and such seeds brought from authentic sources can maintain pure line selection to avoid undesirable performance.

Jackfruit : Jackfruit (*Artocarpus heterophyllus*) as a fruit tree has not received serious attention for cultivation in W. Bengal but it is a coveted tree for planting in almost every private house in the villages. The green fruits after proper dressing are cooked for preparation of delicious food dishes and ripe fruits also have great demand for its pulpy sweet inner parts. Jackfruit is a native of India and tolerates varied climate and soil. The species also grows wild in Western Ghats. The most common method of propagation is through seeds, other vegetative methods like cutting, air layering and budding are also found to be effective.

Water Melon : Water melon (*Citrullus lanatus*) is one of the most favourite fruits of hot summer and grown very well in dry riverian soil and islands of southern W. Bengal. During the last two decades, its cultivation has been very much successful due to favourable climatic and edaphic factors of some areas of Lower Ganga Plain. Huge quantity of fruits of few small varieties are now being grown in Sagar Islands of south 24-Parganas and also in different localities of Midnapore and Murshidabad districts. Plants are solely propagated through seeds during February-March and fruits are harvested within 3-4 months.

Litchi : Litchi (*Litchi chinensis*) of excellent quality is a very delicious fruit of summer and is of comparatively short duration in W. Bengal. It is a plant

native of southern China and is now widespread in South East Asia, Hawaii, S. Africa, W. Indies and warmer parts of America. It is also distributed in southern part of Japan. In India it is best grown in North Bihar and Uttar Pradesh. W. Bengal also produces a good quantity of this fruit. Fruiting in W. Bengal is much earlier than in Bihar and U.P. About 1640 hectares of land of this state is under cultivation of Litchi in 24-Parganas, Hooghly, Nadia and Murshidabad districts. Among common vegetative methods air layering is found to be most effective and this practice is followed during the onset of monsoon.

Other Fruits : Apart from the fruits mentioned earlier there are quite a number of others like *Aegle marmelos* (Bel), *Syzygium cumini* (Kalojam) which are found wild as well as commonly grown in many gardens throughout W. Bengal. Whereas *Syzygium javanicum* (Jamrul), *S. jambos* (Golapjam) are also two common fruit trees having some ornamental usage also. *Grewia asiatica*, *Ziziphus mauritiana*, *Annona squamosa* (Ata) etc. though common and widespread in some localities of W. Bengal may be treated as minor fruits. *Anacardium occidentale* (Kaju) though abundantly cultivated in eastern coast of the peninsular plains as a very vital cash crop for international market, is grown in limited areas of coastal Midnapore district. The plant is usually propagated through seeds as well as by air-layering.

Vegetables : With a density of c. 400 people per sq. km. in the state no doubt a lot of consumable vegetables from other neighbouring states have a good market in W. Bengal but at the same time seasonal vegetables are grown in huge quantity throughout the state and also exported to other states.

W. Bengal in comparison to other states is specially rich in varieties of green vegetables. Here Cucurbitaceous species dominate in contributing major green vegetables and Amaranthaceous species and several others provide leafy vegetables of selective kinds suiting to the people of different tastes. The predominating cucurbit vegetables which flourish in most of the districts of the state, have great demand in other states also. The common species which are mainly grown in summer include *Trichosanthes dioica* (Patal), *Luffa acutangula* (Jhinga), *Momordica charantia* (Uchhe, Karala), *Cucumis sativus* (Shasha), *Luffa cylindrica* (Chichinga), *Cucurbita maxima* (Kumra). Though improved horticultural practices are overcoming the seasonal fruiting behaviour of many vegetables but commercially it is difficult to bring them to common market. Some of the cucurbits are now available throughout the year but commonly grown species are *Lagenaria ciceraria* (Lau), *Momordica dioica* (Kankrol), *Benincasa hispida* (Chalkumra), *Sechium edule* (Squash). During cold months three varieties of *Brassica oleracea* (Phalkopi, Bandha Kopi, Oikopi), *Raphanus sativus* (Mulo) and different horticultural varieties of *Solanum melongena* (Begun) provide extensive vegetables alongwith a number of subterranean tubers, corms like *Solanum tuberosum* (Alu), *Amorphophallus campanulatus* (Ol), *Colocasia antiquorum* (Gant Kachu), *Allocasia indica* (Man Kachu) and others.

A number of leguminous vegetables belonging to the species like *Pisum sativum* (Matar), more than six varieties of *Dolichos lablab* (Sim) are profusely grown in winter whereas *Vigna sinensis* (Barhatt), *Phaseolus vulgaris* are now commonly grown in different parts of the state.

Ornamentals : Flowering and ornamental plants have aroused considerable interest among people of W. Bengal with the support of state Government and also private organisers. Such appreciations are manifested through flower shows organised in many districts including those in Calcutta. Several private gardens in Calcutta as well as reputed nurseries in Calcutta & Howrah are actively engaged in providing flowering and ornamental plants of different seasons through their sale counters. The Indian Botanic Garden as a pioneering organisation for horticulture has a rich collection of flowering and ornamental plants of various categories. Special mention may be made about *Bougainvillea*, *Aroids*, *Nymphaeas*, *Jasminum* and *Canna*, together with the richest collections of almost all the ornamental and economic species of palms. Apart from a treasure of many succulents, ferns and rare and highly interesting flowering trees and shrubs, the garden has also a National Orchidarium housing hundreds of rich collection of orchids. The state Forest Department is also playing a vital role in providing many ornamental and flowering plants to private and government organisations. Jagannath Ghat in Calcutta is having one of the largest wholesale flower market in India on the eastern bank of the river Ganges. Flowers from different districts of Burdwan Division provide the largest quantity of supply of flowers in this market and Midnapore district has a dominant share in their supply. Some of the bulk quantity of flowers include *Tagetes patula* (Genda), *T. chinensis*, *Polyanthes tuberosa* (Rajani Gandha), *Impatiens balsamina* (Dopati), *Hibiscus rosa-sinensis* (Jaba), *Gladiolus sp.* (Gladiote), *Rosa damasciana* (Golap), *Tabernaemontana divaricata* (Tagar) *Jasminum sambac* (Jain) and almost all the common seasonal flowers throughout the year. *Nyctanthes arbor-tristis* (Shiulce), the most elegant flower of autumn and blooming in profusion with delicate fragrance during Durga Puja festival has been honoured as the State Flower of W. Bengal.

Orchid as a most fascinating flowering plant is now largely grown only in the hilly districts of Darjeeling and Kalimpong. The Pradhans having several nurseries at Kalimpong are growing large number of cultivated species of orchids and are marketing their plants not only in the country but also exporting to foreign countries.

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KEY TO THE FAMILIES

(D.M. Verma & Anand Kumar)

1. Stem with vascular bundles arranged in one or more rings; leaves usually reticulately veined; flowers generally 4-5 merous; cotyledons usually 2 :
 2. Perianth present, biseriate or multiseriate :
 3. Petals all free, or only some united :
 4. Ovary fully superior, or at least one whorl of perianth inferior, or stamens inferior or inserted on the top of a hypogynous disc in which the ovary may be immersed :
 5. Glands alternating with the petals; antheriferous stamens as many as or double or treble the number of petals; capsules 3-lobed, lobes prominently beaked ... GERANIACEAE
 5. Flowers and fruits not as above :
 6. Stamens more than twice as many as the petals :
 7. Aquatic herbs with rotundate peltate leaves; pistils many, embedded in a fleshy turbinate receptacle
... NELUMBONACEAE
 7. Plants not as above :
 8. Spinous trees or shrubs; leaves gland-dotted, 1- or 3-foliate; rachis usually winged; disc present between the stamens and the ovary; ovary 8-many-loculed, ovules many in each locule ... RUTACEAE
 8. Plants not as above :
 9. Stamens united into one or more bundles :
 10. Leaves opposite :
 11. Leaves punctate; seeds not arillate
... HYPERICACEAE
 11. Leaves not punctate; seeds often arillate
... CLUSIACEAE

10. Leaves alternate :

12. Anthers 1-celled:

13. Trees; leaves digitately compound; carpels in fruits not or rarely splitting away from the central axis; pollen mostly smooth ... BOMBACACEAE
13. Herbs, shrubs or trees; leaves simple or digitately compound; carpels frequently splitting away from the central axis or becoming free in fruit; pollen more or less muriculate ... MALVACEAE

12. Anthers 2-celled :

14. Flowers unisexual :

15. Carpels many ... MAGNOLIACEAE
15. Carpel solitary ... EUPHORBIACEAE

14. Flowers bisexual :

16. Leaves stipulate ... STERCULIACEAE
16. Leaves exstipulate ... THEACEAE

9. Stamens all free:

17. Pistils more than one:

18. Stamens perigynous, arising from the hypanthium :

... ROSACEAE

18. Stamens hypogynous, arising from the receptacle :

19. Perianth three- or more-seriate, 3-4-merous :

20. Anthers extrorse ... ANNONACEAE
20. Anthers introrse or latrorse ... MAGNOLIACEAE

19. Perianth two-seriate, 5-merous :

21. Trees; sepals always persistent ... DILLENIACEAE
21. Herbs, shrubs or climbers; sepals usually caducous ... RANUNCULACEAE

17. Pistil one:

22. Ovary stipitate on a gynophore ... CAPPARACEAE

22. Ovary sessile or subsessile :

23. Stamens perigynous, arising from hypanthium :

24. Anthers opening by an apical pore

... SAURAUICEAE

24. Anthers opening by longitudinal slits :

25. Leaves stipulate ... ROSACEAE

25. Leaves exstipulate :

26. Seeds minute, testa produced at both

ends in two tails

... SONNERATIACEAE

26. Seeds larger, winged from their summit ... LYTHRACEAE
23. Stamens hypogynous, arising from receptacle :
27. Flowers unisexual :
28. Climbing shrubs; styles many ... ACTINIDIACEAE
28. Trees, shrubs or herbs; styles 1-5, or absent :
29. Petals with a ciliate scale within the base; ovules many on five parietal placentas ... FLACOURTIACEAE
29. Characters not combined as above :
30. Styles 2-4 ... EUPHORBIACEAE
30. Style 1 or absent ... CLUSIACEAE
27. Flowers bisexual :
31. Leaves opposite :
32. Calyx campanulate, thick and leathery, 4-8-lobed, lobes valvate ... SONNERATIACEAE
32. Calyx not as above, 4-5-lobed, lobes imbricate ... HYPERICACEAE
31. Leaves alternate :
33. Leaves palmately veined :
34. Placentation axile ... TILIACEAE
34. Placentation parietal :
35. Leaves simple; anthers horse-shoe-shaped; fruits often echinate; seeds with red fleshy testa ... BIXACEAE
35. Leaves palmately lobed; anthers not curved as above; fruits smooth; seeds woolly ... COCHLOSPERMACEAE
33. Leaves pinnately veined :
36. Small creeping herbs; placentation basal ... PORTULACACEAE
36. Trees, shrubs or herbs; placentation otherwise :
37. Sepals 2 ... PAPAVERACEAE
37. Sepals 4-6 :
38. Leaves with prominent parallel lateral nerves, dentate; sepals accrescent ... DILLENIACEAE
38. Leaves neither prominently veined as above nor dentate; sepals accrescent or not :

39. Fruits of 3-10 drupes, seated on a broad disc ... OCHNACEAE
39. Fruits not as above :
40. Calyx accrescent in fruit ... DIPTEROCARPACEAE
40. Calyx not accrescent in fruit :
41. Ovary 1-loculed; placentation parietal ... FLACOURTIACEAE
41. Ovary 2-10-loculed; placentation axile :
42. Anthers dehiscing by longitudinal slits ... TILIACEAE
42. Anthers dehiscing by apical pores ... ELAEOCARPACEAE
6. Stamens fewer, at the most twice as many as the petals :
43. Parasitic yellowish brown herbs ... MONOTROPACEAE
43. Autotrophic green plants of various habits :
44. Shrubs, small trees with small scale-like leaves ... TAMARICACEAE
44. Plants of various habits, with well developed leaves:
45. Plants succulent; carpels free, usually as many as the petals, usually with a gland or a scale at the base of each petal; fruit a follicle ... CRASSULACEAE
45. Plants not as above:
46. Ovary 1-loculed, usually stipitate; ovules numerous on 2-4 parietal placentas; fruit usually a capsule, rarely a berry ... CAPPARACEAE
46. Above characters not combined :
47. Trees or shrubs, rarely herbs, with pellucid glands filled with essential oil; disc present within the stamens, crenate or lobed, sometimes large or long ... RUTACEAE
47. Plants not as above :
48. Leaves simple :
49. Ovary 1-loculed (or imperfectly up to 5-loculed) :
50. Climbers; flowers unisexual, 3-merous; seeds usually hooked or reniform, often curved ... MENISPERMACEAE
50. Plants not as above :
51. Climbers; flowers actinomorphic, with a distinct corona; ovules many, attached on three parietal placentas ... PASSIFLORACEAE

51. Above characters not combined :
52. Climbers or scandent shrubs; flowers with a disc;
ovules 1-3 :
53. Disc annular, more or less adherent around the
base of the ovary; calyx distinct, lobed ... OLACACEAE
53. Disc of separate glands or parts only united at the
base but not adherent to the ovary, calyx minute or
absent ... OPILIACEAE
52. Plants of various habits, other characters not united :
54. Small creeping herbs, sepals 2, jointed below, the
free part soon deciduous; capsule circumscissile
... PORTULACACEAE
54. Plants not as above:
55. Perianth in 3-series, connectives produced;
carpels many ... ANNONACEAE
55. Plants not as above :
56. Placentation free-central :
57. Herbs or undershrubs; leaves opposite;
stamens 8 or 10 ... CARYOPHYLLACEAE
57. Shrubs or small trees; leaves alternate;
stamens 3-7 (usually 5) ... MYRSINACEAE
56. Placentation otherwise:
58. Ovules biseriate on the posterior margin:
59. Leaves 2-pinnate, rarely phyllodic;
corolla actinomorphic; petals valvate;
stamens 4-many; seeds with a U-shaped
lateral line ... MIMOSACEAE
59. Leaves various; corolla zygomorphic;
petals imbricate, rarely absent; stamens
10(-5); seeds without a lateral line or
rarely with a closed line:
60. Adaxial petal interior (ascending
imbrication) or petals absent
... CAESALPINIACEAE
60. Adaxial petal exterior
(descending imbrication) ... FABACEAE
58. Ovules not arranged as above :
61. Plants insectivorous, covered with
sticky glandular hairs or leaves with
automatically closing lamina
... DROSERACEAE

61. Plants not insectivorous :
62. Anther connective produced beyond the cells;
anthers more or less connivent around the pistil; one
of the anther cells spurred ... VIOLACEAE
62. Anthers not as above :
63. Leaves stipulate :
64. Herbs with the leaves in a basal cluster
... SAXIFRAGACEAE
64. Trees or shrubs or if herbs then the
leaves distributed throughout the stem :
65. Fruit a capsule ... FLACOURTIACEAE
65. Fruit a drupe, pome, follicle or
achene ... ROSACEAE
63. Leaves exstipulate :
66. Scapigerous 1-flowered herbs
... PARNASSIACEAE
66. Plants not as above:
67. Style 1:
68. Seeds embedded in viscous pulp
... PITTOSPORACEAE
68. Seeds not embedded in viscous
pulp :
69. Anthers opening by valves
... BERBERIDACEAE
69. Anthers opening by
longitudinal slits :
70. Disc prominent
... ANACARDIACEAE
70. Disc absent or obscure
... ICACINACEAE
67. Styles 2-3 :
71. Fruit a capsule; seeds many,
arillate ... TURNERACEAE
71. Fruit a drupe; seeds 1-5, not
arillate ... ANACARDIACEAE
49. Ovary perfectly 2-or more-loculed :
72. Stamens usually tetradynamous, 4 long and 2 short;
petals 4, placed cross-wise; ovary divided by a spurious
membranous septum; fruit usually a siliqua ... BRASSICACEAE

72. Flowers and fruits not as above:

73. Fruit a samara; mericarps 2, prominently winged on the outer side ... ACERACEAE

73. Fruit not as above:

74. Flowers irregular:

75. Leaves peltate; calyx coloured, 2-lipped, lobes 5, dorsal lobe spurred; stamens 8, free, declinate; ovary 3-loculed ... TROPAEOLACEAE

75. Leaves not peltate; flowers not as above :

76. Calyx tubular with minute teeth; capsule included in the calyx ... LYTHRACEAE

76. Calyx broad above with 3-5 distinct lobes; capsule not included in the calyx :

77. Sepals 3, posterior petaloid, usually spurred at base; stamens 5, anthers connate over the ovary; ovary 5-loculed ... BALSAMINACEAE

77. Sepals 5, inner 2 petaloid, wing-like; stamens usually 8, or 4-5, monadelphous, the sheath split above; ovary 2-loculed ... POLYGALACEAE

74. Flowers regular :

78. Leaves opposite :

79. Herbs :

80. Style 1 ... LYTHRACEAE

80. Styles 2-5 ... ELATINACEAE

79. Trees, shrubs or climbers :

81. Stamens 10 ... MALPIGHIACEAE

81. Stamens less than 10 :

82. Stamens 2 ... OLEACEAE

82. Stamens 3-8 :

83. Ovules many in each locule ... LYTHRACEAE

83. Ovules 1-2 in each locule :

84. Axillary spines present ... SALVADORACEAE

84. Unarmed or branches sometimes spinescent but without axillary spines ... CELASTRACEAE

78. Leaves alternate :
85. Androecium columnar or tubular ... STERCULIACEAE
85. Androecium not as above :
86. Flowers all unisexual :
87. Pistils 3-6 MENISPERMACEAE
87. Pistil 1 :
88. Leaves stipulate; disc present ... EUPHORBIACEAE
88. Leaves exstipulate; disc absent ... AQUIFOLIACEAE
86. Flowers all bisexual or intermixed with unisexuals :
89. Plants climbing or creeping, with tendrils ... VITACEAE
89. Plants of various habits, without tendrils :
90. Ovary 3-5-loculed but spuriously
6-10-loculed due to secondary septa ... LINACEAE
90. Ovary without secondary septa:
91. Ovules many in each locule :
92. Anthers opening by apical pores
... ERICACEAE
92. Anthers opening by longitudinal slits:
93. Leaves verticillate ... ELATINACEAE
93. Leaves evenly distributed:
94. Flowers in spikes; bracts
connate at the base
... STACHYURACEAE
94. Inflorescence and bracts not
as above:
95. Disc present ROSACEAE
95. Disc absent ... TILIACEAE
91. Ovules 1-few in each locule :
96. Leaves stipulate:
97. Disc absent ... TILIACEAE
97. Disc present:
98. Stipules paired ... ROSACEAE
98. Stipules not paired :
99. Calyx lobes imbricate
... CELASTRACEAE
99. Calyx lobes valvate
... RHAMNACEAE
96. Leaves exstipulate:

100. Fruits containing viscous pulp ... **PITTOSPORACEAE**
100. Fruits without viscous pulp:
101. Anther-cells bursting transversely or by a deciduous cap, connectives thick ... **SABIACEAE**
101. Anthers not as above:
102. Fruit a capsule or a berry; seeds usually arillate ... **CELASTRACEAE**
102. Fruit a drupe; seeds not arillate:
103. Petals valvate ... **OLACACEAE**
103. Petals imbricate or sub-valvate ... **ANACARDIACEAE**
48. Leaves compound:
104. Herbs; leaves pinnate; stipules partially or completely adnate to the petiole; flowers 2-5 bracteolate; calyx persistent, disc lining the calyx-tube; fruit achenial ... **ROSACEAE**
104. Plants not as above :
105. Carpels 3-5:
106. Petals 6; carpels 3; fruit a berry ... **LARDIZABALACEAE**
106. Petals 3-5; carpels 4-5; fruit a drupe, samara or schizocarp ... **SIMAROUBAÇEAE**
105. Carpel 1:
107. Ovary 1-loculed :
108. Perennial herbs; leaves almost all radical, peltate, palmately lobed or 2-3-foliolate; fruit a berry or a follicle opening transversely or obliquely ... **PODOPHYLLACEAE**
108. Plants not as above:
109. Herbs; leaves usually dissected; flowers zygomorphic, in racemes; sepals 2, scale-like, deciduous; petals 4 in very dissimilar pairs, one or both gibbous or spurred; 2 inner smaller, erect, tips often coherent ... **FUMARIACEAE**
109. Plants not as above :

110. Shrubs; sepals and petals 6 each, imbricate, both
 biseriate; petals usually with 2 basal glands inside;
 stamens 6, anther-cells opening by recurved valves
 ... BERBERIDACEAE
110. Plants not as above :
111. Ovule 1, pendulous ... ANACARDIACEAE
111. Ovules 2 or more, not pendulous :
112. Trees with 2-3-pinnate leaves; stamens 5,
 staminodes 5-7; fruit a ribbed cylindrical
 3-valved capsule ... MORINGACEAE
112. Plants not as above :
113. Leaves 2-pinnate, rarely phyllodic;
 corolla actinomorphic, petals valvate;
 stamens 4-many; seeds with a U-shaped
 lateral line ... MIMOSACEAE
113. Leaves simple, digitate or 1-2-pinnate;
 corolla zygomorphic, petals imbricate,
 rarely absent; stamens 10 (-5); seeds
 usually without a lateral line, rarely with a
 closed line:
114. Adaxial petal interior (ascending
 imbrication) or petals absent
 ... CAESALPINIACEAE
114. Adaxial petal exterior
 (descending imbrication) ... FABACEAE
107. Ovary 2- or more-loculed :
115. Trees or shrubs; fruit a samara, mericarps 2, winged
 on the outer side, 1-2-seeded ... ACERACEAE
115. Not as above:
116. Stamens usually tetradynamous, 4 long and 2
 short; petals 4, often clawed, placed cross-wise;
 ovary divided by a spurious membranous septum;
 fruit usually a siliqua ... BRASSICACEAE
116. Plants not as above:
117. Plants with tendrils:
118. Leaves stipulate, simple, angled or
 palmately or pedately lobed or compound
 ... VITACEAE
118. Leaves exstipulate, biternately
 compound ... SAPINDACEAE
117. Plants without tendrils:

119. Slender creeping herbs:
120. Leaves stipulate ... ZYGOPHYLLACEAE
120. Leaves exstipulate ... OXALIDACEAE
119. Trees or shrubs:
121. Stamens opposite to petals and equal to or fewer than these ... SABIACEAE
121. Stamens at least one whorl alternating with the petals, equal to or up to twice as many as the petals:
122. Disc absent ... AVERRHOACEAE
122. Disc present:
123. Leaves 2-foliolate or digitate:
124. Leaves 2-foliolate ... BALANITACEAE
124. Leaves digitate ... SAPINDACEAE
123. Leaves otherwise:
125. Flowers irregular; disc extrastaminal ... SAPINDACEAE
125. Flowers regular; disc intrastaminal:
126. Filaments pilose, anthers versatile ... SAPINDACEAE
126. Filaments glabrous, anthers otherwise:
127. Leaves stipulate or exstipulate; filaments free or connate at the base; fruit a drupe, rarely a pseudo-capsule; seeds not winged ... BURSERACEAE
127. Leaves exstipulate; filaments usually connate in to a tube, fruit a capsule or a drupe; seeds not winged; if filaments free, then fruit a capsule with winged seeds ... MELIACEAE
4. Ovary fully inferior or perianth and stamens perigynous :
128. Stamens more than twice as many as the petals :
129. Aquatic plants; lamina floating, peltate with a basal sinus; pistils many; fruit a spongy berry ... NYMPHAEACEAE
129. Plants not as above :

130. Flowers unisexual or polygamous :
131. Succulent herbs or undershrubs; leaf-base oblique;
capsules often winged ... BEGONIACEAE
131. Trees; leaf-base equal; capsules not winged
... HAMAMELIDACEAE
130. Flowers bisexual:
132. Sepals 2 ... PORTULACACEAE
132. Sepals more than 2:
133. Plants spiny, succulent, almost leafless ... CACTACEAE
133. Plants not as above:
134. Leaves gland-dotted ... MYRTACEAE
134. Leaves not gland-dotted:
135. Leaves opposite or fasciculate:
136. Leaves stipulate; petals 2-fid,
each lobe multifid ... RHIZOPHORACEAE
136. Leaves exstipulate; petals entire:
137. Petals wrinkled; ovary-loculi
superposed in 2 series, the lower
with axile, the upper with parietal
placentas ... PUNICACEAE
137. Petals not wrinkled;
ovary-loculi not superposed;
placentation throughout axile
... SONNERATIACEAE
135. Leaves alternate:
138. Leaves stipulate ... ROSACEAE
138. Leaves exstipulate:
139. Disc absent ... SYMPLICACEAE
139. Disc present:
140. Flowers in racemes or
interrupted spikes, petals
imbricate ... LECYTHIDACEAE
140. Flowers in axillary
cymes; petals valvate
... ALANGIACEAE
128. Stamens twice as many as the petals or less :
141. Aquatic or terrestrial wiry plants; leaves simple, entire
or pectinately dissected; flowers in axillary fascicles, spikes
or racemes; stigmas 2-4, plumose, sessile
... HALORAGACEAE

141. Plants not as above:

142. Aquatic herbs; floating leaves rhomboid; fruits
2-spined ... TRAPACEAE

142. Plants not as above:

143. Succulent herbs; sepals 2, connate below, the
free part deciduous ... PORTULACACEAE

143. Plants not as above:

144. Perennial scapigerous herbs; scape angular,
1-flowered; leaves radical, long petioled
... PARNASSIACEAE

144. Plants not as above:

145. Dichotomously branched pubescent or
glandular-pilose herbs; flowers axillary,
paired; ovary 1-loculed, ovules numerous
attached to 2 large placentas hanging from
the apex of the loculus ... VAHLIACEAE

145. Plants not as above :

146. Inflorescence umbellate :

147. Plants usually woody; fruit a
berry or a drupe ... ARALIACEAE

147. Plants herbaceous; fruit a
cremocarp ... APIACEAE

146. Inflorescence otherwise:

148. Fruits winged :

149. Wing 1 ... RHAMNACEAE

149. Wings 2-5 ... COMBRETACEAE

148. Fruits not winged :

150. Leaves stipulate :

151. Leaves opposite;
stamens in pairs
... RHIZOPHORACEAE

151. Leaves alternate;
stamens not in pairs :

152. Stipules mostly
paired; disc lining
the calyx tube or
forming a ring at
its base; style
basal, lateral or
subterminal
... ROSACEAE

152. Plants not as above :
153. Ovary 1-loculed :
154. Leaves plicate or convolute in bud; stamens
4-5, alternate with the petals; fruit a berry
... GROSSULARIACEAE
154. Leaves neither plicate nor convolute in bud;
stamens solitary or in fascicles of 2-7,
opposite the petals with alternating glands;
fruit a capsule ... FLACOURTIACEAE
153. Ovary 2-4-loculed :
155. Anther-connective broad or produced;
hypogynous scales present ... HAMAMELIDACEAE
155. Anther-connective not as above;
hypogynous scales absent ... RHAMNACEAE
150. Leaves exstipulate :
156. Ovules pendulous :
157. Ovary 2-5-loculed :
158. Ovules 2-4 in each locule; stamens adnate
to the petals ... SYMPLOCACEAE
158. Ovule 1 in each locule; stamens not adnate
to the petals ... CORNACEAE
157. Ovary 1-loculed :
159. Petals linear, deciduous; filaments villous;
drupes ribbed, crowned with persistent disc
and calyx lobes ... ALANGIACEAE
159. Plants not as above :
160. Flowers in spikes or racemes
... COMBRETACEAE
160. Flowers in cymose panicles or heads
... CORNACEAE
156. Ovules on axile, parietal or free-central placenta:
161. Climbing herbs or shrubs with tendrils
... CUCURBITACEAE
161. Herbs, shrubs, trees or climbers without tendrils:
162. Leaves plicate or convolute in bud; fruit a
pulpy berry crowned by the persistent calyx
... GROSSULARIACEAE
162. Leaves and fruits not as above:
163. Ovules few (1-5):

175. Parasitic, brown or yellowish leafless herbs
... MONOTROPACEAE
175. Autotrophic green plants:
176. Plants succulent; ovary apocarpous or free almost to the base
... CRASSULACEAE
176. Plant not as above:
177. Herbs; leaves digitately or pinnately compound; stamens 10, obdiplostemonous; ovary 5-loculed; styles 5; fruit a capsule
... OXALIDACEAE
177. Plants not as above:
178. Filaments connate into a tube; anthers erect, usually sessile; disc present
... MELIACEAE
178. Above characters not united:
179. Leaves usually compound; fruit a legume, sometimes indehiscent or lomentoid:
180. Leaves 2-pinnate, rarely phyllodic; corolla actinomorphic; petals valvate
... MIMOSACEAE
180. Leaves simple, digitate or 1-pinnate; corolla zygomorphic, petals imbricate
... FABACEAE
179. Leaves always simple or palmately-lobed; fruit a berry or a capsule:
181. Leaves palmately-lobed:
182. Ovary 1-loculed or spuriously 5-loculed; ovules many on parietal placentas; fruit a pulpy obovoid berry
... CARICACEAE
182. Ovary 2-4-loculed; ovule 1, pendulous from the inner angle of the loculus; fruit a capsule
... EUPHORBIACEAE
181. Leaves simple :
183. Petals united at the base only:
184. Resinous trees; stamens subulate, cuspidate; calyx accrescent in fruits
... DIPTEROCARPACEAE
184. Plants not as above :

185. Bracts 2, well developed ... TERNSTROEMIACEAE
185. Bracts inconspicuous or absent :
186. Calyx lobes free; stamens many; anthers
dehiscing by pores ... SAURAUACEAE
186. Calyx campanulate; stamens 10; anthers
dehiscing by longitudinal slits ... STYRACACEAE
183. Petals united for most of its length :
187. Flowers unisexual :
188. Plants usually dioecious; fruit a berry with
accrescent calyx ... EBENACEAE
188. Plants monoecious; fruit a capsule
without accrescent calyx ... EUPHORBIACEAE
187. Flowers bisexual:
189. Anthers opening by terminal pores or pore
like slits; ovules many in each locule ... ERICACEAE
189. Anthers opening lengthwise; ovule 1 in
each locule ... SAPOTACEAE
170. Stamens as many as the corolla lobes or fewer:
190. Scandent shrubs, usually root-parasites; flowers
bisexual; calyx lobes minute; corolla tubular or urceolate,
lobes 4-5, reflexed; disc lobes alternating with the
stamens; ovary 1-loculed, 1-ovuled; fruit a drupe
... OPILIACEAE
190. Plants not as above:
191. Ovary partly or fully inferior:
192. Creepers or climbers with tendrils; sepals
and petals 5 each; stamens basically 5, usually 3,
2 two-celled, 1 one-celled but sometimes 4, 2 or
even 1; anthers very often variously
conduplicate; fruit a pepo, berry or capsule
... CUCURBITACEAE
192. Plants of various habits, mostly without
tendrils; other characters not in above
combination :
193. Corolla usually zygomorphic; stamens
didynamous, often 2 only fertile, rarely 5
fertile, anthers connate or connivent in
pairs, rarely free; disc usually present;
ovary 1-loculed with 2 parietal or intrusive
placentas; ovules many; fruit a capsule,
rarely a berry ... GESNERIACEAE
193. Flowers not as above :

194. Anthers or filaments and style connate:
195. Flowers in involucrate heads; ovary 1-loculed
... ASTERACEAE
195. Flowers not in heads; ovary 2-3-loculed :
196. Stamens 2; filaments and style connate into a column
... STYLIDIACEAE
196. Stamens 5; anthers coherent into a tube around the style, filaments free
... CAMPANULACEAE
194. Anthers or filaments and style free :
197. Ovary 1-loculed:
198. Leaves alternate; flowers in racemes; ovules many
... MYRSINACEAE
198. Leaves opposite or whorled; flowers in cymes or whorled in spikes or more often in dense heads; ovule solitary
... DIPSACACEAE
197. Ovary 2-10-loculed:
199. Leaves pinnate or pinnatifid:
200. Leaves stipulate; stamens 5
... CAPRIFOLIACEAE
200. Leaves exstipulate; stamens 1-4
... VALERIANACEAE
199. Leaves simple :
201. Leaves with inter- or intra-petiolar stipules; if the stipules are absent then leaves usually whorled
... RUBIACEAE
201. Leaves not as above :
202. Corolla lobes imbricate in bud
... CAPRIFOLIACEAE
202. Corolla lobes valvate in bud:
203. Flowers in dense cylindrical spikes; capsules circumscissile
... SPHENOCLEACEAE
203. Flowers variously arranged; fruits not as above
... CAMPANULACEAE
191. Ovary superior :
204. Plants often with milky latex, frequently climbing; corolla often with a corona of hairs, scales or teeth;

pollen in waxy subpellucid masses (pollinia), filaments connate into a tube, or pollen granular and filaments free; fruit of 2 follicles, dehiscing ventrally; seeds usually winged and/or crowned with a coma of silky hairs

... ASCLEPIADACEAE

204. Plants not as above:

205. Succulent herbs or undershrubs with opposite leaves;

corolla lobes 4-5; hypogynous scales present; carpels 4-5,

free

... CRASSULACEAE

205. Plants not as above :

206. Stamens opposite the corolla lobes :

207. Ovary 1-loculed :

208. Styles 5; placentation basal

... PLUMBAGINACEAE

208. Style 1; placentation free-central :

209. Shrubs or small trees; leaves

alternate; fruits indehiscent or

longitudinally dehiscing

... MYRSINACEAE

209. Herbs; leaves usually opposite;

fruits dehiscing transversely or by

valves

... PRIMULACEAE

207. Ovary 2-or more-loculed :

210. Leaves compound; stamens united by the filaments

... LEEACEAE

210. Leaves simple; stamens free :

211. Flowers bisexual; stamens

epipetalous; ovules ascending from

the inner angle; seeds with a large

broad hilum

... SAPOTACEAE

211. Flowers unisexual; stamens not

epipetalous; ovules pendulous from

the inner angle; seeds with a small

hilum

... EBENACEAE

206. Stamens alternate with the corolla lobes :

212. Corolla irregular :

213. Nodes swollen; leaves opposite, often

with distinct cystoliths; inflorescence

usually with conspicuous bracts; fruits

mostly elastically dehiscent; seeds often on

upcurved processes (retinacula)

... ACANTHACEAE

213. Plants not as above :
214. Ovules and seeds few:
215. Mangrove plants; seeds without testa
... AVICENNIACEAE
215. Non-mangrove plants; seeds with testa :
216. Leaves all alternate :
217. Fruit a capsule ... SCROPHULARIACEAE
217. Fruit a drupe or of 2-4 nutlets
... BORAGINACEAE
216. Leaves all opposite or sometimes upper
leaves alternate :
218. Ovary 4-lobed :
219. Style gynobasic ... LAMIACEAE
219. Style terminal ... VERBENACEAE
218. Ovary not lobed :
220. Disc absent or inconspicuous
... VERBENACEAE
220. Disc conspicuous :
221. Capsules with spinules
... PEDALIACEAE
221. Capsules without spinules
... SCROPHULARIACEAE
214. Ovules and seeds many :
222. Plants of aquatic or wet places, typically with
small insectivorous bladders; leaves radical-rosulate,
capillary-multifid or obsolete; flowers scapose;
stamens 2, anther-cells transversely confluent
... LENTIBULARIACEAE
222. Plants not as above :
223. Leaves compound ... BIGNONIACEAE
223. Leaves simple or dissected :
224. Plants root-parasites devoid of
chlorophyll; leaves absent or scale like
... OROBANCHACEAE
224. Plants free-living, with chlorophyll;
leaves well developed :
225. Placentation parietal, sometimes
intruded and meeting below the

- middle of the locule but branched or winged ... GENTIANACEAE
225. Placentation axile, unbranched:
226. Anthers opening by pores ... ERICACEAE
226. Anthers opening by longitudinal slits:
227. Ovary 2-loculed ... SCROPHULARIACEAE
227. Ovary spuriously 4-loculed ... PEDALIACEAE
212. Corolla regular :
228. Scapigerous herbs; leaves usually radical; corolla scarious; fruit a circumscissile capsule ... PLANTAGINACEAE
228. Plants not as above :
229. Trees, shrubs or climbers; leaves opposite, simple or compound; corolla monopetalous, rarely 4-9-petalous; stamens 2; ovary 2-loculed, ovules 1-2 (rarely 3-4) in each locule ... OLEACEAE
229. Plants not as above :
230. Herbs or shrubs; leaves alternate, often in unequal pairs, rarely clustered, entire or lobed or pinnate; flowers bisexual, rarely unisexual; calyx usually persistent, often accrescent; corolla funnel-shaped, campanulate or rotate, often plaited; anthers opening by apical pores or longitudinal slits; ovary usually 2-loculed or imperfectly 1-4-loculed (rarely 3-5-loculed); ovules many on prominent peltate placentas; fruit a berry or a capsule ... SOLANACEAE
230. Plants not as above :
231. Leaves alternate :
232. Climbing herbs with milky sap; leaves broadly cordate; stigmas 2, one elongated and columnar, and persistent in the fruit, the other short ... CARDIOPTERIDACEAE
232. Plants not as above :
233. Flowers in scorpioid cymes or calyx with appendaged sinuses:
234. Fruit a capsule ... HYDROPHYLLACEAE
234. Fruit of 2-4-nutlets or a drupe ... BORAGINACEAE

233. Flowers neither in scorpioid cymes nor calyx appendaged :
235. Ovary of 2 distinct carpels ... APOCYNACEAE
235. Ovary not as above :
236. Ovules pendulous from the apex of ovary :
237. Calyx cupular, lobes valvate;
leaf-margin not prickly ... ICACINACEAE
237. Calyx not cupular, lobes imbricate;
leaf-margin usually prickly ... AQUIFOLIACEAE
236. Ovules otherwise :
238. Placentation parietal :
239. Aquatic herbs; corolla lobes
induplicate valvate in bud
... MENYANTHACEAE
239. Terrestrial shrubs or trees;
corolla lobes imbricate in bud
... PITTOSPORACEAE
238. Placentation axile :
240. Ovules many in each locule
... CAMPANULACEAE
240. Ovules 1-2 in each locule :
241. Plants usually climbing,
rarely leafless; sepals free;
corolla lobes plicate-contorted;
style terminal; fruit capsular or
fleshy and indehiscent
... CONVULVACEAE
241. Plants erect herbs, shrubs or
trees, always leafy; sepals
connate; corolla lobes imbricate;
style terminal or gynobasic; fruit
dry with 4 nutlets or drupaceous
with 1-4-loculed pyrene
... BORAGINACEAE
231. Leaves opposite, sometimes whorled or crowded :
242. Plants usually with milky sap; corolla rotate or
salver-shaped, contorted and often twisted in bud;
anthers connivent or free around the stigma; ovary
1-2-loculed or of 2 free or partly connate carpels; fruit a
berry, drupe or a follicle; seeds often winged, or
appendaged with long silky hairs ... APOCYNACEAE

242. Plants not as above :
243. Ovules 1 or a few in each locule :
244. Ovary 1-loculed; style very short or almost absent ... SALVADORACEAE
244. Ovary 2-4-loculed; style well developed:
245. Flowers usually in dichotomous scorpioid cymes, rarely solitary and axillary; branchlets often terete ... BORAGINACEAE
245. Flowers in compound or paniced cymes, racemes or spikes; branchlets often quadrangular ... VERBENACEAE
243. Ovules many in each locule:
246. Undershrubs with prostrate branches; leaves densely crowded; flowers solitary terminal, corolla campanulate, persistent ... DIAPENSIACEAE
246. Plants not as above:
247. Leaves connate at the base by a nerve or stipular sheath ... LOGANIACEAE
247. Leaves not connate as above:
248. Scandent shrubs or trees ... LOGANIACEAE
248. Herbs:
249. Corolla lobes contorted ... GENTIANACEAE
249. Corolla lobes imbricate ... SCROPHULARIACEAE
2. Perianth absent or if present, then uniseriate:
250. Plants parasitic (sometimes partly):
251. Plants twining ... LAURACEAE
251. Plants erect:
252. Herbs:
253. Scale leaves present; flowers unisexual, very rarely bisexual, densely crowded into unisexual or androgynous inflorescence; ovules 1-3 ... BALANOPHORACEAE
253. Scale leaves absent; flowers bisexual, solitary; ovules many ... FLACOURTIACEAE
252. Trees or shrubs :

254. Plants stem-parasites ... LORANTHACEAE
254. Plants root-parasites :
255. Ovary superior ... OPILIACEAE
255. Ovary inferior ... SANTALACEAE
250. Plants autotrophic :
256. Plants submerged :
257. Plants free-floating; flowers unisexual; ovule
 solitary ... CERATOPHYLLACEAE
257. Plants attached to rocks in streams; flowers
 bisexual; ovules many ... PODOSTEMACEAE
256. Plants not submerged:
258. Perianth absent:
259. Flowers solitary ... CALLITRICHACEAE
259. Flowers not solitary:
260. Flowers in cyathia; latex present
 ... EUPHORBIACEAE
260. Flowers not in cyathia; latex absent:
261. Leaves reduced, scale-like
 ... CASUARINACEAE
261. Leaves well developed:
262. Ovary 2-loculed ... OLEACEAE
262. Ovary 1-loculed:
263. Flowers usually bisexual;
 ovule solitary; fruit a drupe
 ... PIPERACEAE
263. Flowers usually
 unisexual; ovules many; fruit
 a capsule ... SALICACEAE
258. Perianth present (at least in one of the sexes, if
 the flowers are unisexual):
264. Ovary inferior or half-inferior:
265. Plants herbaceous:
266. Leaves alternate:
267. Succulent herbs; leaves
 oblique; flowers unisexual,
 usually zygomorphic; ovary
 angled or winged ... BEGONIACEAE
267. Plants not as above:
268. Leaves stipulate ... ROSACEAE
268. Leaves exstipulate :

269. Ovules 1-4 ... HALORAGACEAE
 269. Ovules many ... SAXIFRAGACEAE
266. Leaves opposite or whorled:
 270. Perianth corolline ... NYCTAGINACEAE
 270. Perianth calycine:
 271. Stamens 1-3, connate into a mass; ovule
 solitary ... CHLORANTHACEAE
 271. Stamens 2 or more, free, ovules many :
 272. Flowers always bisexual; fruit a capsule
 ... LYTHRACEAE
 272. Flowers unisexual or bisexual; fruit a
 nut or a drupe, indehiscent or rarely
 breaking into cocci ... HALORAGACEAE
265. Plants woody, usually trees or shrubs :
 273. Leaves stipulate :
 274. Flowers unisexual :
 275. Male flowers without calyx :
 276. Leaves opposite ... CHLORANTHACEAE
 276. Leaves alternate :
 277. Male and female flowers in heads;
 ovules many ... HAMAMELIDACEAE
 277. Male flowers in catkins; female
 flowers geminate in a short spike;
 ovules 1-2 ... CORYLACEAE
 275. Male flowers with calyx:
 278. Stipules paired ... HAMAMELIDACEAE
 278. Stipules not paired ... FAGACEAE
 274. Flowers bisexual ... HAMAMELIDACEAE
273. Leaves exstipulate:
 279. Disc present (in male flowers only in
 Tetramelaceae):
 280. Leaves glandular-punctate ... MYRTACEAE
 280. Leaves not glandular-punctate:
 281. Stamens 8-10 ... COMBRETACEAE
 281. Stamens 4-5:
 282. Ovule 1-3:
 283. Ovary inferior ... SANTALACEAE
 283. Ovary half-inferior ... OPILIACEAE
 282. Ovules many ... TETRAMELACEAE
 279. Disc absent:

284. Herbs or shrubs, often climbing ... ARISTOLOCHIACEAE
284. Trees:
285. Leaves imparipinnate, alternate, rarely opposite,
flowers unisexual, in spikes or catkins ... JUGLANDACEAE
285. Leaves simple, opposite; flowers bisexual, 1 or 3
together ... SONNERATIACEAE
264. Ovary superior :
286. Anthers opening from the base upwards by valves ... LAURACEAE
286. Anthers not dehiscing as above :
287. Thorny shrubs or small trees; leaves aromatic;
petiole and rachis winged ... RUTACEAE
287. Plants not as above:
288. Carpels 2 or more:
289. Carpels free:
290. Herbs or climbing shrubs:
291. Flowers bisexual; stamens
free; fruit an achene or a follicle ... RANUNCULACEAE
291. Flowers unisexual, dioecious;
stamens connate; fruit a drupe ... MENISPERMACEAE
290. Trees or shrubs:
292. Fruits woody or membranous ... STERCULIACEAE
292. Fruits fleshy ... LARDIZABALACEAE
289. Carpels united below:
293. Small trees; leaves stipulate ... HAMAMELIDACEAE
293. Herbs; leaves exstipulate ... SAXIFRAGACEAE
288. Carpel 1:
294. Ovary 2- or more-loculed:
295. Placentation axile:
296. Ovules many in each locule ... AIZOACEAE
296. Ovules 1-3 in each locule:

297. Stipules and disc absent; stamens 2; ovary 2-loculed
... OLEACEAE
297. Stipules and disc usually present; stamens 1 to many;
ovary usually 3-loculed(rarely 2-or more-loculed)
... EUPHORBIACEAE
295. Placentation otherwise:
298. Herbs ... AIZOACEAE
298. Trees, shrubs or climbers:
299. Plants armed; leaves prominently 3-nerved :
... RHAMNACEAE
299. Plants unarmed; leaves not prominently
3-nerved :
300. Leaves simple :
301. Fruits 3-winged ... SAPINDACEAE
301. Fruits not winged as above:
302. Flowers bisexual, in axillary and
terminal umbels; perianth
campanulate ... THYMELEACEAE
302. Flowers unisexual, males in
pendulous catkins, females in
cylindrical cone-like spikes; perianth
much reduced or absent, not
campanulate ... BETULACEAE
300. Leaves pinnate ... SAPINDACEAE
294. Ovary 1-loculed :
303. Plants twining, dioecious; flowers minute; anthers
4-5, connate into a peltate disc; fruit a drupe; seed
solitary, horse- shoe-shaped ... MENISPERMACEAE
303. Plants not as above:
304. Annual or perennial herbs, rarely undershrubs:
305. Plants with ochreate stipules ... POLYGONACEAE
305. Plants without ochreate stipule :
306. Perianth and bracts hyaline or scarious
... AMARANTHACEAE.
306. Perianth and bracts herbaceous:
307. Flowers unisexual:
308. Filaments inflexed in bud
... URTICACEAE
308. Filaments erect in bud:

309. Leaves stipulate ... CANNABACEAE
 309. Leaves exstipulate ... CHENOPODIACEAE
307. Flowers bisexual:
310. Stamens, at least 1 whorl alternating with the perianth lobes ... PHYTOLACCACEAE
310. Stamens opposite the perianth lobes:
311. Twining herbs; bracteoles adnate to the perianth ... BASELLACEAE
311. Erect or prostrate herbs; bracteoles free from the perianth ... CHENOPODIACEAE
304. Trees or shrubs, sometimes scandent:
312. Leaves stipulate:
313. Plants usually scandent; flowers bisexual; perianth lobes 4-5, free or united at the base; stamens 4-5, opposite the perianth, free or united to the base of tepals; disc glands alternating with the stamens ... OPILIAACEAE
313. Plants not as above:
314. Perianth tubular or campanulate:
315. Plants with lepidote or stellate indumentum; ovule solitary, basal ... ELAEAGNACEAE
315. Plants without lepidote or stellate indumentum; ovule solitary, apical ... THYMELEACEAE
314. Perianth otherwise :
316. Leaves opposite ... CLUSIACEAE
316. Leaves alternate:
317. Ovule 1, basal ... CHENOPODIACEAE
317. Ovules more than 1, parietal ... FLACOURTIACEAE
312. Leaves exstipulate:
318. Leaves pinnate; fruit a legume ... CAESALPINIACEAE
318. Leaves and fruits otherwise:
319. Placentation parietal ... FLACOURTIACEAE
319. Placentation otherwise:
320. Ovules 2:
321. Style branched ... EUPHORBIACEAE
321. Style unbranched ... ROSACEAE
320. Ovule 1:

322. Ovule basal ... URTICACEAE
322. Ovule apical:
323. Anthers inflexed and reversed in bud ... MORACEAE
323. Anthers erect in bud ... ULMACEAE
1. Stem with vascular bundles scattered; leaves usually parallel-veined; flowers generally 3-merous; cotyledon 1:
324. Plant body thalloid, not differentiated into stem and leaves; minute floating aquatic herbs ... LEMNACEAE
324. Plant body not thalloid, differentiated into stem and leaves, or stem sometimes absent; terrestrial or aquatic plants:
325. Trees, shrubs or scramblers with plicate fan-shaped or pinnatisect leaves; flowers almost sessile, 3-merous, in fleshy spikes or panicles with spatheaceous bracts ... ARECACEAE
325. Plants not as above:
326. Dioecious spiny trees or shrubs often supported by stilt roots; leaves long, linear, leathery; perianth rudimentary; fruit a syncarp ... PANDANACEAE
326. Plants not as above:
327. Plants sarmentose, climbing with cirrhous leaf-tips; flowers bisexual, in terminal panicles; ovary 3-loculed with 1 ovule in each locule; fruit a drupe ... FLAGELLARIACEAE
327. Plants not as above:
328. Tall aquatic monoecious herbs; leaves basal, striate, plano-convex above the sheath, female and male flowers in two cylindrical superposed spikes ... TYPHACEAE
328. Plants not as above:
329. Leaves large, spirally arranged with long sheathing imbricated petioles forming tall pseudostem; flowers in spadix with several spathes, monoecious, zygomorphic; fertile stamens 5; fruits fleshy, usually indehiscent ... MUSACEAE
329. Plants not as above:

330. Inflorescence a spadix of inconspicuous florets subtended by a spathe which is usually large and showy; fruit a berry ... ARACEAE
330. Inflorescence, flowers and fruits not as above:
331. Ovary inferior or half-inferior:
332. Perennial herbs; leaves usually ensiform, equitant; flowers solitary or in racemes; perianth large, showy; stamens 3; ovary not winged ... IRIDACEAE
332. Plants not as above :
333. Flowers actinomorphic or sometimes slightly zygomorphic:
334. Plants aquatic, usually submerged. flowers unisexual or bisexual, subtended by a pair of more or less connate spathes ... HYDROCHARITACEAE
334. Plants usually terrestrial, never submerged; flowers not as above:
335. Plants climbing; leaves simple or digitately compound; flowers unisexual capsules winged ... DIOSCOREACEAE
335. Plants not as above:
336. Leaves absent, scale-like or well developed; flowers solitary or cymose; perianth minute; ovary 3-winged ... BURMANNIACEAE
336. Leaves always well developed flowers not as above :
337. Leaves prickly throughout the margins, or at least with a prickle at the tip ... AGAVACEAE
337. Leaves not prickly:
338. Perianth lobes 4, hisciate; fertile stamens 4 ... STEMONACEAE
338. Perianth lobes various; fertile stamens 3 or 6 :

339. Perianth tubular or campanulate, persistent in fruits, often covered with plumose hairs
... HAEMODORACEAE
339. Perianth not as above:
340. Inflorescence umbellate with four broad involueral bracts and many filiform bractenles; placentation parietal ... TACCACEAE
340. Inflorescence not as above; placentation axile:
341. Outer perianth lobes calycine, inner corolline ... BROMELIACEAE
341. Perianth lobes all corolline:
342. Rootstock bulbous; flowers in umbels ... AMARYLLIDACEAE
342. Rootstock tuberous; flowers in spikes or racemes ... HYPOXIDACEAE
333. Flowers strongly zygomorphic:
343. Median petal modified into a lip (labellum); stamens and style united into a column; pollen usually in pollinia; seeds without endosperm
... ORCHIDACEAE
343. Flowers not as above, the lip formed by the union of petaloid staminodes; column and pollinia absent; seeds with endosperm:
344. Anther 1-loculed:
345. Ovule solitary in each locule ... MARANTACEAE
345. Ovules many in each locule ... CANNACEAE
344. Anther 2-loculed ... ZINGIBERACEAE
331. Ovary superior or naked:
346. Perianth petaloid or subpetaloid, at least in part:
347. Carpels many, free:
348. Flowers in spikes ... APONOGETONACEAE
348. Flowers not in spikes:
349. Flowers solitary or umbellate; ovules many, scattered on the reticulately branched parietal placentas; fruit a follicle
... BUTOMACEAE
349. Flowers often whorled, racemose or paniculate; ovule solitary or many, basal or on the inner angle; fruit an achene
... ALISMATACEAE

347. Carpels solitary or united:
350. Perianth biseriate with the outer whorl sepaloid and inner whorl petaloid:
351. Sepals heteromorphic; ovary 1- or imperfectly 3-loculed; placentation parietal or basal ... XYRIDACEAE
351. Sepals homomorphic; ovary 2-3-loculed; placentation axile :
352. Ovules many in each locule; fruits fleshy ... BROMELIACEAE
352. Ovules one or few in each locule; fruits not fleshy ... COMMELINACEAE
350. Perianth uniseriate or if biseriate then the inner and the outer whorls similar, often petaloid or united into a tube below:
353. Aquatic herbs; inflorescence subtended by a spathe-like leaf sheath ... PONTEDERIACEAE
353. Terrestrial herbs, shrubs or climbers; inflorescence not subtended by a spathe-like leaf sheath:
354. Plants herbaceous; leaves succulent or membranous ... LILIACEAE
354. Plants woody; leaves coriaceous:
355. Plants climbing; venation reticulate; anthers 1 celled ... SMILACACEAE
355. Plants not climbing; venation parallel; anthers 2-loculed ... AGAVACEAE
346. Perianth absent, or of scales, hairs, bristles or lodicules, never petaloid:
356. Inflorescence capitate subtended by an involucre of bracts; flowers unisexual, usually monoecious; perianth lobes in two series of 2-3 each, the inner sometimes absent ... ERIOCAULACEAE
356. Flowers not as above:
357. Flowers imbricated in distichous or cylindrical spikelets (sometimes 1-flowered), each flower subtended by 1-2 glumaceous bracts and more or less hidden within it:
358. Stems usually solid and 3-angled; leaf sheath usually closed; flower subtended by a single glume; anthers basifixed ... CYPERACEAE

358. Stem usually with hollow internodes and terete; leaf sheath usually open; flower enclosed by two glumes lemma and palea (sometimes one or both absent); anther mostly dorsifixed and versatile ... POACEAE
357. Flowers arranged in heads, spikes, cymes, fascicles or panicles, not in spikelets, sometimes solitary, axillary:
359. Plants mostly terrestrial; flowers variously arranged; tepals 3 or 6, scarious; carpels united; fruit a capsule ... JUNCACEAE
359. Plants aquatic; flowers axillary or in spikes; other characters not in above combination :
360. Flowers arranged in spikes :
361. Saline water plants; perianth absent; fruiting carpels stipitate ... RUPPIACEAE
361. Fresh water plants; perianth present; fruiting carpels sessile:
362. Perianth lobes 1-3, membranous; carpels 3-6, ovules 2 or more in each carpel ... APONOGETONACEAE
362. Perianth lobes 4, herbaceous; carpels 4; ovule 1 in each carpel ... POTAMOGETONACEAE
360. Flowers not arranged in spikes, axillary:
363. Annuals; carpel 1; ovule basal, erect ... NAJADACEAE
363. Perennials; carpels 2-9; ovule apical, pendulous ... ZANICHELLIACEAE

RANUNCULACEAE

(B. P. Uniyal & K. Thothathri)

A family of ca 50 genera and 1900 species chiefly in North Temperate zone; 15 genera and 52 species are reported from West Bengal.

1. Flowers zygomorphic:
 2. Posterior sepal helmet-shaped ... 1. ACONITUM
 2. Posterior sepal spurred:
 3. Nectary one or absent; follicle single ... 7. CONSOLIDA
 3. Nectaries 2; follicles 3-5 ... 8. DELPHINIUM
1. Flowers actinomorphic:
 4. Leaves opposite or whorled:
 5. Terminal leaflet usually transformed into tendril; petals present ... 11. NARAVELIA
 5. Terminal leaflet similar to others; petals absent ... 6. CLEMATIS
 4. Leaves radical or alternate:
 6. Flowers several in dense racemes; petals 2-horned at tip ... 5. CIMICIFUGA
 6. Flowers solitary or few in cymes, corymbs, umbels or panicles; petals, if present, not horned:
 7. Petals present:
 8. Petals 10 - 15 ... 13. OXYGRAPHIS
 8. Petals usually 5:
 9. Fruit follicular:
 10. Follicles connate almost up to apex ... 12. NIGELLA
 10. Follicles connate at base only ... 9. DICHOCAPIUM
 9. Fruit an achene:
 11. Achenes prominently longitudinally veined ... 10. HALERPESTES
 11. Achenes without longitudinal veins ... 14. RANUNCULUS
 7. Petals absent (sepals petaloid) :
 12. Fruit follicular:
 13. Leaves divided ... 3. CALATHIODES
 13. Leaves entire or dentate, not divided ... 4. CALTHA
 12. Fruit an achene:
 14. Involucral leaves present ... 2. ANEMONE
 14. Involucral leaves absent ... 15. THALICTRUM

I. ACONITUM L.

Tuberous perennial erect herbs, rarely twining. Leaves alternate, palmately or pinnately divided, rarely entire. Flowers in racemes or panicles, irregular, blue, red, purple, yellow or white. Sepals 5, petaloid; posterior helmet-shaped. Petals 2-5, 2 posterior clawed; limb hooded and enclosed in helmet. Stamens many. Fruits follicular, 3-5(-6), sessile, free or connate at base only. Seeds many; testa spongy, rugose or wrinkled.

A genus with ca 300 species; 7 species in West Bengal.

- 1. Plants twining ... 2. *A. elwesii*
- 1. Plants erect:
 - 2. Flowers red:
 - 3. Filaments hispidulous in upper part; follicles finely pubescent ... 5. *A. laciniatum*
 - 3. Filaments glabrous; follicles glabrescent ... 6. *A. novoluridum*
 - 2. Flowers bluish or violet:
 - 4. Carpels glabrous ... 1. *A. bisma*
 - 4. Carpels yellow pubescent, villous, or tomentose:
 - 5. Leaves pedately 6-lobed ... 3. *A. ferox*
 - 5. Leaves simply 3-lobed:
 - 6. Inflorescence lax, pubescent; follicles glabrate or pubescent ... 4. *A. heterophylloides*
 - 6. Inflorescence dense, tomentose; follicles hairy ... 7. *A. spicatum*

1. *Aconitum bisma* (Buch.-Ham.) Rap. in Nov. Kozl. 6: 164. 1907; Rau in Sharma *et al.*, Fl. India 1:7. 1993. *Caltha bisma* Buch.-Ham. in Brewst. Edinb. J. Sci. 1:251. 1824. *Aconitum palmatum* D. Don Prodr. Fl. Nep. 196. 1825; Biswas, Plants of Darjeeling & Sikkim Himal 1: 94. 1966, "Seto Bikhoxma" (Nep.).

Stem stout ca 1 m high, hollow, shining. Leaves scattered; lamina orbicular-cordate-reniform, palmately 5- or 3-partite. Inflorescence a leafy panicle or racemose, 10-20 cm long. Bracts ovate-deltoid, dentate, shortly stalked. Sepals bluish or bluish-white; helmet obscurely beaked. Nectaries glabrous extinguisher-shaped. Filaments glabrous. Carpels 5, glabrous. Follicles loosely reticulate, ca 3 cm long.

Fl. & Fr. : July -Oct. Darjeeling.

2. *Aconitum elwesii* Stapf in Ann. Roy. Bot. Gard. Calcutta 10(2): 174. t. 112A. 1905; Rau in Sharma *et al.*, l.c.10. *A. uncinatum sensu* Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1: 28. 1872; non L.

Stems scandent, flexuous, slender. Leaves scattered; lamina cordate-ovate or rotundate, 3-partite, ca 5 x 4-6 cm. Inflorescence axillary and terminal, racemose or sub-paniculate, nodding, few-many flowered. Flowers erect. Sepals blue or

violet, sparingly pubescent; helmet semi-elliptic, shortly beaked. Nectaries glabrous. Carpels 5, glabrous. Follicles 5, ca 12 mm long.

Fl. & Fr. : May - July. Darjeeling (*vide* Rau, *l.c.*).

Plants reported as poisonous.

3. *Aconitum ferox* Wall. ex Ser., Mus. Helvet. 1: 160. 1823; Hook.f. & Thoms. in Hook.f., *l.c.* 28, *p.p.*; Rau in Sharma *et al.*, *l.c.* 12. **Fig. 1**

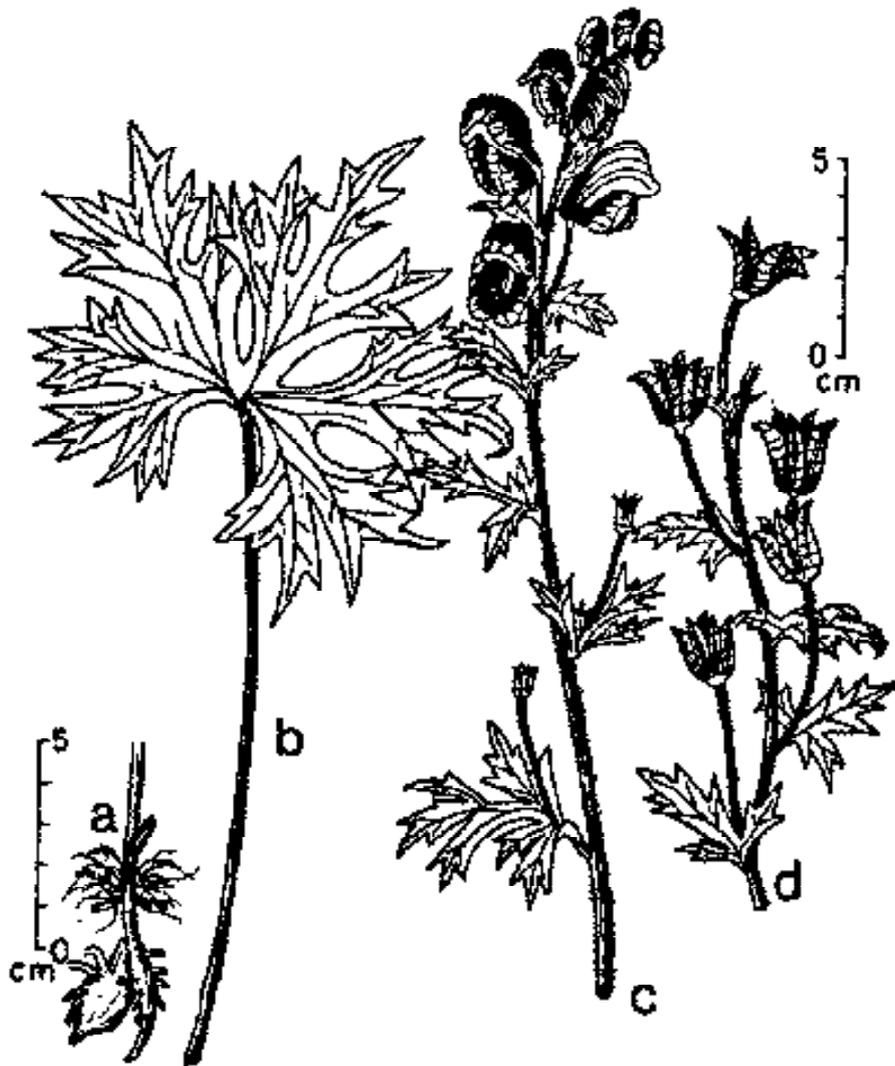


Fig. 1. *Aconitum ferox* Wallich ex Seringe: a. tuber; b. basal leaf; c. inflorescence; d. infructescence (from H.J. Chowdhery in Red Data Book of Indian Plants 1:314. 1987).

Stems erect, 40-90 cm high, hollow, hairy above. Leaves scattered; lamina orbicular, cordate-reniform, pedately 5-partite, 11 × 20 cm; petiole much dilated at base. Inflorescence a loose raceme, 10-25 cm long. Sepals blue, hairy; helmet

semi-orbicular, shortly beaked. Nectaries glabrous. Filaments glabrous. Carpels 5, tomentose. Follicles conspicuously reticulate, thinly hairy or becoming glabrous on maturity, 1.5-2 cm long.

Fl. & Fr. : Aug. - Oct. Darjeeling.

4. *Aconitum heterophylloides* (Brühl) Stapf in Ann. Roy. Bot. Gard. Calcutta 10(2):171. 1905; Rau in Sharma *et al.*, l.c. 14. *A. ferox* Wall. ex Ser. var. *heterophylloides* Brühl in Ann. Roy. Bot. Gard. Calcutta 5: 110 1896, p.p. "Nirhanshi" (Nep.).

Stems erect, angular, often zigzag, ca 30 cm high. Leaves scattered, basal 5-9; lamina finely pubescent particularly on nerves below, ovate-reniform, 3-partite, up to 6 × 3-12 cm. Inflorescence a raceme or a panicle, few-many flowered. Flowers blue or bluish white, pubescent; helmet shortly beaked. Nectaries hispidulous. Filaments hispidulous in upper part. Carpels 5, rarely 6-7, fulvo-pubescent. Follicles 5 or 3, pubescent or glabrous, up to 2 cm long.

Fl. & Fr. : June - Oct. Darjeeling (*vide* Stapf, l.c.).

5. *Aconitum laciniatum* (Brühl) Stapf in Ann. Roy. Bot. Gard. Calcutta 10(2):168. 1905; Rau in Sharma *et al.*, l.c. 17. *A. ferox* Wall. ex Ser. var. *laciniata* Brühl, l.c. 111, p.p. "Kalo-bikhoma" (Nep.).

Stems erect, 5-10 cm tall. Leaves scattered, basal 5-8; lamina reniform, rarely cordate-orbicular, somewhat fleshy, pedately 5-partite, 4-10 × 7-12 cm. Inflorescence racemose or paniculate, finely greyish pubescent. Sepals red or red-purple, finely pubescent; helmet shortly beaked. Nectaries hispidulous. Filaments hispidulous in upper part. Carpels 3, rarely 4 or 5, densely appressed pubescent. Follicles finely pubescent, up to 2.5 cm long.

Fl. & Fr. : July - Sept. Darjeeling.

6. *Aconitum novoluridum* Munz in Gentes Herb. 6: 472. 1945; Rau, in Sharma *et al.*, l.c. 21. *A. luridum* Hook. f. & Thoms. in Hook. f., l.c. 28 (*non* Salisb. 1816).

Stems up to 80 cm high, softly hairy or tomentose. Leaves up to 4; lamina orbicular-cordate or reniform, palmately 5-partite, up to 6.5 cm long; petioles dilated at base. Inflorescence racemose, rather dense, up to 40 cm long. Sepals lurid, reddish or brownish-red or purple outside, yellowish within; helmet with an equally long or longer obtuse beak. Nectaries hammer-shaped. Filaments glabrous. Carpels 3, densely hairy, rarely glabrous. Follicles erect, glabrescent, ca 1 cm long.

Fl. & Fr. : July - Oct. Darjeeling.

7. *Aconitum spicatum* (Brühl) Stapf in Ann. Roy. Bot. Gard. Calcutta 10(2): 165. 1905. Rau in Sharma *et al.*, l.c. 22. *A. ferox* var. *spicata* Brühl, l.c. 110 et vars. *crassicaulis*, *heterophylloides* p.p. & *laxiflora*. "Bikh" (Nep.).

Stems erect, up to 1.5 m high. Leaves many; lamina orbicular-cordate, reniform or broadly-ovate, 3-partite; petioles dilated at base. Inflorescence racemose or paniced, many-flowered. Sepals blue, purplish blue or pale blue,

pubescent-tomentose; helmet with a short beak. Filaments glabrous or sparingly hispidulous in upper part. Carpels 5, densely tomentose. Follicles 5, hairy, somewhat turgid, *ca* 1 cm long.

Fl. & Fr. : Aug. - Oct. Darjeeling.

2. ANEMONE L.

Perennial herbs. Leaves chiefly radical, lobed or divided. Flowering stems with 3-4 free or partially united involucreal leaves. Flowers one or more, on scapes. Sepals petaloid, 4-20. Petals absent. Stamens many. Carpels many; ovule 1. Fruit a head of sessile achenes, tipped with short or long styles.

A genus with *ca* 150 species; 4 species in West Bengal.

1. Leaves densely white tomentose below; achenes embedded in dense wool ...4. *A. vitifolia*
1. Leaves not white tomentose below; achenes not embedded in dense wool :
 2. Involucreal leaves sessile ...2. *A. obtusiloba*
 2. Involucreal leaves petioled:
 3. Flowers 1-2 on scapes ...1. *A. griffithii*
 3. Flowers many in cymes ...3. *A. rivularis*

1. **Anemone griffithii** Hook. f. & Thoms., *Fl. Ind.* 21. 1855 et in Hook. f., *Fl. Brit. India* 1: 8. 1872; Rau in Sharma *et al.*, *l.c.* 31.

Small herbs; rootstock woody. Leaves 3-partite; segments tapering upwards to a point, 3-lobed. Involucreal leaves long-petioled. Flowers 1-2 on scape. Sepals white or pinkish. Achenes not embedded in wool.

Fl. & Fr. : June - Aug. Darjeeling (*vide* Biswas, *Pl. Darjeeling & Sikkim Himal.* 1:94. 1966).

2. **Anemone obtusiloba** D. Don. *Prodr. Fl. Nep.* 194. 1825; Hook. f. & Thoms. in Hook. f., *l.c.* 8; Rau in Sharma *et al.*, *l.c.* 32.

Tufted herbs, glabrous or softly hairy. Radical leaves many, suborbicular-cordate, tripartite, softly hairy on both surfaces. Involucreal leaves small, sessile, trifid. Flowers 1-3 on scapes, up to 5 cm across. Sepals petaloid, white, purplish or golden yellow. Achenes usually strigose, beaked, *ca* 6 mm long.

Fl. & Fr. : April - Aug. Darjeeling.

3. **Anemone rivularis** Buch.-Ham. in DC., *Syst.* 1: 211. 1818; Hook. f. & Thoms. in Hook. f., *l.c.* 9; Hara, *Fl. East Himal.* 1:87. 1966; Rau in Sharma *et al.*, *l.c.* 35.

Fig. 2

Perennial silky pubescent herbs. Radical leaves tripartite; segments lobed and serrate; petiole of radical leaves up to 20 cm long. Involucreal leaves large, petioled, free. Flowers many in cymes, *ca* 3.5 cm across. Sepals white or bluish outside. Achenes glabrous, up to 9 mm long.

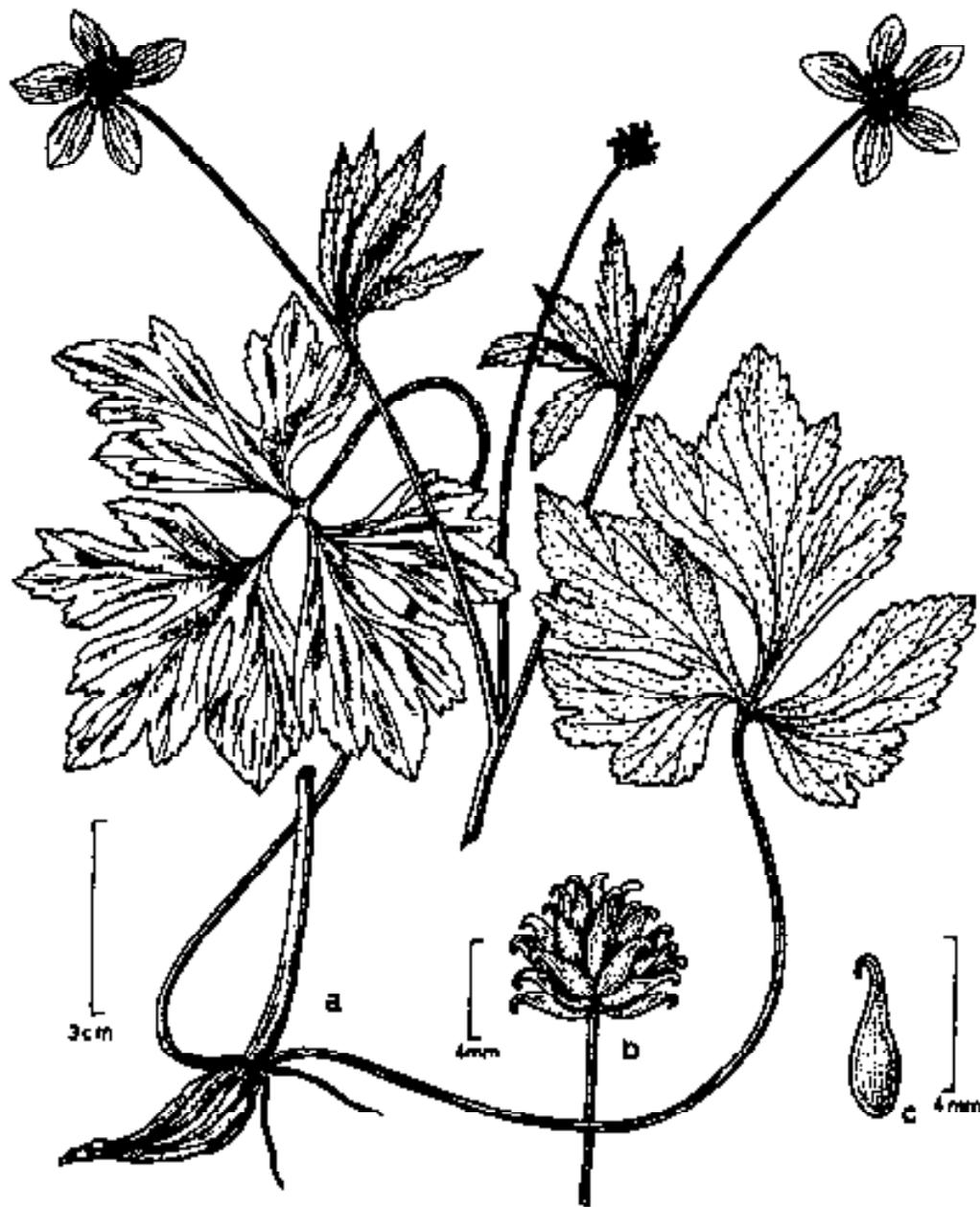


Fig. 2. *Anemone rivularis* Buch. Ham. : a. plant, lower and upper portions; b. head of achenes; c. achene.

Fl. & Fr. : June - Oct. Darjeeling (*vide* Hara, *l.c.*)

4. *Anemone vitifolia* Buch. -Ham. ex DC., Syst. 1: 211. 1818; Hook. f. & Thoms. in Hook. f., *l.c.* 8; Rau in Sharma *et al.*, *l.c.* 40.

Stout herbs, ca 2.5 m high. Radical leaves deeply 5-lobed, glabrous above, white tomentose below, becoming glabrescent with age, ca 17 × 16 cm; involucral leaves petioled. Flowers in decomposed cymes, ca 5 cm across. Sepals white. Achenes in large heads, embedded in dense wool.

Fl. & Fr. : June - Oct. Darjeeling.

3. CALATHODES Hook. f. & Thoms.

Perennial leafy herbs. Leaves palmately divided. Flowers terminal. Sepals 5, petaloid, deciduous. Petals absent. Carpels many.

A genus with *ca* 3 species; 1 species in West Bengal.

Calathodes palmata Hook. f. & Thoms., Fl. Ind. 41. 1855 et in Hook. f., *l.c.* 22; Rau in Sharma *et al.*, *l.c.* 44.

Erect herbs. Radical leaves falling off early; cauline leaves tripartite; segments deeply 3-lobed; lobes incised-serrate; petiole sheathing; sheath inflated, membranous. Sepals golden yellow.

Fl. & Fr. : June - Sept. Darjeeling [(*vide* Gamble in Rec. Bot. Surv. India 1(2):3.1894)].

4. CALTHA L.

Glabrous perennial herbs. Leaves alternate, simple, ovate-cordate. Flowers solitary or few, in corymbiform inflorescence. Sepals petaloid. Petals absent. Stamens and carpels numerous. Fruits follicular.

A genus with *ca* 25 species; 2 species in West Bengal.

1. Follicles sessile ...1. *C. palustris*

1. Follicles stipitate ...2. *C. scaposa*

1. **Caltha palustris** L., Sp. Pl. 558. 1753; Hook. f. & Thoms. in Hook. f., *l.c.* 21; Rau in Sharma *et al.*, *l.c.* 47. *C. govaniensis* Wall. ex Royle, Ill. Bot. Himal. 54. 1834; Hara, *l.c.* 87.

Glabrous perennial herbs. Stems up to 80 cm high. Leaves chiefly radical, reniform or deltoid, entire or crenate-dentate, long petioled; cauline sub-sessile. Flowers up to 5 cm across. Sepals 4-9, petaloid, bright yellow. Follicles beaked, up to 18 mm long.

Fl. & Fr. : May - Sept. Darjeeling (*vide* Hara, *l.c.*).

2. **Caltha scaposa** Hook. f. & Thoms., Fl. Ind. 40. 1855 et in Hook. f., *l.c.* 2); Rau in Sharma *et al.*, *l.c.* 49.

Plants 8-20 cm tall. Leaves all radical, ovate-cordate, entire or dentate. Flowers usually solitary, on scapes, *ca* 2.5 cm across. Sepals yellow. Follicles stalked.

Fl. & Fr. : May - Oct. Darjeeling (*vide* Biswas, *l.c.*)

5. CIMICIFUGA Wernischeck

Erect herbs. Leaves 2-5 ternate. Flowers regular, many in long racemes. Sepals 4-5, petaloid. Petals 1-8, small, 2-horned at tip. Stamens many. Carpels 1-8. Fruit follicular.

A genus with *ca* 15 species; 1 species in West Bengal.

Cimicifuga foetida L., Syst. ed. 12: 659. 1767; Hook. f. & Thoms. in Hook. f., *l.c.* 30. Hara, *l.c.* 88; Rau in Sharma *et al.*, *l.c.* 51.

Perennial foetid smelling herbs, up to 2 m high. Stems leafy. Leaves pinnately compound, up to 40 cm long; leaflets ovate-lanceolate, sharply toothed, ca 8 × 5 cm. Flowers crowded in racemes, small yellowish. Sepals deciduous.

Fl. & Fr. : July - Oct. Darjeeling (*vide* Hara, *l.c.*)

6. CLEMATIS L.

Woody climbers, climbing by means of twisted petioles. Leaves opposite or whorled, exstipulate, usually pinnately compound, sometimes simple; leaflets entire or toothed; petioles often widened and connate at base. Flowers axillary or terminal, solitary, fascicled or paniced. Sepals 4(-8), petaloid. Petals absent. Stamens many. Carpels many. Achenes usually with long feathery styles.

A genus with ca 250 species of cosmopolitan distribution, mostly in temperate zones; 11 species in West Bengal.

1. Leaves clustered at nodes :
 2. Pedicels with two connate bracts above middle ... 9. *C. napaulensis*
 2. Pedicels naked ... 8. *C. montana* subsp. *praecox*
1. Leaves opposite:
 3. Filaments glabrous:
 4. Flowers mostly solitary, rarely two:
 5. Sepals usually 5-6; achenes rostrate, without feathery tails ... 4. *C. cadmia*
 5. Sepals usually 4; achenes not rostrate, with feathery tails ... 12. *C. tongluensis*
 4. Inflorescence 3 or more-flowered:
 6. Leaves simple or pinnately 3-foliolate:
 7. Leaves simple ... 11. *C. smilacifolia*
 7. Leaves trifoliolate ... 2. *C. andersonii*
 6. Leaves bipinnate or if pinnate then leaflets more than 3:
 8. Branches with more than 6 ribs; panicles usually exceeding the leaves ... 6. *C. gouriana*
 8. Branches 6-ribbed; panicles shorter than the leaves ... 10. *C. puberula*
 3. Filaments hairy :
 9. Petioles connate, forming a leathery cup ... 5. *C. connata*
 9. Petioles not connate:
 10. Branches glabrous or pubescent ... 1. *C. acuminata* subsp. *sikkimensis*
 10. Branches villous or tomentose:

11. Sepals not ribbed ...7. *C. grewiaeflora*
 11. Sepals ribbed ...3. *C. buchananiana*

1. ***Clematis acuminata*** DC. subsp. ***sikkimensis*** (Hook. f. & Thoms.) Brühl in Ann. Roy. Bot. Gard. Calcutta 5: 75. 1896; Rau in Sharma *et al.*, *l.c.* 56. *C. acuminata* var. *sikkimensis* Hook. f. & Thoms. in Hook. f., *l.c.* 6.

Branches sulcate, glabrous or with few scattered hairs. Leaves opposite, trifoliolate, up to 22 cm long; leaflets chartaceous, puberulous or nearly glabrous on both surfaces. Inflorescence axillary, many-flowered, usually shorter or equalling the leaves. Sepals 4, glabrous or puberulous outside, *ca* 9 × 3.5 mm, sparsely villous inside towards apex, densely villose-tomentose on the margin and tips. Filaments hairy except at base. Achenes ovate or obovate-elliptic, compressed, margined, hairy, *ca* 3 mm long, tail up to 35 mm long.

Fl. & Fr. : June - Nov. Darjeeling.

2. ***Clematis andersonii*** (Clarke ex Ktze.) Eichler in Bibl. Bot. Stuttgart 124: 47. 1958; Rau in Sharma *et al.*, *l.c.* 57. *C. smilacifolia* Wall. var. *andersonii* C.B. Clarke ex O. Ktze. Verh. Bot. Ver.Brandenb. 26.167. 1885.

Branches sulcate, glabrous. Leaves opposite, pinnately 3-foliolate, up to 37 cm long; leaflets ovate-lanceolate, elliptic-lanceolate or oblong-elliptic, 5-7-9-nerved, chartaceous, glabrous on both surfaces, opposite, petioles flattened at base, often joined at node to form a narrow leathery expansion. Inflorescence up to 9-flowered, shorter or longer than leaves. Sepals 5 or 6, velvety tomentose outside, reflexed, 1-5 mm. Filaments glabrous.

Fl. & Fr. : Oct. Jan. Darjeeling (*vide* Kapoor in Bull. Nat Bot. Gard. Lucknow 124 : 11.1968).

3. ***Clematis buchananiana*** DC., Syst. 1: 140. 1818; Hook. f. & Thoms. in Hook.f., *l.c.* 6; Rau in Sharma *et al.*, *l.c.* 60. "Penasy-lahara" (Nep.).

Branches villous or villous-tomentose. Leaves pinnately 3-5-foliolate, up to 28 cm long; leaflets ovate-orbicular, simple or 2-3-lobed, villous beneath, rugose above. Inflorescence axillary, covered with greyish or pale-grey tomentum, 3-many flowered. Sepals 4, erect, *ca* 5 cm, tomentose without. Filaments hairy; connectives not produced. Achenes hairy, ovate or obovate, *ca* 4 × 2 mm; tail up to 4 cm long.

Darjeeling.

4. ***Clematis cadmia*** Buch. Ham. ex Hook. f. & Thoms., Fl. Ind. 5. 1855 et in Hook.f., Fl. Brit. India 1: 2.1872; Prain, Bengal Pl. 1: 124. 1963 (repr. ed.); Rau in Sharma *et al.*, *l.c.* 60.

Slender climbers. Branches ribbed, densely pubescent at nodes and young shoots. Leaves opposite, ternately decompose, up to 23 cm long; leaflets ovate or ovate-lanceolate, usually simple, occasionally lobed, entire or minutely crenulate, glabrous or puberulous on both sides. Flowers axillary, solitary; bracts foliaceous near base of pedicels. Sepals 5-6, rarely 4, spreading, up to 4.3 × 1.4 cm, veined

on both sides, villous-tomentose, margined. Filaments glabrous. Achenes rostrate, compressed, thickly margined, without feathery tails.

Fl. & Fr. : Dec. - June. Jalpaiguri.

5. *Clematis connata* DC., Prodr. 1:4. 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 6; Rau in Sharma *et al.*, *l.c.* 61.

Large woody climbers. Branches glabrous. Leaves 3-5-7- foliolate, up to 37 cm long; leaflets broadly ovate, ovate lanceolate or elliptic, simple or lobed, chartaceous; petioles connate into a leathery expansion. Inflorescence many-flowered, usually shorter or equalling the leaves, rarely longer. Bracts and bracteoles foliaceous. Sepals 4, erect, *ca* 2.5 × 8 cm, villous-pubescent without, villous within. Filaments hairy. Achenes densely hairy, ovate or obovate, *ca* 4 × 2 mm, compressed, margined; tail up to 3.5 cm long.

Fl. & Fr. : July - Nov. Darjeeling.

6. *Clematis gouriana* Roxb. ex DC., Syst. Nat. 138. 1817; Hook. f. & Thoms. in Hook. f., *Fl. Brit. India* 1: 4. 1872; Prain, *l.c.* 124 (rep.ed.); Rau in Sharma *et al.*, *l.c.* 64.

Shrubby climbers. Stems and branches angled, usually glabrous, young parts pubescent. Leaves pinnate or bipinnate, up to 35 cm long; leaflets up to 6 × 2.8 cm, ovate-oblong, acuminate. Flowers in dense panicles, yellowish or greenish white. Lower bracts foliaceous. Sepals 4 or 5, puberulous. Filaments glabrous. Carpels many. Achenes oblong-lanceolate, *ca* 4 × 2 mm, hairy; tail up to 6 cm.

Fl. & Fr. : May - Aug. Birbhum, Jalpaiguri.

7. *Clematis grewiaeflora* DC., Syst. 1: 140. 1818; Hook. f. & Thoms. in Hook. f., *l.c.* 6; Rau in Sharma *et al.*, *l.c.* 66. Fig. 3

Large woody climbers. Branches grey-brown, hairy. Leaves pinnately 3-5-foliolate, up to 35 cm long; leaflets ovate, subcoriaceous, simple or lobed, densely sericeous above, sericeo-villous below. Inflorescence 3-many-flowered, densely villous-tomentose. Bracts linear, linear-oblong to ovate, entire or lobed. Sepals 4, densely tomentose or villous without, sparsely villous within. Filaments hairy. Achenes hairy, ovate-obovate, *ca* 4.5 cm long, compressed, margined, tail up to 3.5 cm long.

Fl. & Fr. : April - Sept. Darjeeling.

8. *Clematis montana* Buch. Ham. ex DC. subsp. *praecox* O. Ktze. in *Verh. Bot. Ver. Brandenh.* 26: 142. 1885; Rau in Sharma *et al.*, *l.c.* 69.

Branches glabrous, sulcate. Leaves crowded, trifoliolate, up to 11 cm long; leaflets ovate-rhombic or ovate, villous on both surfaces when young. Flowers crowded, concealed in axils of hard scales; pedicels 2-9 cm long. Sepals 4, spreading, *ca* 2 × 1 cm. Filaments glabrous. Achenes compressed, margined, hairy, broadly ovate elongate, *ca* 5 mm long; tail up to 3 cm long.

Fl. & Fr. : April - Nov. Darjeeling (*vide* Kapour, *Bull. Nat. Bot. Gard. Lucknow* 124: 49. 1968).

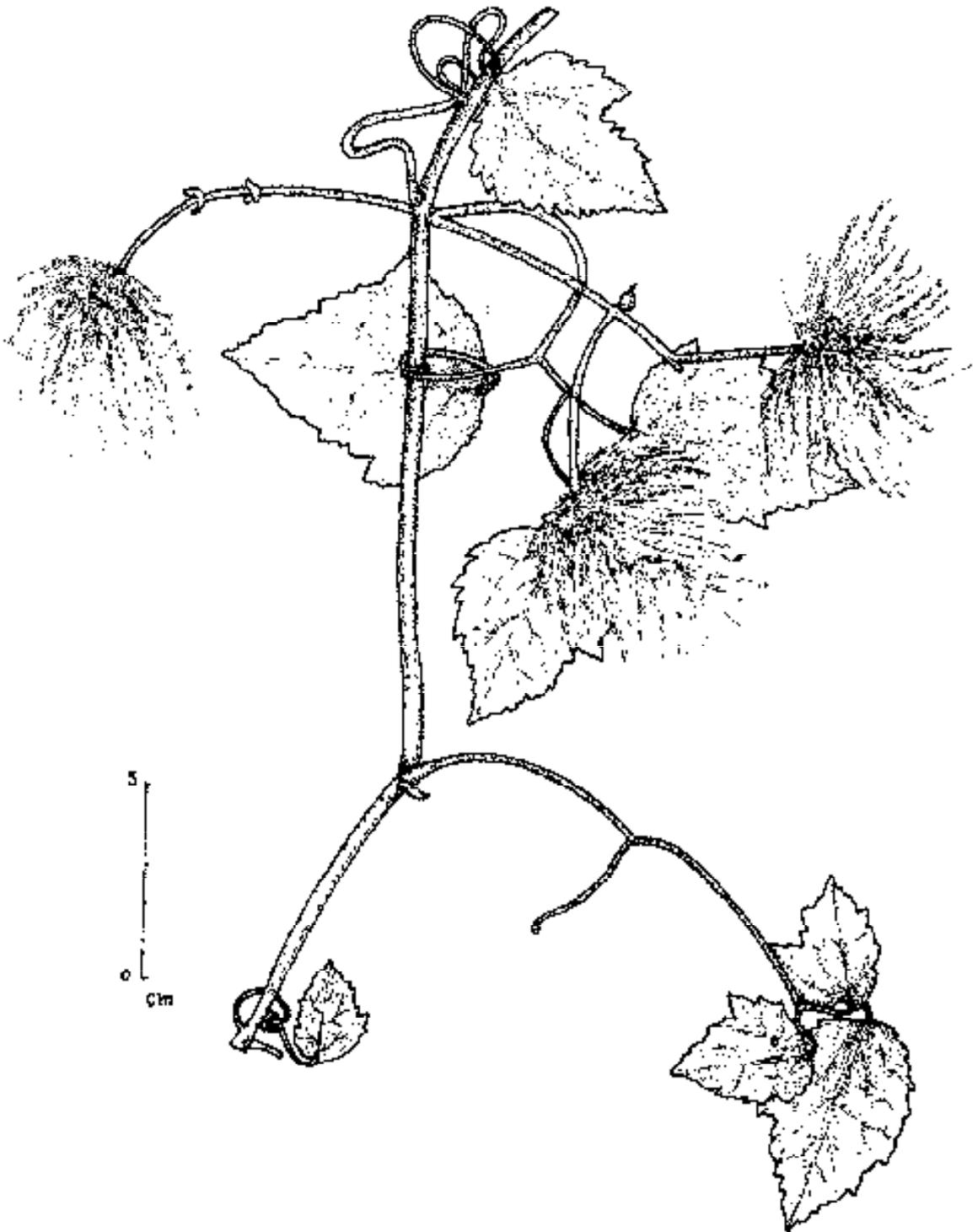


Fig. 3. *Clematis grewiae* flora DC.

9. **Clematis napaulensis** DC., Syst. 1: 164. 1818; Hook. f. & Thoms. in Hook.f., *l.c.* 3; Rau in Sharma *et al.*, *l.c.* 71.

Spreading climbers. Leaves verticillate, usually simple or trifoliolate; leaflets lanceolate, elliptic-lanceolate, shallowly or deeply 3-lobed, base oblique in lateral leaflets. Flowers fasciated in axils. Bracts forming bilobed cup above middle of pedicel. Sepals 4, suberect, villous tomentose without. Filaments glabrous. Achenes margined, hairy, ovate, obovate or suborbicular, ca 5 × 4 mm; tail up to 4.5 cm.

Fl. & Fr. : May - Oct. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:96. 1966).

10. **Clematis puberula** Hook. f. & Thoms. in Hook.f., *l.c.* 4; Biswas, *l.c.* 97; Rau in Sharma *et al.*, *l.c.* 74.

Slender climbers. Branches 6-ribbed, appressedly pubescent. Leaves pinnate or bipinnate, up to 20 cm long; leaflets lanceolate-ovate to lanceolate, shallowly or deeply 2-3-lobed. Inflorescence usually shorter than leaves, occasionally longer. Bracts usually foliaceous. Sepals 4 or 5, spreading, sericeously villous without. Filaments glabrous. Achenes sericeously hairy when young.

Fl. & Fr. : Sept. - Dec. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:97. 1966).

11. **Clematis smilacifolia** Wall. in Asiat. Res. 14: 402. 1820; Hook. f. & Thoms. in Hook.f., *l.c.* 3; Rau in Sharma *et al.*, *l.c.* 75.

Branches glabrous or glabrescent. Leaves simple, ovate to broadly ovate, entire, glabrous on both surfaces, chartaceous, up to 33 cm long. Inflorescence 3-many-flowered. Sepals 4, spreading, velvety tomentose, ribbed outside. Filaments glabrous; connective produced. Achenes margined, narrowed at both ends, elongate-ovate, ca 1 cm long; tail up to 7.5 cm long.

Fl. & Fr. : March - Sept. Darjeeling.

12. **Clematis tongluensis** (Brühl) Tamura in Acta Phytotax. Geobot. Kyoto 19: 77. 1962; Rau in Sharma *et al.*, *l.c.* 75. *C. montana* var. *tongluensis* Brühl in Ann. Roy. Bot. Gard. Calcutta 5: 75. 1896.

Branches glabrous, sulcate. Leaves usually opposite, trifoliolate, up to 17 cm long; leaflets elongate-ovate or ovate-lanceolate, simple or lobed, laterals with oblique base. Flowers solitary, axillary, pedicelled. Pedicels longer than leaves. Sepals 4, spreading, oblong or oblong-lanceolate, narrowly acuminate, broad tomentose-villous bordered, appressedly hairy inside up to 6 × 1.8 cm. Filaments glabrous. Achenes broadly ovate, compressed, margined hairy, 3 mm long; tail up to 3 cm long.

Fl. & Fr. : July - Oct. Darjeeling.

7. CONSOLIDA (DC.) Opiz

Annuals. Leaves lacinate. Inflorescence racemose or paniculate. Flowers zygomorphic. Sepals 5, petaloid, posterior spurred. Petal or nectary one. Stamens in 5 spiral series. Fruits follicular.

A genus with *ca* 40 species; 1 species in West Bengal.

Consolida ambigua (L.) Ball. & Heywood in Fedde, *Repert.* 66: 151, 1961; Rau in Sharma *et al.*, *l.c.* 81. *Delphinium ambiguum* L. *Sp.Pl.* ed. 2. 749, 1763.

Erect annual herbs, up to 1 m high. Lower leaves long-petioled, gradually decreasing upwards in size, multifid, ultimate segments linear. Flowers in raceme-like cymes, blue, pink or white. Sepals clawed; spur hairy, slightly curved upwards. Nectary 3-lobed. Follicles densely hirsute, beaked, 15-20 mm long.

Fl. & Fr. : Feb. - June.

Cultivated as an ornamental.

8. DELPHINIUM L.

Erect annual or perennial herbs. Leaves palmately lobed or deeply pinnatisect. Flowers in racemes corymbs or panicles, irregular. Sepals 5, white, blue or purplish; dorsal sepal spurred. Petals 2-4, small. Stamens many. Follicles 1-7, free.

A genus with *ca* 250 species; 4 species in West Bengal.

1. Follicles 4-5:

2. Leaves 5-7-lobed; spur equalling or exceeding sepal ...1. *D. caeruleum*

2. Leaves tripartite; spur shorter than sepal ...2. *D. glaciale*

1. Follicles 3:

3. Spur decurved or straight; filaments strongly dilated; follicles glabrous ...3. *D. pyramidate*

3. Spur incurved; filaments slightly dilated; follicles ciliate on sutures ...4. *D. viscosum*

1. **Delphinium caeruleum** Jacq. ex Camb. in Jacq. *Voy. Bot.* 4: t.6, 1843; Hook. f. & Thoms. in Hook. *f.*, *l.c.* 25; Rau in Sharma *et al.*, *l.c.* 88.

Herbs. Stems branched from base, up to 40 cm tall, leafy. Leaves suborbicular, 5-7-lobed, 1-4 cm across; lobes incised or pinnatifid. Flowers few, in panicles or subcorymbose racemes. Sepals pale blue, hairy, shorter than spur; spur subulate, 1.8 - 2.5 cm long. Petals bluish. Follicles 5, hairy.

Fl. & Fr. : July - Oct. Darjeeling (*vide* Biswas, *l.c.*).

2. **Delphinium glaciale** Hook. f. & Thoms., *Fl. Ind.* 53, 1855 et in Hook. *f.*, *l.c.* 27; Rau in Sharma *et al.*, *l.c.* 92.

Perennials with musky smell, 6-15 cm tall. Stems glandular, hairy, strigulose. Leaves reniform, tripartite, 2-5 cm across; segments deeply multifid. Flowers few, large, in corymbs. Sepals pale blue, somewhat pilose without; spur shorter

than sepals, slightly curved, *ca* 1.5 cm long. Petals blackish. Filaments ciliate, much widened at base. Follicles 5, subglabrous, 1-1.3 cm long.

Fl. & Fr. : July - Oct. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:104, 1966).

3. *Delphinium pyramidale* Royle, Ill. Bot. Himal. Mount. 56, 1834; Rau in Sharma *et al.*, *l.c.* 98. *D. speciosum* Bieb. var. *pyramidale* (Royle) Mukherjee in Bull. Bot. Surv. India 2: 293, 1961. *D. elatum* L. var. *ranunculifolium* Hook.f. & Thoms. in Hook.f., Fl. Brit. India 1: 26, 1872.

Tall herbs, up to 2 m high. Stems glabrous or with spreading hairs. Leaves rounded-pentagonal, 3-5-partite, *ca* 30 cm long, including petiole; segments cleft and incised. Flowers many, in racemes. Sepals blue or purple, pubescent on both surfaces; spur straight or decurved, nearly equalling sepals. Petals bluish-black. Filaments strongly dilated, glabrous. Follicles usually 3, glabrous.

Fl. & Fr. : Aug. - Oct. Darjeeling.

4. *Delphinium viscosum* Hook. f. & Thoms., Fl. Ind. 52, 1855 et in Hook.f., Fl. Brit. India 1:27, 1872; Biswas, *l.c.* 104; Rau in Sharma *et al.*, *l.c.* 101.

Perennial glandular herbs, 30-80 cm tall. Leaves round-reniform, palmately 5-7-lobed, 3-10 cm across; lobes coarsely crenate-dentate, glandular-tipped. Flowers lax, in corymbs or racemes. Sepals violet, blue or purplish-blue, villous to hirsute without; spur incurved nearly equalling sepals. Petals dark purple. Filaments slightly dilated, glabrous. Follicles 3, ciliate on sutures.

Fl. & Fr. : July - Oct. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:104, 1966.).

9. DICHOCARPUM W.T. Wang & Hsiao

Herbs. Leaves pedately 3-5-15-foliolate; leaf lobes distinctly emarginate, provided with a minute gland at apex. Inflorescence dichasial. Pedicels usually swollen at top. Petals with stalk longer than the blade. Follicles two, connate at base, much divaricate, with a longitudinal vein or veins on each side.

A genus with 16 species; 1 species in West Bengal.

Dichocarpum adiantifolium (Hook.f. & Thoms.) Wang & Hsiao in Acta Phytotax. Sin. 9: 325, 1964; Tamura & Laucner in Notes Roy. Bot. Gard. Edinb. 28: 267-273, 1968; Rau in Sharma *et al.*, *l.c.* 102. *Isopyrum adiantifolium* Hook. f. & Thoms. in Hook.f., *l.c.* 23.

Slender herbs up to 15 cm high. Leaflets rhombic, thin, crenate, *ca* 5 × 6 mm. Flowers solitary, on slender scapes, white, *ca* 1 cm across. Follicles two.

Fl. & Fr. : March - July. Darjeeling.

10. HALERPESTES Greene

Creeping herbs. Leaves radical, in rosettes and at nodes of shoots, orbicular or elliptic, toothed. Flowers 1-4, on scapes, yellow. Sepals 5. Nectaries 5-12.

Achenes numerous, closely appressed, with a series of prominent longitudinal veins more developed on one side; shortly beaked.

A genus with about 7 species; 1 species in West Bengal.

Halerpestes tricuspis (Maxim.) Hand.-Mazz. in Acta Hort. Gotob. 13: 135. 1940; Rau in Sharma *et al.*, *l.c.* 103. *Ranunculus tricuspis* Maxim. Fl. Tangut. 12. 1889. *R. cymbalariae* Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:17. 1872, *p.p. non* Pursh.

Slender annual or perennial herbs, up to 8 cm high. Radical leaves oblong-ovate, *ca* 1 cm long; cauline leaves similar, hairy. Flowers solitary, or up to 4 in corymbose cyme, yellow, *ca* 8 mm across. Achenes in globose heads, thin, striate, *ca* 1 mm long.

Fl. & Fr. : May - July. Darjeeling.

11. NARAVELIA DC. *nom. cons.*

Woody climbers. Leaves exstipulate, 3-foliolate; leaflets ovate-rotundate, entire or distinctly toothed, terminal, usually transformed into tendril. Flowers in axillary or terminal panicles. Sepals 4-5, petaloid. Petals 6-12 (-14), linear. Stamens many; filament short; connective produced beyond anthers. Carpels many, 1-ovuled. Fruit an achene with feathery tail.

A genus with about 6 species; 1 species in West Bengal.

Naravelia zeylanica (L.) DC., Syst 1: 167. 1817; Hook. f. & Thoms. in Hook. f., *l.c.* 7; Prain, *l.c.* 124 (repr. ed.); Rau in Sharma *et al.*, *l.c.* 106. "Chaul-bati, Muruche" (Beng.).

Fig. 4

Woody climbers. Leaves exstipulate, 3-foliolate; terminal leaflet usually transformed into tendril. Flowers in axillary or terminal panicles. Sepals 4-5, buff tomentose without. Petals 6-12(-14), linear. Stamens many. Carpels, 1-ovuled. Achenes villous, with feathery tail.

Fl. & Fr. : Feb. - Sept. Darjeeling and other districts west of the river Hooghly.

Ropes are made from the stem.

12. NIGELLA L.

Annual herbs. Leaves pinnate or palmatisect, rarely entire. Sepals 5, deciduous, rarely persistent, petaloid, usually yellow, blue or whitish, often with a claw. Petals 5-8, developed as nectaries, bilobate, upper lip usually much shorter than lower, nectariferous pits present. Stamens numerous; anthers obtuse or acuminate. Follicles more or less connate, inflated or flattened.

A genus with 20 species; 1 species in West Bengal.

Nigella sativa L., Sp. Pl. ed. 2. 753. 1762; Prain, *l.c.* 125 (repr. ed.); Rau in Sharma *et al.*, *l.c.* 108. "Kalajeera" (Beng.).

Annuals. Leaves 2-3 cm long, bi- or tri-pinnately dissected into short, divergent lobules. Sepals oblong, 1-1.5 cm long, obtuse, narrowed into short

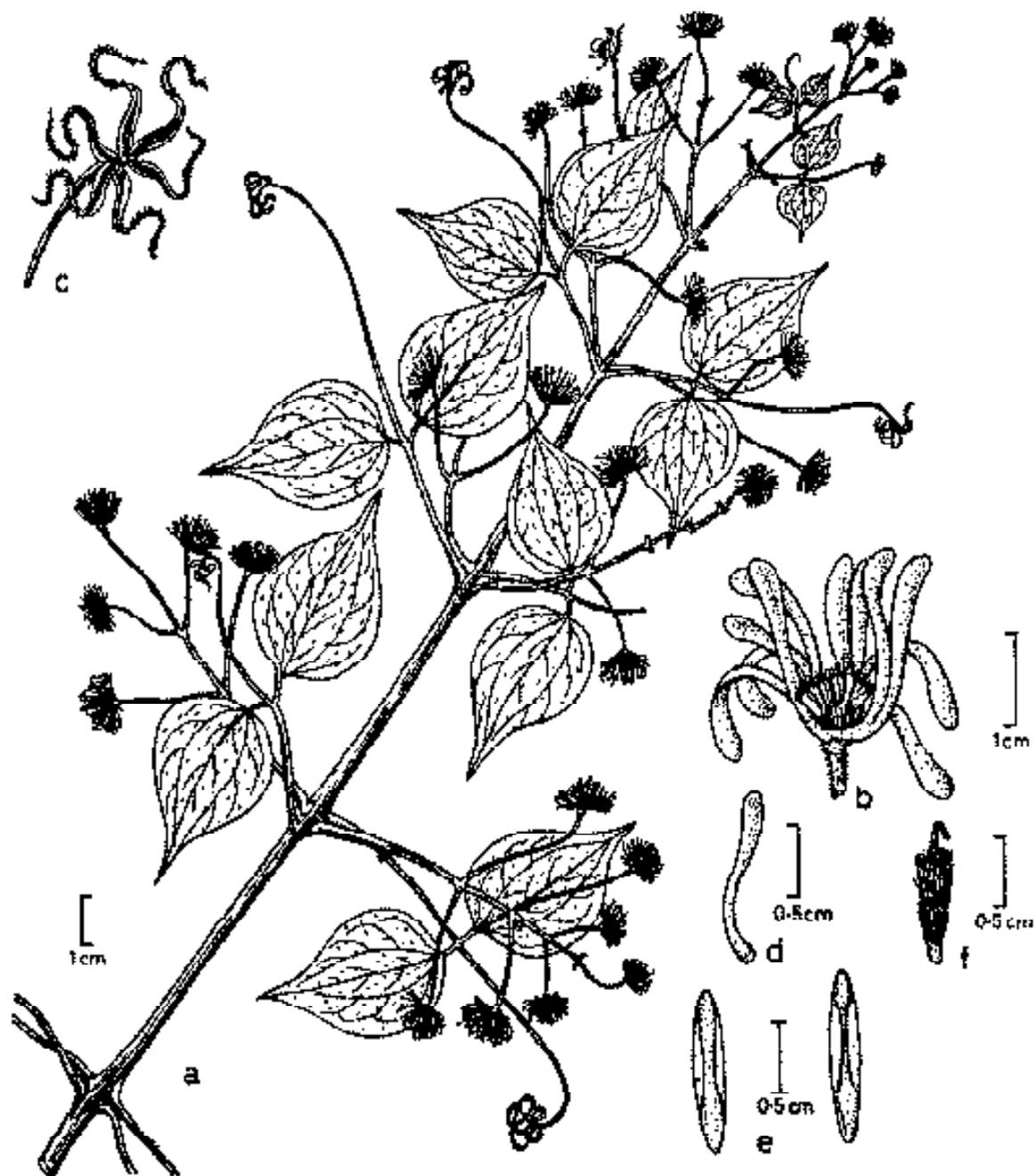


Fig. 4. *Naravelia zeylanica* (L.) DC. : a. branch; b. flower; c. achenes with twisted tails; d. petal; e. stamens; f. carpel.

stalk. Petal nectaries with short stalk, upper lip slightly shorter than lower. Anthers obtuse or slightly acuminate. Follicles granular-torulose, inflated, connate almost to apex, 1.5 cm long, beak ribbed, longitudinally involute, about as long as ovary. Seeds triquetrous, rugose-tuberculate.

Fl. & Fr. : March - Aug. Cultivated in drier western districts. Seeds are used as condiment.

13. OXYGRAPHIS Bunge

Dwarf perennial caulescent herbs. Leaves orbicular, entire or crenate. Flowers solitary on scapes. Sepals 5, persistent, enlarging after flowering. Petals 10-15; claw with a nectariferous pit. Stamens many. Achenes many in globose heads, membranaceous, beaked.

A genus with 2 species; 1 species in West Bengal.

Oxygraphis endlicheri (Walp.) Bennet & Chandra in Ind. For. 108 : 374, 1982; Rau in Sharma *et al.*, *l.c.* 109. *Callianthemum endlicheri* Walp. Rep. 1:33, 1842. *O. polypetala* Hook. f. & Thoms., Fl. Ind. 27, 1855 et in Hook. f., Fl. Brit. India 1:21, 1872; Biswas, *l.c.*

Tufted herbs. Leaves radical, orbicular, crenate-lobed, membranous, *ca* 1 × 1.5 cm. Flowers on scapes, *ca* 2 cm across. Sepals 5, accrescent. Petals 10-15, yellow. Achenes membranaceous, beaked.

Fl. & Fr. : April -Sept. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:198, 1966).

14. RANUNCULUS L.

Annual or perennial herbs. Leaves alternate, entire, lobed or dissected, stipulate or exstipulate. Flowers solitary or in panicles. Sepals 3-5, caducous. Petals 5, sometimes absent, often glandular at base, yellow or white. Stamens numerous. Carpels many, each with one ovule. Achenes beaked.

A genus with about 400 species; 8 species in West Bengal.

1. Achenes muricate:

2. Prostrate herbs forming patches ...4. *R. ficarifolius*

2. Erect herbs:

3. Achenes with marginal spines ...7. *R. sardous*

3. Achenes with spines all over the body ...6. *R. muricatus*

1. Achenes not muricate:

4. Achenes in oblong heads:

5. Leaves 5-9-lobed ... 2. *R. brotherusi*

5. Leaves 3-lobed:

6. Small herbs, *ca* 6 cm high, more or less hairy, particularly the petiole, densely hairy in upper part ... 1. *R. adoxifolius*
6. Tall herbs, up to 60 cm high, glabrous throughout ... 8. *R. sceleratus*
4. Achenes in globose heads:
7. Achenes dotted ... 3. *R. diffusus*
7. Achenes not dotted ... 5. *R. laetus*

1. **Ranunculus adoxifolius** Hand. Mazz. in Acta Hort. Gothob. 13:152. 1939; Hara in Fl. East. Himal. 2:30. 1971; Rau in Sharma *et al.*, *l.c.* 115. *R. affinis non R. Br.*; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:18. 1872, *p.p.*

Decumbent or prostrate herbs, 4-6 cm high. Leaves radical, reniform, long-petioled, deeply 3-lobed; segments entire or again 3-5-lobed. Flowers yellow. Sepals glabrous. Achenes inflated, glabrous.

Fl. & Fr. : June - Aug. Darjeeling (*vide* Hara, *l.c.*).

2. **Ranunculus brotherusi** Freyn. in Bull. Herb. Boiss. 6:885. 1898; Hara. Fl. East Himal. 1:90. 1966; Rau in Sharma *et al.*, *l.c.* 116. *R. affinis auct. non R. Br.*; Hook. f. & Thoms. in Hook. f., *l.c.* 18. *p.p.*

Erect or diffuse hairy herbs. Radical leaves reniform, pedately 5-9-lobed; lower cauline leaves narrow-linear, segmented. Flowers *ca* 10 mm across. Sepals silky. Petals yellow. Achenes in oblong heads, inflated; beak straight.

Fl. & Fr. : May - Aug. Darjeeling (*vide* Hara, *l.c.*).

3. **Ranunculus diffusus** DC. Prodr. 1:38. 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 19; Hara, *l.c.* 90; Rau in Sharma *et al.*, *l.c.* 119.

Diffuse or prostrate hairy herbs; runners from among radical leaves. Stem up to 20 cm. Radical leaves 3-partite, 3.5-8 cm in diam., segments cuncate. Flowers terminal or leaf-opposed, *ca* 1.7 cm across. Petals 5. Achenes in globose heads, smooth, dotted, up to 9 mm across.

Fl. & Fr. : Aug. - Oct. Darjeeling.

4. **Ranunculus ficarifolius** Levl. & Vaniot in Bull. Soc. Bot. Fr. 51: 289. 1904; Rau in Sharma *et al.*, *l.c.* 120. *R. flaccidus* Hook. f. & Thoms., Fl. Ind. 38. 1855 & *et* in Hook. f., Fl. Brit. India 1: 20. 1872; *non Pers.*

Perennial prostrate herbs, forming dense patches. Stems slender. Leaves reniform or orbicular, 3-5-crenate. Flowers solitary, leaf opposed, *ca* 5 mm across. Sepals 5, reflexed, glabrous, equalling the petals. Achenes 3-8 in a head, echinate; beak reflexed.

Fl. & Fr. : May - July. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:100. 1966).

5. **Ranunculus laetus** Wall. in Royle, *l.c.* 53; Hook. f. & Thoms. in *l.c.* 19; Rau in Sharma *et al.*, *l.c.* 122.

Erect appressedly hairy herbs, up to 70 cm high. Leaves 3-partite; radical with deeply-cut segments, up to 6.5 cm diam.; petioles up to 16 cm long. Flowers

many, *ca* 2.5 cm across, yellow. Sepals 5, silky. Petals 5. Achenes 15-25, in globose heads, *ca* 3 mm across, not dotted, intramarginal rib present; beak small straight.

Fl. & Fr. : April - Oct. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:99, 1966).

6. *Ranunculus muricatus* L., Sp. Pl. 555. 1753; Hook. f. & Thoms. in Hook. f., *l.c.* 20; Rau in Sharma *et al.*, *l.c.* 124.

Erect glabrous herbs. Stems fistular. Leaves orbicular or reniform, shallowly lobed or 3-partite, up to 11 cm across. Flowers terminal or leaf-opposed, *ca* 1.5 cm across. Sepals shorter than petals, reflexed. Petals yellow, with a nectary at base. Achenes ovoid, beaked, muricate, rarely smooth, broad-margined.

Fl. & Fr. : Feb. - May. In northern and western districts.

7. *Ranunculus sardous* Crantz. Strip. Austr. 2: 84. 1763; Mukherjee & Sinha in Bull. Bot. Surv. India 20: 158-159. 1978; Rau in Sharma *et al.*, *l.c.* 127.

Annual herbs. Basal leaves 3-partite; middle segment abruptly contracted into a stalk; lower cauline leaves similar; smaller. Petals yellow. Achenes with a row of punctiform tubercles along the borders.

Fl. & Fr. : March - Aug. Howrah (*vide* Mukherjee & Sinha, *l.c.*).

8. *Ranunculus sceleratus* L., Sp. Pl. 551. 1753; Hook. f. & Thoms. in Hook. f., *l.c.* 19; Prain, *l.c.* 125; Rau in Sharma *et al.*, *l.c.* 128.

Erect glabrous herbs. Stems fleshy, branched above. Basal leaves long-petioled; upper sessile, 3-palmatilobed-partite. Flowers yellow. Achenes in oblong heads, ovoid, minutely transversely ridged, *ca* 1 mm long, very shortly beaked.

Fl. & Fr. : April - Nov. Howrah, Murshidabad.

Plants medicinal.

15. THALICTRUM L.

Erect perennial herbs. Leaves alternate, 2-3-pinnate or ternate; petiole sheathing. Flowers in racemes or panicles, often polygamous. Sepals 4-5, petaloid. Petals absent. Stamens numerous. Carpels many, sessile or stalked. Achenes in heads, stalked or sessile, ribbed or reticulate.

A genus with about 50 species; 9 species in West Bengal.

1. Achenes compressed laterally, distinctly stalked:
 2. Achenes membranaceous, reticulate ... 1. *T. chelidonii*
 2. Achenes 3-ribbed on each face:
 3. Achenes glabrous, stalk of achenes short, not as long as body ... 2. *T. cultratum*
 3. Achenes pubescent; stalk of achenes as long as the body ... 6. *T. reniforme*
1. Achenes not compressed, sessile or shortly stalked:

- 4. Leaves simply ternate ... 9. *T. virgatum*
- 4. Leaves ternately or pinnately decomposed:
 - 5. Achenes stalked ... 7. *T. rostellatum*
 - 5. Achenes sessile:
 - 6. Filaments club-shaped ... 4. *T. javanicum*
 - 6. Filaments filiform:
 - 7. Achenes up to 5 in a head; leaves exstipulate:
 - 8. Leaf-sheath auricled; achenes sharply ribbed ... 3. *T. foliolosum*
 - 8. Leaf-sheath not auricled; achenes faintly ribbed ... 5. *T. minus*
 - 7. Achenes more than 5 in a head; leaves stipulate ... 8. *T. saniculæforme*

1. ***Thalictrum chelidonii*** DC., Prodr. 1: 13. 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 11; Biswas, *l.c.* 101; Rau in Sharma *et al.*, *l.c.* 134.

Much branched tall herbs. Leaves large; leaflets orbicular-cordate, 3-4-crenate or -lobed. Flowers in panicles, lilac or purple, ca 2.5 cm across. Achenes long-stalked, membranaceous, reticulate.

Fl. & Fr. : June - Sept. Darjeeling.

2. ***Thalictrum cultratum*** Wall., Pl. Asiat. Rar. 2 : 26. 1831; Hook. f. & Thoms. in Hook. f., *l.c.* 11; Rau in Sharma *et al.*, *l.c.* 134.

Glabrous, branched, tall herbs. Leaves large; leaflets obovate, obtusely 3-lobed. Leaf sheaths auriculate; auricles small. Flowers paniculate, greenish-white. Anthers long pointed. Achenes short stalked, 3-ribbed on each side.

Fl. & Fr. : June - Oct. Darjeeling.

3. ***Thalictrum foliolosum*** DC., Syst. 1: 75. 1818; Hook. f. & Thoms. in Hook.f., *l.c.* 14; Rau in Sharma *et al.*, *l.c.* 136.

Tall herbs. Leaves pinnately decomposed, up to 45 cm long; leaflets ca 30 x 20 mm, orbicular; leaf sheaths auriculate. Flowers in much branched panicles, white, pale-green or dingy purple, sometimes scented, polygamous. Achenes subsessile, 2-5, prominently ribbed; beak very short.

Fl. & Fr. : June - Sept. Darjeeling (*vide* Biswas, Pt. Darjeeling & Sikkim Himal. 1:102.1966).

4. ***Thalictrum javanicum*** Blume, Bijdr. 2. 1826; Hook. f. & Thoms. in Hook.f., *l.c.* 13; Prain, *l.c.* 125; Rau in Sharma *et al.*, *l.c.* 136.

Tall herbs. Leaves ternately decomposed, up to 30 cm long; leaflets membranous; stipules adnate, fimbriate. Flowers in branched panicles. Sepals white. Filaments club-shaped; anthers blunt. Achenes sessile, 8-15, strongly ribbed.

Fl. & Fr. : June - Oct. Darjeeling.

5. **Thalictrum minus** L., Sp. Pl. 546. 1753; Hook. f. & Thoms. in Hook. f., *l.c.* 14; Rau in Sharma *et al.*, *l.c.* 137.

Herbs reaching up to 1.5 m high. Leaves 3-4-ternate, exstipulate; leaflets suborbicular to broadly ovate, irregularly lobed in upper half. Flowers in panicles, yellowish. Filaments filiform. Achenes sessile, 3-15 in a head.

Fl. & Fr. : May - Aug. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:102.1966).

6. **Thalictrum reniforme** Wall., Pl. Asiat. Rar. 2:26. 1831; Hook. f. & Thoms. in Hook. f., *l.c.* 11; Rau in Sharma *et al.*, *l.c.* 140.

Much branched, hollow stemmed herbs, glandular when young. Leaves *ca* 30 cm long; leaflets orbicular-cordate, up to 8 × 5 cm; leaf sheaths expanded into adnate stipules. Flowers in decomposed panicles. Sepals pale green. Achenes stalked, 3-ribbed on each face.

Fl. & Fr. : Aug. - Oct. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:100. 1966).

7. **Thalictrum rostellatum** Hook. f. & Thoms., Fl. Ind. 15. 1855 et in Hook. f., Fl. Brit. India 1:12. 1872; Rau in Sharma *et al.*, *l.c.* 140.

Diffusely branched herbs. Leaves ternately compound, up to 15 cm long; leaflets orbicular. Flowers small. Sepals white. Stamens shorter than sepals. Achenes few, shortly stalked, ribbed, beaked; beak hooked.

Fl. & Fr. : June - Sept. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:102.1966).

8. **Thalictrum saniculaeforme** DC., Prodr. 1:12. 1824; Hook. f. & Thoms. in Hook.f., *l.c.* 13; Rau in Sharma *et al.*, *l.c.* 141.

Erect wiry glabrous herbs. Leaf usually one, radical, ternately decomposed, rarely few cauline; leaflets orbicular-ovate. Flowers few or solitary on branches. Sepals white. Stamens shorter than sepals; anthers pointed. Achenes many, sessile; beak hooked.

Fl. & Fr. : May - Sept. Darjeeling (*vide* Biswas, Pl. Darjeeling & Sikkim Himal. 1:101.1966).

9. **Thalictrum virgatum** Hook. f. & Thoms., Fl. Ind 14. 1855 et in Hook. f., Fl. Brit. India 1: 12.1872; Rau in Sharma *et al.*, *l.c.* 143.

Glabrous herbs. Leaves subsessile, simply ternate; leaflets coriaceous, orbicular. Flowers in decomposed panicles. Sepals white. Achenes subsessile, acute at both ends, ribbed.

Fl. & Fr. : June - July. Darjeeling (*vide* Pl. Darjeeling & Sikkim Himal. 1: 1966).

DILLENACEAE

(N.C. Majumdar)

A family of ca 10 genera and 400 species mainly distributed in the tropics and subtropics of the world; 2 genera and 4 species are reported from West Bengal.

1. Trees; fruit indehiscent, enclosed by enlarged sepals;
anther loculi parallel; receptacle conical ... 1. DILLENIA
1. Shrubs or woody climbers; fruit dehiscent; anther loculi
divergent towards base; receptacle flat ... 2. TETRACERA

1. DILLENIA L.

Trees. Leaves large, sometimes stipulate; petiole channelled above. Flowers showy, solitary or in terminal racemes, sometimes fasciculate on short shoots, without or with caducous bracts and bracteoles. Sepals 5, persistent, fleshy, enlarged in fruit. Petals 5, deciduous, yellow or white, spatulate, membranaceous. Stamens numerous; filaments equal or unequal in length; anthers linear, loculi parallel, inner erect and introrse, outer recurved and extrorse. Carpels 5-20, adherent to the axis; ovules 4-80. Fruits indehiscent, enclosed by enlarged thick sepals. Seeds arillate or exarillate.

A genus with about 60 species distributed in S.E. Asia; 3 species in West Bengal.

1. Flowers large 15-20 cm across, white; fruits large, 8-10 cm
diam.; carpels 14-20 ... 2. *D. indica*
1. Flowers smaller, 3-12 cm across, yellow; fruits smaller, up
to 3.5 cm diam.; carpels 5-12 :
 2. Anther thecae opening by apical pores; flowers 10-12 cm
across ... 1. *D. aurea*
 2. Anther thecae opening by longitudinal slits; flowers
2.5-3 cm across ... 3. *D. pentagyna*

1. *Dillenia aurea* Smith in Exot. Bot. 2: 65, t. 92, 93, 1806; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:37, 1872, p.p., excl. syn; Prain, l.c. 126; Majumdar in Sharma *et al.*, Fl. India 1:153, 1993. *D. pulcherrima* Kurz in J. Asiat. Soc. Bengal 40, 2: 46, 1871. "Chamaggai" (Beng.); "Dhengr" (Nep.); "Rai" (Or.).

Deciduous trees up to 14 m tall, flowering with or before new leaves. Leaves elliptic-oblong, 20-35 × 10-20 cm. Flowers 1 or 2 on short side branches, bracteate. Petals obovate. Outer stamens 10-11 mm long, inner ones with reflexed apex, 16-21 mm long. Fruits globular, orange-yellow. Seeds obovoid, exarillate.

Fl. : March - May; Fr. : May - July. Bankura, Midnapur, Purulia.

Wood used as fuel. Fruits are eaten by wild elephants.

2. *Dillenia indica* L., Sp. Pl. 1:535. 1753; Hook. f. & Thoms. in Hook. f., *Lc.* 36, p.p. excl. syn. Prain, *l.c.* 126; Majumdar in Sharma *et al.*, *l.c.* 155. "Chalta" (Beng.); "Mechiaphal" (Nep.).

Fig. 5

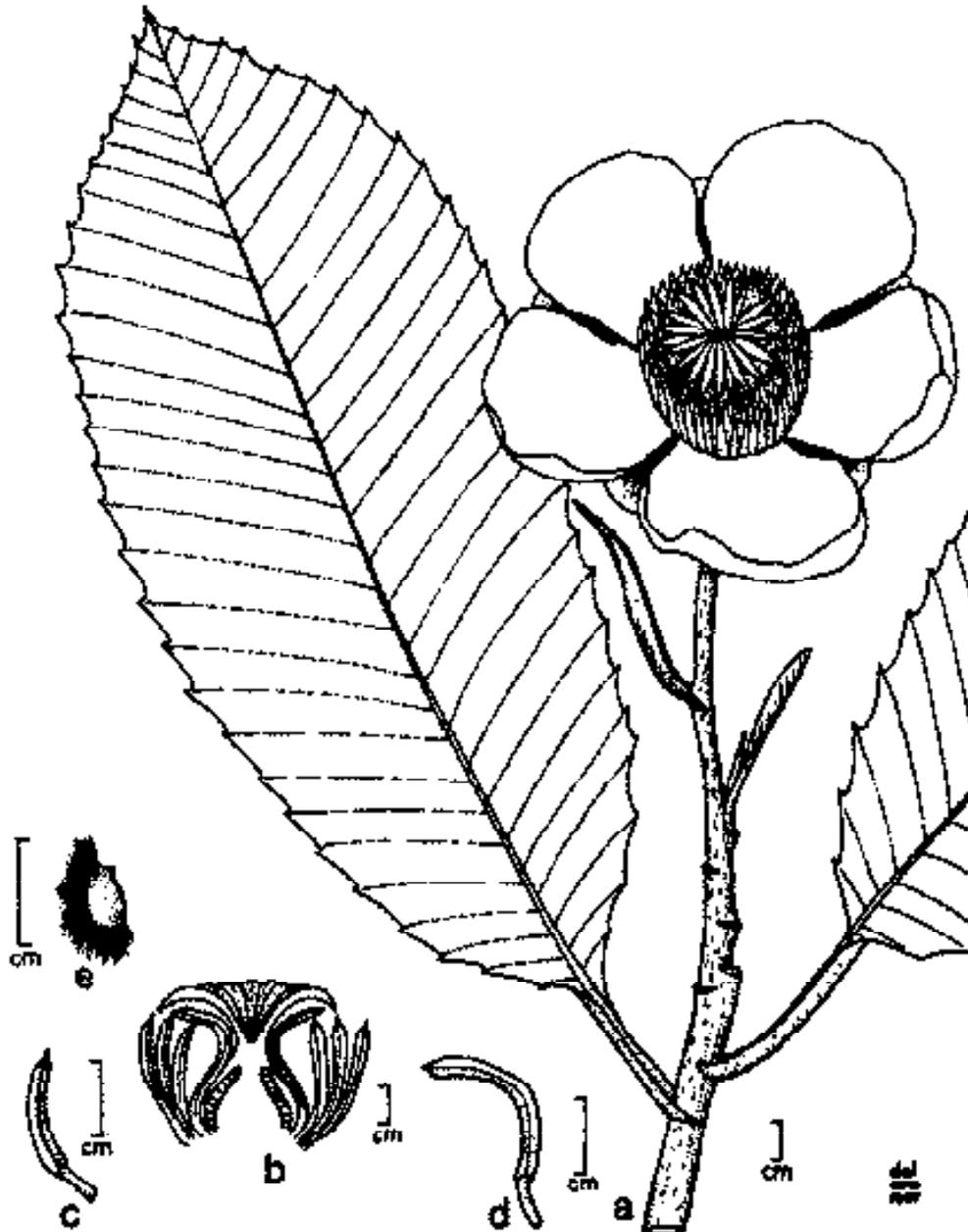


Fig. 5. *Dillenia indica* L. : a. twig with flower, b. longitudinal section of pistil, c. & d. stamens; e. seed.

Evergreen trees up to 30 m tall. Leaves oblong, acute to acuminate, dentate, 15-30 × 5-12 cm. Flowers solitary, pendant. Petals white, 7-9 cm long. Outer

stamens 13-15 mm long, inner ones with reflexed apex. 20-22 mm long. Carpels 14-20, each with 40-80 ovules. Style 25 mm long. Fruits yellow-green. Seeds reniform black.

Fl. : May - July; *Fr.* : Sept. - Feb. Birbhum, Calcutta, Darjeeling.

Often planted as an ornamental. Fruits are edible, dispersed by animals.

3. *Dillenia pentagyna* Roxb., Pl. Corom. 1 : 21, t. 20, 1795; Hook. f. & Thoms. in Hook. f., Fl., Brit. India 1:38, 1872, p.p., excl. syn. Prain, *l.c.* 126; Majumdar in Sharma *et al.*, *l.c.* 156. "Karkotta" (Beng.); "Akshi" (Assm.); "Rai" (Or.).

Deciduous trees, up to 25 m tall. Leaves obovate-oblong, 20-50 × 10-20 cm. Flowers 2-7 on short, up to 3 mm long shoots, bracteate, 2.5-3 cm diam. Petals yellow. Outer stamens 2.5-4 mm long, inner 10, each 6-9 mm long. Carpels 6, each with 5-20 ovules. Fruits subglobular, 15 × 13 mm. Seeds ovoid, exarillate.

Fl. & Fr. : March - Nov. Bankura, Birbhum, Darjeeling, Jalpaiguri, Purulia.

Wood used for furniture and match-stick. Fruits edible. Leaves used as green manure, dry leaves used for polishing ivory and horn. Bark yields a good fibre.

2. TETRACERA L.

Shrubs or lianas, sometimes straggling. Leaves simple, often scabrid; petioles short furrowed. Panicles axillary or terminal, few to many-flowered. Flowers scented. Sepals 4-5, persistent, often reflexed in fruit. Petals 3-5, white to reddish white, emarginate at apex, caducous. Stamens numerous with broad connectives. Carpels 1-4, free, each with 4-20 ovules; styles short. Follicles ovoid to globose with a short beak, coriaceous, dehiscing by 1-2 longitudinal slits, one to few-seeded. Seeds glossy black or dark-brown.

A genus with about 40 species in the tropics; 1 species in West Bengal.

Tetracera sarmentosa (L.) Vahl subsp. *andamanica* (Hoogl.) Hoogl. in Blumea 9: 588, 1959; Majumdar in Sharma *et al.*, *l.c.* 159. *T. asiatica* (Lour.) Hoogl. subsp. *andamanica* Hoogl. in Steenis, Fl. Mal. 1, 4: 144, 1951 et in Reinwardtia 2:195, 1953. *Delima sarmentosa* var. *glabra* Hook. f. & Thoms. in Hook. f., *l.c.* 31; Prain, *l.c.* 126 (*non L.*). "Ou-lots" "Panilewa" (Assm.).

Shrubs or lianas, up to 6 m long; young shoots sparsely strigose with divergent tufts of 3-12 short (0.3-0.5 mm) hairs. Leaves oblong, 5-12 × 2-6 cm, sparsely strigose on nerves beneath. Sepals 5, hirsute outside, inner three larger. Petals 3, white or yellowish white, 3-4 × 2-3 mm. Stamens 100-125, each 3-4 mm long. Carpels 1(-2). Follicles ovoid with 2-5 mm long beak, glabrous, purplish, shining, 1(-2)-seeded. Seeds 4 × 3 mm, aril up to 5 mm long, fimbriate.

Fl. : May - Oct.; *Fr.* : June - Feb. Darjeeling (*vide* Hoogland, Reinwardtia 2: 196, 1953).

MAGNOLIACEAE

(D. C. S. Raju)

A family of ca 8 genera and nearly 100 species distributed in the tropics and temperate regions of the world; 2 genera and 9 species in West Bengal.

- 1. Flowers terminal; gynoecium sessile ... 1. MAGNOLIA
- 1. Flowers axillary; gynoecium stalked ... 2. MICHELIA

1. MAGNOLIA L.

Trees. Leaves large. Stipules free or adnate to petiole. Flowers terminal, large and snowy. Tepals 9-12, mostly spathaceous, subequal. Anthers dehiscing introrsely or laterally; connective produced. Gynoecium sessile. Carpels numerous, free; ovules 3-4. Fruiting carpels dehiscing along dorsal suture.

A widely distributed genus comprising of ca 80 species of S.E. Asia, America, Mexico and Caribbean Island. Only 3 species in the Darjeeling Himalayas.

- 1. Petals coloured:
 - 2. Leaves tomentose beneath; petals pink; connective produced ... 1. *M. campbellii*
 - 2. Leaves glabrous; petals red; connective not produced ... 3. *M. hodgsonii*
- 1. Petals always white:
 - 3. Leaves ovate; fruits small, ca 1.2 cm long ... 2. *M. globosa*
 - 3. Leaves elliptic-oblong; fruits large up to 15 cm long ... 4. *M. pterocarpa*

1. *Magnolia campbellii* Hook. f. & Thoms., Fl. Ind. 77. 1855 et in Hook. f., Fl. Brit. India 1:41. 1872; Raju in Sharma *et al.*, Fl. India 1:166. 1993.

Large trees, up to 50m high. Leaves elliptic or oblong-obovate, up to 26 × 10 cm, acute or acuminate at base, glabrous above, pubescent beneath, lateral veins 12-15 on either side; petioles ca 3.5 cm long; stipules present, pilose. Flowers terminal, solitary, spathaceous bracts enclosing the buds large, deciduous, ca 6 × 4 cm, ovate to obovate with golden yellow tomentum. Tepals pink, about 12-16-seriate, 9-11 × 5 cm, obovate. Stamens numerous ca 100 or more, free; filaments 6 mm, flat; anthers ca 2.5 cm long, dehiscence latrorse, connective produced into an appendage. Gynoecium sessile, exerted above the stamens; carpels numerous, ovoid, each with a stigmatic crest set with papillae. Fruits cylindrical, ca 16 cm long and 3 cm in diam, ripe carpels ca 1.2 × 1 cm, dehiscing dorsally. Seeds 2, compressed, ca 8 × 5 × 3 mm, obovoid.

Fl. : Feb. - April; Fr. : Sept. - Oct. Darjeeling.

Planted as an ornamental tree.

2. *Magnolia globosa* Hook. f. & Thoms., Fl. Ind. 77, 1855 et in Hook.f., Lc. 40; Raju in Sharma *et al.*, Lc. 167.

Trees. Leaves ovate, 9-12 cm long, glabrous on upper surface, rufous-villous on undersurface, apex mucronate, base rounded, lateral nerves 8-12 on either side; petioles ca 5 cm long, rufous tomentose. Flowers leaf-opposed, white, fragrant. Pedicels up to 6 cm long. Tepals 9, free, outer 3 sepaloid, obovate, 2.5 × 1.5 cm, inner 6 broadly obovate, ca 6 × 4 cm. Stamens numerous, crimson coloured; filaments ca 3 cm long; anthers ca 1 cm long, oblong, truncate at apex. Gynoecium ca 2 × 1 cm, ellipsoid. Carpels about 20, ca 1.2 cm long compressed, angular, rounded at base, beaked at apex, dehiscence dorsal. Seeds 2, rounded at base.

Fl. : July; Fr. : Aug. Darjeeling.

3. *Magnolia hodgsonii* (Hook. f. & Thoms.) Keng in Gard. Bull. 31 : 129, 1987; Raju in Sharma *et al.*, Lc. 168. *Talauma hodgsonii* Hook. f. & Thoms. Lc. 75 et in Hook. f., Lc. 40.

Trees; branches spreading. Leaves oblanceolate, coriaceous, up to 40 × 20 cm, glabrous, acute or abruptly acuminate at apex; lateral nerves 18-22 on either side; petioles ca 6 mm long, stout. Tepals 9-15, outer 3 sepaloid, ca 3.5 × 2.5 cm, greenish purple. Petals ca 5.5 × 4 cm, whitish at base, bright red above. Stamens many, short; anthers ca 12 mm long. Fruits ovoid, 10-15 × 6-8 cm, carpel axis leaving red seeds suspended by silky cords from upper end of pits.

Fl. : April - May; Fr. : Aug. - Sept. Darjeeling.

4. *Magnolia pterocarpa* Roxb., Pl. Corom. 3: 62, t. 266, 1820; Raju in Sharma *et al.*, Lc. 172. *M. sphenocarpa* Hook. f. & Thoms., Lc. 78 et in Hook.f., Lc. 41; Prain, Bengal Pl. 1 : 127, 1963. Fig. 6

Evergreen trees; branchlets pubescent when young. Leaves obovate-oblong, coriaceous, up to 30 × 13 cm, acute at apex and base; lateral nerves 15 on either side; petioles up to 4 cm long. Flowers white, fragrant. Tepals 9, outer 3 sepaloid, ca 4 × 3.2 cm, ovate. Petals 6, fleshy in bud. Stamens numerous; filaments short; anthers ca 3 cm, introrse. Gynoecium ca 3.5 cm in diam., ovoid. Carpels ca 80, adpressed at base, ca 1 cm long, beaked, feathery. Fruits up to 15 cm long, 8 cm diam., ripe carpels oblong. Seeds 2, orange coloured.

Fl. : June - July; Fr. : Oct. - Nov. Darjeeling.

2. MICHELIA L.

Trees or shrubs. Stipules adnate to or free from the petiole. Flowers bisexual, solitary, axillary. Tepals 6-8, mostly subequal, 3-6 merous. Anthers dehiscing laterally; connective produced into an appendage. Gynoecium stalked. Carpels few, free; ovules 2 or more in each carpel. Fruiting carpels free or rarely syncarpous, laxly spaced, dehiscing along the suture, rarely the fleshy carpels rotting away leaving the cartilaginous hook-like structures persistent on the axis.

About 50 species in tropical Asia and China; 5 species in West Bengal.

1. Tepals always more than 4 cm long:

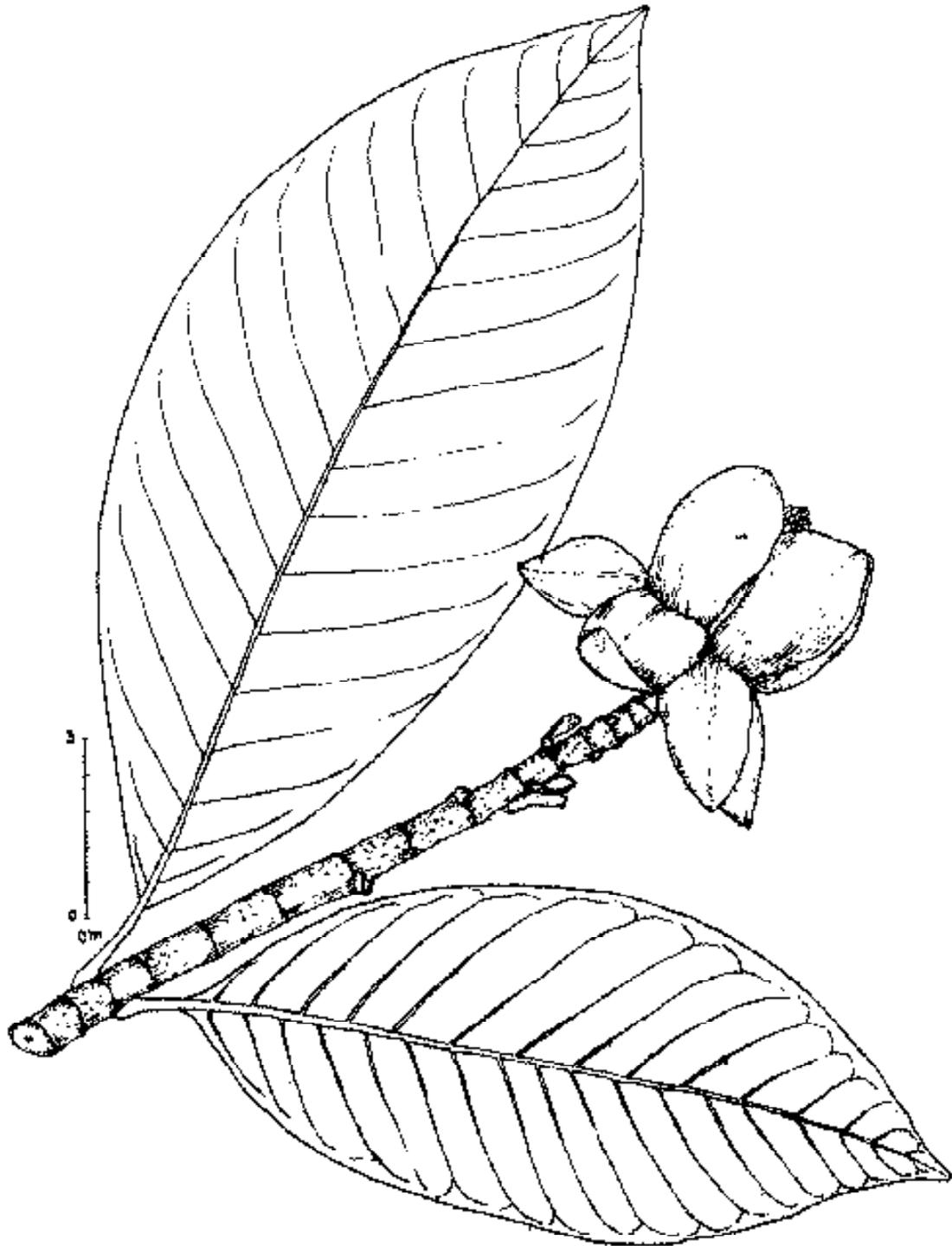


Fig. 6. *Magnolia pterocarpa* Roxb.

- 2. Perianth segments up to 12:
 - 3. Leaves broad at base, glaucous beneath ... 3. *M. doltsopa*
 - 3. Leaves narrowed at base, pilose beneath ... 1. *M. cathcartii*
- 2. Perianth segments more than 12 ... 5. *M. velutina*
- 1. Tepals never more than 4 cm long:
 - 4. Peduncles distinct, ca 3 cm long; fruitlets oblong ... 2. *M. champaca*
 - 4. Peduncles very short ca 0.2 cm long; fruitlets globose ... 4. *M. kisopa*

1. **Michelia cathcartii** Hook. f. & Thoms., Fl. Ind. 79. 1855 et. in Hook.f., Fl. Lc. 42; Raju in Sharma *et al.*, Lc. 175.

Small tree; branchlets rusty tomentose when young. Leaves 9-13 × 4-5 cm, elliptic-lanceolate, glabrous above, pilose beneath, acute at apex, narrowed to the base. Flowers large, peduncles stout, 2 cm long. Petals 9, obovoid, ca 4.5 × 1.5 cm, inner ones narrow. Stamens ca 40; anther up to 3 cm long; filaments short, connective produced into appendage, 3 mm long. Gynoecium stipitate, 7 mm long. Carpels 20 on a cylindrical column, ca 3 × 2.5 mm, ovoid; stigma recurved. Fruiting carpels ovoid, dehiscing along dorsal suture. Seeds 2.

Fl. : May; Fr. : July - Aug. Darjeeling.

2. **Michelia champaca** L., Sp. Pl. 536. 1753; Hook. f. & Thoms., Lc. 42. 1872; Prain, Lc. 127; Raju in Sharma *et al.*, Lc. 175.

Trees, branches sericeous when young. Leaves ovate-lanceolate, 8 × 6 cm, minutely pubescent below, apex acuminate, base acute, lateral nerves 12-15 on either side; petioles up to 3 cm long. Flowers axillary, peduncle ca 1.5 cm long. Tepals 12-15, orange, oblanceolate, ca 4 × 1 cm, fleshy. Stamens numerous, sub-clavate. Carpels numerous, ovoid-oblong; 8-10 × 4 mm; stigmatic crest recurved, 2 mm long; fruiting peduncle elongate; ripe carpels laxly arranged, 1-2 cm long. Seeds many, enclosed in fleshy red aril.

Fl. : March - May; Fr. : Aug. - Oct. Commonly planted as an ornamental tree.

3. **Michelia doltsopa** Buch. Ham. ex DC., Syst. 1:448. 1881 et Prodr. 1:79. 1824; Raju in Sharma *et al.*, Lc. 176. *M. excelsa* Wall ex Bl. Fl. Jav. 9. 1828; Hook. f. & Thoms. in Hook.L., Lc. 43. 1872.

Trees up to 16 m high; branchlets densely ferruginous tomentose. Leaves ovate-lanceolate to elliptic, 15-29 × 5-7 cm, acute to round at base, acute to acuminate at apex, glabrous above, glaucous on undersurface, lateral nerves 7-9 on either side; petioles up to 2 cm long, glabrous; stipules present. Flowers large, white, ca 14 cm across when fully open; bracts 2, spathaceous, 4-6 × 2-3 cm, ovate-oblong; peduncles 4-8 mm long. Tepals 12, white, 5-6 × 2-3.5 cm, obovate to spatulate. Stamens about 60; filaments short; anthers up to 1 cm long, connective produced into short appendage. Gynoecium stipitate, numerous, 1.5-1 mm, minutely tomentose. Fruiting axis elongate, up to 15 cm long, ripe carpels ca 1 × 0.6 mm, ovoid, dehiscence ventral. Seeds 1-2, compressed.

Fl. : March - May; Fr. : Aug. - Oct. Darjeeling.

4. *Michelia kisopa* Buch. Ham. ex DC., Syst. 1: 448. 1818 et Prodr. 1: 79. 1824; Hook. f. & Thoms. in Hook. f. *l.c.* 43; Raju in Sharma *et al.*, *l.c.* 178.

Evergreen trees, up to 12 m high; branchlets glabrous. Leaves oblong-lanceolate, *ca* 15 × 5 cm, glabrous shining above, acute to shortly acuminate at apex, rounded at base. Flowers subsessile; peduncles *ca* 2 mm long, stout; bracts spathaceous, 1.5 × 1 cm, ovate. Tepals yellow, outer 12-15 obovate, 3 × 1 cm, inner few smaller. Stamens about 40, many-seriate; filaments short; anthers up to 1 cm. long, linear, connective thick; dehiscence latrorse. Carpels stipitate, about 40 or less, 1-2.5 × 0.75 cm ovoid; style recurved. Fruiting peduncle up to 10 cm long; ripe carpels *ca* 25, each attached to a round base, wall tuberculate. Seeds 1 or 2, large.

Fl. : Oct. - Dec.; *Fr.* : Jan. Darjeeling.

5. *Michelia velutina* DC., Prodr. 79. 1824; Raju in Sharma *et al.*, *l.c.* 181. *M. lanuginosa* Wall. Tent. Fl. Nepal 8. 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 43.

Trees, up to 30 m tall; branchlets velutinous when young. Leaves lanceolate to elliptic, 16-24 × 5-7 cm, densely velutinous on lower surface, apex acuminate, base acute; lateral nerves 15-18 on either side. Flowers white, large and fragrant; peduncles short; bracts 2, spathaceous, oblong, densely velutinous. Tepals 12-18-seriate, each 3-5 × 0.8-1 cm, oblanceolate elliptic, fleshy. Stamens 30 or more, twisted when dry. Gynoecium stipitate, conical, 10-14 × 6 mm, densely velutinous, stalk up to 1 cm long. Carpels 60 or more, 3-4 × 2 mm, ovoid, glabrous; style slender, beaked, dark-brown when dry. Fruits 8-10 cm long; ripe carpels *ca* 2 × 1.5 cm, dark brown, tubercled. Seeds large, 1-3 angular, testa hard and brown.

Fl. : July - Sept.; *Fr.* : Nov. - Dec. Darjeeling.

ANNONACEAE

(Debika Mitra)

A family of *ca* 122 genera and 1100 species almost confined to the tropics of the Old World; 10 genera and 20 species are reported from West Bengal.

1. Ripe carpels free, forming apocarpous fruits:
 2. Anther-cells concealed by overlapping connectives; sepals and petals distinguishable:
 3. Petals imbricate ... 10. UVARIA
 3. Petals valvate:
 4. Petals of 2 series equal or subequal :
 5. Ripe carpels moniliform ... 5. DESMOS
 5. Ripe carpels not moniliform:
 6. Peduncles flattened or hooked ... 3. ARTABORIS
 6. Peduncles neither flattened nor hooked:

- 7. Stamens 3 mm long, connectives apiculate ... 4. CANANGA
- 7. Stamens less than 3 mm long, connectives not apiculate ... 9. POLYALTHIA
- 4. Petals of 2 series unequal:
 - 8. Inner 3 petals triquetrous ... 6. FINNISTIGMA
 - 8. Inner 3 petals forming mitriform cap over stamens and carpels ... 7. GONIOFIALAMUS
- 2. Anther-cells not concealed by overlapping connectives; sepals and petals not distinguishable:
 - 9. Outer set of petals similar and equalling sepals; inner set of petals larger ... 8. MILNEA
 - 9. Outer set of petals not like sepals, both sets of petals subequal or inner smaller ... 1. ALPHONSEA
- 1. Ripe carpels united forming many-celled syncarpous fruits ... 2. ANNONA

1. ALPHONSEA Hook. f. & Thoms.

Tall trees. Leaves glabrous, coriaceous. Flowers 1 to several, fascicled, leaf-opposed or extra-axillary, bracteate. Sepals 3, small, valvate. Petals 6 (3+3), valvate, subequal or inner smaller. Stamens indefinite, miliusoid, connectives apiculate not concealing anther cells. Carpels 1-8; ovules 4-10 in 2 rows; stigma almost sessile. Ripe carpels many, subsessile or stalked, glabrous, tomentose or verrucose.

A genus with about 30 species in S.E. Asia; 1 species in West Bengal.

Alphonsea ventricosa (Roxb.) Hook. f. & Thoms., Fl. Ind. 1 : 152. 1855 et in Hook. f., *l.c.* 89. 1872; Prain, Bengal Pl. 1: 131. 1963 (repr. ed.); D. Mitra in Sharma *et al.*, Fl. India 1:211. 1993. *Uvaria ventricosa* Roxb. Fl. Ind. 2 : 658. 1832.

Trees, branches brown-tomentose when young. Leaves oblong to elliptic-oblong, long acuminate, 20-26 × 5-8.5 cm. Flowers in a few-flowered raceme; bracts ovate, tomentose. Sepals very small, ovate, connate below, tomentose outside. Petals ovate-oblong, acute, brown-tomentose outside, *ca* 1 × 0.7 cm, inner smaller. Stamens many, *ca* 1.5 mm long, top of the connectives apiculate. Carpels about 10, *ca* 3 mm long, oblong, stigma subsessile, capitate. Ripe carpels 4-5, ovoid or subglobose, 2.5-3.5 cm in diam. Stalk about 2.5 cm long. Seeds many in 2 rows.

Fl. : March; *Fr.* : July-Aug. Howrah, planted in the Indian Botanic Garden.

2. ANNONA L.

Trees or shrubs. Leaves glabrous, coriaceous. Flowers bisexual, solitary or fascicled, axillary, leaf-opposed or terminal. Sepals 3, small, valvate. Petals usually 6 (3+3), valvate fleshy; outer lanceolate or ovate, inner usually rudimentary or absent. Stamens numerous, anthers narrow, top of the connectives

ovoid. Carpels many, sub-connate, ovule 1, erect, basal; style oblong. Ripe carpels confluent into a many-celled ovoid or globose fruit, sometimes with spines. Seeds many, enclosed by a membranous aril.

A genus with about 110 species distributed in India, Africa, Central and South America, West Indies; 2 species in West Bengal.

1. Leaves oblong, obtuse; fruits tuberculate ... 2. *A. squamosa*

1. Leaves oblong-lanceolate acute; fruits reticulate areolate ... 1. *A. reticulata*

1. ***Annona reticulata*** L., Sp. Pl. 1 : 573. 1753; Hook. f. & Thoms. in Hook. f., *l.c.* 78. 1872; Prain, *l.c.* 134; D. Mitra in Sharma *et al.*, *l.c.* 207. "Nona" (Beng.); "Ramphal" (H); "Neua" (Or.).

Trees. Leaves oblong-lanceolate, acute to acuminate, glabrous, pubescent beneath when young, 12-20 × 3-5 cm. Flowers 2-3 together, axillary; bracts pubescent. Sepals broadly ovate, shortly acuminate, pubescent outside, 1.5-3 × 2-3 mm. Petals whitish, reddish at the base inside, outer narrow oblong, triquetrous, 1.5-2 × 0.4-0.5 cm, inner minute. Stamens numerous, 1 mm long, top of the connectives ovoid. Carpels many, *ca* 1 mm long, linear; style oblong; stigma entire. Ripe carpels subglobose, pentagonal, reticulate, areolate, yellowish-brown to reddish brown. Seeds many, black.

Fl. : May - July ; *Fr.* : Nov. - Jan. Cultivated and naturalised in West Bengal.

Fruits edible, anthelmintic and antidyenteric. Leaves and seeds insecticidal. Bark astringent.

2. ***Annona squamosa*** L., Sp. Pl. 1 : 537. 1753; Hook. f. & Thoms. Fl. Ind. 1:115. 1855 et in Hook. f., *l.c.* 78. 1872; Prain, *l.c.* 134; D. Mitra in Sharma *et al.*, *l.c.* 207. "Ata" (Beng.); "Sharipha, Sitaphal" (H); "Ato" (Or.). Fig. 7

Small trees. Leaves oblong, obtuse or slightly acute, glabrous or pubescent on the nerves when young, 8-14 × 3.5-5 cm. Flowers solitary or a few together, axillary or leaf opposed, bracts pubescent. Sepals broadly ovate, shortly acuminate, pubescent, 2-3 × 3-4 mm. Petals greenish white, reddish at the base inside, outer narrow-oblong, 1.5-3 × 0.3-0.5 cm; inner rudimentary *ca* 1 mm long. Stamens numerous, *ca* 1 mm long, top of the connectives ovoid. Carpels many, *ca* 1 mm long, ovate, pubescent; style oblong; stigma entire. Ripe carpels many-celled, globose, fleshy, tuberculate. Seeds many, black, shining.

Fl. : May - Aug.; *Fr.* : Sept. - Jan. Cultivated and almost naturalised in West Bengal.

Fruits edible. Seeds insecticidal, fish poison, used to remove lice in hairs.

3. ARTABOTRYS R. Br.

Climbers or scandent shrubs. Leaves coriaceous. Flowers solitary or fascicled on woody hooked recurved peduncle. Sepals 3, valvate. Petals 6. (3+3) valvate, clawed, base concave and connivent, limb spreading, flat, terete or clavate. Stamens many, oblong or cuneate, connectives flat-topped. Carpels few to many;

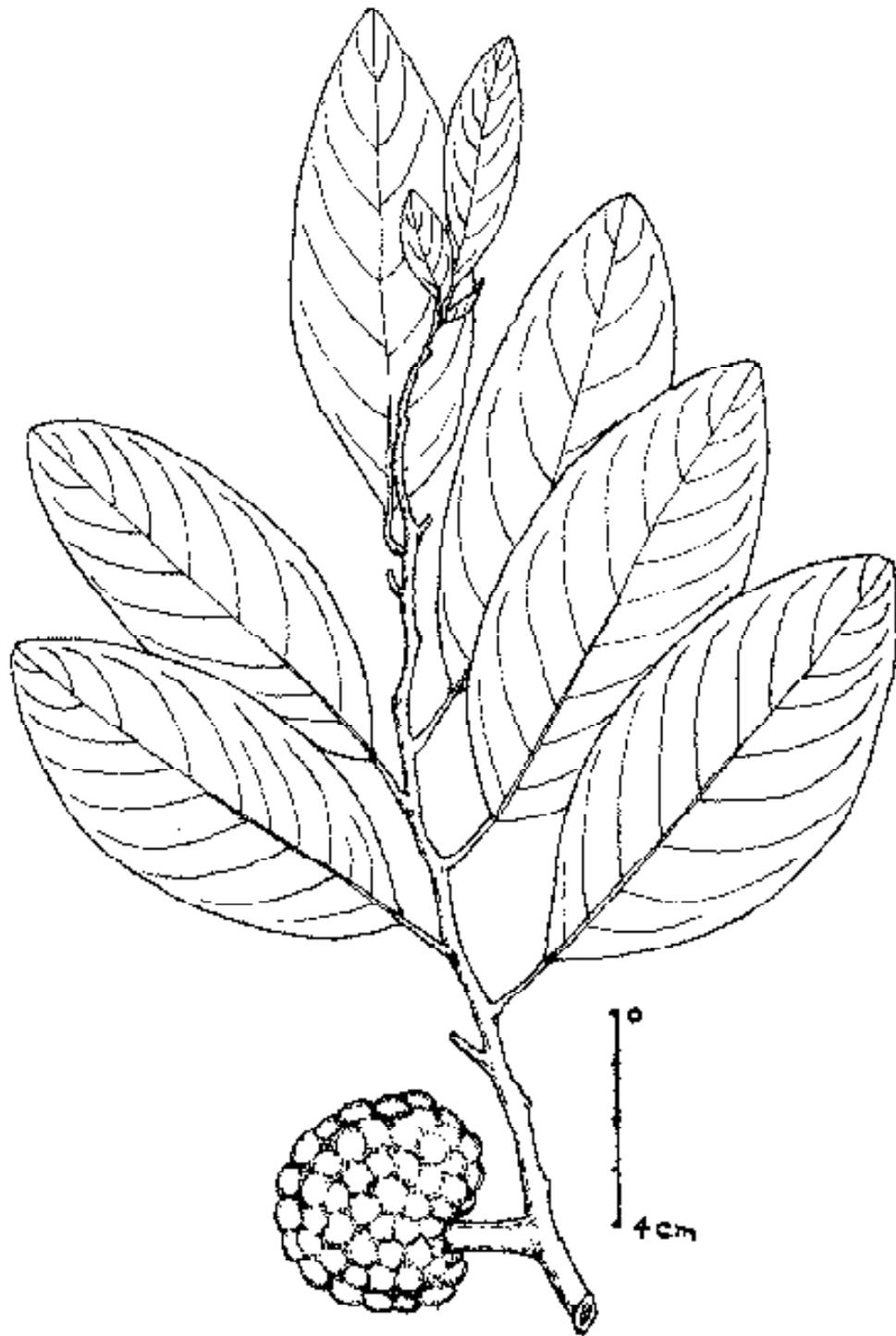


Fig. 7. *Annona squamosa* L.

style oblong or columnar; ovules 2, erect, collateral. Ripe carpels many, berry. Seeds 2, sometimes 1.

A genus with about 100 species in S.E. Asia, Australia and Africa; 1 species in West Bengal.

Artabotrys hexapetalus (L.f.) Bhandari in *Baileya* 12: 147, 1964; D. Mitra in Sharma *et al.*, *Fl. India* 1:251, 1993. *Antonia hexapetala* Linn. f. *Sp. Pl. Suppl.* 270, 1781. *Artabotrys odoratissimus* R. Br. in *Bot. Reg.* 5: t. 423, 1819, (*non* Blume); Hook. f. & Thoms. in *Hook. f., l.c.* 54; Prain, *l.c.* 131. "Kanthalichampa" (Beng.); "Madanmasi" (H); "Kilomuro" (Or.).

Fig. 8

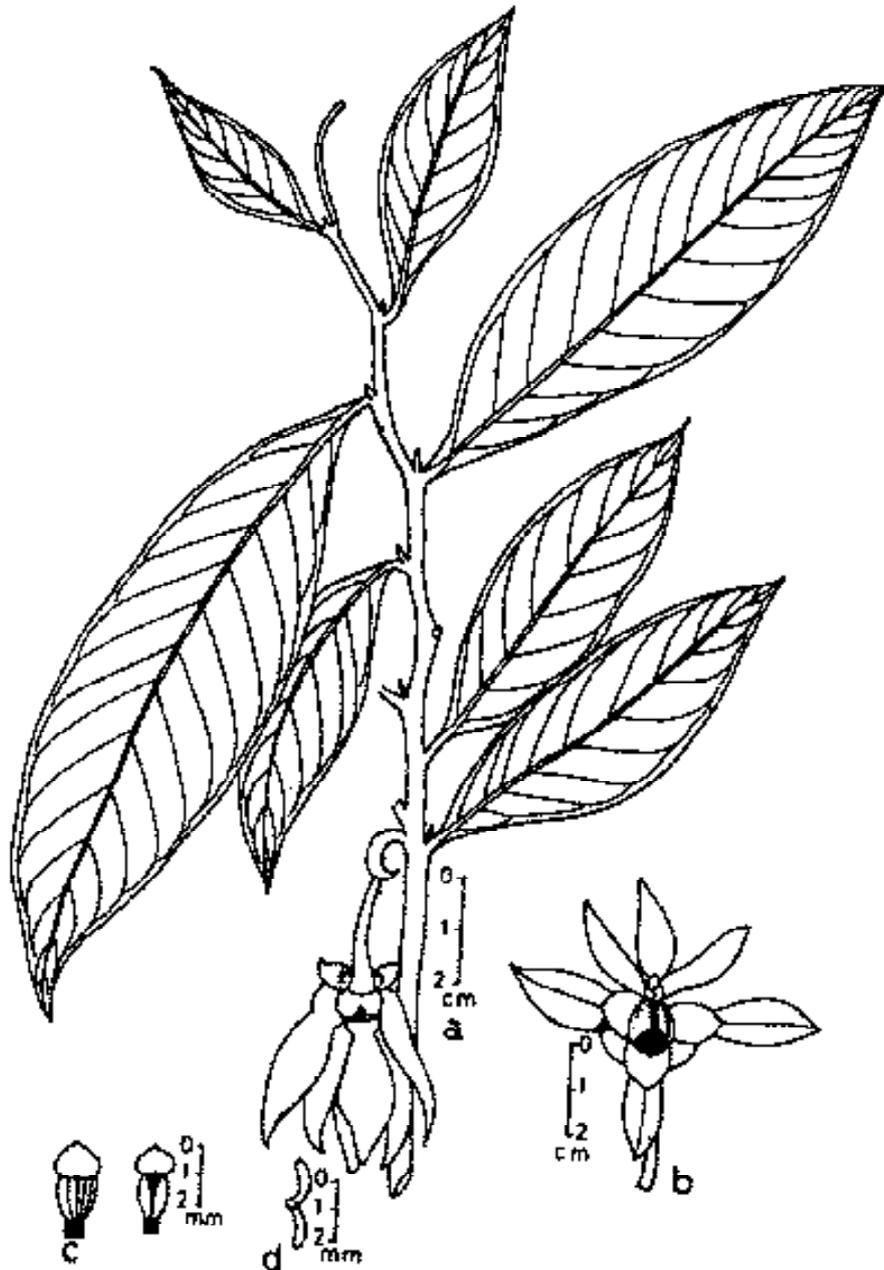


Fig. 8. *Artabotrys hexapetalus* (L. f.) Bhandari : a. flowering twig; b. flower; c. stamens, front and back views; d. carpel.

Bushy shrubs, often scandent. Leaves oblong-lanceolate, shortly acuminate, 10-12 × 3.5-5.5 cm. Flowers solitary or in pairs, drooping. Sepals ovate, acute, 5-7 × 6 mm, reflexed. Petals 6 (3+3), sometimes 9, 3-5 × 0.7-1.2 cm, yellow, sweet scented, clawed, limb lanceolate. Stamens many, 1.5 mm, connectives triangular, peltate. Carpels few, sickle-shaped; style curved, stigma blunt. Ripe carpels 6-10, narrowly obovoid, apiculate, stalk very short. Seed 1.

Fl. : April - July; *Fr.* : Sept. - Feb. Cultivated throughout the plains of West Bengal in parks and gardens.

Decoction of leaves is given in cholera. An essential oil used in perfumery is prepared from the flowers.

4. CANANGA (A. DC.) Hook. f. & Thoms.

Tall trees. Leaves large. Flowers solitary or fasciated on short axillary peduncle. Sepals 3, valvate, ovate or triangular. Petals 6(3+3), valvate, greenish-yellow, strap-shaped, fragrant. Stamens many, linear, connectives produced to an acute end. Carpels many; ovaries oblong; stigma subcapitate. Ripe carpels many, berries, pulpy, stalked or sessile. Seeds many, in 2 rows, pitted, sending spinous processes into the albumen.

A genus with 2 species in S. E. Asia; 1 species in West Bengal.

Cananga odorata (Lamk.) Hook. f. & Thoms., *Fl. Ind.* 1: 130, 1855 et in Hook. f. *Fl. Brit. India* 1: 56, 1872; Prain, *l.c.* 132; D. Mitra in Sharma *et al.*, *l.c.* 254. *Uvaria odorata* Lamk., *Encycl.* 1:595, 1789. *Canangium odoratum* King in *Mat. Fl. Malay-Penin.* 1: 4, 290, 1892 et in *Ann. Roy. Bot. Gard. Calcutta* 4:51, t. 67, 1893. "Aparva Champakame" (Tel.); "Aparva Campaka" (Kan.).

Trees, 10-20 m tall, branching at the top of the trunk. Leaves elliptic-ovate to oblong-lanceolate, 9-18 × 4-7 cm, shortly acuminate. Flowers in short pedunculate raceme, pendulous; bracts basal and sub-median, pubescent. Sepals connate at base, 5-7 × 4-5 mm, triangular, reflexed. Petals linear-lanceolate, 5-7 × 0.7 cm, silky, pubescent with age, several nerved. Stamens numerous, ca 3 mm long, linear. Carpels many, 3-4 mm long; ovaries narrow-oblong; style curved; stigma peltate. Ripe carpels 10-12, oblong-ovoid, 1-2.5 cm long, stalk 1-2 cm long. Seeds 6-12 in two rows, pale brown with pitted surface.

Fl. : June - July; *Fr.* : Oct. -Nov. Usually cultivated.

Flowers yield an essential oil commonly known as Cananga oil. Leaves also yield an oil which is used in headache, ophthalmia and gout.

5. DESMOS Lour.

Erect or scandent shrubs. Leaves often glaucous beneath, shining above. Flowers usually solitary, extra-axillary, axillary or leaf-opposed, usually pendulous. Sepals 3, small, valvate. Petals 6, [(3 + 3) (sometimes 4-2 when inner absent)], valvate, clawed at base. Stamens numerous, anther cells linear, top of the connective sub-globose or truncate. Carpels numerous; style oblong or ovoid;

stigma oblong, ovoid or clavate with U-shaped opening; ovules 2-8. Ripe carpels many, moniliform, 1-8 segmented. Seeds solitary in each segment.

A genus with about 30 species in S.E. Asia, Australia, Pacific Islands and Africa; 2 species and 2 varieties in West Bengal.

- 1. Petals lanceolate; pedicels 3-5 cm long; leaves oblong to oblong-lanceolate ...1. *D. chinensis*
- 1. Petals spatulate; pedicels 2-3.5 cm long; leaves ovate-oblong to obovate ...2. *D. dumosus*

1. ***Desmos chinensis*** Lour., Fl. Cochinch. 1: 352. 1790; D. Mitra in Sharma *et al.*, *l.c.*: 257. *Unona discolor* Vahl, Symb. Bot. 2: 63. t.36. 1791; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1: 59. 1872; Prain, *l.c.*: 132.

Spreading or sarmentose shrubs. Leaves oblong or oblong-lanceolate. Flowers solitary, extra-axillary or leaf-opposed. Sepals 5-10 × 3-4 mm, ovate-lanceolate, glabrous. Petals outer 4-7 × 1 cm, narrowly lanceolate, pubescent, inner shorter. Stamens *ca* 1 mm long, connectives flat topped. Carpels numerous, *ca* 2 mm long; ovary oblong. Ripe carpels many, 1.5 - 4 cm long, moniliform, with 2-6 joints, terminal joint slightly apiculate.

- 1. Leaves densely pubescent beneath ... var. *pubescens*
- 1. Leaves glabrous:
 - 2. Flowers silky villous ... var. *laevigata*
 - 2. Flowers glabrous ... var. *chinensis*

var. ***chinensis***

Climbing shrubs, leaves oblong or oblong-lanceolate, 7-18 × 3-6 cm; sepals glabrous. Petals narrowly lanceolate, pubescent.

Fl.: April - June; *Fr.*: Sept - Jan. Jalpaiguri.

Decoction of roots is used for dysentery and vertigo.

var. ***laevigata*** (Hook. f. & Thoms.) Mitra, *comb. nov.* *Unona discolor* Vahl var. *laevigata* Hook. f. & Thoms. Fl. Ind. 1:133. 1855 et in Hook. f., Fl. Brit. India 1:59. 1872.

Leaves oblong or lanceolate, 11-16 × 4-5.5 cm, apex acute, base rounded or sometimes slightly cordate. Flowers silky villous.

Indian Botanic Garden, Howrah. var. *pubescens* (Hook. f. & Thoms.) D.B. Deb in Fl. Tripura State 1:83. 1981. *Unona discolor* Vahl.

var. ***pubescens*** Hook. f. & Thoms., Fl. India 1:133. 1855 et in Hook. f., Fl. Brit. India 1: 59. 1872.

Leaves oblong, 12-22 × 3.5-7 cm, acute or acuminate, densely pubescent beneath. Flowering pedicels with a sub-median bract, strigose beneath.

Fl. : May - June; *Fr.* : Nov. - Feb. Jalpaiguri.

2. *Desmos dumosus* (Roxb.) Safford in Bull. Torrey Bot. Cl. 39: 506. 1912; D. Mitra in Sharma *et al.*, *l.c.* 260. *Unona dumosa* Roxb., Fl. India 2: 607. 1832; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:59. 1872.

Woody climbers. Leaves ovate-oblong or obovate, shortly and abruptly acute at apex. 8-15 × 4-7 cm. Flowers solitary, terminal or leaf-opposed, pendulous. Sepals ovate, acute, 7-10 × 5-6 mm, pubescent. Petals outer 4-7 × 2-3.5 cm, yellowish-green, spatulate, densely pubescent, inner smaller. Stamens numerous, 1.5 mm long, connectives flat at the top. Carpels many; stigma sessile, curved. Ripe carpels many, moniliform, stalk very short. Seed solitary in each segment.

Fl. : May - June; *Fr.* : Oct. - Jan. Jalpaiguri.

6. FISSISTIGMA Griff.

Climbing shrubs. Leaves with strong parallel nerves. Flowers solitary or fascicled or panicle. buds triquetrous. Sepals 3, valvate, persistent. Petals 6(3+3), thick, outer trigonous, flat; inner triquetrous above, connate at the flat base, shorter than outer. Stamens many, top of the connectives ovoid, quadrate or apiculate. Carpels many, style oblong to narrow clavate, stigma short. Ripe carpels berry, usually stalked. Seeds many.

A genus with about 70 species in S.E. Asia, China, Australia and Africa; 1 species in West Bengal.

Fissistigma bicolor (Roxb.) Merr. in Philip. Journ. Sci. (Bot.) 15:131. 1919; D. Mitra in Sharma *et al.*, *l.c.* 297. *Uvaria bicolor* Roxb. Fl. Ind. 2: 662. 1832 (*non* Wall.). *Melodorum bicolor* Hook. f. & Thoms., Fl. Ind. 1: 119. 1855 et in Hook. f., *l.c.* 80. 1872.

Large woody climbers. Leaves oblong or elliptic-oblong, obtuse to shortly acuminate, brown pubescent beneath, 11-18.5 × 5-8.5 cm. Flowers solitary or 2-3 together, leaf-opposed, velvety tomentose; bracts 7 mm long, tomentose outside. Sepals ovate, acute, thin, tomentose outside, 5-8 × 5-6 mm. Petals outer ovate-lanceolate, yellowish, villous outside, 1.8-2 × 0.6-0.7 cm, inner glabrous, red, triquetrous above, 1.3-1.7 × 0.4 cm. Stamens many, *ca* 2 mm long, top of the connectives ovoid. Carpels many, oblong, *ca* 3 mm long, style short, curved stigma bifid. Ripe carpels globose, mucronate, tomentose, stalk below 1 cm. Seeds 4-8.

Fl. : Oct. - Nov.; *Fr.* : May - June. Jalpaiguri.

7. GONIOTHALAMUS (Blume) Hook. f. & Thoms.

Shrubs or small trees. Leaves with nerves forming intramarginal loops. Flowers solitary or fascicled, sometimes cauliflorous. Sepals 3, valvate, nerved, persistent in fruit. Petals 6 (3+3), valvate; outer flat, inner smaller, shortly clawed, cohering in a vaulted cap over the stamens and carpels. Stamens many, linear-oblong; pollen grains large. Carpels many, cylindrical; stigma simple or bifid. Ripe carpels berry. Seed 1, sometimes 2-4.

A genus with about 115 species in S.E. Asia, New Zealand and Guinea; 1 species in West Bengal.

Goniothalamus sesquipetalis (Wall.) Hook. f. & Thoms., Fl. Ind. 1:108. 1855 et in Hook. f., *l.c.* 73; D. Mitra in Sharma *et al.*, *l.c.* 237. *Gnatteria sesquipetalis* Wall., Pl. Asiat. Rar. 3:t. 266. 1832.

Shrubs. Leaves linear-oblong or lanceolate, abruptly and obtusely acuminate, 25-36 × 5.5 - 10 cm. Flowers solitary, axillary or supra-axillary; 2-6 bracts present at the base of pedicels. Sepals ovate, acute, 5-8 × 4-6 mm (bigger in size when persistent in fruit). Petals greenish yellow, outer linear-lanceolate, 1.2 - 2.2 × 0.3 - 0.5 cm. Stamens many, 1.5 mm, top of the connectives peltate and slightly pubescent. Carpels few, linear *ca* 4 mm; ovaries golden strigose; style curved, stigma funnel-shaped. Ripe carpels few, red when ripe, mucronate, shortly stalked. Seed 1.

Fl.: April - May; *Fr.*: Oct - Nov. Jalpaiguri

8. MILIUSA Leschen. ex A. DC.

Small trees or shrubs. Leaves usually pubescent below when young. Flowers usually bisexual, sometimes unisexual, solitary or fasciated. Sepals 3, valvate. Petals 6(3+3), outer sepaloid, inner cohering at the margin when young, free with age, larger than outer. Stamens definite or indefinite, anthers ovoid, connectives not concealing the anthers, top of the connectives rounded or apiculate. Carpels indefinite, linear-oblong; style short, stigma club-shaped. Ripe carpels many, globose or oblong, stalked or sub-sessile. Seeds 1 to many

A genus with 40 species in S.E. Asia, Australia and New Zealand; 5 species in West Bengal.

1. Pedicels below 1 cm long:
 2. Leaves 12-22 cm long; sepals 3-4 mm long; inner petals oblong-lanceolate, about 2 cm long ...3. *M. longiflora*
 2. Leaves 4-5 cm long; sepals *ca* 1.5 mm; inner petals ovate, about 1.5 cm long ...2. *M. indica*
1. Pedicels more than 1 cm long:
 3. Flowers bisexual:
 4. Leaves pubescent or glabrous, 12-20 cm long, lanceolate or narrowly oblong ...4. *M. macrocarpa*
 4. Leaves velvety tomentose, 15-36 cm long, ovate or broadly oblong ...5. *M. velutina*
 3. Flowers bisexual or unisexual, dioecious or polygamous ...1. *M. globosa*

1. **Miliusa globosa** (DC.) Panigr. & S.C. Mishra in Taxon 33:713 : 1984; D. Mitra in Sharma *et al.*, *l.c.* 215. *Gnatteria globosa* DC. in Mem. Soc. Phys. Hist.

Geneve 5:41 (43) repr. 1831. *M. roxburghiana* (Wall.) Hook. f. & Thoms., Fl. Ind. 1:150. 1855 et in Hook. f., *l.c.* 87; Prain, *l.c.* 130. "Tasbi" (Beng.).

Small trees. Leaves ovate-lanceolate or lanceolate, abruptly acuminate, pubescent beneath, glabrous with age, 10 - 16.5 × 3.5 - 5 cm. Flowers bisexual or unisexual, dioecious or polygamous, solitary or 2-3 together, axillary or leaf-opposed, bracteate. Sepals lanceolate, 3 - 6 mm. Petals of outer series sepaloïd, inner ovate, obtuse, connate up to the middle, 1 - 1.5 × 0.4 - 0.7 cm. Stamens many, *ca* 1 mm, top of the connectives slightly projecting. Carpels many, *ca* 2 mm; stigma sessile, capitate. Ripe carpels many, globose to oblong, stalk 1 - 1.5 cm long. Seed 1 to few.

Fl. : April - May; *Fr.* : Aug. - Sept. Jalpaiguri.

2. *Milium indica* Leschen. ex A. DC. in Mem. Soc. Phys. Genev. 5:213. 1832; Hook. f. & Thoms., Fl. Ind. 1: 148. 1855 et in Hook. f., *l.c.* 86; D. Mitra in Sharma *et al.*, *l.c.* 217.

Shrubs. Leaves oblong-elliptic or oblong lanceolate, obtuse or acute, pubescent beneath, 4-5 × 1.5 - 2 cm. Flowers solitary, axillary; bracts basal; pedicel 3-4 mm long. Sepals ovate, acute, reflexed, *ca* 1.5 × 1 mm. Petals outer broadly ovate, inner ovate, subacute, united up to the middle, 1.2 - 1.6 × 0.7 cm. Stamens numerous, *ca* 1 mm long, top of the connectives round, apiculate. Carpels many, *ca* 2 mm long, linear-oblong; ovaries densely pilose; style short; stigma subclavate. Ripe carpels many, ovoid or obovoid, silky pubescent, subsessile. Seeds 2.

Fl. : June - July; *Fr.* : Oct. - Nov. Calcutta.

3. *Milium longiflorum* (Hook. f. & Thoms.) Finet & Gagnep. in Bull. Bot. Fr. 53(4):153. 1906; D. Mitra in Sharma *et al.*, *l.c.* 217. *Saccopetalum longiflorum* Hook. f. & Thoms., Fl. Ind 1: 151. 1855 et in Hook. f., *l.c.* 88; Prain, *l.c.* 130.

Trees. Leaves ovate-oblong or oblong-lanceolate, acuminate, adpressed pubescent beneath, 12-25 × 5-11 cm. Flowers solitary or 2-3 together, axillary or in axils of fallen leaves; bracts basal. Sepals linear-lanceolate, 2-4 × 1-1.5 mm, pubescent. Petals outer sepaloïd, inner oblong-lanceolate, tapering to an obtuse apex, 1.8 - 2 × 0.4 - 0.6 cm. Stamens many, *ca* 1 mm long, top of the connectives rounded. Carpels 6 or more, *ca* 2 mm long; ovules 6-many; style linear; stigma concave. Ripe carpels many, 2-3 cm in diam, subglobose, glabrous, stalk 1.5-2 cm. Seeds many.

Fl. : Feb. - March; *Fr.* : May. N. Bengal, Indian Botanic Garden, Howrah.

4. *Milium macrocarpa* Hook. f. & Thoms., Fl. Ind. 1: 150. 1855 et in Hook. f., *l.c.* 86; D. Mitra in Sharma *et al.*, *l.c.* 218.

Small trees. Leaves lanceolate or narrowly oblong, long acuminate, 12-20 × 4-6 cm. Flowers in few-flowered cymes, sometimes solitary, extra-axillary or leaf-opposed, pedicels 5-8 cm long; bracts ovate-lanceolate, little above the base. Sepals ovate, acute, 8-10 × 6 mm. Outer petals like sepals, inner broadly ovate, obtuse or subacute, hairy near margin and tip, 10-15 × 5-7 mm. Stamens many, *ca* 1.5 mm long, top of the connectives flat, filaments prominent. Carpels many,

ca 2.5 mm long, spatulate; style short; stigma broad, blunt. Ripe carpels many, 12-16 mm long, oblong or obovoid, stalk as long as fruitlets. Seeds 1-2.

Fl. : April - May; *Fr.* : Aug. - Nov. Darjeeling.

5. *Milusa velutina* (Dunal) Hook. f. & Thoms., *Fl. Ind* 1:151. 1855 et in Hook. f., *l.c.* 87; D. Mitra in Sharma *et al.*, *l.c.* 222; Prain, *l.c.* 130. *Uvaria velutina* Dunal, *Monogr. Anon.* 91. 1817. *U. villosa* Roxb., *Fl. Ind.* 2:664. 1832. "Dom-sal" (H).

Large trees; branches golden tomentose. Leaves ovate or oblong, acute or acuminate, 15-36 × 7-17 cm, both surfaces velvety tomentose. Flowers few in leaf-opposed cyme; bracts minute, basal. Sepals ovate, acute densely tomentose. Petals outer sepaloid, inner broadly ovate, slightly acute, densely tomentose outside, glabrous inside, 0.6 - 1 × 0.6 cm. Stamens many, ca 1.5 mm long, top of the connectives bluntly apiculate. Carpels many, ca 2 mm long, oblong; ovaries velutinous; stigma subsessile, bilobed. Ripe carpels many, ovoid or oblong; 1.5 cm in diam. Seeds 2.

Fl. : Feb. - May. *Fr.* : June - Oct. Malda, Midnapur, N. Bengal, Purulia, West Dinajpur.

9. POLYALTHIA Blume

Trees or shrubs. Leaves glabrous or pubescent. Flowers solitary or a few, axillary or leaf-opposed or on woody tubercles, glabrous or pubescent. Sepals 3, valvate. Petals 6 (3+3), valvate, subequal. Stamens numerous, cuneate, connectives produced with various shaped appendage. Carpels indefinite, oblong or angled, with 1-2 ovules sometimes 5; style almost absent. Ripe carpels few to many, berry usually stalked. Seeds 1-5.

A genus with ca 120 species in S.E. Asia; 4 species in West Bengal.

1. Petals up to 15 mm long:

2. Petals equal in 2 series; leaves acute or acuminate ...1. *P. cerasoides*

2. Petals unequal in 2 series, outer shorter than inner; leaves obtuse ...4. *P. suberosa*

1. Petals more than 15 mm long:

3. Trunk with conical crown; leaf margins undulate; petals thin ...2. *P. longifolia*

3. Trunk with no conical crown; leaf margins straight; petals thickly coriaceous ...3. *P. simiarum*

1. *Polyalthia cerasoides* (Roxb.) Bedd., *Fl. Sylvat.* t. 1. 1869; Hook. f. & Thoms. in Hook. f., *Fl. Brit. India* 163. 1872; D. Mitra in Sharma *et al.*, *Fl. India* 1:270. 1993; Prain, *l.c.* 133. *Uvaria cerasoides* Roxb. *Pl. Corom.* 1:30. l.33. 1795. "Kudumi" (H); "Potmossu" (Or.); "Panjon" (Santh.).

Shrubs or small trees. Leaves oblong-lanceolate or lanceolate, acute or acuminate, 8-18 × 2.5-4 cm. Flowers solitary or 2-3, axillary or extra-axillary;

bracts 1-2, leafy, basal or submedian. Sepals ovate-lanceolate, 5-8 × 3-4 mm, hairy outside, glabrous within. Petals ovate-oblong, acute, thick, 6-8 × 4-5 mm. Stamens numerous, *ca* 1.5 mm long, top of the connective flat. Carpels many, *ca* 2 mm long, linear, hairy; stigma slightly curved. Ripe carpels many, broadly ovoid, *ca* 1 cm long, apiculate, reddish-brown. Seed 1.

Fl. : April - July; *Fr.* : Sept. - Dec. Midnapur.

2. ***Polyalthia longifolia*** (Sonner) Thw., Enum. Pl. Zeyl. 398, 1864; Hook. f. & Thoms. in Hook. f., *l.c.* 62; D. Mitra in Sharma *et al.*, *l.c.* 274; Prain, *l.c.* 133. *Uvaria longifolia* Sonner, Voyage aux Indes 2: 233, t. 131, 1782. "Debdaru" (Beng.); "Debodaru" (Or.); "Ashoka" (H.).

Tall trees with a conical crown. Leaves narrow, lanceolate, acuminate, 15-23 × 3-4 cm, margin undulate. Flowers many, sub-umbelled, axillary, greenish, bract sub-median. Sepals connate at base, broadly triangular, acute, reflexed, 1-2 × 1-1.5 mm. Petals linear, acuminate, broad at base, 1.5-2 × 0.2 cm. Stamens numerous, *ca* 1 mm long, top of the connectives convex. Carpels many, *ca* 1.5 mm long linear; stigma subglobose. Ripe carpels numerous, ovoid, obtuse at both ends, *ca* 2 cm long, yellowish, reddish to black with age, stalked. Seed 1, longitudinally grooved.

Fl.: March - May; *Fr.* : June-Sept. Several horticultural varieties of this ornamental tree are planted in the gardens throughout West Bengal.

3. ***Polyalthia simiarum*** (Hook. f. & Thoms.) Hook. f. & Thoms. in Hook. f., *l.c.* 63; D. Mitra in Sharma *et al.*, *l.c.* 276. *Guatteria simiarum* Hook. f. & Thoms. Fl. Ind. 1: 142, 1855; Prain, *l.c.* 133. "Dighi-bentia" (Santh); "Ojhar" or "Mongai" (Or.); "Boga-kainla" (Duars).

Trees. Leaves ovate-oblong or oblong-lanceolate, entire, acute or shortly acuminate, glabrous, 15-30 × 5 - 11 cm. Flowers in fascicles of 3 - 5, in axils of fallen leaves or on tubercles of old branches; bracts small sub-median and basal. Sepals *ca* 2 × 2.5 mm, obtusely triangular, reflexed, pubescent outside. Petals 2 - 3 × 0.3 - 0.4 cm, inner set slightly larger, linear lanceolate, acute, thickly coriaceous, puberulous outside, glabrous inside. Stamens numerous, less than 1 mm, subglobose, top of the connectives almost round, flat. Carpels many, 1 mm; ovule 1; stigma spatulate. Ripe carpels many, 2.5 - 3.5 cm long, ovoid-elliptic, apiculate, glabrous, orange red to bluish black, stipitate. Seed 1, transversely striate.

Fl. : April - Aug. *Fr.* : July - Nov. Darjeeling, Jalpaiguri.

4. ***Polyalthia suberosa*** (Roxb.) Thw. Enum. Pl. Zeyl. 398, 1864; Hook. f. & Thoms. in Hook. f., *l.c.* 65; D. Mitra in Sharma *et al.*, *l.c.* 278; Prain, *l.c.* 133. *Uvaria suberosa* Roxb. Pl. Corm. 1: 34, 1785 et Fl. Ind. 2: 667, 1832. "Kukurjam", "Barachali" (Beng.).

Shrubs or small trees. Leaves oblong or oblong-lanceolate, obtuse, 4-10.5 × 1.5-3.5 cm. Flowers solitary, rarely in pairs, extra-axillary, with minute acute bracts at base of the pedicel. Sepals ovate, acute, *ca* 2 × 1 mm. Petals *ca* 6 × 4-5 mm, reddish-brown, oblong-lanceolate, acute, reflexed, thickly coriaceous.

Stamens *ca* 1 mm, top of the connectives slightly convex. Carpels many, *ca* 2 mm long; stigma triangular. Ripe carpels many, *ca* 5 mm in diam., purple; stalk slender, 0.5-1 cm. Seeds 1-2.

Fl. : April - May; *Fr.* : Oct. - Dec. Bankura, Hooghly, Howrah, Murshidabad, 24-Parganas, West Dinajpur.

10. UVARIA L.

Scandent or sarmentose shrubs, usually stellate pubescent. Flowers bisexual, rarely unisexual, terminal or leaf-opposed, in few-flowered cymes, sometimes solitary, yellow, purple or reddish-brown. Sepals 3, often connate below. Petals 6 (3 + 3), free, sometimes connate at base. Stamens numerous, outer sometimes sterile, ovoid-oblong, truncate or sub-foliaceous, top of the connectives produced. Carpels many; ovaries linear-oblong; style short, thick; ovules many, 2-seriate, rarely few and 1-seriate; torus concave, pubescent or tomentose. Ripe carpels many, dry or berries, often sweet and edible. Seed few to many, 1- 2-seriate.

A genus with *ca* 150 species in S.E. Asia, Australia, New Zealand & Africa; 2 species in West Bengal.

1. Petioles *ca* 1 cm long; pedicels 0.7 - 1 cm long; ripe carpels oblong, stalk 1-1.3 cm long ...1. *U. cordata*

1. Petioles *ca* 6 mm long; pedicels 2.5-4 cm long; ripe carpels ovoid to subglobose, stalk 2.5-5.5 cm long ...2. *U. hamiltonii*

1. ***Uvaria cordata*** (Dunal) Alston, Hand-book Fl. Ceylon, Suppl. 6: 4. 1931; D. Mitra in Sharma *et al.*, Fl. India 1: 289. 1993. *Guatteria cordata* Dunal, Monogr. Fam. Anon. 129, t. 30. 1817. *U. macrophylla* Roxb., Fl. Ind. 2:663. 1832; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1: 49. 1872; King in Ann. Roy. Bot. Gard. Calcutta 4: 19, t. 10. 1893; Prain, Bengal Pl. 1: 129. "Bagh-runga" (Beng.).

Large scandent shrubs. Leaves elliptic-oblong to ovate-oblong, 13-28 × 6.5-13.5 cm, cordate at base, abruptly acuminate at apex, stellate-pubescent. Flowers 3-5 in extra-axillary cymes, bracts 2. Sepals 1.5-2 cm in diam., connate into a cup, stellate-pubescent. Petals reddish brown, pubescent, broad-rotund, subequal, 1.2-1.5 × 0.8 - 1 cm margin split with age. Stamens many, inner 5-7 mm long, fertile, outer ones sterile and longer. Carpels 5 mm long, linear; stigma sessile truncate. Ripe carpels many, 2-4 cm long, scarlet. Seeds many, in 2 rows.

Fl. : June - July; *Fr.* : Aug. - Sept. Near Calcutta; Indian Botanic Garden.

2. ***Uvaria hamiltonii*** Hook. f. & Thoms., Fl. Ind. 1: 96. 1855 et in Hook. f., *l.c.* 48; D. Mitra in Sharma *et al.*, *l.c.* 290; Prain, *l.c.* 129. "Latkan" (Beng.).

Fig. 9

Scandent shrubs. Leaves elliptic to elliptic-oblong or obovate, slightly cordate at base, densely rufous stellate tomentose below, 15-25 × 7-11 cm. Flowers solitary or 2-3 together, extra-axillary, brown tomentose, bracteate. Sepals 1-1.2 × 1 cm, connate at base, broadly ovate, reflexed. Petals brick-red, 2-3 × 1.2 - 1.5 cm, obovate, coriaceous. Stamens many, *ca* 4 mm long. Carpels many, *ca* 4 mm

long; stigma sessile. Ripe carpels about 10, orange-coloured, 1.5-2.5 cm long. Seeds many.

Fl. : May - July; *Fr.* : Aug. - Sept. Teesta Valley, Darjeeling.

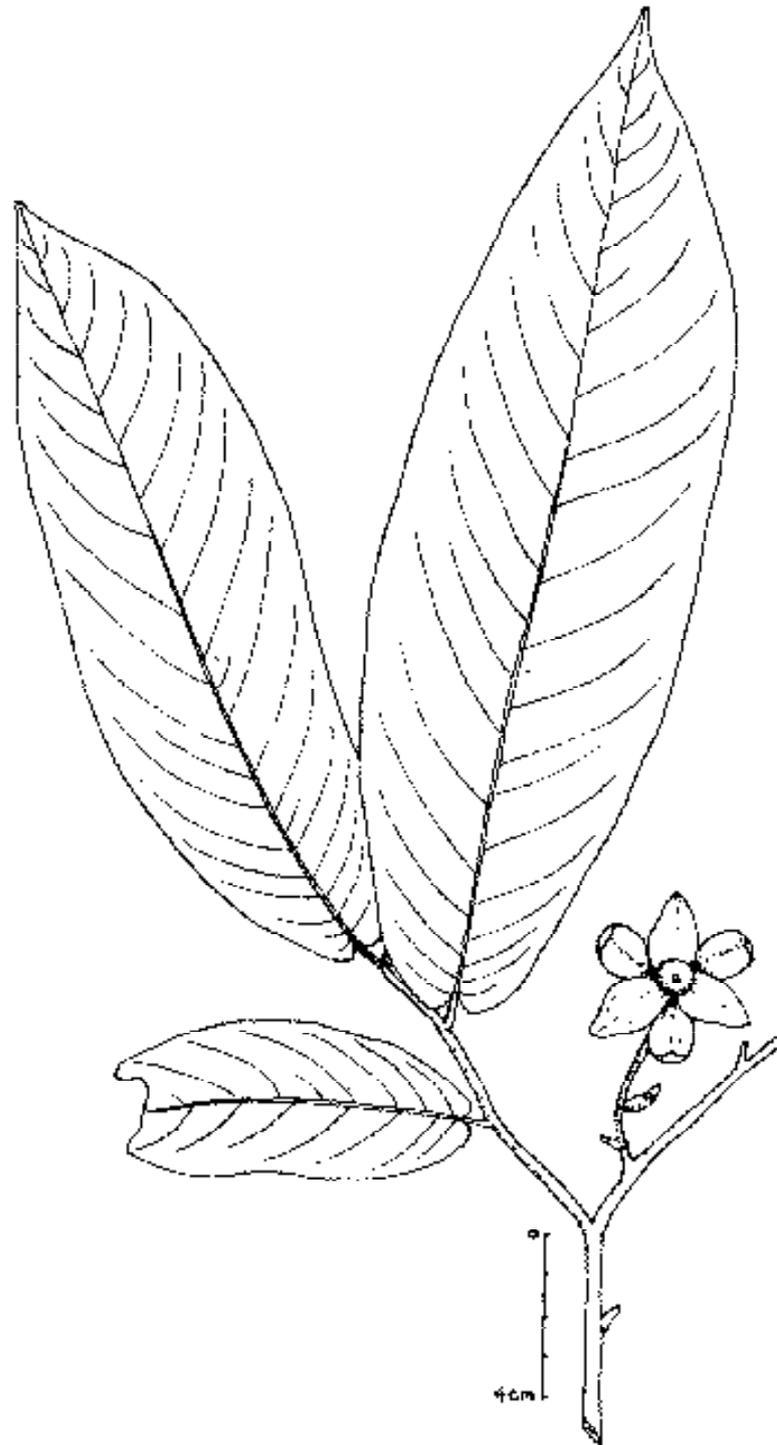


Fig. 9. *Uvaria haniltonii* Hook. f. & Thoms.

MENISPERMACEAE

(A. Pramanik & M. Gangopadhyay)

A family of about 65 genera and nearly 350 species, mainly in the tropical and subtropical regions of the world; 8 genera and 11 species in West Bengal.

1. Leaves peltate or sub-peltate:
 2. Lamina (3-)5-nerved, basal lateral nerves running alongside midrib for 4-10 mm before diverging outwards; stamens usually free ... 7. TILIACORA
 2. Lamina 5 or more-nerved, all nerves diverging directly from the base of the midrib; stamens united into a peltate synandrium:
 3. Seed straight, flat; endocarp without condyle ... 1. ASPIDOCARYA
 3. Seed horse-shoe shaped; endocarp with condyle:
 4. Sepals 4; petals united, cup-shaped; staminal-column more or less inserted in corolla in male flowers; in female sepal 1; drupe hairy ... 2. CISSAMPLOS
 4. Sepals 6-8; petals 3-4, free, erecto-patent; staminal-column exerted from corolla in male flowers; in female sepal 1-8; drups glabrous ... 6. STEPHANIA
1. Leaves not peltate:
 5. Lamina sagittate, margins dentate, rarely entire; stamens united into a peltate synandrium ... 4. PARABAENA
 5. Lamina not sagittate, rarely lobed, margins entire; stamens free:
 6. Anthers dehiscing longitudinally; styles bifid; seed oblong, dorsally convex:
 7. Sepals 6, 2-seriate ... 8. TINOSPORA
 7. Sepals 9, 3-seriate ... 5. PERICAMPYLUS
 6. Anthers dehiscing transversely; styles entire; seeds horse-shoe shaped ... 3. COCCULIS-

1. ASPIDOCARYA Hook. f. et Thoms.

Slender woody climbers. Leaves sub-peltate, ovate, entire, palmately 5-7 nerved, nerves diverging directly from the base of midrib. Flowers in axillary pseudopanicles. Sepals in male flowers 6-12 in 2-4 whorls of 3. Petals 6, with lateral edges inrolled. Stamens united into a peltate synandrium; anthers 6, transversely dehiscing. In female flowers sepals and petals similar to male; staminodes 6, linear; carpels 3; stigma reflexed, lobed. Drupes with flattened scutiform endocarp with a median dorsal ridge and thin lateral wings, condyle

absent. Seed straight, flat; endosperm fleshy, cotyledons oblong, divaricate, flat, very thin, radical short.

A monotypic genus distributed in South-West China, Bhutan and India.

Aspidocarya uvifera Hook. f. et Thoms., Fl. Ind. 180, 1855 et in Hook f., Fl. Brit. India 1:95, 1872; Forman in Kew Bull. 39(1) : 101, f. 1, A+B, 1984. Pramanik in Sharma *et al.*, Fl. India 1:345, 1993, "Myungareirik" (Lepcha).

Climbers. Petioles 7-15 cm long, slender, geniculate at base, inserted 1-2 mm from the base of lamina; lamina 9-17 × 6-14 cm, base cordate to truncate, apex caudate acuminate. Flowers small, 1-3 mm long, pedicellate. Outer whorl of sepals green in male flowers, 2-3.5 mm long, inner ones yellow, 3 mm long, obovate to broadly elliptic, glabrous; synandrium 2 mm long, column thick. In female flowers, sepals as in male; petals narrower; staminodes 1.5 mm long. Endocarp 17 × 10 mm, dorsal surface sparsely spinulose, ventral surface with 2 lateral irregular ridges, marginal wings notched along the edge, pointed at base and apex.

Fl : May ; Fr. : May - Aug. Darjeeling.

Fruits are edible, taste like green grapes.

2. CISSAMPELOS L.

Scandent shrubs or lianas. Leaves peltate, petiolate. Male inflorescence; flowers in axillary peduncled corymbose cymes, solitary or fascicled. Male flowers: sepals 4, obovate; petals united, cup-shaped; stamens united into a peltate synandrium, more or less inserted in corolla. Female inflorescence elongate thyrsoid, composed of fascicles; bracts orbicular. Female flowers : sepal 1; petals 1 or 2-3; staminodes 0; carpel 1. Drupes pubescent; endocarp with dorsal ridges in 2 rows and bordered by a horse-shoe shaped condyle; embryo elongate, terete, cotyledons flattened, embedded in endosperm.

A genus with about 30 species in the tropics; only 1 variety occurs in West Bengal.

Cissampelos pareira L. var. **hirsuta** (Buch.-Ham. ex DC.) Forman in Kew Bull. 22(3): 356, 1968; Gangopadhyay in Sharma *et al.*, *l.c.* 317. *C. hirsuta* Buch.-Ham. ex DC., Syst. 1:535, 1817 et Prodr. 1: 101, 1824. *C. pareira* L., Sp. Pl. 1031, 1753, *pro parte quoad* B; Hook. f. et Thoms., Fl. India 1 : 199, 1855 et in Hook.f., *l.c.* 103; Prain, Bengal Pl. 1:136, 1963 (repr. ed.). "Akanandi, Nemuka" (Beng.); "Baral-panrhe" (Nep.).

Lianas; branches mostly puberulous. Petioles 2-10 cm long; lamina ovate-orbicular, 3-12 × 3-11 cm, tomentose. Male inflorescences 2-5 cm long, flowers many; sepals pilose above. Female inflorescence: bracts and bracteoles persistent, puberulous or tomentose; sepal obovate, deciduous. Ovary pilose; stigma 3-fid. Drupes obovoid, red or orange, 5-7 × 2.5-4 mm; embryo *ca* 1 mm long, radicle mucronate at base.

Fl. : July - Oct.; *Fr.* : March - May. Bankura, Burdwan, Darjeeling, Hooghly, Murshidabad, Purulia.

The whole plant is used in medicine. Ropes are manufactured from the strong fibers of stem.

3. COCCULUS A. P. DC.

Climbing, straggling or erect herbs or shrubs. Leaves not peltate, variously shaped, entire or 3-5-lobed, usually 3-5-palmatinerved at base. Inflorescence cymose or thyrsoid. Male flowers : sepals 6 in 2 whorls, long pubescent, imbricate, outer smaller; petals 6, usually bifid at apex, auricled below, sparsely pubescent to glabrescent; stamens 6, free; anthers dehiscing transversely. Female flowers: sepals and petals as in male; staminodes 6 or absent; carpels 3 or 6; styles entire, cylindrical. Drupes curved with style-scar near base, compressed, obovate or sub-orbicular; endocarp bony, often perforate on both sides, transversely ridged on dorsal sides, septum of condyle perforated. Seeds horse-shoe shaped; endosperm present as a thin layer.

A pantropical genus with *ca* 20 species; 1 species in West Bengal.

Cocculus hirsutus (L.) Diels in Engler, *Pflanzenr.* IV, heft 46: 236, 1910; Pramanik in Sharma *et al.*, *l.c.* 318. *Menispermum hirsutum* L., *Sp. Pl.* 341, 1753. *Cocculus villosus* DC., *Syst.* 1:525, 1817 et *Prodr.* 1:98, 1824; Hook.f. & Thoms. in Hook.f., *l.c.* 101; Prain, *l.c.* 137. "Jaliamani" (H.); "Huver" (Beng.).

Subwoody climbers, densely pubescent. Leaves yellowish green tomentose; petioles 0.5 - 2.5 cm long; leaflets of lower leaves 3-5-lobed, upper leaflets narrowly to broadly ovate, ovate-oblong or obovate, 4-8 × 2.5-7 cm; base broadly obtuse or cuneate, apex obtuse or mucronate. Male flowers : 3 inner sepals 1.5-2.5 × 1.7-2.0 mm, broadly ovate or obovate, 3 outer ones 1.4 - 2.0 × 0.4 - 0.8 mm, oblong to lanceolate; petals 0.5 - 1.5 × 0.3 - 0.6 mm, ovate oblong, sparsely pubescent to glabrescent; stamens 0.7-1.0 mm long. Female flowers : sepals and petals as in male; staminodes 0.5 mm long; carpels 0.7-1 mm long. Drupes 4-8 × 4-5 mm; endocarp distinctly ribbed on lateral surface and with a prominent dorsal crest.

Fl. : Aug. - Feb.; *Fr.* : March - May. Hooghly, Howrah, Murshidabad.

Highly variable in the shape and hairiness of the leaves.

4. PARABAENA Miers.

Slender woody climbers. Leaves sagittate, not peltate, margin repand, dentate, rarely entire, palmatinerved at base. Flowers in axillary cymes or narrow thyrse. Male flowers : sepals 6, free, equal or inner 3 broader; petals 6, minute; stamens united into a peltate synandrium; anthers 6, dehiscing transversely. Female flowers : sepals and petals similar to male; staminodes 6, minute; carpels 3; style recurved. Drupes 3, borne on subglobose carpophore, style-scar subterminal; endocarp bony, dorsal and lateral surfaces variously ridged or spiny; condyle represented by ventral concavity, sometimes bordered by incurved spines. Seed

curved, ventrally concave; endosperm copious, cotyledons broad, divaricate, leafy, radicle prominent.

A genus with ca 6 species in S. E. Asia; 1 species in West Bengal.

Parabaena sagittata Miers. ex Hook. f. & Thoms., Fl. Ind. 181. 1855 et in Hook. f., l.c. 96; Prain, l.c. 135; Pramanik in Sharma *et al.*, l.c. 346.

Climbers. Petioles 4-12 cm long, swollen and geniculate at base; lamina 11-24 × 6-15 cm, sagittate with basal lobes rounded to acute, lower surface densely pubescent. Inflorescence 3-10 cm long. Male flowers : sepals 1.5-2 mm long, elliptic, equal, cream or yellow, externally pubescent or glabrous. Petals 1-1.5 mm long, narrowly obovate; synandrium 1 mm long; anthers with transverse slits. Female flowers not seen. Drupes orange, glabrous, with an apical keel and a prominent dorsal ridge, carpophores 4-6 mm long; endocarp 5-6 × 4.5-5.5 mm, orbiculate, dorsal surface bearing scattered spines.

Fl. : April - Oct.; Fr. : Aug. - Dec. Darjeeling.

Preferably grows in mixed forest on steep slopes in shady ravines.

5. PERICAMPYLUS Miers.

Woody climbers. Leaves broadly triangular-ovate, palmately 5-nerved. Flowers in axillary, solitary or fasciculate cymes. Male flowers : sepals 9, 3-seriate, outer 3 narrow and valvate, minute, middle and inner ones imbricate and concave, inner 3 broader than others; petals 6, cuneate; stamens 6, free; anthers longitudinally dehiscent. Female flowers : sepals and petals as in male; staminodes 6, filamentose; carpels 3; styles deeply bifid, recurved. Drupes purple to black, sub-globose; style-scar sub-basal; endocarp orbiculate, with lateral and dorsally pointed process, laterally concave; condyle septiform, imperforate. Seed dorsally convex; embryo enclosed in endosperm, elongate, narrow; radicle much longer than subterete cotyledons.

A genus with ca 5 species in tropical and subtropical Asia; 1 species in West Bengal.

Pericampylus glaucus (Lamk.) Merr. Interpr. Rumph. Herb. Amboin. 219. 1917; Pramanik in Sharma *et al.*, l.c. 330. *Menispermum glaucum* Lamk., Encycl. Meth. Bot. 4:100. 1797. *Pericampylus incanus* (Colebr.) Miers. in Ann. Nat. Hist. ser. 7, 2: 40. 1851; Hook. f. & Thoms. in Hook. f., l.c. 102. "Barakanta" (Beng. & H.)

Climbers. Stems sulcate. Petioles 3-7 cm long; lamina 5-10 × 4.5-9.5 cm, base cordate or truncate, often obtuse, apex apiculate to obtuse, lower surface tomentose or softly pubescent, upper surface sparsely pubescent, margin finely crenate. Flowers white or yellow with ca 1 mm long pedicel. Male flowers: sepals externally pubescent, outer ca 0.5 mm long, narrow, middle ones ca 1 mm long, oblanceolate, inner ones ca 1 mm long, obovate; petals ca 0.5 mm long, obcuneate, glabrous; stamens ca 0.8 mm long. Female flowers : sepals and petals as in male; carpels ca 0.5 mm long. Drupes ca 0.8 mm diam., sub-globose, bluish-black.

Fl. : Aug. - Oct.; Fr. : Feb. - June. Darjeeling.

6. STEPHANIA Lour.

Climbers. Stems woody or herbaceous. Leaves peltate, ovate to sub-orbicular, mostly glabrous. Inflorescence axillary, flowers in umbelliform cymes or disciform capitula; flowers symmetrical. Male flowers : sepals 6-8 in 2 whorls, obovate, free; petals 3-4, free, erecto-patent, broadly obovate; stamens united into a peltate synandrium, exerted from corolla; anthers dehiscing longitudinally. Female flowers : sepals 1-8; petals 2-4; carpel 1; style short; stigma short. Drupes having style-scar near base, glabrous; mesocarp fleshy, endocarp bony, horse-shoe shaped, tuberculate or ridged, condyle perforate. Seeds curved; embryo with incumbent cotyledons.

A genus with ca 40 species in palaeotropical regions; 2 species and 1 variety in West Bengal.

1. Lamina 5-nerved; cymes ultimately lax; flowers pedicellate; endocarp transversely ribbed :
 2. Petioles 5-15 cm long. Sepals linear-oblong, internally glandular. Synandrium 1.5 - 2 mm long ... 2. *S. glabra*
 2. Petioles 2-4 cm long. Sepals obovate, gland absent. Synandrium ca 0.5 mm long. Drupes obovoid ... 1. *S. elegans*
1. Lamina 9-11-nerved; cymes ultimately congested into heads; flowers sessile or subsessile; endocarp with erect tubercles ... 3. *S. japonica* var. *discolor*

1. **Stephania elegans** Hook. f. & Thoms., Fl. Ind. 195. 1855 et in Hook. f., l.c. 103; Gangopadhyay in Sharma *et al.*, l.c. 333.

Climbers. Petioles 2-4 cm long; lamina 5-10 × 4-6 cm, oblong- triangular, 5-nerved. Inflorescence an umbel, peduncle filiform; flowers green or purple; bracts and bracteoles linear. Male flowers : sepals 6, obovate; petals 3 or 4; ovary oblong. Drupes 6-8 × 6-7 mm, obovoid; endocarp transversely ribbed.

Fl. : June - Nov.; Fr. : Sept. - May. Darjeeling.

2. **Stephania glabra** (Roxb.) Miers in Contrib. Bot. 3: 217. 1871; Gangopadhyay in Sharma *et al.*, l.c. 334. *Cissampelos glabra* Roxb., Fl. Ind. 3: 840. 1832.

Climbers. Petioles 5-14 cm long; lamina ovate or suborbicular, obtuse at apex, 4-15 × 4-12 cm, membranous. Male inflorescence : peduncles 4-8 cm long; branchlets dichotomous; bracts linear; sepals 2-2.5 mm long; petals ca 2 mm long; stigma 4-5 cleft. Drupes ca 5 × 6 mm. Seeds ca 4 mm long; embryo ca 4 mm long; radicle terete; cotyledons oblong.

Fl. : May - Sept.; Fr. : Oct. - April. Darjeeling.

The tuberous roots are used in medicine.

3. **Stephania japonica** (Thunb.) Miers var. **discolor** (Bl.) Forman in Kew Bull. 1956: 56, 1957; Gangopadhyay in Sharma *et al.*, l.c. 337. *Clypea discolor*

Bl., Bijdr. 26, 1825. *Stephania discolor* (Bl.) Spreng., Syst. Veg. 4(2): 316, 1827.
S. hernandiifolia (Willd.) Walp., Rep. Bot. Syst. 1: 96, 1842; Prain, l.c. 136.
 "Agandnemuka." "Kamadi" (Beng.).

Fig. 10

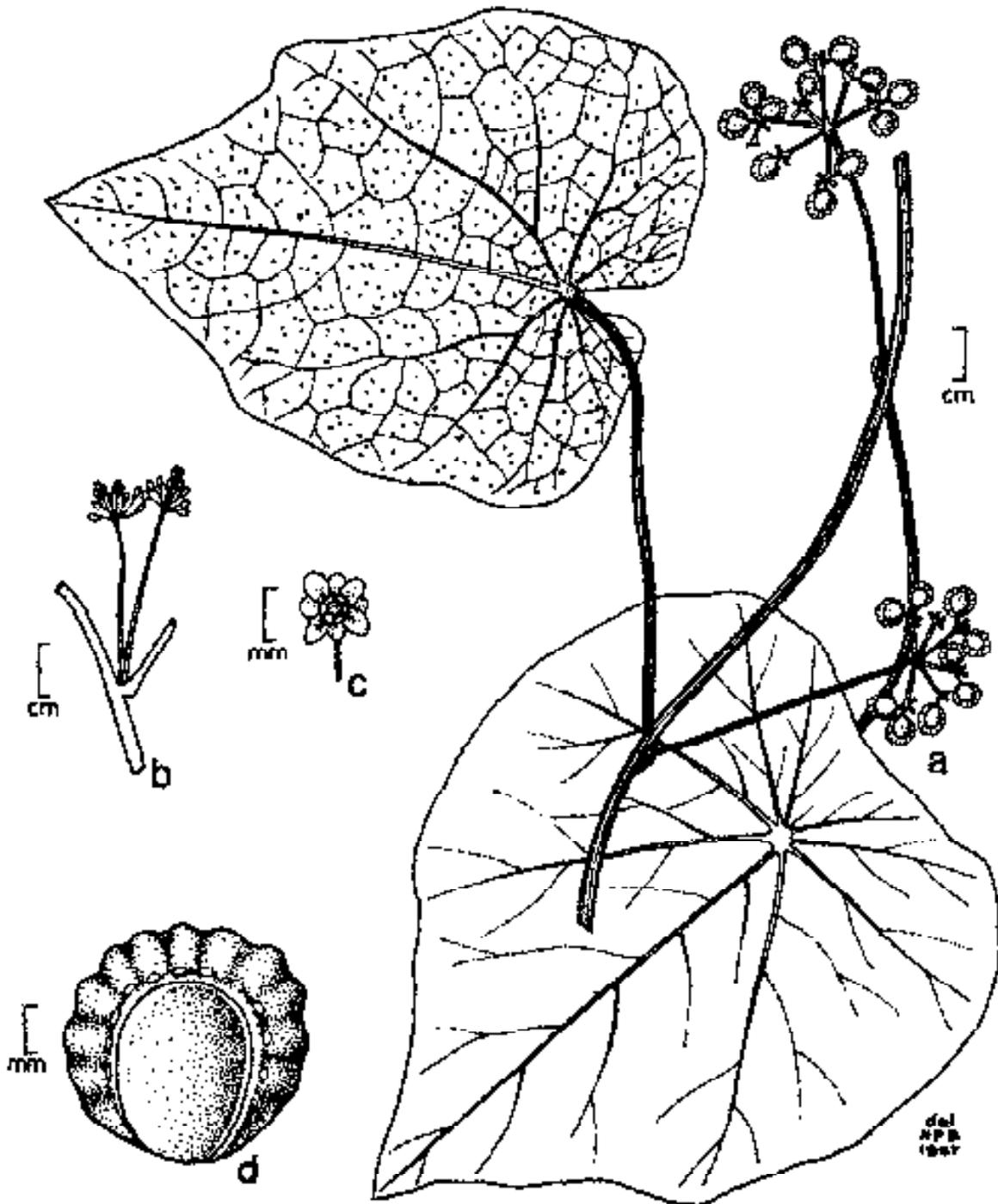


Fig. 10. *Stephania japonica* (Thunb.) Miers. var. *discolor* (Blume) Forman :
 a. branch with fruits; b. flowering branch; c. flower; d. fruit.

Climbers. Petioles 3-12 cm long; lamina 4-17 × 4-15 cm, glabrous or puberulous beneath. Male inflorescence: peduncles 2-8 cm long. Male flowers: sessile to subsessile; sepals *ca* 1 mm long, puberulous above; petals 1 mm long, glabrous; synandrium 0.5-1 mm long, almost exerted. Female flowers: ovary 0.5-1 mm long, ovoid; stigma 3-5-lobed. Drupes obovoid, red, 4-8 × 4-7 mm, endocarp mostly perforate, 8-10 transverse ridges in 2 rows, ridges often 2-lobed and forming 4 distinct longitudinal rows of tubercles. Seed 5-6 mm long; embryo 4-5.5 mm long, radicle terete; cotyledons fleshy.

Fl.: March - June; *Fr.*: Dec. - Feb. Burdwan, Coochbehar, Hooghly, Howrah, Malda, Murshidabad.

Roots are used in medicine. Crushed leaves are used in breast infections.

7. TILIACORA Colebr.

Woody extensive climbers. Leaves sub-peltate, ovate or lanceolate, entire, (3-) 5- palmately nerved, basal lateral nerves running alongside the midrib for 4-10 mm before diverging outwards. Flowers sessile or sub-sessile in axillary panicles or sometimes polygamous. Male flowers: sepals 6-12, in 3 series, free, ovate, acute, fleshy, outer ones smallest, inner ones largest, valvate; petals 3 or 6, free; stamens 5-7, free; anthers 2-celled, dehiscing obliquely or longitudinally. Female flowers: sepals and petals as in male; staminodes occasionally present; carpels 6-15; style recurved. Drupes borne on branched carpophores, subobovoid, shortly stipitate, endocarp hard, often deeply ruminant; condyle linear. Seeds horse-shoe shaped; cotyledons subcompressed, fleshy, much longer than radicle.

A genus with *ca* 21 species in warm regions of South-East Asia and Africa; 1 species in West Bengal.

Tiliacora acuminata (Lamk.) Hook. f. & Thoms., *Fl. Ind.* 187. 1855; Haines, *Bot. Bihar & Orissa* 1:19.1925; Pramanik in Sharma *et al.*, *l.c.* 343. *Menispermum acuminatum* Lamk. *Encycl. Meth.* 4 : 101. 1797. *Tiliacora racemosa* Colebr. in *Trans. Linn. Soc.* 13: 67, t. 6. 1822; Hook. f. & Thoms. in Hook. f., *l.c.* 99; Prain, *l.c.* 137. "Tiliacora" (Beng.); "Bhaga-mushada, Bhagaluta" (H.).

Fig. 11

Extensive lianoid climbers, sparsely puberulous. Leaves comparatively larger in male plants; petioles 1.5-5 cm long, glabrous, sulcate, curved at apex; lamina 4.3-22 × 4.5-13.5 cm, chartaceous, ovate, base rounded, truncate or sub-cordate, apex acute to acuminate. Inflorescence 2-21 cm long. Flowers yellow; inner sepals 4-4.5 × 2-3.8 mm, middle ones 2-2.3 × 1.4-1.7 mm, outer ones 1-1.5 × 0.9-1.5 mm, broadly elliptic, glabrous. Petals 1-1.5 mm long, obovate concave, glabrous. Male flowers: stamens 6, 2.5-3.5 mm long, subcylindric; anthers longitudinally dehiscing. Female flowers: staminodes 0.5 mm; carpels (3-) 8-12, 1.6 mm long; carpophores 3.5 mm long; styles curved. Drupes in group of 3-7, oblong-ovoid, subcompressed, 10-12 × 6-7 mm, glabrous; endocarp hard, with ridge.

Fl. : April - June; *Fr.* : June - Dec. Howrah, Hooghly, Malda, 24-Parganas.



Fig. 11. *Tiliacora acuminata* (Lamk.) Hook. f. & Thoms.

Roots reportedly mixed with water is given as a drink for the cure of snake bite.

8. TYNOSPORA Miers.

Herbaceous, lenticular, deciduous climbers, bark peeling off on maturity, often succulent. Leaves petiolate, ovate-rounded, usually cordate, often 3-lobed, margin entire, 5-7-palminerved. Flowers in axillary or terminal racemes or pseudopanicles. Male flowers : sepals 6, 2-seriate, more or less free, outer 3 usually smaller, 1-1.5 mm, inner 3-3.5 mm; petals 6, minute, broadly or narrowly cuneate-ovate, with lateral edges inrolled, free, fleshy; stamens 6; anthers oblique, dehiscing longitudinally. Female flowers : sepals and petals as in male; staminodes 6, clavate or subulate; carpels 3; stigma bifid, reflexed. Drupes 1-3, borne on a short or columnar carpophore; style-scar subterminal; endocarp bony, rugose, keeled on the back, concave below; condyle deeply intrusive. Seeds oblong, grooved ventrally or curved round the intruded endocarp; albumen ruminant below; cotyledons leafy.

A genus with *ca* 25 species in tropical Africa, Madagascar, Asia to Australia and the Pacific; 2 species in West Bengal.

1. Bark corky; leaves not lobed, glabrous with glandular papillose patches (domatia) on lower surface; peduncles 4-7 mm long; endocarp smooth ...1. *T. cordifolia*
1. Bark papery; leaves often 3-lobed, tomentose on both surface, usually lacking glandular patches; peduncles 8-11 (-15) mm long; endocarp tubercled ...2. *T. sinensis*

1. *Tinospora cordifolia* (Willd.) Hook. f. & Thoms., Fl. Ind. 184. 1855 et in Hook. f., *l.c.* 1: 97. Prain, *l.c.* 137; Pramanik in Sharma *et al.*, *l.c.* 347. *Menispermum cordifolium* Willd., Sp. Pl. ed. 4, 4: 826. 1806. "Gulantha" (Beng.).

Climbers, entirely glabrous, with corky bark and scattered lenticles. Petioles 2-7 cm long; lamina 6-15 × 6-13 cm, broadly cordate, basal sinus often very broad, apex abruptly acuminate, margin entire, glabrous with glandular papillose patches (domatia) on lower surface. Flowers on 5-17 cm long pseudo-panicles. Male flowers usually clustered; pedicels 3-4 mm long, slender; sepals yellow, outer ones 1-1.5 mm long, ovate, inner 3 elliptic, concave, 3-4 mm long; petals equal, 2-2.5 mm long, broadly spatulate, lateral edges incurved; stamens 3 mm long. Female flowers : usually solitary; pedicels *ca* 5 cm long; sepals green; petals *ca* 2.5 mm long, broadly spatulate; staminode 1.5 mm long, subulate; carpels 3, ellipsoid 1.5 mm long; stigma capitate. Drupes red, borne on very short, 3-branched carpophores; endocarp 6-7 mm long, very thinly bony, broadly elliptic or subrotund, with an obscure dorsal ridge.

Fl. : Aug. - Dec.; *Fr.* : Sept. - May. Howrah, Murshidabad.

The plant is sometimes cultivated as ornamental and is propagated by cuttings.

2. *Tinospora sinensis* (Lour.) Merr. in Sunyatsenta 1 : 193, 1934 et in Trans. Amer. Philos. Soc. n. s. 24 (2) : 158, 1935, Forman in Kew Bull. 36(2) : 386, 1981; Pramanik in Sharma *et al.*, *l.c.* 349. *Campylus sinensis* Lour., Fl. Cochinch. 113, 1790. *Menispermum malabaricum* Lamk., Encycl. Meth. Bot. 4 : 96, 1797. *Tinospora malabarica* (Lamk.) Hook. f. et Thoms., Fl. Ind. 1 : 183, 1855 et in Hook. f., *l.c.* 96. *Cocculus tomentosus* Colebr. in Trans. Linn. Soc. Lond. 13 : 56, 1872. *Tinospora tomentosa* (Colebr.) Hook. f. & Thoms., Fl. Ind. 183, 1855 et in Hook. f., *l.c.* 96; Prain, *l.c.* 137. "Padmagulancha" (Beng.).

Large, fleshy climbers. Stem bark papery, with lenticles, young shoots pubescent, later glabrescent, shining. Petioles 4-10 cm long; lamina 7-15 × 4.5-12 cm, ovate to sub-rotund, frequently 3-lobed, deeply cordate at base, apex acuminate, occasional glandular patches in basal nerve axils, tomentose on both surfaces. Flowers yellowish green, in 3-10 cm long racemes. Male flowers : pedicels 2-5 mm long; sepals yellowish, glabrous, outer 3 ovate, 1-1.5 mm long, inner 3 broadly elliptic, 3.5 × 2.5 mm; petals 3-4 × 1-3 mm; stamens 3 non long. Female flowers : pedicels 3-10 mm long; sepals and petals as in male; staminodes *ca* 1 mm long; carpels 1.5-2 mm long, ellipsoidal. Drupes scarlet or orange; endocarp smooth, strongly bony, 7-9 × 6 mm, broadly elliptic to sub-rotund, tubercled.

Fl. : Feb. - March; *Fr.* : March - June. Bengal (*vide* Prain, *l.c.*).

The stem tastes sweetish; having some medicinal value.

CULTIVATED SPECIES

Anamirta cocculus (L.) Wt. & Arn. Prodr. 1 : 446, 1834; Pramanik in Sharma *et al.*, *l.c.* 311.

Although the species is recorded by Prain in Bengal Plants, (Vol. 1 : 135, 1963, repr. ed.) its occurrence is marked in 'Orissa' where it is very common. However, in West Bengal it is found only as a cultivated species as is evidenced by a few collections deposited at CAL specifically noted as "cultivated"

BERBERIDACEAE

(Syamali Dasgupta)

About 4 genera and 575 species, mostly in N. temperate region, tropical mountains and S. America; 2 genera and 11 species in West Bengal.

- | | |
|--|------------|
| 1. Leaves simple; spines present ; bract absent | 1 BERBERIS |
| 1. Leaves compound; spines absent; bracts present at the base of the inflorescence | 2 MAHONIA |

1. BERBERIS L.

Shrubs evergreen, wood yellow. Spines reduced leaves, conspicuous or inconspicuous, 3-5 partite. Leaves simple, 1 or 2 or more in fascicle in the axils of the spines, often deciduous, elliptic or lanceolate, base attenuated, without conspicuous petiole, margin often spiny, veins unicostate, reticulate. Flowers solitary to many in racemes or fascicles or panicles, yellow, regular, hermaphrodite, pedicelled; prophylls 1-3, free, deltoid, smaller than sepals. Sepals 6 in 2 whorls of 3 in each. Petals 6, in 2 whorls of 3 each, smaller, with 2 basal nectarial glands inside on either side of the midvein. Stamens 6, free; anthers 2-celled, opening by valves from base upwards. Ovary simple; stigma peltate on a short style; ovules few, basal, erect. Berry few-seeded.

About 450 species in N. & S. America, Eurasia, N. Africa; 9 species in West Bengal.

1. Fruits black, often pruinose :
 2. Flowers fascicled; leaves oblong-lanceolate, subsessile :
 3. Flowers 8-20; pedicel short (5-15 mm); fruit stylose; leaves large (4-16 × 1.5 - 4 cm), with hypoderm, below epruinose :
 4. Spines absent; stem terete, dark-red ...6. *B. insignis*
 4. Spines present; stem subangled, yellow ...9. *B. wallichiana*
 3. Flowers 3-6; pedicel long (15-25 mm); fruit estylose; leaves small (3-6 × 0.8-1.8 cm), without hypoderm, below lighter pruinose ...5. *B. hookeri*
 2. Flowers in racemes or corymbs; leaves obovate, petiolate ...2. *B. asiatica*
1. Fruits red or red-purple :
 5. Flowers in racemes, corymbs or subumbels :
 6. Berries estylose; inflorescence 1.5-3.5 cm long, 3-6 or rarely 10-flowered ...8. *B. umbellata*
 6. Berries stylose; inflorescence 8-11 cm long, 10-25-flowered ...3. *B. chitria*
 5. Flowers solitary :
 7. Leaf-margin entire; berries subglobose ...1. *B. angulosa*
 7. Leaf-margin spinose; berries oblong :
 8. Stem subterete, yellow-brown, pubescent; outer and inner sepals equal in size ...7. *B. macrosepala*.
 8. Stem sulcate, dark-red, glabrous; outer sepals smaller than median and inner ones ...4. *B. concina*

1. **Berberis angulosa** Wall. ex Hook. f. & Thoms., Fl. Ind. 1 : 227, 1855 et in Hook. f., Fl. Brit. India 1 : 111, 1872; P.B. Sur in Sharma *et al.*, Fl. India 1:355, 1993.

Shrubs 1 m or more high, rigid. Stem dark-brown, sulcate, conspicuously hairy. Spines 1-5-fid, 4-6 mm long, slender, often puberulous below. Leaves 10-40 × 6-15 mm, obovate, base cuneate, apex rounded, margins entire, above lustrous, deep yellow-green, below concolorous lustrous, papillose. Flowers solitary, large; pedicel 12-25 mm long. Sepals 8-10 × 4-9 mm, inner broader. Petals 7-8 × 5-6 mm, basal glands oblong. Stamens truncate. Berries red, 10-12 × 9-12 mm, ellipsoid-globose, stylose.

Fl. & Fr. : May - Oct. Darjeeling, 3000-4000 m.

2. **Berberis asiatica** Roxb. ex DC., Syst. Nat. 2 : 13, 1821, non Griff, Hook. f. & Thoms., *l.c.* 224 et in Hook. f., *l.c.* 110; Prain, Bengal Pl. 1:139, 1963 (repr. ed.); B.P. Uniyal & R. R. Rao in Sharma *et al.*, *l.c.* 370.

Shrubs, 1-2 m high, erect. Stem terete, mature glabrous. Spines 1-3 cm. Leaves 2.5-8 × 1.5-3 cm, obovate, thick, rigid, acute, petiolate, above lustrous dark-green, below white pruinose, papillose, subentire or rarely spinose margin. Flowers 15-25, racemose or corymbose, 3-8 mm in diam.; pedicel 15-25 mm long; prophylls *ca* 2 × 2 mm. Sepals 5-8 × 4-5 mm, outer smaller. Petals *ca* 7 × 5 mm, obovate, emarginate; glands 1.5 × 0.8 mm, obovate. Stamens 5 mm long, not produced, truncate. Berries black, 8 × 7 mm, oblong, stylose.

Fl. & Fr. : April - May. Darjeeling, 1000-2000 m.

3. **Berberis chitria** Ker-Gawler in Edward, Bot. Reg. 9 : t. 729, 1823; R. N. Banerjee in Sharma *et al.*, *l.c.* 381. *B. aristata sensu* Hook. f. & Thoms., *l.c.* et Hook. f., *l.c.* 110, *non* DC.

Stem terete, dark red in young ones, pubescent. Internodes 3-5 cm long. Spines 1-3 fid, 1-1.9 cm long. Leaves *ca* 8 × 4 cm, obovate-oblongate, finely reticulate on both the surfaces. Flowers 10-25 in loose corymbose paniculate inflorescence; rachis including peduncle 9-11 cm long; pedicels 8-15 mm long; prophylls 1-2 mm long. Outer sepals 3, 2-4 mm long, oblong; median one ovate; inner *ca* 7 mm long, obovate. Petals *ca* 6 mm long, oblong with elliptic glands. Stamens smaller than petals, connective capitate; anthers linear. Ovary 5 mm long; stigma capitate. Berries dark-red brown, pruinose, narrowly ovoid, oblong, stylose.

Fl. : April - May; *Fr.* : Oct. - Dec. Darjeeling, 1500-2000 m.

4. **Berberis concinna** Hook. f. in Curtis, Bot. Mag. 79, t. 4744, 1853; Hook. f. & Thoms., *l.c.* 228 et in Hook. f., *l.c.* 111; P. B. Sur in Sharma *et al.*, *l.c.* 355.

Shrubs, up to 1 m long, prostrate. Stem dark-red, lustrous, glabrous, sulcate. Internodes 1-2 cm long. Spines orange, 3-fid 1-2.5 cm long. Leaves 10-30 × 5-14 mm, oblong-obovate, margins 3-5-spinose, lustrous, deep-green above, white below, pruinose, papillose. Flowers lemon-yellow or orange, solitary; pedicel 1-2 cm long; prophylls 2-2.5 × 1.5-2 mm, red, oblong-triangular. Outer sepals 4-6 × 3-4 mm; median and inner 9-10 × 6-7 mm, obovate. Petals 6.5 ×

4.5 mm, obovate; basal glands concolorous. Stamens 4-4.5 mm long, truncate; ovules 6-8. Berries 13-16 × 6-8 mm, oblong, dull-red, estylose.

Fl. & Fr. : June - Nov. Darjeeling, above 3000 m.

5. **Berberis hookeri** Lemaire in III. Hort. 6: t. 207. 1859; Syamali Dasgupta in Sharma *et al.*, *l.c.* 395. *B. wallichiana sensu* Hook. f. in Curtis, Bot. Mag. 78., t. 4656. 1852, *non* DC. Fig. 12

Shrubs, erect, about 1 m high. Stem terete, mature yellow, angled at the top, glabrous, gland-dotted, profusely branching. Internodes 2-6 cm long. Spines up to 2.5 cm long. Leaves 5-9, oblong or broadly lanceolate, 3-8 × 0.8-3 cm, acute or obtuse, base attenuated petiole-like 0.5 cm long, without hypoderm, upper lustrous, deeper colour, veins prominent, below pruinose, light coloured, prominently reticulately veined, margins revolute, spinose, with spines 5-19 on either side, 3-7 mm apart, 1-2 mm long. Flowers 3-6 in fascicle; pedicel 1.5-3.5 cm long; prophylls 2-3, 2.5-3.5 × 1.5-2 mm, ovate, concave, acute, thickened in the middle. Sepals 4-10 × 3-7 mm, ovate or obovate, concave, hooded, acute or obtuse entire. Petals 6-7 × 5-6 mm, obovate, entire, base cuneate, obtuse; glands 1 × 0.6 mm. Stamens 3-4 mm long; filaments 2.2 mm long, connective tip truncate; anthers 1.2-1.7 × 1.2-1.7 mm. Ovary 3-4.5 × 1-2 mm, oblong, estylose; stigma 1.2-2 mm broad; ovules 6-9. Berries purplish black, 1-1.5 × 0.4-0.7 cm, oblong, estylose. Seeds 3, obovoid-oblong, plano-convex.

Fl. : May - June; *Fr.* : June - Oct. Darjeeling, 2400 - 3400 m in Moss Covered Tsuga Forest.

6. **Berberis insignis** Hook. f. & Thoms., Fl. Ind. 1 : 226. 1855 et in Hook. f., *l.c.* 111; Syamali Dasgupta in Sharma *et al.*, *l.c.* 399. Fig. 13

Shrubs about 1 m high. Stem terete, dark-red, glabrous; internodes 1-7 cm long. Spines absent or in the lower nodes, 0.5-1.2 cm long. Leaves 1-5, lanceolate, 4-16 × 1.5-4 cm, coriaceous, with hypoderm, attenuated at base, acute or acuminate at apex, midvein prominent, veins depressed above, protruding below, margin spiny; spines 2-4 mm long. Flowers 8-14, in fascicles; pedicels 0.7-1.5 cm long; prophylls 3-4, 1.5-3 × 1-2 mm, deltoid. Sepals 5-6 × 4-5 mm, broadly oblong, margins wavy, with few parallel veins, entire. Petals 4-5 × 3-4 mm, broadly oblong emarginate, with few parallel veins; glands 1 × 0.5 mm, elongate, ovoid. Filaments 1-2 × 0.5-1 mm; anthers 1-1.2 × 1-1.2 mm, ovoid, connective obtuse. Ovary 1.5-2 × 0.7-1 mm, oblong; style inconspicuous; stigma ± 1 × 1.5 mm. Berries black, 6-8 × 3-4 mm, obovoid-oblong with 0.5 mm long style as a small cap at the top, surface uneven, irregularly reticulate. Seeds 3, 4-5 × 1-2 mm, obovoid, plano-convex or concavo-convex, brownish-black, not shining, often one smaller than the other.

Fl. : April - Aug. ; *Fr.* : Aug. - Nov. Darjeeling, 2000-3300 m.

7. **Berberis macrosepala** Hook. f. & Thoms., Fl. Ind. 228. 1855 et in Hook. f., *l.c.* 111; P.B. Sur in Sharma *et al.*, *l.c.* 357.

Shrubs, 2 m high, spreading. Stem green, puberulous, often somewhat sulcate when young, yellow, glabrous subterete when matured; internodes 1-3 cm long.

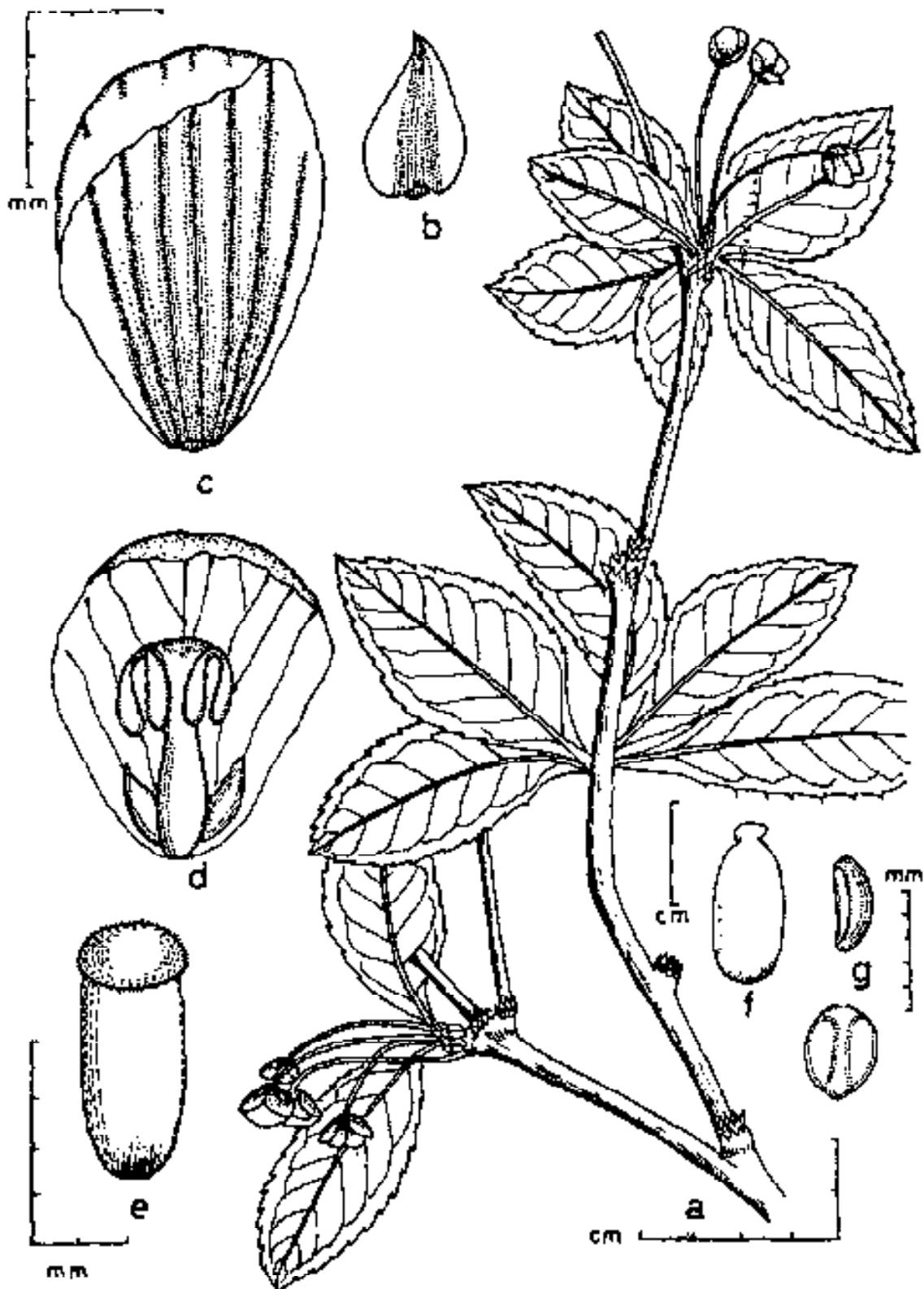


Fig. 12. *Berberis hookeri* Lemaire : a. twig; b. prophyll; c. sepal; d. petal with glands; e. pistil; f. berry; g. seeds, dorsal and lateral views.

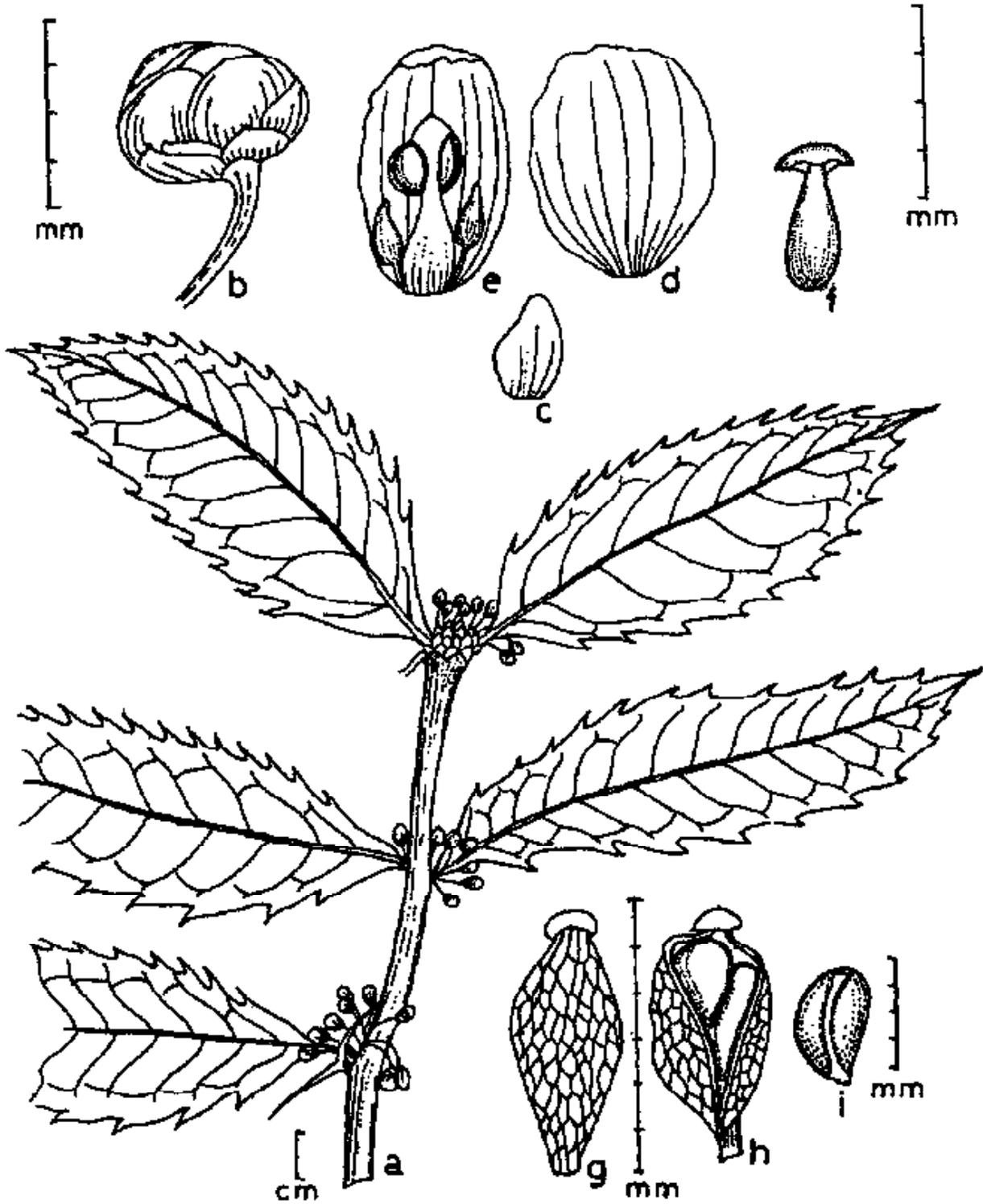


Fig. 13. *Berberis insignis* Hook. f. & Thoms. : a. twig with flowers; b. flower; c. prophyll; d. sepal; e. petal with glands and stamen; f. pistil; g. berry; h. berry with seeds inside; i. seed.

Spines 3-fid, 1-2 cm long. Leaves 20-45 × 10-20 cm, obovate, base contracted to decurrent, petiole 2-7 mm long, margin 2-12 spinose serratous, above lustrous, deep yellow-green, below grey pruinose. Flower solitary. Sepals 8.5-10 × 5-6 mm. Petals 6-7 × 3.5-4.5 mm, obovate with separate lanceolate glands. Stamens 4-4.5 mm, connective produced, round truncate. Berries red, 12-16 × 7-10 mm, oblong, estylose.

Fl. & Fr. : July - Oct. Darjeeling, 3000-4000 m.

8. *Berberis umbellata* Wall. ex G. Don, Gen. Syst. 1 : 116, 1831; Hook. f. & Thoms., *l.c.* 224; et in Hook. f., *l.c.* 110; P.B. Sur in Sharma *et al.*, *l.c.* 389.

Shrubs, 2-3 m high. Stem deep red, sulcate. Internodes 1.2-5 cm long. Spines 7-17 mm long, 3-fid, lateral part shorter, or absent. Leaves 2-5.5 × 0.7-2.5 cm, obovate, acute or obtuse, reticulate, lustrous above, grey densely papillose below, cuneate to decurrent at base, petiole 5-8 mm long; margin 5-20 spinose. Flowers 3-10, subumbelled or fascicled, peduncle long, naked; pedicel 1-2 cm long, glabrous; prophylls red, 2 × 1.8 mm, ovate. Sepals outer 3.5-4.5 × 2.5-3 mm, ovate; inner 5-6 × 3.5-4 mm, obovate. Petals 5.5-6.5 × 4-5 mm, obovate, entire, basal glands 1 × 0.4 mm, lanceolate. Stamens 3 mm long. Ovules stipitate. Berries dark-red, 10-12 × 4.5-6 mm, oblong, estylose, pruinose. Seed dark-brown.

Fl. : May - June; *Fr.* : Oct. - Nov. Darjeeling, 2000 - 3000 m.

9. *Berberis walllichiana* DC. Prodr. 1 : 107, 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 110; D.N. Guha Bakshi in Sharma *et al.*, *l.c.* 395.

Shrubs, erect, 2-3 m high. Stem subangled, yellow, internodes 2-8 cm long. Spines 1.5-2.5 cm long, slender, slightly sulcate. Leaves 6-12 × 2-2.8 cm, oblong-lanceolate, acute to obtuse, subsessile, above green, sublustrous, below paler, epruinose, epapillose, with thick hypoderm, margin, 12-25 spinose, veins distinct reticulate. Flowers 8-25 in a fascicle; pedicel 6-10 mm long; prophyll 1 × 1 mm, acuminate. Sepals 3-5 × 1.5-3 mm, oblong-ovate. Petals 4.7-5.2 × 2.5 mm, obovate, entire; basal glands separate, lanceolate. Stamens 3.5-4 mm long, connective produced, subapiculate. Ovules solitary, shortly stipitate. Berries black, 8-9 × 4-5 mm, excluding style, ovoid, epruinose; style 0.5-0.7 mm.

Fl. : May; *Fr.* : Oct. - Dec. Darjeeling, 2000 - 3000 m.

2. MAHONIA Nutt.

Shrubs, evergreen, wood yellow. Spines absent. Leaves compound, imparipinnate, petiolate; leaflets 2-20 pairs, ovate or oblong, acute, acuminate or rounded, reticulate or enervate, margins spinulose or not. Inflorescence of fascicles of 2-20 racemes, rarely simple raceme or panicle; bracts at the base of inflorescence. Flowers yellow or reddish yellow, globose, hermaphrodite, regular, pedicelled; prophylls present or absent. Sepals 9 in 3 whorls, 3 in each. Petals 6 in 2 whorls; inner with 2 basal nectarial glands present on either side of midrib. Stamens 6, free; anthers 2-celled. Ovary simple; style present. Berry black, generally globose, rarely not, pruinose.

A genus with *ca* 70 species in Himalayas, Japan and Sumatra, N. & C. America; 2 species in West Bengal.

1. Leaves large, more than 40 cm long; leaflets *ca* 11 pairs; outer sepals very small, *ca* 2 × 2 mm ovate; filaments apiculate, longer than anthers ...1. *M. acanthifolia*
1. Leaves smaller, up to 40 cm long; leaflets 3-7 pairs; outer sepals 3-4 × 2 mm, oblong; filaments triangular at apex, equal to anthers ...2. *M. napaulensis*

1. **Mahonia acanthifolia** G. Don, Gen. Syst. 118. 1831; D. N. Guha Bakshi in Sharma *et al.*, Fl. India 1:407. 1993.

Leaves 40 cm long or more, oblong-lanceolate; leaflets *ca* 11 pairs, 4-7 × 2.5-4 cm, terminal *ca* 7 × 4 cm, oblong or ovate-oblong, margins 2-5 spinose, apex elongated, acuminate. Racemes 7-12, fascicled, many-flowered. Bracts 3-5 mm long, lanceolate. Pedicel 5-6 mm long. Sepals outer smaller, *ca* 2 × 2 mm, ovate; middle 4-5 × 3 mm, ovate; inner 7-8 × 3 mm, oblong. Petals 6-7 × 3 mm, oblong, apex bifid; basal glands distinct. Stamens smaller than petals; filaments dilated at apex, apiculate, longer than anthers. Berries 8-10 mm long, ovoid, stylose, pruinose, nigrocoerulea.

Fl.: Oct. - Dec.; *Fr.*: March. Darjeeling, 2000 - 2900 m.

2. **Mahonia napaulensis** DC., Syst. Nat. 2:21. 1821; D. N. Guha Bakshi in Sharma *et al.*, *l.c.* 411. *Berberis nepalensis* Spreng. Syst. Veg. 2 : 120. 1825; Hook. f. & Thoms., Fl. India 1 : 219. 1855 et in Fl. Brit. India 1 : 109. 1872.

Leaves up to 40 × 12 cm, oblong-oblong-lanceolate; leaflets 3-7 pairs, 5.5-9.5 × 3-4 cm, ovate-oblong, terminal *ca* 9.5 × 4.5 cm, lanceolate, margins 4-10 spinose, apex acuminate. Racemes 7.5-30 cm long, erect or pendulous, 6-7 fascicled, many-flowered. Bracts 4-6 mm long, oblong-lanceolate; pedicel 5-10 mm long. Sepals outer 3.4 × 2 mm, oblong; middle and inner 5-6 × 3 mm, oblong. Petals smaller than inner sepals, basal gland distinct. Stamens connective triangular, filaments and anthers equal. Ovary 5 mm long, stylose. Berries *ca* 9 × 6 mm, globose.

Fl.: Oct. - Nov. Darjeeling, 1500 - 2500 m.

PODOPHYLLACEAE

(Syamali Dasgupta)

About 6 genera and 20 species in N. temperate region, especially in E. Asia, and E. & N. America; 1 genus and 1 species in West Bengal.

PODOPHYLLUM L.

About 10 species in Himalayas & E. Asia and 1 in E. & N. America; 1 species in West Bengal.

Podophyllum hexandrum Royle, Ill. Bot. Himal. 64. 1834; Hara, Fl. East Himal. 2: 34. 1971; Rao & Hajra in Sharma *et al.*, Fl. India 1: 415. 1993. *P. emodi* Wall. ex Royle, Ill. Bot. Himal. 64. 1834, *nom. seminud.* & 379 in nota, 1839; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1: 112. 1872. **Fig. 14**

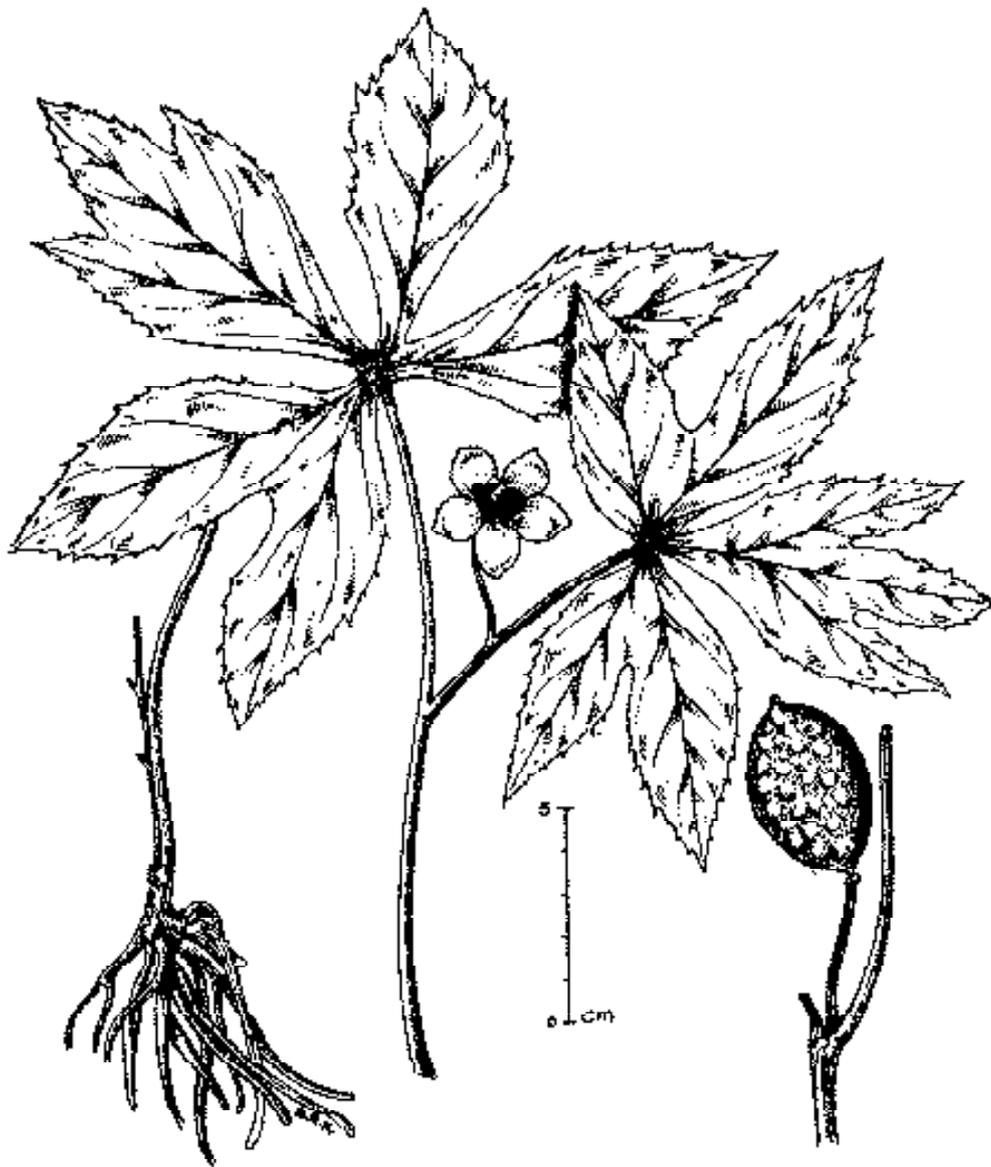


Fig. 14. *Podophyllum hexandrum* Royle

Herbs, scapigerous, 15-100 cm long, erect. Rhizome produces annual shoots with 2 large peltate leaves at the apex, pendulous like closed umbrella when young. Leaves 2, vernal, alternate, palmate, long petioled, 12-25 cm diam., orbicular, irregularly 5-10 lobed to the middle or base, plaited and deflexed in venation; lobes cuneate, margin acutely serrate. Peduncle terminal in bud, then apparently supra axillary or on the petiole of the upper leaf. Flowers rose-coloured, 2.5-3.7 mm diam. Sepals 3-6, petaloid, deciduous. Petals 4-6, obovate-oblong. Stamens as many or twice as many as petals. Berries red, 3-5 × 1.5-2 cm, oblong, with small style, surface bluntly mucronate.

Fl. : May; *Fr.* : Sept. - Oct. Darjeeling, 3000-4000 m.

LARDIZABALACEAE

(S. Chandra)

About 9 genera and 36 species, mainly in the Himalayas, Japan and South America (Chile); 1 genus and 1 species with 2 varieties in West Bengal.

1. HOLBOELLIA Wall.

Climbing monoecious shrubs, 3-5 m high. Leaves alternate, palmate, compound, coriaceous. Flowers in axillary fascicles or cymes, unisexual. Sepals 6, 2-seriate; 3 outer valvate. Petals 6, minute, orbicular. Male flowers: stamens 6, free with or without rudimentary pistillodes, nectariferous, anthers apiculate. Female flowers: staminodes 6, minute; ovary 3, superior, stigma oblong; ovules many in longitudinal rows on the lateral walls, anatropous. Fruit a berry. Seeds many embedded in the pulp. Embryo small and straight, endosperm copious.

A genus with ca 10 species in the Himalayas, China and Indo-China; 1 species in West Bengal.

Holboellia latifolia Wall., Tent. Fl. Nep. 24, t. 16, 1824; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1 : 108, 1872; Nayar & Paul in Sharma *et al.*, Fl. India 1 : 423, 1993.

Trunk 10-15 cm in diam., bark corky when old. Leaves 3-9- foliolate; petiole 4-8 cm long; leaflets 4-13 × 1.2 cm, ovate or oblong, lanceolate or linear, margin entire, acuminate at apex, base rounded, shining above, pale and reticulate below; petiolule 0.3-5.0 cm long. Flowers 1-2 cm across, subcorymbose, purplish-green, sweet-scented; peduncles solitary or fascicled, as long as petiolule, sepals 10-15 × 2.5 mm, oblong or oblong-elliptic. Stamens ca 2-3 as long as sepals. Carpels free, ca half as long as sepals, oblong, one or each maturing into separate divergent fruit. Fruit 5-10 × 2.6 cm. Seeds 2 mm long, orbicular, rosy-purple.

1. Leaflets 3-5, ovate or oblong, seed obovoid ... var. *latifolia*
 1. Leaflets 7-9, narrow or linear-lanceolate, seeds curved ... var. *angustifolia*

var. *latifolia* Hook. f. & Thoms. in Hook. f., *l.c.* 108; Das & Chandra, *l.c.* 116; Nayar & Paul, *l.c.* 34 et Sharma *et al.*, *l.c.* 423.

Fig. 15

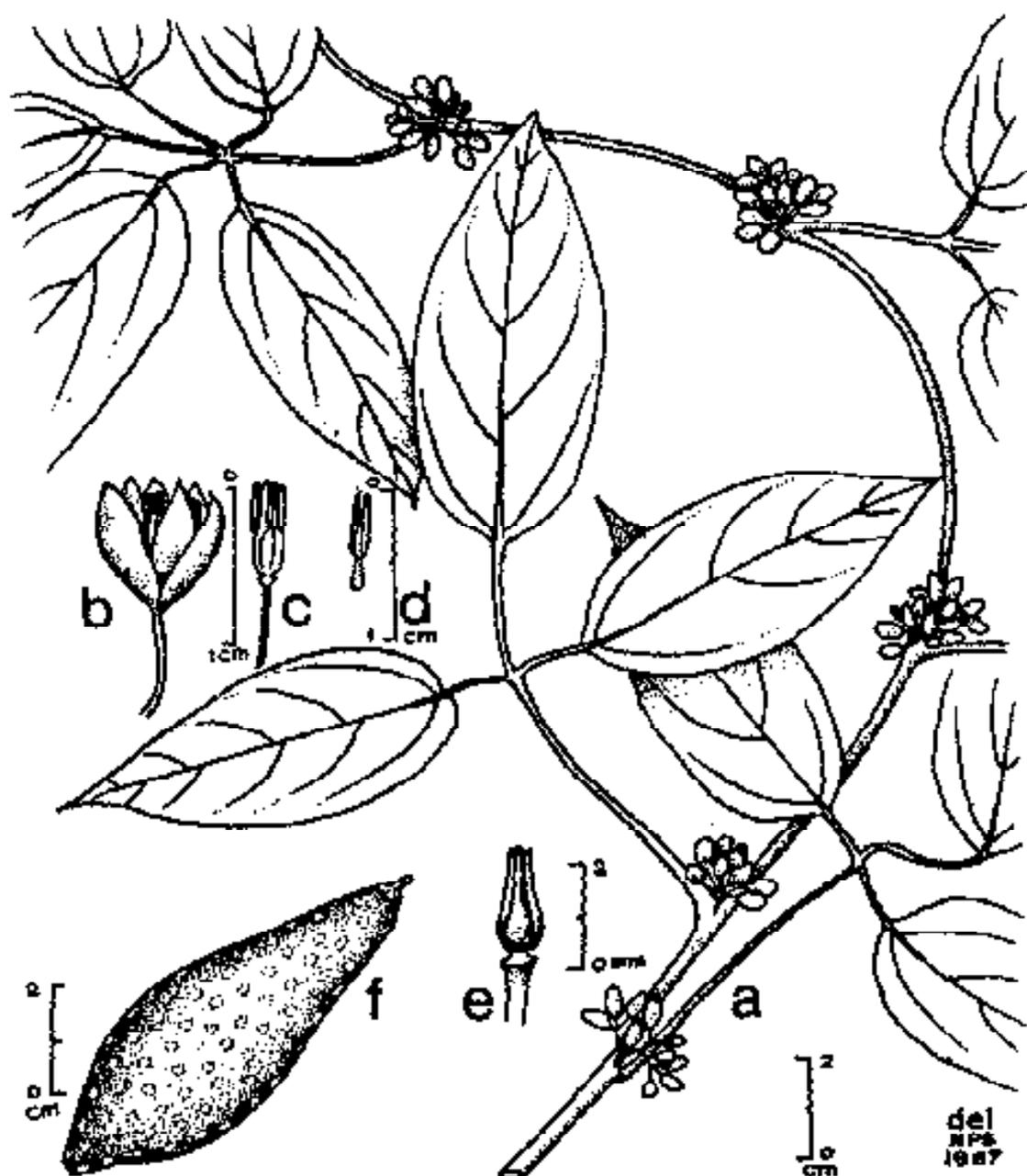


Fig. 15. *Holboellia latifolia* Wall. var. *latifolia* Hook. f. & Thoms. : a. branch; b. flower; c. flower with perianth removed; d. stamen; e. pistil; f. fruit.

Fl. : March - June; *Fr.* : June - Aug. Darjeeling, Tonglu.

Crown for ornamental foliage and large edible fruits.

var. *angustifolia* (Wall.) Hook. f. & Thoms. in Hook. f., *l.c.* 108; Nayar & Paul in Sharma *et al.*, *l.c.* 423. *Holboellia angustifolia* Wall. Tent. Fl. Nep. 24, t. 17.1824.

Fl. : March - June; *Fr.* : June - Aug. Darjeeling.

NYMPHAEACEAE

(R. L. Mitra)

An aquatic family of 5 genera and about 70 species in the tropical and temperate regions of the world; 2 genera and 4 species in West Bengal.

1. Plants densely prickly; sepals, petals and stamens epigynous ... 1. EURYALE
1. Plants without prickles; sepals, petals and stamens hypogynous to perigynous ... 2. NYMPHAEA

1. EURYALE Salisb.

Annual or short-lived perennial, rhizomatous, acaulescent herbs. Leaves polymorphic, long petiolate; juvenile leaves membranous, at first subulate, hastate, sagittate, deltoid or cordate-ovate and submerged, afterwards floating, broadly elliptic to elliptic- orbicular and non-peltate with a deep sinus, then peltate with a shallow sinus; adult leaves coriaceous, centrally peltate and floating. Flowers on densely prickly peduncles, partially submerged; sepals, petals and stamens epigynous. Sepals 4. Petals *ca* 25, innermost few transitional to stamens. Stamens numerous; outer ones broader with reduced anthers, inner ones larger, narrower, with longer anthers. Ovary 7-12-loculate with a cup-like depression above formed by the radiating stigmas; ovules 2-3 in each locule, at length usually one by abortion, anatropous. Berries 8-20-seeded. Seeds enclosed in pulpy aril, operculate.

Monotypic genus distributed in East and South-east Asia, and Ussari in Russia; 1 species in West Bengal.

Euryale ferox Salisb. in Koenig & Sims ed., *Ann. Bot.* 2 : 74. 1805; Hook. f. & Thoms. in Hook. f., *Fl. Brit. India* 1 : 115. 1872; Prain, *Bengal Pl.* 1 : 140. 1963 (repr. ed.); Mitra in Sharma *et al.*, *Fl. India* 1: 427. 1993. "Makhna", "Makhana" (Beng.).

Leaves 30-120 × 25-110 cm, orbicular, coriaceous, green, bullate and prickly along veins above, violet, strongly venose and prickly also along veins beneath. Flowers 3-5 cm long, dark-violet, fading to white towards centre. Sepals 2-3 × 1.2 - 1.8 cm, triangular - ovate, concave, fleshy, green and prickly without. Outer petals 1.8 - 2.5 × 0.8 - 1.2 cm, oblong, concave. Outer stamens 8-10 mm long. Berries 6-10 cm across, globular-ovoid, tuberculate and densely prickly with a

conical crown of persistent floral appendages. Seeds 7-12 mm across, subglobose; testa thick and hard; aril white, marked with scattered reddish streaks.

Fl. : April-July; *Fr.* : June-Oct. 24-Parganas, Howrah (rare, probably introduced).

Extensively cultivated in North Bihar for its starchy edible seeds; sold in market.

2. NYMPHAEA L.

Perennial, rhizomatous, acaulescent herbs. Leaves polymorphic, long petiolate; juvenile leaves membranous, at first subulate, hastate, sagittate, deltoid or cordate-ovate and submerged, afterwards elliptic and cleft up to petiole-base and floating; adult leaves coriaceous, prominently venose beneath, broadly elliptic to orbicular and deeply cleft near or up to petiole-base, floating. Flowers on long peduncles, floating or emersed showy. Sepals 4, hypogynous. Petals numerous, hypogynous to perigynous, innermost ones often transitional to stamens. Stamens numerous, perigynous. Carpels 5-35, partially (septa double) or fully (septa single) coherent, fused peripherally, arranged radially around and adnate below to central core of receptacular tissue to about half their length, with a cup-shaped depression above formed by radiating, curvate bilobed stigmas. Ovules numerous, anatropous. Berries globose, often crowned with persistent green filaments, ripening under water. Seeds enclosed in bell-shaped aril, indurate, operculate.

About 50 species in tropical and temperate regions inhabiting stagnant fresh water ponds, lakes and swamps; 3 species in West Bengal.

1. Leaves glabrous; sepals obscurely veined, persistent in fruit; stamens with distal sterile appendages ... 1. *N. nouchali*
1. Leaves velutinous pubescent beneath; sepals conspicuously veined, decaying after flowering; stamens without sterile appendages:
 2. Flowers white or a few sepals or outer petals with tinge of purple towards apex without; stamens yellow; filaments of inner stamens without purplish band ... 2. *N. pubescens*
 2. Flowers crimson red; stamens red; filaments of inner stamens with a purplish band without ... 3. *N. rubra*

1. ***Nymphaea nouchali*** Burm. f., Fl. Ind. 120, 1768; van Royen in Nova Guinea 8: 110, f. 2, 1962, *pp.*; Mitra in Sharma *et al.*, *l.c.* 430. *N. stellata* Willd. Sp. Pl. 2: 1153, 1799; Hook. f. & Thoms. in Hook. f., *l.c.* 114, incl. var.; Prain, *l.c.* 140, incl. var. "Scundi", "Nil sapla" (Beng.). Fig. 16

Leaves 6-45 × 5-41 cm, elliptic-orbicular to subrotund, repand to irregularly sinuate-dentate with broad obtuse teeth, or subentire, glabrous and often punctulate on both surfaces, green and sometimes also blotched purple above.

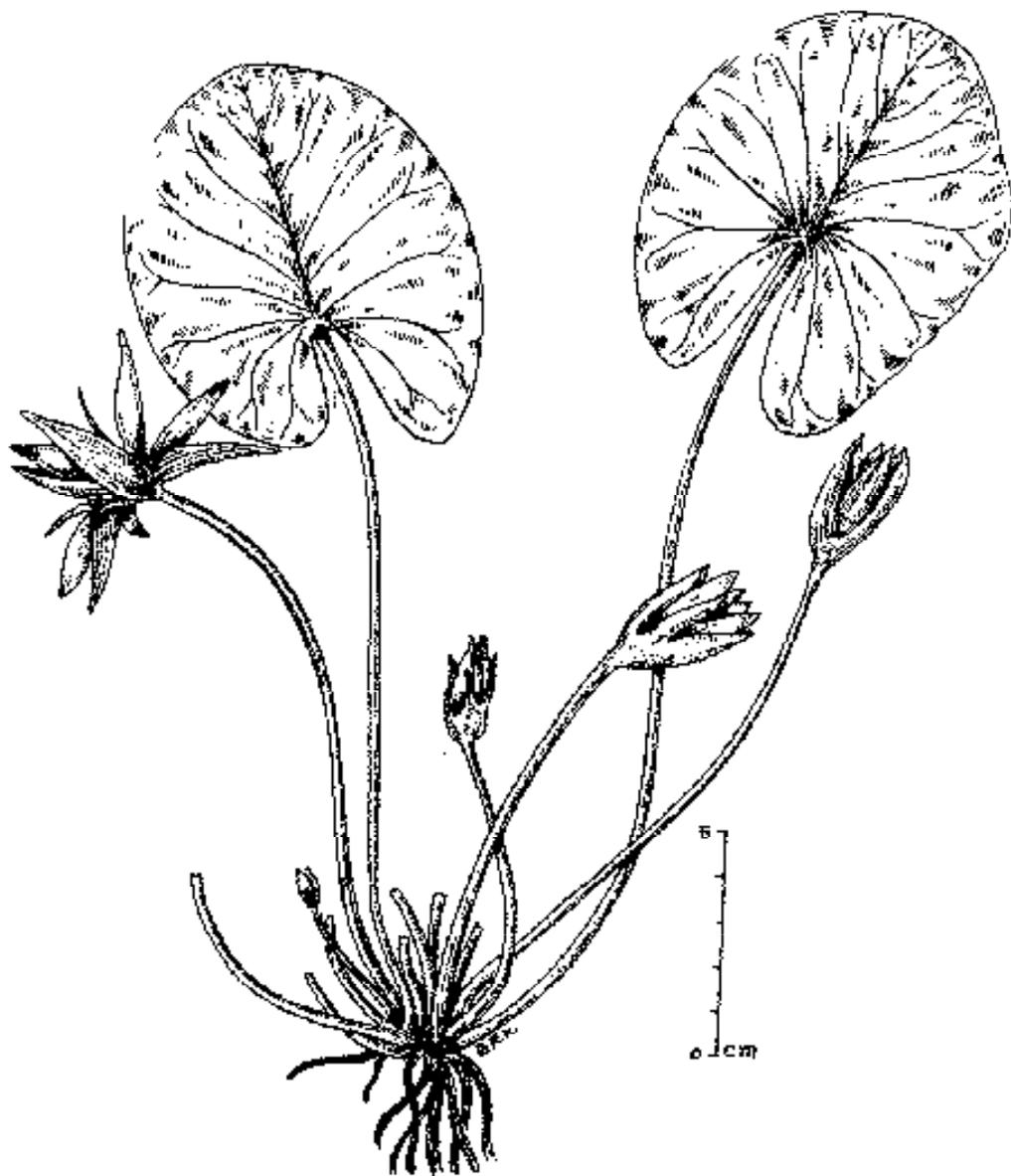


Fig. 16. *Nymphaea nouchali* Burm. f.

reddish-purple beneath. Flowers 4-17 cm across, bluish-purple, blue or pale bluish-white, fragrant. Sepals 2.5-9 × 0.7-2.6 cm, triangular-ovate, green and often with dark purplish streaks without. Petals 8-15, outer ones 2.5-7.5 × 0.8-1.7 cm, lanceolate to oblong-lanceolate. Stamens 25-40, outer ones 1.5-3 cm long, yellow with blue appendage. Ovary 8-16-loculate. Berries 1.5-4 cm across. Seeds ca 1.5 mm long, ellipsoid, reticulate, longitudinally ribbed, conspicuously ciliate along ribs when immature, become glabrate with growth of aril.

Fl. & Fr. : All round the year, profusely during Aug. to Jan. Throughout in the plains.

The tuberous rhizomes and peduncles are eaten as vegetable; seeds on frying are eaten as puffed grain.

2. *Nymphaea pubescens* Willd., Sp. Pl. 2 : 1154. 1799; Mitra in Sharma *et al.*, *l.c.* 431. *N. lotus* var. *pubescens* (Willd.) Hook. f. & Thoms., Fl. Ind. 1 : 241. 1855 et in Hook. f., Fl. Brit. India 1 : 114. 1872. *N. lotus* auct. non L. (1753); Hook. f. & Thoms. in Hook. f., *l.c.* 114, p.p.; Prain, *l.c.* 140 "Shaluk", "Shapla" (Beng.).

Leaves 15-50 × 12-45 cm, broadly ovate-elliptic, or reniform to orbicular, repand to sinuately spinose-dentate and somewhat crispate along margin, dark-green, glabrous and pustulate above, green or dull purplish green and velutinous pubescent beneath. Flowers 4-15 cm across, slightly fragrant. Sepals 2.5-8 × 1-3.2 cm, usually ovate-lanceolate, elliptic-oblong and obovate-oblong respectively, puberulous and greenish with 5-9 prominent white veins outside. Petals 10-25; outer ones 2-7 × 1-2.8 cm, oblanceolate. Stamens 25-70; outer ones 1.5-3.5 cm long. Ovary 13-22-loculate. Berries 2.5-4 cm across. Seeds ca 1.5 × 1 mm, ellipsoid, longitudinally marked with rows of irregular papillae.

Fl. & Fr. : All round the year; profusely during Aug. - Jan. Throughout in the plains.

Rhizomes, peduncles and seeds are eaten like *N. nouchali*.

3. *Nymphaea rubra* Roxb. ex Andrews, Bot. Rep. 8(104): t. 503. 1808; Prain, *l.c.* 140; Mitra & Subramanyam in Bull. Bot. Surv. India 24:83. 1983; Mitra in Sharma *et al.*, *l.c.* 432. *N. lotus* auct. non L. (1753); Hook. f. & Thoms. in Hook. f., *l.c.* 114, p.p. *quoad* syn. *N. rubra*, "Rakto shaluk", "Lat sapla" (Beng.).

Very similar to *N. pubescens* Willd., but differs chiefly in colour of leaves, flowers and in being completely sterile. Leaves at first dark-red both above and beneath, turning greenish above with age. Flowers usually 5-15 cm across, crimson red. Petals 16-25. Stamens with a dark-purplish band near base. Ovary 17-27, usually 19-21-loculate.

Fl. : All round the year; profusely during Aug. - Jan. Occasional in permanent ponds, swamps and lakes in the plain region.

Used like *N. nouchali* and *N. pubescens*.

N. rubra Roxb. ex Andrews, originally claimed to be native of Bengal, never sets fruit in nature and appears to be an obligate apomictic species. The flowers

open consecutively for three to four days and then float in water and start decaying. Unlike the two preceding species of West Bengal plains, *N. rubra* is not met with in temporary habitats like seasonally inundated fields, rice swamps, lakes, etc. This is indicative of its sterile nature and dispersal by human agencies.

NELUMBONACEAE

(R. L. Mitra)

A monotypic, aquatic family of 2 species distributed in the tropical and subtropical regions; 1 species in West Bengal.

NELUMBO Adans.

Perennial, rhizomatous, milky laticiferous, acaulescent herbs. Leaves long petiolate, orbicular with radiating veins; juvenile ones eccentrically peltate, floating; adult ones centrally peltate, floating or emersed. Flowers on long peduncles, raised well above water, large, showy, hypogynous. Sepals 4-5, subequal, petaloid, persistent. Petals often numerous, intermediate ones largest, caducous; innermost ones sometimes transitional to stamens. Stamens numerous, long and linear, with a distal, clavate, incurved sterile appendage. Carpels (9-) 12 - 28(-39), distinct, embedded singly in cavities on turbinate accrescent receptacles. Ovules solitary in each carpel, orthotropous, anatropous at maturity. Nuts ripening above water; pericarp smooth, bony. Seeds filling the carpel, exarillate, operculate.

Nelumbo nucifera Gaertn., *Fruct.* 1 : 73, t. 19, f. 2, 1788; Mitra in Sharma *et al.*, *L.c.* 441. *Nelumbium speciosum* Willd., *Sp. Pl.* 2 : 1258, 1799; Hook. f. & Thoms. in Hook. f., *L.c.* 116; Prain, *L.c.* 141. "Padma" (Beng.).

Leaves 20-80 cm across, flat when floating, somewhat cupped when emersed, suborbicular, glabrous and glaucous on both surfaces, dark-green above, paler beneath, coriaceous, membranous when dry; petioles beset with scattered, hard, minute papillae. Flowers 8-25 cm across, rose-pink or white, fragrant; peduncles similar to petioles. Sepals 1.5-5 × 0.8-3.5 cm, ovate or elliptic, concave, green (in white flowers) or pinkish-green (in rose-pink flowers). Petals ca 20 (single form) or ca 110 (double form), each 4-15 × 2-8 cm, elliptic, concave, gradually becoming obovate to spatulate. Stamens up to 225, each 2.2-4.5 cm long; outermost ones in double form staminodial. Receptacles 2-4 cm across, spongy, becoming 5-10 cm across in fruit. Carpel 8-10 × 2-3 mm, becoming ca 2 × 1 cm in fruit.

Fl. & Fr. : March - Dec. Throughout West Bengal in freshwater ponds and lakes.

The sacred lotus of Hindus, used for religious and decorative purposes, and also in indigenous system of medicine. Tuberous rhizomes and ripe carpels are edible and the leaves are used as plates.

PAPAVERACEAE

(H.S. Debnath)

A family of 26 genera and nearly 200 species, mainly distributed in the temperate and subtropical regions of northern hemisphere; 3 genera and 8 species in West Bengal.

1. Styles absent; stigmas discoid; capsules opening by pores just beneath the persistent stigmas ... 3. PAPAVER
1. Styles present or inconspicuous; stigmas not discoid; capsules opening by usually short valves;
 2. Styles distinct, conspicuously broad and large; stigmas forming a globular mass over the ovary ... 2. MECONOPSIS
 2. Styles inconspicuous (rarely very short); stigmas not forming globular mass over the ovary ... 1. ARGEMONE

1. ARGEMONE L.

Prickly erect herbs with yellow latex. Leaves sessile, inciso pinnatifid, sinuate-lobulate, middle and upper elliptic-oblong, lower obovate or oblanceolate, margin toothed, terminating into prickle. Buds subspherical to elliptical, oblong to obovate. Flowers terminal, white, yellow or orange, pedunculate. Stamens numerous; filaments filiform; anthers linear, basifixed. Ovary ovate-oblong or subfusiform, unilocular; ovules numerous on parietal placentae; styles very short or obsolete; stigmas radiating, 3-7-lobed, lobes opposite the placental strands. Capsules elliptical to oblong, lanceolate or ovate, prickly or smooth, dehiscent by 3-6 short valves. Seeds numerous, subspherical-spherical, pitted.

A genus of 22 species, mainly American, some naturalized as weeds in warm countries; 2 species in West Bengal.

1. Flowers bright yellow; stigmatic lobes closely appressed to styles at anthesis; styles up to 1 mm long in fruit ... 1. *A. mexicana*
1. Flowers white (turning pale yellowish with age); stigmatic lobes divergent, not appressed to styles; styles 1-3 mm long in fruit ... 2. *A. ochroleuca*

1. *Argemone mexicana* L., Sp. Pl. 508. 1753; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1 : 117. 1872; Prain, Bengal Pl. 1 : 142. 1963 (repr. ed.); Debnath & Nayar in Sharma *et al.*, Fl. India 2 : 2. 1993. "Bara Shil-kantal" (Beng.).

Fig. 17

Herbs, 30-125 cm tall. Leaves sessile, elliptic-oblong, pinnatifid, sinuate-lobulate, lower surface prickly, upper smooth, 3-22 × 2-8 cm. Buds 9-24 × 6-12 mm, sparingly prickly. Flowers 4-7 cm in diameter, subtended by 2-3 foliaceous bracts. Sepals 8-12 × 5-7 mm, sepal horns 6-9 mm long. Petals 4-6, obovate. Stamens 8-10 mm long; anthers 2 mm long. Ovary 8-15 × 3-6 mm,

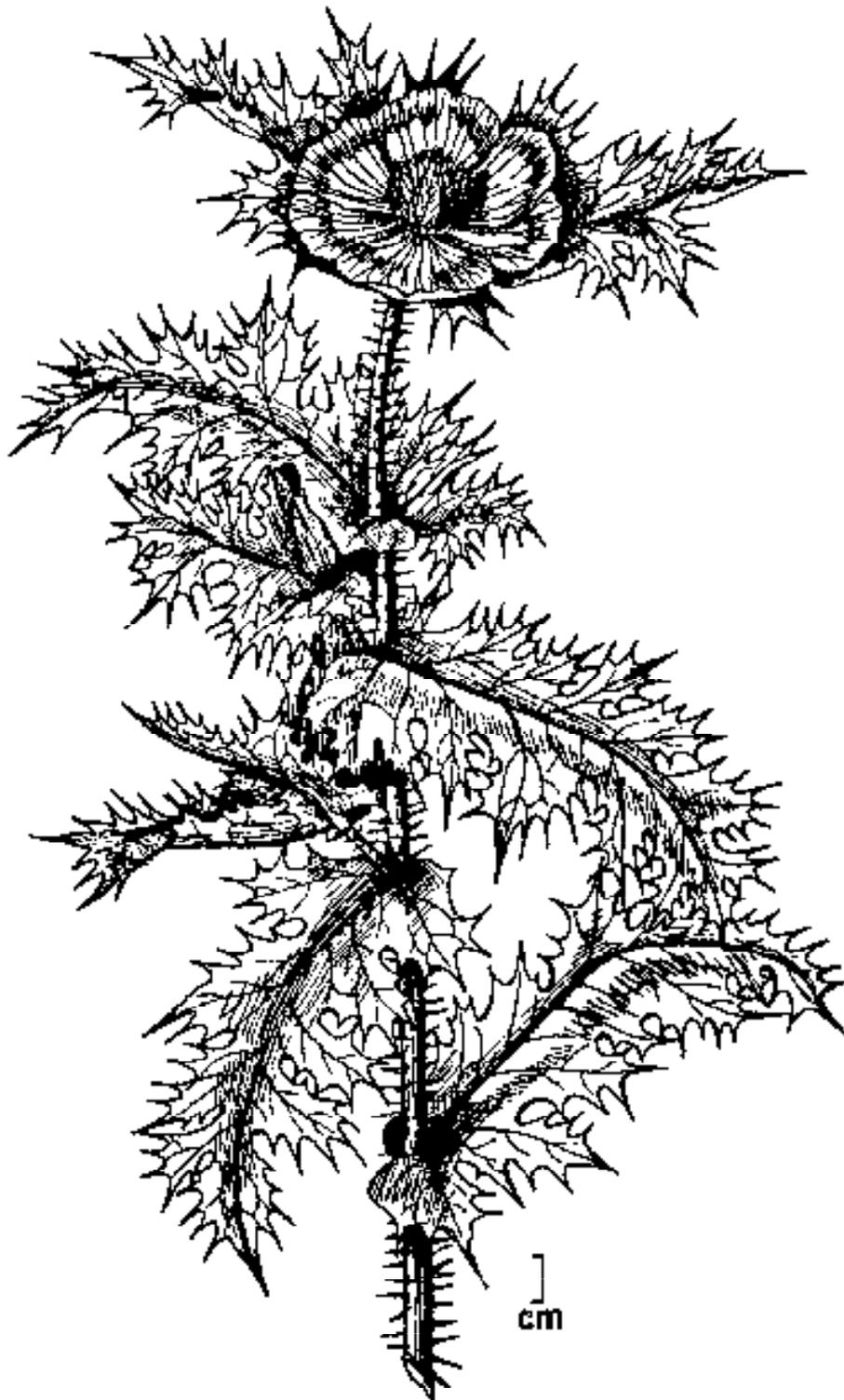


Fig. 17. *Argemone mexicana* L.

ovate. Capsules oblong or elliptic-oblong, 1.4 × 0.5-2 cm. Seeds 1.5-2 mm long, deeply reticulate-suborbiculate.

Fl. : Feb. - March; *Fr.* : March - May. Common throughout the State.

Yellow latex is used as a medicine for dropsy, jaundice and cutaneous affections. The seed oil is used as a medicine for ulcers and eruptions.

2. *Argemone ochroleuca* Sweet, Brit. Fl. Gard. 3: t. 242, 1829; Debnath & Nayar in Sharma *et al.*, *l.c.* 5.

Herbs, 15-100 cm tall. Leaves oblanceolate, sinuate-pinnatifid. Buds 8-15 × 4-9 mm. Flowers 2.5-3.5 cm across, subtended by 2-3 foliaceous bracts. Sepals 3, 8-12 × 5-7 mm. Petals 6, 2.8-3 × 1.8 cm, obcordate-obovate. Stamens 8-10 mm long, ovary 8-10 × 5 mm; stigmas 5-lobed. Capsules 10-4 × 4-17 mm. Seeds 1.5-2.0 mm diam.; finely reticulate.

Fl. : Feb. - March; *Fr.* : April - June. West Dinajpur.

2. MECONOPSIS Vig.

Erect perennial monocarpic or polycarpic herbs, often woody at base. Stems scapose or leafy, usually simple. Leaves radical or cauline, entire to 2-pinnatifid-pinnatifid, rarely palmatifid. Flowers solitary terminal on scapose stems, or on pedicels arising all along the central flowering axis forming leafy racemes, or in axillary cymes forming leafy panicle inflorescence. Sepals 2, caducous. Petals 4, more often 5-9 (- 10), variously coloured. Ovary usually with a distinct style, stigmas 2-12, free or confluent, more or less decurrent lobes, forming clavate or subglobose or capitate, structure, with the lobes opposite to the placental ridges. Capsules usually dehiscent by interplacental valves at apex only, rarely to the base. Seeds many, subreniform or ellipsoid-oblong, smooth or rugose, often papillose.

About 47 species, mainly in temperate Asia; 4 species in West Bengal.

1. Polycarpic, petals yellow ... 4. *M. villosa*

1. Polycarpic (but then petals never yellow) or monocarpic.

Petals yellow, blue, purple, red or rarely white:

2. Hairs if present, non-barbellate ... 1. *M. lyrata*

2. Hairs barbellate:

3. Plants with setose-villous hairs ... 2. *M. nepaulensis*

3. Plants villous with or without densely stellate or stellate hairs ... 3. *M. paniculata*

1. *Meconopsis lyrata* (Cummins & Prain ex Prain) Fedde (in Engler, Pflanzenr. 4: 104: 246, 1909, *nomen synonymum*) ex Prain in Bull. Misc. Inf. Kew 1915: 142, 1915; Debnath & Nayar in Sharma *et al.*, *l.c.* 19. *Cathcartia lyrata* Cummins & Prain ex Prain in J. Asiat. Soc. Bengal 64, 2: 325, 1896.

Monocarpic herbs, 5-30 cm tall, clothed with persistent, membranous leafy sheaths at base, glabrous or sparsely bristly with golden-brown bristles. Leaves

0.3-4 × 0.3-2.5 cm, ovate or oblong-ovate, spatulate or oblanceolate with a hastate or subcordate-rounded base and decurrent into petioles, acute to rounded at apex, entire to lyrate-pinnatifid, glabrous or sparingly bristly, glaucous beneath, basal leaves often with bulbils in their axils. Flowers borne singly in the axils of the upper cauline leaves, rarely on a basal scape, solitary, terminal and axillary; pedicels pendulous, 2-15 cm long. Sepals 8-10 mm long, obovate-oblong, glabrous or sparingly bristly. Petals 4(-5-6), obovate-suborbicular, 9-17 × 10-18 mm, acute to rounded, denticulate-fimbriate, pale pink, blue or white. Stamens 12-36, filaments 4-5 mm long; anthers 2 mm long, golden yellow. Ovary narrowly oblong or oblong-ellipsoid; styles 2-4 mm long; stigmas subclavate, 2-4 lobed. Capsules narrowly oblong or obovoid, ca 2.5 cm long (incl. beak), dehiscent by 3-4 valves. Seeds ellipsoid-oblong.

Fl. : July - Aug.; *Fr.* : Sept. - Oct. Darjeeling, 2745-3660 m.

The presence of bulbils in leaf axils is a unique feature of this species in the family Papaveraceae.

2. ***Meconopsis napaulensis*** DC., Prodr. 1: 121, 1824; Biswas, Fl. Dar. & Sikkim Himal. 1: 126, 1966; Debnath & Nayar in Sharma *et al.*, l.c. 20. *M. wallichii* Hook. in Curt. Bot. Mag. 78, t. 4668, 1852.

Monocarpic herbs. Stems 0.5 - 2.0 m tall, clothed with bristles. Leaves up to 45 cm long, elliptic-oblong in outline, imperfectly 1-2 pinnatifid, uppermost often entire, clothed with bristles, segments ovate-oblong, sinuate-pinnatifid, basal leaves on 5-20 cm long petioles, upper one sessile with semi-amplexicaul base. Flowers axillary, solitary or in cymes; pedicels 2.5-8 cm long, bristly. Sepals 1.5-2 cm long, ovate-oblong, obtuse-rounded. Petals 4, obovate-suborbicular, entire to denticulate, 2-4 cm long, red to purple or blue, often white. Stamens numerous; filaments 8-10 mm long; anthers 2 mm long. Ovary ellipsoid-oblong or ovoid; styles 2-10 mm long; stigmas 5-8 lobed, capitate or subclavate. Capsules 1-3.5 cm long, oblong or ellipsoid-oblong, bristly, dehiscent by 5-8 valves. Seeds ca 1 mm long, ovoid-ellipsoid or oblong.

Fl. : July - Aug.; *Fr.* : Sept. - Oct. Darjeeling, 3050 - 3965 m.

3. ***Meconopsis paniculata*** (D. Don) Prain in J. Asiat. Soc. Bengal 64, 2: 316, 1896; Debnath & Nayar in Sharma *et al.*, l.c. 21. *Papaver paniculatum* D. Don, Prodr. Fl. Nepal. 197, 1825. *Meconopsis nipalensis* Hook. f. & Thoms., Fl. Ind. 253, 1855 et in Hook. f., Fl. Brit. India 1: 118, 1872.

Monocarpic herbs, up to 2 m tall, sparsely or densely clothed with patent or deflexed golden-brown long bristles mixed with sub-stellate short bristles, rarely glabrescent. Leaves linear-oblong in outline, pinnatifid -pinnatifid, segments ovate-oblong, acute to obtuse at the apex, margin entire or lobed, basal leaves up to 60 × 14 cm, petioled, higher ones sessile with a semi-amplexicaul base; petioles up to 20 cm long. Flowers axillary or terminal, solitary or in 2-6-flowered cymes, forming a leafy raceme or a panicle; pedicels 2-15 cm long, pendulous. Sepals broadly ovate-oblong, obtuse-rounded. Petals 4(-5), obovate to suborbicular, 3-5 cm long, entire to subentire, rarely denticulate, yellow. Stamens

numerous; filaments 7-15 mm long; anthers 2 mm long, ovary globose or ovoid-ellipsoid; styles 5-15 mm long, hairy on lower part, thickened considerably at base; stigmas capitate, 6-12 lobed. Capsules oblong or ellipsoid-oblong, 1.5-3.5 cm long, hairy dehiscent by 6-12 valves. Seeds 1-1.2 mm long, sub-reniform.

Fl. : June - Aug.; *Fr.* : Sept. - Oct. Darjeeling, 3050-3965 m.

4. ***Meconopsis villosa*** (Hook. f. ex Hook.) G. Taylor, *Acc. genus Meconopsis* 28: 1934; Debnath & Nayar in Sharma *et al.*, *l.c.* 25. *Cathcartia villosa* Hook. f. ex Hook. in *Curt. Bot. Mag.* 77: t. 4596. 1851.

Polycarpic herbs, up to 60 cm tall, patently bristly with rufous barbellate bristles. Leaves broadly ovate-cordate or orbicular, cuneate or cordate at base, 3-10 × 3-10 cm, 3 palmatifid with palmilobed segments, basal leaves petiolate, higher ones sessile. Flowers solitary, axillary or terminal, forming 1-7-flowered inflorescence; pedicels 2.5-12 cm long. Sepals 1.5-2 cm long ovate-oblong, subacute-obtuse, appressed bristly. Petals 4, obovate-suborbicular, 2.5-3.5 × 3.5-4 cm, yellow, obtuse to rounded at the apex, entire. Stamens many; filaments 8-10 mm long, yellow; anthers 2 mm long, yellow to dark-brown, basifixed. Ovary narrowly oblong, glabrous; stigma sessile, with 4-7 radiating lobes. Capsules narrowly oblong, with 4-7 prominent ribs alternating with faint ribs, dehiscent by 4-7 valves, 0.4-0.9 × 0.3-0.5 cm. Seeds sub-reniform, dark.

Fl. & Fr. : July - Sept. Darjeeling, 3050 - 3965 m.

3. PAPAVER L.

Erect herbs with milky, whitish, yellowish or orange sap. Leaves mostly pinnatifid, pinnatilobed or pinnatipartite, margin mostly incised, dentate or serrate, rarely entire, usually hairy-bristly or glabrous. Inflorescences often paniculate, mostly patent or adpressed setose. Buds ovate or subglobose. Sepals 2(-3), free, ovate-orbicular. Stamens numerous; filaments filiform or dilated; anthers orbicular to linear. Ovary mostly ovoid; stigmas sessile, 4-20, borne on a disc, margin crenate to deeply dissected, stigma rays opposite to placentas, usually united into a continuous disc by a pyramidal convex or flat disc. Capsules dehiscent by pores just beneath persistent stigmatic disc. Seeds very small, kidney-shaped, alveolate-reticulate, brown, black, dark-grey or white, without appendage.

About 50 species in temperate Europe, Africa and Asia; 2 species in West Bengal.

1. Plants usually densely hispid or stiffly hairy; cauline leaves not amplexicaule; flowers many ...1. *P. rhoeas*
1. Plants glabrous or nearly so; cauline leaves amplexicaule; flowers solitary or few ...2. *P. somniferum*

1. ***Papaver rhoeas*** L., *Sp. Pl.* 507. 1753; Hook.f. & Thoms. in Hook.f., *l.c.* 117; Debnath & Nayar in Sharma *et al.*, *l.c.* 31. *P. hookeri* Backer ex Hook. f. in *Bot. Mag.* t. 6729. 1883. "Lalposht" (Beng.); "Lal post", "Postekabija" (H.).

Herbs, 18-50 cm tall. Leaves 5.5 - 18.5 × 3 - 7.5 cm, sinuate-pinnatifid to bipinnati-partite. Peduncles 10-25 cm long, dilated at summit, hairy. Buds 1.5 - 3.9 × 1 - 2 cm, obovoid. Flowers 7.5 cm across. Petals 3.7 × 3.3 - 6.5 cm, obovate to suborbicular. Stamens numerous; anthers 1 mm long, oblong. Capsules 12 × 7.5 mm, campanulate, glabrous; rays of the stigma disc 9-13 in number. Seeds dark brown.

Fl. : April - July; *Fr.* : July - Sept. Cultivated as an ornamental in all districts.

The latex from the capsules is narcotic and has slightly sedative properties.

2. **Papaver somniferum** L., Sp. Pl. 1 : 508, 1753; Hook. f. & Thoms. in Hook. f., *l.c.* 117; Prain, *l.c.* 141; Debnath & Nayar in Sharma *et. al.*, *l.c.* 32. "Posto, Post" (Beng.); "Afyum, Khas-Kash Post" (H.).

Fig. 18

Herbs, 0.1-1 m tall. Leaves serrate-dentate, rarely pinnatifid, 3-15 × 1-8 cm. Pedicels 3-20 cm long. Buds ovoid-oblong, 1.5-3 × 1-2 cm. Flowers 2-10 cm across. Petals obovate-orbicular, 1.5 - 5.5 × 1.5 - 6.5 cm. Filaments 5-10 mm long; anthers oblong-linear, 10-15 mm long. Capsules 7 × 3-6 cm; stigmatic disc scarious with 7-18 stigma rays. Seeds white, grey-black.

Fl. : April - June; *Fr.* : July- Aug. Cultivated.

Latex from the capsules, known as opium, is used in diarrhoea, diabetes and rheumatism and also as an antidote to snake-poison and scorpion sting. The seed is used in cooking and making sweets. Seeds oil is suitable for making candle, soap, medicine and food.

BRASSICACEAE

(Cruciferae)

(G.H.Bhaumik)

A family of about 340 genera and 3350 species, distributed throughout the world, primarily in the temperate regions and most successfully in the arid areas; 10 genera and 18 species in West Bengal.

1. Fruits beaked or biarticulated; cotyledons usually longitudinally folded (conduplicate) :
 2. Petals with dark brown or purple veins; beak seedless; seeds 2- seriate ...7 ERUCA
 2. Petal veins not deeply coloured; beak 0-3 seeded; seeds 1-seriate ...1. BRASSICA
1. Fruits neither beaked nor biarticulated (or rarely with beak-like apex); cotyledons not so folded:
 3. Fruits generally laterally compressed at right angles to the septum, narrowly septate :
 4. Seeds 1 per locule :

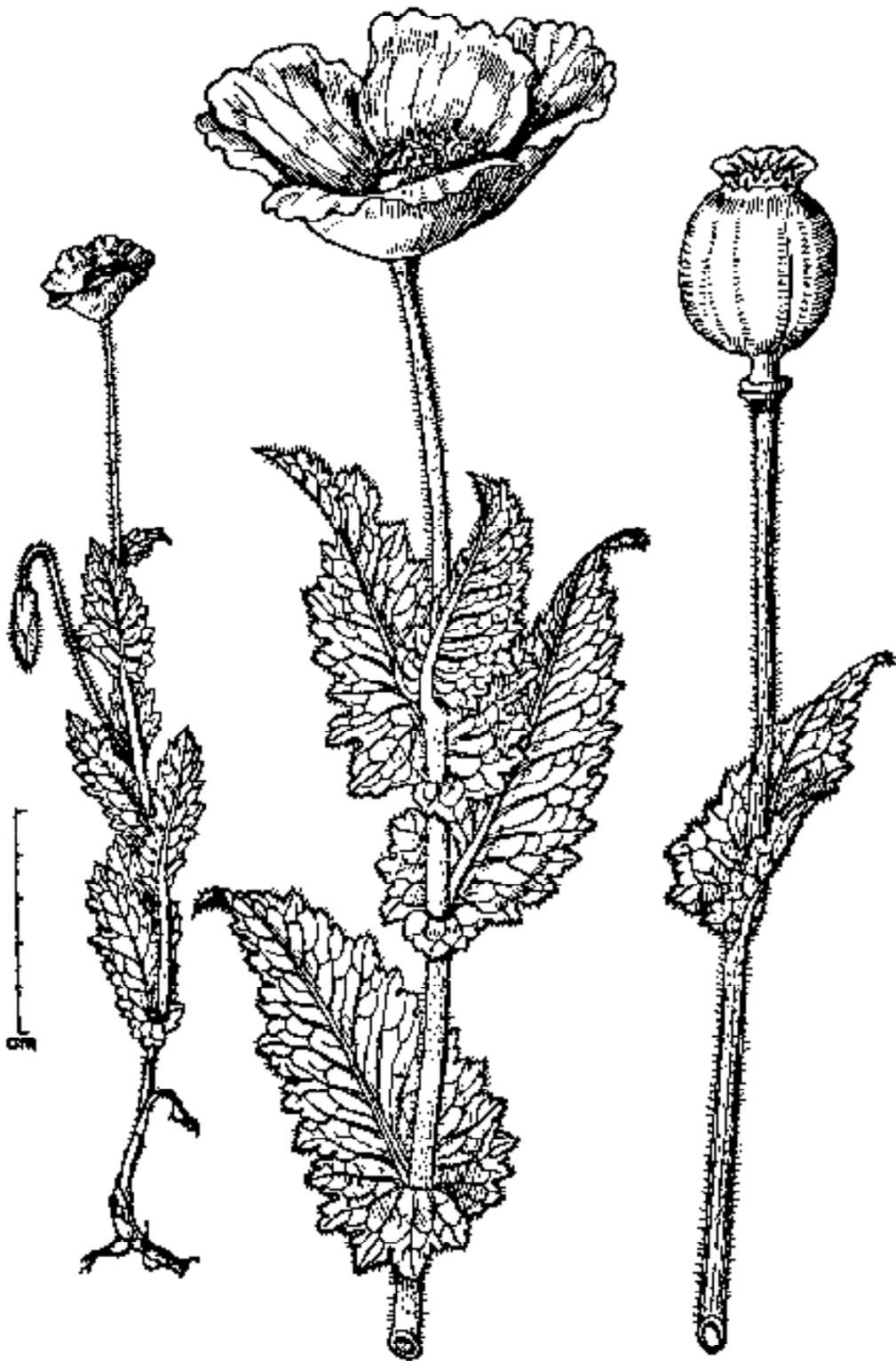


Fig. 18. *Papaver somniferum* L.

- 5. Fruits coarsely reticulate or verrucose; inflorescences axillary ...5. CORONOPUS
- 5. Fruits smooth; inflorescences terminal ...8. LEPIDIUM
- 4. Seeds 2-many in each locule :
 - 6. Silicula triangular-obcordate; strongly compressed ...2. CAPSELLA
 - 6. Silicula ellipsoid, not strongly compressed ...4. CYPHEARIA
- 3. Fruits compressed parallel to the septum, broadly septate :
 - 7. Plants scapose; usually hairy with branched or simple hairs ...6. DRABA
 - 7. Plants not scapose; glabrous or pubescent with simple hairs only :
 - 8. Seeds 1-seriate ...3. CARDAMINE
 - 8. Seeds 2-seriate or sub-biseriate :
 - 9. Aquatic creeping herbs with white flowers ...9. NASUTRILUM
 - 9. Terrestrial erect herbs with yellow flowers ...10. RORIPPA

1. BRASSICA L.

Annual, biennial or perennial herbs with erect branching stems. Leaves alternate; basal pinnatifid, cauline toothed to entire. Flowers yellow, in elongated racemes. Pods elongated, terete or 4-sided, sessile, tipped with a conical beak; valves 1-3 nerved. Seeds uniseriate, subglobose, marginless; cotyledons conduplicate.

About 40 species, mostly in the Mediterranean region; 1 species in West Bengal.

Brassica juncea (L.) Czern. & Coss. in Czern., *Conspect. Fl. Chark.* 8, 1859; Hook. f. & T. Anders. in Hook. f., *Fl. Brit. India* 1 : 157, 1872; Hajra, Chowdhury & Bhaumik in Sharma *et al.*, *Fl. India* 2:134, 1993. *Sinapis juncea* L., *Sp. Pl.* 668, 1753. "Rai" (Beng.).

Annual, 30-100 cm tall, branched herbs more or less glabrous above, sparsely hairy below. Basal leaves petiolate, lyrate-pinnatifid, coarsely doubly-serrate or dentate; upper leaves oblong-linear, acute, narrowed at base into a short stalk, entire or subentire. Flowers in terminal racemes; pedicels 1-1.5 cm long in fruits, ascending. Sepals 4-5 mm long, oblong; petals 5-7 mm long, obovate, clawed. Pods 15-40 x 2-3 mm, linear, more or less torulose, narrowed into a 5-8 mm long subulate beak. Seeds 10-20 in each cell, ca 1 mm in diam.

Fl. & Fr. : Feb. - June. Cultivated throughout West Bengal and often escaping in damp waste places.

Several varieties of *Brassica oleracea* are well-known vegetables of winter months like Cauliflower, Cabbage, Turnip etc.

2. CAPSELLA Medik.

Annual or biennial herbs, with a tuft of basal rosette of leaves; cauline leaves few, reduced on the branched stems; basal leaves pinnate to entire, stalked; upper leaves sessile, sinuate-dentate to entire, auricled, amplexicaul. Flowers usually white, in corymbs. Sepals spreading, equal at the base. Stamens 6. Pods obtriangular or obovate-triangular, laterally compressed; valves boat-shaped, keeled. Seeds many in each loculus; cotyledons incumbent.

A genus with ca 5 species in temperate regions of both hemispheres; 1 species in West Bengal.

Capsella bursa-pastoris (L.) Medik., *Pflanzengatt.* 1 : 85, 1792; Hook. f. & T. Anders. in Hook. f., *l.c.* 159; Prain, *Bengal Pl.* 1 : 147, 1963 (repr. ed.); Bhaumik in Sharma *et al.*, *Fl. India* 2:189, 1993. *Thlaspi bursa-pastoris* L., *Sp. Pl.* 647, 1753. "Shepherd's purse" (E.).

Annual branched herbs, up to 45 cm tall, glabrous or with branched hairs on stems and leaves. Radical leaves oblong-lanceolate, pinnatifid, lobes triangular; cauline leaves ovate-lanceolate to linear. Sepals ca 1.5 mm long, oblong, obtuse. Petals ca 2.5 mm long, obovate-oblong or oblanceolate, cuneate. Pods 5-9 × 3.5-6 mm, triangular-obcordate, lateral margins straight or convex, slightly emarginate at apex, apical notch wide. Seeds ca 1 mm long, ellipsoid, reddish brown to black.

Fl. & Fr. : April - Oct. Darjeeling.

3. CARDAMINE L.

Annual, biennial or perennial herbs with entire, lobed or pinnate leaves. Flowers white or purple, rarely yellow, in racemes or corymbs. Sepals equal at base. Petals clawed. Pods narrow-linear, compressed, tapering at both ends; valves nerveless, elastically dehiscent. Seeds 1-seriate, flattened; cotyledons accumbent.

A genus of ca 125 species in temperate regions of both hemispheres; 5 species in West Bengal.

1. Leaves trifoliolate, irregularly lobed, slightly or deeply toothed ...5. *C. trifoliolata*
1. Leaves multi-jugate, pinnatisect :
 2. Plants robust, usually 45-150 cm high ...4. *C. macrophylla*
 2. Plants slender, stem up to 40 cm (rarely up to 60 cm) :
 3. Leaves auricled at base ...3. *C. impatiens*
 3. Leaves not auricled :
 4. Leaflets sessile, lowest pair of leaflets at the base of petiole adhering to stem ...2. *C. griffithii*
 4. Leaflets petioled, the lowest pair of leaflets not adhering to stem ...1. *C. flexuosa*

1. **Cardamine flexuosa** Withering, Bot. Arr. Br. Pl. ed. 3, 3 : 578, 1976; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2 : 110, 1993, *C. hirsuta* L. var. *sylvatica* acut. *nom* Link.; Hook. f. & T. Anders. in Hook. f., *l.c.* 138, *p.p.*; Prain, *l.c.* 144, *C. scutata* Thunb. ssp. *flexuosa* (With.) Hara in Journ. Fac. Sci. Univ. Tokyo B, 6 : 59, 1952 et in Fl. East. Himal. 108, 1966.

Annual or biennial herbs, 10-30 cm high, usually spreading, pilose on lower parts, sometimes branched above. Basal leaves 7-17-foliolate, often very thinly pilose; leaflets ovate to orbicular-ovate, sometimes 3-5-lobed, terminal little larger; leaflets of upper leaves 3-11, lanceolate, sometimes denticulate to incised, sessile or subsessile. Flowers white. Petals 3-4 mm long, cuneate-obovate. Pods 12-25 × 1 mm, cylindric, somewhat compressed. Seeds *ca* 1 mm in diam., oval.

Fl. & Fr. : March - June. Darjeeling, in moist shady places between 1500-3000 m.

2. **Cardamine griffithii** Hook. f. & Thoms. in J. Linn. Soc. Bot. 5 : 146, 1861; Hook. f. & T. Anders. in Hook. f., *l.c.* 139; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 112.

Annual or perennial glabrous herbs, 30-60 cm tall. Rootstalk creeping. Stem angled and grooved. Leaves sessile; leaflets in 3-6 pairs, ovate-oblong or rounded, entire or sinuate. Flowers lilac or purple. Sepals 2-3 mm long, oblong. Petals 4-10 mm long, oblong-obovate, narrowly cuneate. Pods 10-15 mm long, slender, somewhat furecate, sometimes pendulous.

Fl. & Fr. : May - July. Darjeeling, in wet shady places at higher hill ranges between 3000-4000 m.

3. **Cardamine impatiens** L., Sp. Pl. 655, 1753; Hook. f. & T. Anders. in Hook. f., *l.c.* 138; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 114.

Annual or biennial herbs, 10-60 cm high. Leaves variable, often of two distinct types, the lower and upper differing in shape and size, many-jugate, auricles sagittate; leaflets in 5-8 pairs. Flowers white, sometimes pale purple outside towards the tip. Sepals 1.5-3 mm long, oblong. Petals 4-5 mm long, oblanceolate or oblong-linear, rounded at the tip. Pods 20-30 mm long, erect, slender, stalked. Seeds *ca* 1 mm long, oval or ellipsoid.

Fl. & Fr. : May - July. Darjeeling, in wet shady places, between 1000-3000 m.

4. **Cardamine macrophylla** Willd., Sp. Pl. 3 : 484, 1800; Hook. f. & T. Anders. in Hook. f., *l.c.* 139; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 115.

Stout herbaceous perennials, 45-150 cm tall, with creeping rootstalk. Leaves all pinnate, petiolate; leaflets in 3-5 pairs usually lanceolate, crenate-serrate or coarsely irregularly lobed or pinnatifid, acute or acuminate, subsessile. Flowers large, showy, rose or purple. Sepals 3-5 mm long. Petals 10-15 mm long, narrowly cuneate-obovate. Pods 25-50 mm long, erect, tapering at both ends, thickly margined. Seeds 1.5-2 mm long, oblong.

Fl. & Fr. : May - July. Darjeeling, 2000 - 3000 m.

5. *Cardamine trifoliolata* Hook.f. & Thoms. in J. Linn. Soc. Bot. 5 : 145. 1861; Hook. f. & T. Anders. in Hook.f., *l.c.* 138; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 117.

Annual succulent slender herbs, 10-30 cm tall, with a creeping rootstalk. Basal leaves on long slender petioles; leaflets small, rounded, sessile, 3-lobed, sparsely hairy above, glabrous beneath; cauline leaves few, shortly petioled. Flowers pale lilac or almost white. Sepals 2-4 mm long, ovate. Petals 5-8 mm long, obovate-cuneate, subtruncate at apices, rarely clawed. Pods 12-15 mm long, erect, slender, linear. Seeds *ca* 1 mm in diam., oval.

Fl. : June - July; *Fr.* : Sept. - Oct. Darjeeling, in moist woods or mossy course of streams between 2500-4000 m.

4. COCHLEARIA L.

Annual or perennial herbs, glabrous, often fleshy. Leaves entire or pinnatifid. Flowers shortly racemed or corymbose, white, rarely yellow or violet. Sepals spreading, equal at base. Petals shortly clawed. Pods ovoid, globose or ellipsoid with convex turgid valves. Seeds biseriate, compressed; cotyledons accumbent.

About 25 species throughout North Temperate and Asiatic regions; 1 species in West Bengal.

Cochlearia cochlearioides (Roth) Santapau & Maheshwari in Journ. Bombay Nat. Hist. Soc. 54 : 804, 1957; Bhaumik in Sharma *et al.*, *l.c.* 191. *Alyssum cochlearioides* Roth, Nov. Sp. Pl. 322, 1821. *Cochlearia flava* Buch. - Ham. ex Roxb., Hort. Beng. 48, 1814, *nom. nud.*; Hook. f. & T. Anders. in Hook.f., *l.c.* 145; Prain, *l.c.* 146.

A diffusely branched annual, up to 30 cm tall. Leaves lanceolate, pinnatifid; lobes sinuate-toothed; basal leaves petioled; upper smaller, sessile or subsessile. Racemes elongating in fruits, flowers white or yellow; pedicels 2-2.5 mm long in fruits. Sepals *ca* 3 mm long. Petals 5-6 mm long, obovate-oblong. Pods 3-4 mm in diam., sub-globose, smooth; valves membranous, hemispheric, nerveless. Seeds numerous, small, rugose.

Fl. & Fr. : July - Feb. C. Bengal (Burdwan) on the bank of the Ganges.

5. CORONOPUS Zinn.

Annual, biennial or perennial procumbent herbs, glabrous or with unbranched hairs. Leaves pinnatisect or deeply dissected. Racemes short, capitate, ebracteate, axillary or terminal, sometimes apparently leaf-opposed. Flowers minute, shortly pedicelled. Sepals subspreading, not saccate at base. Petals whitish, some times absent. Stamens 6, 4 or 2. Pods short, usually with 2- hemispherical lobes, valves thick, reticulately pitted or tubercled. Seed 1 in each cell; cotyledons incumbent.

A genus with *ca* 10 species, mostly Eurasian; 1 species in West Bengal.

Coronopus didymus (L.) Smith, Fl. Britain 2 : 691. 1800; Bhaumik in Sharma *et al.*, *l.c.* 192. *Lepidium didymum* L., Mant. Pl. 1 : 92. 1767. *Seneciera pinnatifida* DC., Mem. Soc. Hist. Nat. Paris 144. t. 9. 1799; Prain, *l.c.* 148.

Fig. 19

Annual or biennial, diffuse or procumbent herbs, 15-30 cm tall, often somewhat foetid. Basal leaves long petioled, deeply pinnatifid, segments with a few deep teeth; cauline leaves similar but smaller. Sepals 0.5-0.8 mm long, ovate-rounded. Petals 0.5 mm long, linear, or absent. Stamens 2. Pods 1.5-1.8 × 2-2.5 mm, emerginate at base and notched at apex, netted rugose; style much included within the notch. Seeds 1 mm long, reniform, punctate-striate, light brown.

Fl. & Fr. : Throughout the year. Burdwan, Calcutta.

6. DRABA L.

Annual, biennial or perennial herbs, often caespitose, with simple, branched or stellate hairs. Basal leaves densely rosulate; all leaves simple, entire to sinuate-dentate. Flowers white or yellow, rarely purple. Sepals subequal, slightly saccate at base. Petals entire or emerginate, shortly clawed. Pods ovate or lanceolate, rarely long linear; valves flat with distinct midnerve at base. Seeds 2-seriate, pendulous; cotyledons accumbent.

A genus containing ca 300 species, chiefly of Arctic and Alpine regions; 1 species in West Bengal.

Draba gracillima Hook. f. & Thoms. in Journ. Linn. Soc. Bot. 5: 153. 1861; Hook. f. & T. Anders. in Hook. f., *l.c.* 144; Basak in Sharma *et al.*, *l.c.* 159.

Perennial sub-erect or procumbent herbs, 10-30 cm tall; stems many, filiform, flexuous. Radical leaves spatulate; cauline few, ovate, sub-entire. Scapes numerous, filiform, flexuous; flowers yellow; pedicels 12 mm long, filiform, spreading or deflexed. Sepals ca 2 mm long. Petals 2.5 mm long, apex subemerginate. Pods 8-12 mm long, erect, linear, tapering at both ends, compressed, straight or curved, glabrous. Seeds ca 1 mm long, ovoid.

Fl. & Fr. : June - July. Darjeeling, 3000 - 4000 m.

7. ERUCA Mill.

Annual or perennial herbs. Leaves pinnatifid; lower stalked; upper sessile or subsessile. Flowers lilac or yellow with violet veins. Sepals erect, laterals saccate at base. Petals obovate, long-clawed. Pods ovate-oblong or subellipsoid, with an ensiform seedless beak; valves with a prominent midvein. Seeds 2 seriate; cotyledons conduplicate.

About 6 species chiefly in Mediterranean and North Africa; 1 species in West Bengal.

Eruca sativa Mill., Gard. Diet. ed. 8, 1 : 1768. Hajra, Chowdhery & Bhaumik in Sharma *et al.*, *l.c.* 143. *E. sativa* Lamk., Fl. France 2 : 496. 1778; Hook. f. & T. Anders. in Hook. f., *l.c.* 158; Prain, *l.c.* 146. "Sweet sarisha" (Beng.).

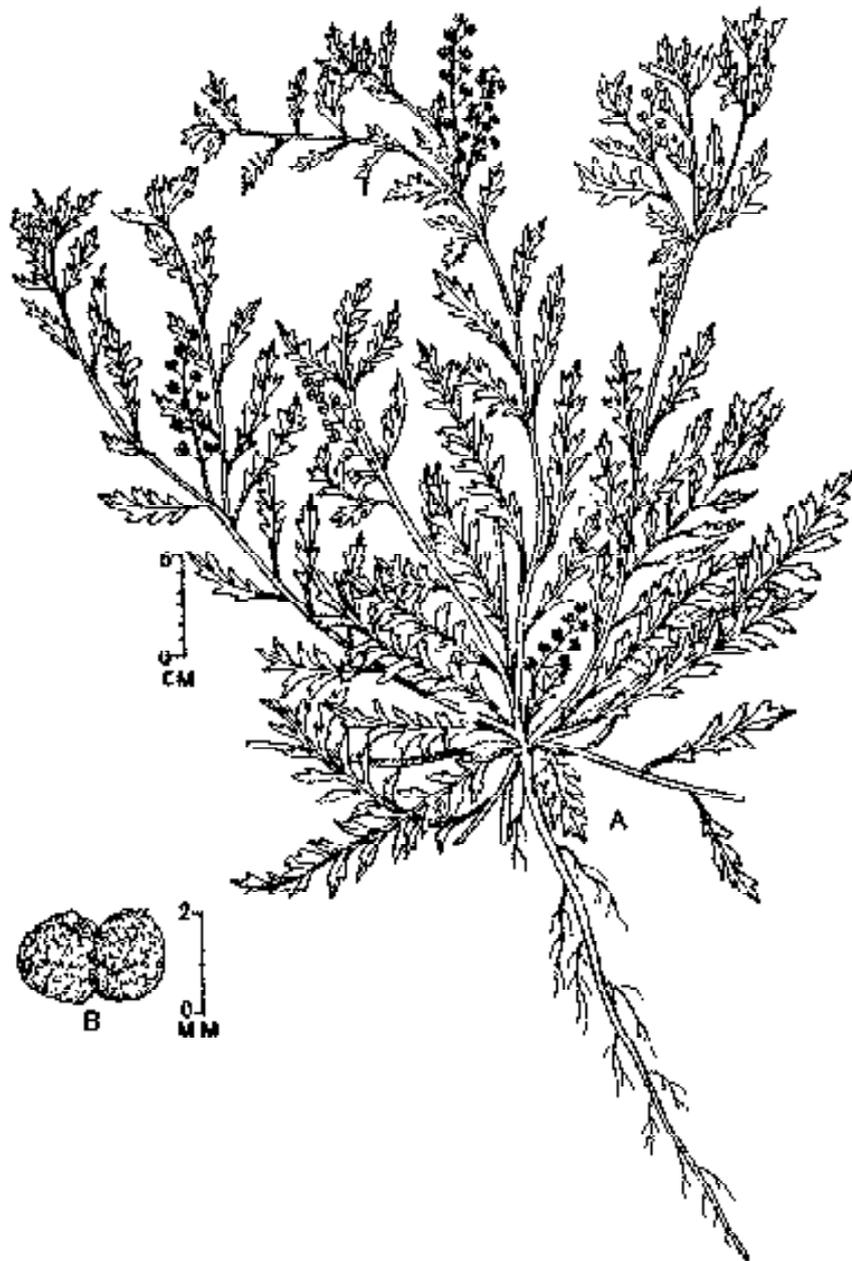


Fig. 19. *Coronopus didymus* (L.) Smith : a. habit with fruits; b. silicula.

Annual erect branched herbs, 20–60 cm or more tall. Stem hispid hairy below, glabrous above. Leaves lyrate-pinnatifid, fleshy, hispid hairy to glabrous; lower subsessile, shortly stalked, irregularly toothed; upper smaller, subsessile or sessile. Racemes lax; flowers yellow, turning to white after anthesis; pedicels 3–5 mm long in fruits. Sepals 8–10 mm long, erect, oblong, caducous. Petals 17–20 mm long, obovate, yellow or cream coloured with dark purplish veins. Pods 10–15 × 3–4.5 mm, ovate-oblong, erect, closely appressed to the stem; beak 5–8 mm long with parallel veins. Seeds 2-seriate, 6–12 in each cell, ovoid or subglobose, 1.5–2 mm in diam.

Fl. & Fr. : April–Sept. On the bank of the Ganges as weed of cultivated fields.

8. LEPIDIUM L.

Annual to perennial, diffuse or erect herbs, or undershrubs. Leaves usually linear to elliptic, entire, toothed or pinnatifid; lower often stalked; upper almost sessile. Flowers white. Sepals equal at base. Petals rudimentary or sometimes absent. Stamens 6, sometimes 4 or 2. Pods ovate, obovate, orbicular or broadly elliptic, apex more or less notched, laterally compressed; valves boat-shaped, keeled or winged. Seed solitary in each cell; cotyledons incumbent or rarely accumbent.

A genus containing ca 150 species, nearly cosmopolitan; 2 species in West Bengal.

1. Stamens 6; silicula 5–6 mm long; cotyledons incumbent, trifold ...1. *L. sativum*
1. Stamens 4 or 2; silicula 3–3.5 mm long; cotyledons obliquely accumbent ...2. *L. virginicum*

1. **Lepidium sativum** L., Sp. Pl. 644. 1753; Hook. f. & T. Anders. in Hook. f., *l.c.* 160; Prain, *l.c.* 147; Bhaumik in Sharma *et al.*, *l.c.* 206. "Halim" (Beng.).

Fig. 20

Annual herbs, 20–50 cm tall. Basal leaves long petioled, irregularly pinnate or bipinnate or lobate; cauline leaves sessile. Flowers white or pinkish. Sepals 1.5–1.75 mm long, sparsely pubescent outside. Petals 2.5–2.8 mm long, spatulate, somewhat clawed. Pods 5–6 × 3.5–5 mm, broadly elliptic to suborbicular, prominently winged and deeply notched at apex; stigma included within the notch. Seeds ca 3 × 1.5 mm, ovoid.

Fl. & Fr. : Almost throughout the year. Rarely cultivated as pot herb in North Bengal.

2. **Lepidium virginicum** L., Sp. Pl. 645. 1753; Bhaumik in Sharma *et al.*, *l.c.* 207. *L. ruderate* sensu Bahu & Biswas in Curr. Sci. 39(12) : 288. 1970; non L.

Annual or biennial herbs, 20–40 cm tall. Basal leaves lyrate to pinnate, rough with short curved hairs; cauline simple, oblanceolate to linear-lanceolate, attenuated at base, sharply serrate to entire. Flowers white. Sepals ca 1 mm long,



Fig. 20. *Lepidium sativum* L. : a. portion of the plant with flowers & fruits; b. flower; c. silicula; d. seed.

elliptic concave, glabrous or puberulent on the adaxial surface. Petals about twice as long as sepals. Silicula broadly ovate to suborbicular, emarginate, narrowly winged at apex; stigma included within the notch. Seeds *ca* 2 mm long, ovoid, narrowly winged (margined).

Fl. & Fr. : Aug. Oct. Hooghly, Nadia, in waste places, rare. This is a new record for West Bengal.

9. NASTURTIUM R. Br.

Perennial herbs of aquatic or wet places, with spreading or ascending leafy shoots rooting at base, glabrous or sparsely hairy with simple hairs. Leaves pinnate. Racemes lax in fruits, ebracteate. Flowers small, white. Sepals ascending, inner pair slightly saccate at the base. Petals obovate, abruptly contracted into claw. Stamens 6. Pods subcylindrical; valves faintly 1- nerved. Seeds 1-2 seriate, conspicuously areolate.

2 species, chiefly in Northern Hemisphere; 1 species in West Bengal.

Nasturtium officinale R. Br. in Ait. Hort. Kew ed. 2.4:110. 1812; Hook. f. & T. Anders. in Hook. f., *Lc.* 133; Hajra & Chowdhery in Sharma *et. al.*, *Lc.* 125. *Sisymbrium nasturtium-aquaticum* L., Sp. Pl. 657. 1753. "Water-cress" (E.).

An aquatic or semi-aquatic profusely branched herb, creeping or floating, rooting below at nodes. Leaves petioled, lyrate-pinnate, lower with 1-5(-7) leaflets; upper with 5-9 leaflets, terminal larger, suborbicular or broadly cordate; laterals entire or sinuate toothed. Flowers in elongating racemes; pedicels up to 12 mm long in fruits. Sepals *ca* 2 mm long. Petals 4-5 mm long. Pods 10-20 × 2-2.5 mm, glabrous, often slightly upcurved. Seeds 2-seriate, ovoid, *ca* 1 mm long.

Fl. & Fr. : March Nov. In hilly regions of West Bengal, especially in Darjeeling.

10. RORIPPA Scop.

Annual or perennial marsh herbs, glabrous or sparsely hairy. Leaves simple, pinnate, lobed, dissected or rarely entire. Flowers yellow, in racemes. Sepals spreading, inner pair saccate at base. Petals spatulate, as long as or longer than sepals, or absent. Stamens 6 or sometimes 4. Pods nearly terete, varying from ovoid or sub-globose to cylindric; valves with an obscure mid-nerve. Seeds many, 2-seriate.

About 90 species throughout the North Temperate zone; 4 species in West Bengal.

- | | |
|------------------------------------|-------------------------------|
| 1. Flowers bracteate, bracts leafy | ... 1. <i>R. benghalensis</i> |
| 1. Flowers usually ebracteate : | |
| 2. Pods 10-15 mm long | ... 3. <i>R. indica</i> |
| 2. Pods 15-30 mm long : | |

3. Petals present ... 4. *R. montana*
 3. Petals absent ... 2. *R. dubia*

1. **Rorippa benghalensis** (DC.) Hara in J. Jap. Bot. 49: 132, 1974; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 128. *Nasturtium benghalense* DC., Syst. Nat. 2:198, 1821. *Sinapis benghalensis* Roxb. ex DC., Syst. Nat. 2:198, 1821 (*pro syn.*). *Nasturtium indicum* L. var. *benghalense* (DC.) Hook. f. & T. Anders. in Hook. f., *l.c.* 134; Prain, *l.c.* 144. "Bil-rai" (Beng.).

Annual or biennial herbs, 15-25 cm tall. Lower leaves petioled, pinnatifid; upper coarsely toothed, sessile. Racemes terminal, many-flowered. Flowers bracteate, yellow; bracts 0.5-20 mm long, linear-lanceolate, variously toothed to entire, sessile. Pods 10-15 mm long.

Fl. & Fr. : March - May. Throughout the plains of West Bengal.

2. **Rorippa dubia** (Pers.) Hara in J. Jap. Bot. 30: 196, 1955; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 129. *Sisymbrium dubium* Pers., Synop. Pl. 2:199, 1806. *Nasturtium indicum sensu* Hook. f. & T. Anders. in Hook. f., *l.c.* 134, *p.p.*, non DC.

Annual or biennial 10-20 cm tall slender herbs with a creeping base, young parts hairy. Basal leaves lyrate-pinnatifid, long petioled; upper obovate-oblongate, entire or irregularly serrate-dentate, sessile or subsessile. Racemes terminal, 6-10 cm long; pedicels erect or erecto-patent, ca 3-4 mm long in fruits. Sepals ca 2 mm long, erect. Petals absent. Pods 25-30 mm long. Seeds 1-seriate.

Fl. & Fr. : Nov. - May. Darjeeling.

3. **Rorippa indica** (L.) Hiern, Cat. Afr. Pl. Welw. 1 : 26, Add et Corr. 1896; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 129. *Sisymbrium indicum* L., Mant. 1: 93, 1767. *Nasturtium indicum* (L.) DC., Syst. Nat. 2 : 199, 1821; Hook. f. & T. Anders. in Hook. f., *l.c.* 134, *p.p.* Fig. 21

Annual or biennial herbs, 10-40 (-60) cm tall, sparsely hairy to glabrous, often much branched above. Leaves almost simple or 1- or 2-lobed at base, sinuate or toothed, pinnatifid, lyrate to almost entire; lower leaves lanceolate, linear or obovate, sessile or subsessile, often with an acute or acuminate apex. Racemes terminal, many-flowered. Flowers yellow; pedicels up to 5 mm long in fruits, ascending or subspreading. Sepals 2-2.5 mm long. Petals as long as sepals or sometimes smaller. Pods 10-15 × 1.5 mm, slender, often slightly recurved. Seeds sub-biseriate, ca 0.5 mm long.

Fl. & Fr. : April - June. Almost throughout the State.

4. **Rorippa montana** (Wall. ex Hook. f. & T. Anders.) Small, Fl. S.E. United States ed. 2: 1336, 1913; Hajra & Chowdhery in Sharma *et al.*, *l.c.* 131. *Nasturtium montanum* Wall. ex Hook. f. & T. Anders. in Hook. f., *l.c.* 134.

Perennial herbs, 20-40 cm tall, usually glabrous. Leaves very similar to *R. indica*, but almost entire or slightly toothed. Racemes terminal, up to 10 cm long in fruits; axis often slightly zig-zag in fruits; pedicels up to 5 mm long in fruits.

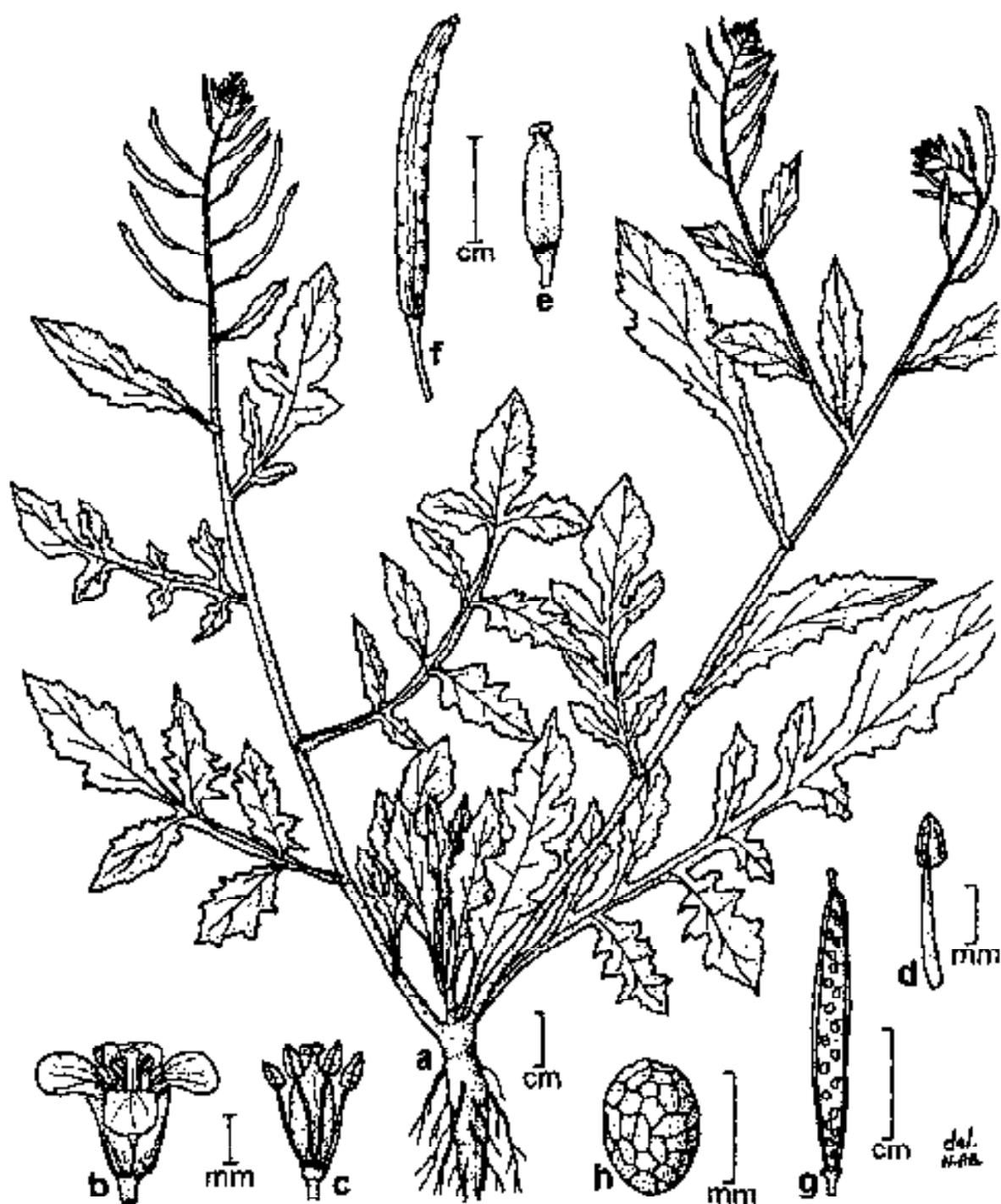


Fig. 21. *Rorippa indica* (L.) Hiern : a. plant; b. flower; c. flower with perianth removed; d. stamen; e. ovary; f. fruit; g. seeds attached to septum; h. seed.

horizontally spreading. Pods 15-20 × 1 mm, linear. Seeds 1- seriate, ca 0.7 mm long.

Fl. & Fr. : March - June. Darjeeling.

CULTIVATED SPECIES / VARIETIES

Brassica napus L. ssp. **napus** - 'Mustard' A cold weather.

var. **quadrivalvis** (Hook. f. & Thoms.) O.E. Schulz. - 'Mustard'

var. **trilocularis** (Roxb.) O.E. Schulz. - 'Mustard'

Brassica oleracea L.

var. **botrytis** L. - 'Cauliflower', 'Phul-gobi'.

var. **capitata** L. - 'Cabbage', 'Bandha-gobi'

var. **gongylodes** L. - 'Knol-kohi', 'Ol-gobi'

Brassica rapa L.

ssp. **rapa** - 'Turnip' 'Shalgam'

ssp. **campestris** (L.) Clapham - 'Sarson'

Brassica rugosa Prain var. **cuneifolia** Roxb. - 'Lahi-sag'.

Cheiranthus chiri L. - 'Wall flower'.

Iberis amara L. - 'Candy - tuft'.

Lubularia maritima (L.) Desv. - 'Sweet Alyssum'.

Raphanus sativus L. - 'Radish' 'Mula'

FUMARIACEAE

(S.N. Biswas)

A family of ca 16 genera and 450 species mainly in the north temperate regions, East & South Africa, Central Asia and Eurasia; 3 genera with 6 species in West Bengal.

1. Leaves generally tendril-bearing; flowers actinomorphic; outer petals gibbous at base ...2. DICENTRA
1. Leaves non-tendrillar; flowers zygomorphic; outer petals spurred at base :
 2. Annuals; fruit a 1-seeded nutlet ...3. FUMARIA
 2. Perennials, mostly alpine herbs; fruit a few to 8-seeded capsule ... 1. CORYDALIS

CORYDALIS DC., *nom. cons.*

Erect or prostrate perennial herbs, sometimes suffruticose woody, rarely annuals. Leaves lobed or pinnately divided, alternate, upper ones sometimes

opposite. Flowers pedicellate, in terminal or axillary racemes, rarely subumbellate, small, bracteate, white, yellow or rose-purple. Sepals 2, small, caducous. Petals 4, free or partially connate, outer two larger, spurred at base, two inner narrower and coherent or rarely free towards apex. Stamens 6, diadelphous. Ovary 1-celled, superior, with 2 parietal placentas; style filiform; stigma dilated, often dentate at margin, ovules 2 to 8. Capsules linear to ovoid-oblong. Seeds small, beaked, usually arillate, impressed punctate or rarely tuberculate.

A genus of *ca* 320 species mainly in Eurasia, some in N. America and South and tropical East Africa; 3 species in West Bengal.

1. Slender simple stemmed or diffusely much branched herbs, 8-30 cm tall; root bulbous or with elongate slender rootstock; upper petal 9-12 mm long :
 2. Bracts 15-20 mm, entire ...2. *C. juncea*
 2. Bracts 2.5-4.5 mm, deeply toothed ...3. *C. pseudolongipes*
1. Suffruticose, stems sub-erect with leafy branches: 0.8-1.0 m tall; root stout fusiform; upper petal 14-17 mm long ...1. *C. geraniifolia*

1. ***Corydalis geraniifolia*** Hook.f. & Thoms., Fl. Ind. 269. 1855; Ludlow & Stern in Bull. Br. Mus. (N.H.) Bot. 5: 49. 1975. Ellis & Balakr. in Sharma *et al.*, Fl. India 2:57. 1993. *C. chaerophylla* var. *geraniifolia* (Hook.f. & Thoms.) Hara, Fl. East Himal. 103. 1966. *C. chaerophylla sensu* Hook.f. & Thoms. in Hook.f., Fl. Brit. India 1: 126. 1872, *non* DC., *p.p.*

Stems suberect with leafy & branched above, 0.8-1.0 m high with stout rootstock. Leaf segments 5-9 × 1.5-6 cm, acuminate, acicular at tips. Bracts obovate, 6-9 mm, deeply 3-5-fid, longer than pedicels. Racemes terminal in lax, forming branched panicles, 5-13 cm long. Petals yellow with brownish tips, spur linear - lanceolate, 9-11 mm, incurved at tips. Capsules cylindric, *ca* 10 × 2 mm. Seeds suborbicular to orbicular, *ca* 1 mm, testa glabrous, shining black.

Fl. & Fr. : Aug. - Oct. Darjeeling, 2400-2800 m.

2. ***Corydalis juncea*** Wall., Tent. Fl. Nepal. 54, t. 42. 1826; Hook.f. & Thoms., *l.c.* 264 et in Hook.f., *l.c.* 123; Ellis & Balakr. in Sharma *et al.*, *l.c.* 63.

Slender unbranched herbs, 8-30 cm high with densely clustered 2- 3.5 (-4) cm long tubers. Radical leaves usually solitary, biternate or rarely triternate, slender, 8-16 cm long; leaflets elliptic to ovate-elliptic, deeply palmatisect, up to 3 cm across with glabrous parallel-veined segments. Racemes 5-20-flowered, 5- 15 cm long. Bracts linear, entire 1.5-2 cm long. Pedicels equalling or exceeding bracts. Upper petal 9-10 mm; spur 3-3.5 × 2 mm, keel broadly crested, lower tip deflexed, crested. Fruits not seen.

Fl. & Fr. : June - Sept. Darjeeling, 3300-3600 m.

3. ***Corydalis pseudolongipes*** Liden in Bull. Brit. Mus. (Nat. Hist.) Botany 18:532, ff. 22D & 23D. 1989; Ellis & Balakr. in Sharma *et al.*, *l.c.* 70. *C. longipes*

auct. non DC.; D. Long in Notes R. Bot. Gard. Edinb. 42:87-106. 1984. *C. sibirica* auct. non (L.f.) Persoon; Hook.f., Fl. Brit. India 1:125. 1872 pp.

Diffusely branched herbs, 15-30 cm high; rootstock slender. Leaves, segments deeply 3-5-lobed, broadly ovate, deeply and equally biternatisect on petiole; petioles slender, 3-5 (-5.5) cm long. Racemes in lax, few-flowered 3.5-7 cm long, terminating in a long slender branch. Upper and lower bracts deeply toothed. Petals purple tipped; nectariferous gland much shorter, 0.6-1.5 mm, one-sixth to one-eighth the length of spur. Capsules obovoid, 4-8 mm long with persistent styles; fruiting pedicels 7-14 mm long. Seeds biserrate, suborbicular to orbicular, 1 mm, testa glabrous, shining black.

Fl. & Fr. : June - Sept. Darjeeling, 3000-3300 m.

2. DICENTRA Bernh. *non cons.*

Perennial climbing herbs or undershrubs. Leaves basal, on caudine and alternate, repeatedly ternate with terminal leaflets usually replaced by branched tendril; leaflets entire, short petiolulate or sessile. Inflorescence paniculate, racemose, corymbose or consisting of a solitary flower. Flowers bracteate, isobilaterally symmetrical, dimerous. Sepals 2, rudimentary, caducous. Petals 4, outer coherent and keeled, forming a compressed tube, gibbous at base, tips hooded and divergent, and inner exposed at mouth with long slender claw, hooded, winged limb enclosing stigma and anthers. Stamens 6, in 2 bundles; filaments adherent to outer petals, each bundle expanded at base into a nectariferous gland enclosed by swollen base of outer petal. Ovary bicarpellary unilocular, ovules anatropous, on parietal placentas. Capsule dehiscing by 2 membranous sterile valves leaving placenta attached to persistent styles. Seeds with copious endosperm, reniform to suborbicular; testareticulate or papillate.

A genus with ca 20 spp distributed from Himalays to Eastern Siberia, Japan, Western China and North America; 2 species in West Bengal.

1. Leaflets 1-3 × 0.5-2 cm, ovate-elliptic; nectariferous gland 4-5 mm long, strongly hooked at apex; capsules ovoid-ellipsoid, 15-22 × 6-8 mm ...1. *D. scandens*
1. Leaflets 2.2-3 × 1-1.3 cm, narrowly ovate-lanceolate; nectariferous gland 3.5 mm long, not hooked at apex; capsule narrowly ellipsoid, 16-24 × 3.5-5.5 mm ...2. *D. ventii*

1. ***Dicentra scandens*** (D. Don) Walpers, Rep. 1: 118. 1842; Stern in Brittonia 13: 47. 1961; Ellis & Balakr. in Sharma *et al.*, *l.c.* 79. *Dietytra scandens* D. Don, Prodr. Fl. Nep. 198. 1825. *Dicentra thalictrifolia* Hook.f. & Thoms., Fl. Ind. 1: 273. 1855 et Hook. f., *l.c.* 121. **Fig. 22**

Climbers, 3-4 m tall. Leaves bi- or tri-ternately compound, membranaceous, glabrous, margins entire. Racemes 5-7-flowered, on 2-7 cm long peduncles. Bracts lanceolate, 4-8 mm long, acuminate, margins entire. Sepals variable, usually ovate-acuminate, 2-3 × 1.5-3 mm, margins entire. Petals yellow.



Fig. 22. *Dicentra scandens* (D. Don) Walpers

sometimes tipped with pink or light purple; outer pair 18-20 × 2-4 mm, inner pair 13-18 × 3-5 mm. Seeds usually reniform, black, 1-1.6 mm long; testa papillate.

Fl. & Fr. : June-Sept. Darjeeling, 1500-2200 m.

2. *Dicentra ventii* Khanh in Fedde, Rep. 83, 540, l. 14, 1972, (1973); Ellis & Balakr. in Sharma *et al.*, *l.c.* 82. *D. scandens* (D. Don) Walp. Rep. 1:118, 1842, *p.p.*

Herbs, climbing, *ca* 45 cm long; stems slender, glabrous 2-2.5 m tall. Leaflets narrowly ovate-lanceolate; leaves biternate, 3-4-veined from base, glabrous, membranous, margins entire. Racemes 3-6-flowered on peduncles 2.5-3.5 cm long. Flowers with short nectariferous glands 3-3.5 × 0.5-1 mm, deflexed, not hooked. Bracts lanceolate, 3-9 mm long, entire. Capsules narrowly ellipsoid to lanceolate, 16-24 × 3.5-5.5 mm. Seeds 1-1.5 mm long, biseriate; testa granulate.

Fl. & Fr. : July - Oct. Darjeeling, Tonglu ridge, 2600 m.

Note : *Dicentra paucinervis* Stern. in Brittonia 13:45, 1961; Long in Grierson & Long, Fl. Bhutan 1(2): 383, 1984; Ellis & Balakr. in Sharma *et al.*, *l.c.* 78.

This taxon has been recorded from Darjeeling and Kurseong by Stern *l.c.* 46; Grierson and Long, *l.c.* 383, and Ellis & Balakr. *l.c.* 79. But no specimens with distribution from Darjeeling or within the geographical boundaries of West Bengal are available in CAL herb. And, therefore, this has not been included in the main text. Long *l.c.* states "Similar to *D. scandens* and *D. ventii* but leaflets larger, broadly ovate, 2.5-5 × 2-3 cm, 3-6-veined from base; fls. with short thick nectariferous glands, 4-5 × *ca* 1.7 mm, not hooked, but often producing a waxy secretion. Capsule 12-20 × 4-8 mm."

3. FUMARIA L.

Herbs. Leaves alternate, exstipulate. Flowers in terminal or leaf-opposed racemes with caducous bracts. Sepals 2, lanceolate, dentate, placed antero-posteriorly. Petals 4, unequal, in two whorls, outer produced into a spur, inner smaller, somewhat coherent at tip 2-clawed, narrow and keeled at base. Stamens 6 (3+3). Carpels 2; placentation parietal with one ovule on each placenta. Stigma bilobed or capitate. Fruit a 1-seeded nutlet wrinkled when dry, rounded at the top with two pits. Seeds nonarillate.

A genus of *ca* 55 species, mainly European, Mediterranean and Central Asian; 1 species in West Bengal.

1. *Fumaria indica* (Haussk.) Pugsley in Journ. Linn. Soc. Bot. 44: 313, 1919; Ellis & Balakr. in Sharma *et al.*, *l.c.* 84. *F. vaillantii* Loisel var. *indica* Haussk. Fl. 56: 443, 1873. *F. parviflora sensu* W. & A., Prodr. 1: 18, 1834, *non* Lamk. 1788; Prain, Bengal Pl. 1: 143, 1963 (repr. ed.). *F. parviflora* ssp. *vaillantii* Loisel (Sp.), Hook. f., *l.c.* 128. "Bansapla" (Beng.); "Pitpara" (H.).

Diffusely branched glabrous annual up to 50 cm high; branches angular. Leaves up to 4.5 cm long; dissected segments narrow. Racemes dense, 10-17 flowered 2.2-4.5 cm long; flowers pink or whitish with purple tips; bracts 2 mm

long, persistent. Sepals 2, lanceolate, caducous, much smaller than petals. Petals 4, 4-5 mm long, the outer 2 dissimilar, inner 2 similar, keeled. Stamens 6, 2.8-3.5 mm long. Styles filiform *ca* equal to the length of stamens; stigma bifid. Fruit a globose nut with slightly flattened top, 2.5-3 mm across, stalked, rugulose when dry. Seed solitary, *ca* 2 mm long.

Fl. & Fr. : Nov. March. Bankura, Bardwan, Hooghly, Howrah, Murshidabad.

The plant used as diuretic and to cure fever and as blood purifier and is also said to be beneficial in dyspepsia and scrofulous skin affections. The seeds of the plant are used by "Mundas" as a remedy for bodyache. The plant is also used as fodder in Assam.

CAPPARACEAE

(Capparidaceae)

(A. Bhattacharyya)

A family of *ca* 30 genera and *ca* 650 species, mainly in the tropics and warm temperate regions of the world; 5 genera, 16 species and 3 subspecies in West Bengal.

1. Herbs; stamens sessile on the disc; fruit a cylindrical capsule ... 2. *CLEOME*
1. Trees, shrubs or climbers; stamens inserted on gynophore or androgynophore; fruit usually a globose berry or a capsule :
 2. Petals absent; stamens borne on short cylindrical androgynophore ... 5. *STIXIS*
 2. Petals present; stamens borne from the base of gynophore:
 3. Sepals joined at the base into a tube ... 4. *MAERUA*
 3. Sepals distinctly spreading:
 4. Leaves simple; thorns mostly present; leaf-scar absent ... 1. *CAPPARIS*
 4. Leaves 3-foliolate; thorns absent; leaf-scar present ... 3. *CRATEVA*

1. *CAPPARIS* L.

Armed or unarmed, tall, erect or climbing shrubs. Leaves simple, glabrous opposite or alternate, sometimes absent. Flowers in racemes, umbels or panicles or solitary, showy. Sepals 4, biseriate, valvate or imbricate. Petals 4, sessile or shortly stalked, imbricate. Stamens numerous. Ovary stalked, 1-4-celled; ovules many, placentation parietal. Fruit a fleshy berry rarely bursting by valves. Seeds many, embedded in pulp.

A genus of *ca* 250 species in warm temperate regions; 8 species in West Bengal.

1. Climbing shrubs:
 2. Thorns prominent, recurved, in pairs at the nodes:
 3. Flowers white turning pink; fruits 3.5-4 cm diam.; young parts tomentose ... 8. *C. zeylanica*
 3. Flowers white; fruits 1-1.5 cm diam.; young parts glabrous ... 7. *C. tenera*
 2. Thorns straight, minute or absent:
 4. Ovary ellipsoid, densely tomentose; stigma persistent in fruits ... 4. *C. olacifolia*
 4. Ovary globose to ellipsoid, glabrous; stigma deciduous in fruits ... 6. *C. sikkimensis*
1. Bushy shrubs:
 5. Ovary hairy; fruit globose without beak:
 6. Fruit a berry:
 7. Petals hairy; flower more than one arising from nodal region ... 1. *C. acutifolia* ssp. *viminea*
 7. Petals glabrous; flower numerous, borne singly directly on stem ... 3. *C. multiflora*
 6. Fruit a drupe ... 5. *C. sepilaria*
 5. Ovary glabrous; fruit ovoid to ellipsoid, beaked ... 2. *C. brevispina*

1. ***Capparis acutifolia*** Sweet ssp. *viminea* Jacobs in Blumea 12 : 429, 1965; Raghavan in Sharma *et al.*, *l.c.* 257. *Capparis viminea* Hook. f. & Thoms. in Hook.f., Fl. Brit. India 1: 179, 1872.

Spiny shrubs; spines minute. Leaves simple, alternate; herbaceous to subcoriaceous, ovate to obovate, 4.5-7.5 × 3-4 cm, acuminate, midrib sunken, 5-7 pairs of nerves, surface glabrous, hairs persistent on main nerves. Sepals of same size, minutely ciliate. Petals 1-1.5 cm long, hairy. Stamens numerous, filaments thin, 1-2.5 cm long. Gynophore 0.5-1 cm long. Ovary globose, glabrous. Fruits 1 cm in diam., many-seeded, pericarp thin.

Fl. & Fr. : April - June. Jalpaiguri.

2. ***Capparis brevispina*** DC., Prodr. 1: 246, 1824; Raghavan in Sharma *et al.*, *l.c.* 260. *C. zeylanica* auct. non L., 1762; Hook. f. & Thoms. in Hook. f., *l.c.* 174, *p.p.*

Much branched bushy shrubs; thorns straight, 2-5 mm. Leaves alternate, elliptic-obovate, 6-8 × 2-3 cm, coriaceous, entire, apex acute, base subcordate, midrib sunken, 5-7 nerved; petioles 2-3.5 mm. Flowers borne axillary or terminally, pedicellate, 2.5-3 cm. Sepals unequal, boat-shaped, minutely villose, 0.8-1 cm. Petals obovate, 1-2 cm. Stamens numerous; filaments thin, 2.5-3 cm. Gynophore 1.3-1.5 cm. Ovary ovoid, beaked, thickly tomentose. Fruit ovoid to ellipsoid, beaked, 1-1.5 cm in diam.

Fl. & Fr. : Nov. - March. Howrah.

3. ***Capparis multiflora*** Hook. f. & Thoms. in Hook. f., *l.c.* 178; Raghavan in Sharma *et al.*, *l.c.* 279.

Tall shrubs; thorns absent or rarely present. Leaves petiolate, oblong-lanceolate, 10-20 × 7-9 cm, herbaceous, entire, base tapering, cuneate to acute, apex gradually acuminate, nerves 5-7 pairs. Flowers numerous, borne singly on stem, pedicellate, 2-4 cm. Sepals 4-6 × 1-2 mm, minutely hairy. Petals 4-6 × 1-2 mm glabrous. Stamens numerous. Gynophore 1-1.5 cm. Ovary ovoid, minutely hairy. Fruit a globose to subglobose berry, 1-1.5 cm in diam.

Fl. & Fr. : April - June. Jalpaiguri.

4. ***Capparis olacifolia*** Hook. f. & Thoms. in Hook. f., *l.c.* 178; Raghavan in Sharma *et al.*, *l.c.* 283.

Twining shrubs; thorns minute, straight, 1-2 mm. Leaves simple, alternate, ovate to ovate-lanceolate, 10.5-11 × 4.5 cm, gradually acuminate, entire, petiolate. Flowers showy, 2 from each node, 5-10 mm. Sepals in two series, outer pair boat shaped 0.8-1 cm. Petals narrowed at base, 2-2.5 × 0.5-0.8 cm. Stamens numerous, free, filaments slender, 3.5-4 cm. Gynophore 2-2.5 cm, glabrous. Ovary ellipsoid, densely tomentose. Fruits globose to ellipsoid with persistent stigma, 1-1.5 cm in diam.

Fl. & Fr. : March - April. Darjeeling, Jalpaiguri.

5. ***Capparis seplaria*** L., Syst. ed. 10:2 : 1071. 1759; Hook. f. & Thoms., *l.c.* 177; Prain, Bengal Pl. 150. 1963. (repr. ed.); Raghavan in Sharma *et al.*, *l.c.* 289. *Capparis glauca* Wall. ex Hook. f. & Thoms. in Hook. f., *l.c.* 180. "Kaliakara" (Beng.).

Much branched bushy shrubs; thorns present at nodes, recurved, about 2-2.5 mm. Leaves simple, alternate, ovate-lanceolate, subcoriaceous, 4-4.5 × 1.8-2 cm, shortly petioled, entire, base rounded. Flowers borne axillary or terminally, 4 mm, shortly stalked. Sepals 3.5-4.5 mm. Stamens numerous, filament short, 2-3.5 mm. Gynophore 5-8.5 mm. Ovary ovoid, glabrous. Fruit a fleshy drupe, 0.8-1.5 cm in diam.

Fl. & Fr. : April - Nov. In most of the districts of West Bengal.

6. ***Capparis sikkimensis*** Kurz in J. Asiat. Soc. Bengal 43 (2) : 181. 1875; Prain in Ann. Gard. Calcutta 9(1) : 8. 1901; Raghavan in Sharma *et al.*, *l.c.* 292. *C. valcarti* Hemsley ex Gamble, Darjeeling list (ed. 2) 6. 1896. Fig. 23

Climbing shrubs; thorns minute or absent. Leaves broadly ovate, petiolate, base rounded, entire, tip acuminate, 7-10 × 5-5.5 cm, lower surface pale-brown, glabrous. Inflorescence an axillary sub-umbel, 5-10-flowered. Sepals equal, 1 cm. Petals deciduous, ovate, 1-1.5 cm. Stamens numerous. Gynophore long, slender. Ovary globose to elliptic. Fruit a globose to elliptic berry, pericarp smooth, thin. Seeds many.

Fl. & Fr. : February - April. Jalpaiguri.

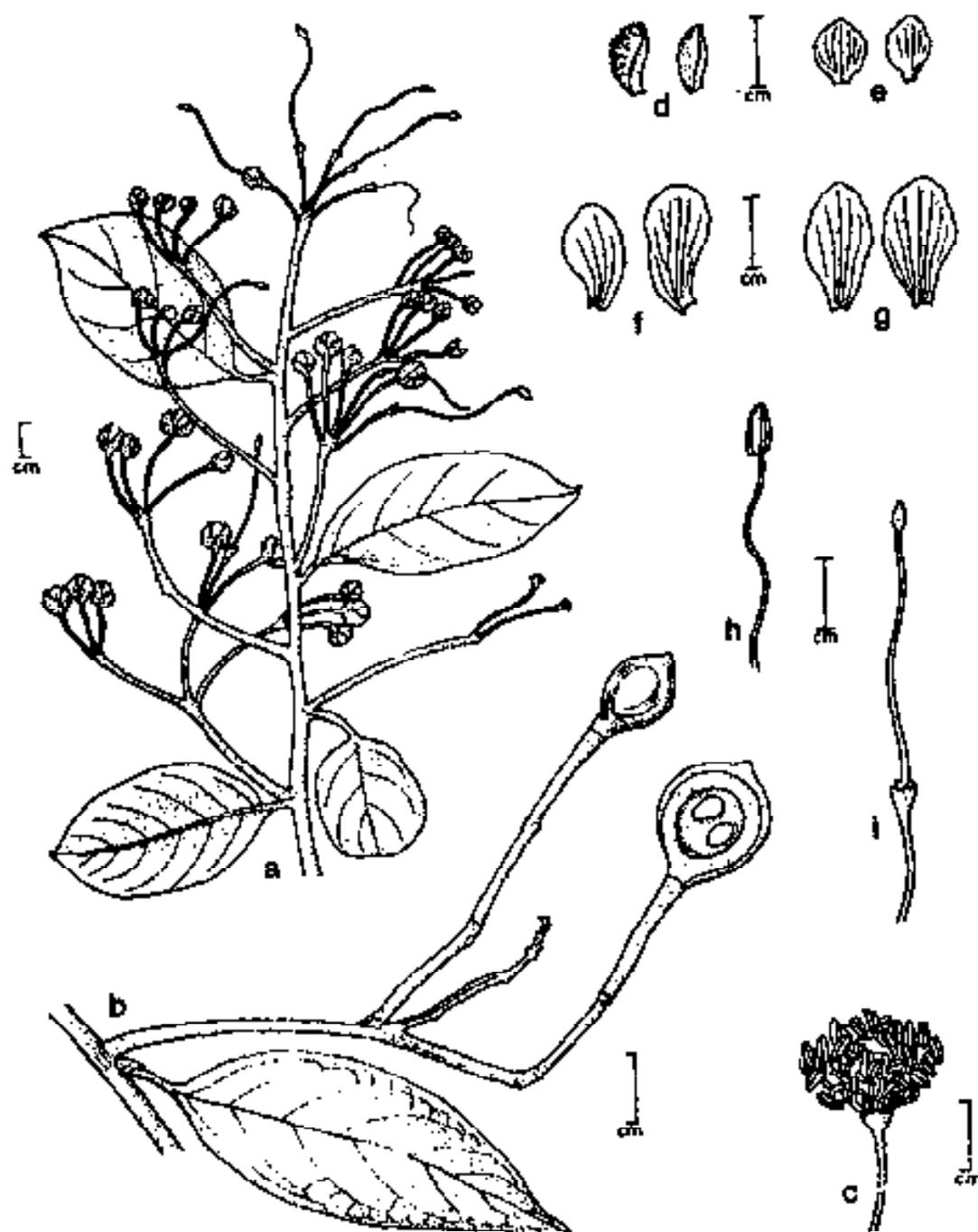


Fig. 23. *Capparis sikkimensis* Kurz : a. flowering twig; b. twig with immature fruits; c. flower with sepals and petals removed; d. outer sepals; e. inner sepals; f. outer petals; g. inner petals; h. stamen; i. pistil.

7. *Capparis tenera* Dalz. in Hook., J. Bot. Kew Gard. Misc. 2 : 41. 1850; Hook. f. & Thoms. in Hook. f., *l.c.* 179 incl. var. *dolzellii*, var. *zeylanica* and var. *latifolia*; Raghavan in Sharma *et al.*, *l.c.* 297.

Climbing shrubs, thorns in pairs, hard, recurved at the nodal region, 2-3 mm. Leaves alternate, ovate-lanceolate, herbaceous to coriaceous, entire, 8-11 × 3-5 cm, base rounded, apex acute, 5-6 nerved. Flowers 3-4 arising in the axils, 3.5-4 mm. Sepals unequal, outer pair broader than the inner, 2.5 - 4.5 mm. Petals ovate, tomentose, 3.5 - 5.5 × 2.5-3 mm. Stamens numerous; filaments thin, long, 2.5-4.5 mm. Gynophore 1-1.5 cm, thin. Ovary small, glabrous, stigma knob-shaped. Fruit a globose berry, 1-1.5 cm. Seeds numerous.

Fl. & Fr. : March - May. Jalpaiguri.

8. *Capparis zeylanica* L., Sp. Pl. ed. 2, 720. 1762; Raghavan in Sharma *et al.*, *l.c.* 298. *C. harrida* Linn. f. Suppl. 264. 1781; Hook. f. & Thoms. in Hook. f., *l.c.* 178; Prain, *l.c.* 150. "Bagnai" "Kalokeri" (Beng.).

Much branched climbing shrubs; thorns in pairs at nodes, recurved 1-1.5 mm. Leaves simple, oblong-lanceolate to obovate, alternate, entire, leathery, 6-6.5 × 3.5-4 cm, base rounded, acute. Flowers solitary axillary, 1-2 cm, shortly stalked. Sepals in two series, 0.5-1 cm, outer pair boat-shaped. Petals pinkish white, 1.5-2 × 0.5-1 cm, broader at apex. Stamens numerous, free, thin, 2-2.5 cm. Gynophore 1.8-4.5 cm. Ovary 0.3 - 0.5 cm, ellipsoid; style linear, thin; stigma small. Fruit globular to ellipsoid, 3.5-4 cm in diam.

Fl. & Fr. : March - May. In most of the districts of West Bengal.

The leaves are used for piles, boils and swellings. The root bark is sedative.

2. CLEOME L.

Annual or perennial herbs with glandular hairs. Leaves petioled, palmately dissected, leaflets 5-7; stipules absent but sometimes modified into spines. Flowers regular, bisexual, in terminal racemes, pedicellate; bracts present or absent. Sepals 4, valvate. Petals 4, often showy, clawed at base. Stamens 6 to numerous, sometimes connate, inserted on gynophore, some-times on androgynophore with filiform filaments. Ovary mostly on gynophore, sometimes sessile, 1-celled, with parietal placentation; stigma capitate. Capsules linear, cylindrical, 2-valved, beaked, dehiscence longitudinal. Seeds numerous, reniform, seed coat sculptured.

A genus with ca 150 species in the tropics and subtropics; 5 species in West Bengal.

1. Leaves compound, 3-7 foliolate:
 2. Flowers yellow; stamens 10-15; ovary glandular; fruits longitudinally striated ...5. *C. viscosa*
 2. Flowers pinkish-violet; stamens 6; ovary glabrous; fruits not striated:

3. Partially procumbent herbs; leaves 3-foliolate
 ... 3. *C. rutidosperma*
3. Erect herbs; leaves 5-7-foliolate:
4. Petals lanceolate; filaments 4-5 cm long;
 gynophore short
 ... 4. *C. speciosa*
4. Petals spatulate; filaments 1.5-2 cm long;
 gynophore long
 ... 1. *C. gynandra*
1. Leaves simple
 ... 2. *C. monophylla*

1. **Cleome gynandra** L., Sp. Pl. ed. 1. 671. 1753; Itis in Brittonia 12 : 284. 1960; Raghavan in Sharma *et al.*, *l.c.* 309. *C. pentaphylla* L., Sp. Pl. ed. 2. 938. 1763. *Gynandropsis pentaphylla* DC., Prodr. 1: 238. 1824; Prain, *l.c.* 150. *G. gynandra* Briq. in Ann. Cons. Jard. Bot. Geneve 17: 382. 1914. "Sada-Huthuria" (Beng.).

Erect branched herbs. Stems glandular-pubescent. Leaves 5-7-foliolate; leaflets obovate, 1.5-4.5 × 0.7-1.8 cm. Flowers in long racemes subtended by foliar bracts. Sepals 1.5-2 mm long, ciliate. Petals rounded at apex, narrowed towards base, 1.8-2.8 × 0.5-0.8 cm. Stamens 6; filaments slender, 1.5-2 cm long. Andro-gynophore 6.5-10 mm long, gynophore 1-2 mm long. Ovary cylindrical, sessile, reduced, 2.5 mm long. Fruit cylindrical, tapering at both ends, 6-8 cm long, longitudinally striated. Seeds numerous, globular, surface with concentric rings.

Fl. & Fr. : July - Aug. In most of the districts of West Bengal.

The roots are used for curing tumours, ulcers, pain, earache, spleen enlargement and bilious fevers. The leaves are applied on boils to prevent pus formation.

2. **Cleome monophylla** L., Sp. Pl. 672. 1753; Hook.f. & Thoms. in Hook. f. *l.c.* 168; Prain, *l.c.* 149; Raghavan in Sharma *et al.*, *l.c.* 312. "Harhara" (Sant.).

Erect herbs. Stems longitudinally striate. Leaves simple, oblong-lanceolate, 4-4.5 × 1.5-1.9 cm. Flowers in long erect racemes; bracts leafy, small; pedicel 5-6 mm long. Sepals linear, acute, 3-5 mm long. Petals obovate, clawed, 9-10 × 4-5 mm. Stamens 6, free, filaments slender, 1 cm long. Gynophore short or absent. Capsules erect, 6-8 cm long, subsessile or shortly stalked, striated, cylindrical, with minute glandular hairs. Seeds numerous, transversely rugose.

Fl. & Fr. : Sept. - Dec. Howrah, Purulia.

Santals use it to restore consciousness when fainted.

3. **Cleome rutidosperma** DC., Prodr. 1:241. 1824; Itis, Brittonia 12: 290. 1960; Raghavan in Sharma *et al.*, *l.c.* 313. *C. ciliata* Schum. & Thonn., Dansk vid. Selsk. Afh. 4:67. 1828.

Erect laxly branched herbs. Leaves trifoliolate, elliptic to oblanceolate, 2-2.8 × 0.5 cm. Flowers borne singly in the axils, 2-2.5 cm. Sepals linear-lanceolate, valvate, 2.2-2.5 cm. Petals oblanceolate-elliptic, 6-6.5 × 2.5-3.5 mm, pinkish.

Stamens 10-12, filaments 8-12 mm, slender; anthers bilobed, ca 6 mm long. Ovary linear-cylindric, glabrous, 6.5-7.5 mm, stigma sessile. Capsules linear, cylindric, long stalked, tapering towards both ends. Seeds many, curved, striate.

Fl. & Fr. : March - April. Howrah, 24 Parganas.

4. *Cleome speciosa* Raf., Fl. Ludovic, 86, 1817; Raghavan in Sharma *et al.*, *l.c.* 316. *Gynandropsis pentaphylla* DC., Prodr. 1:238, 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 171; Prain, *l.c.* 149.

Erect herbs. Leaves 5-7-foliolate, subsessile, lanceolate, 10-12 × 2.5-3 cm. Flowers in terminal racemes, subtended by subsessile leaves. Sepals subulate, 0.8-1 cm long. Petals lanceolate, clawed, 8-12 × 3-5 mm. Stamens 6; filaments filiform, 4-5 mm; anthers linear, attached to androgynophore, latter 6-7.5 mm long. Ovary cylindrical. Fruits linear-cylindric, parallel nerved, 7.5-8 cm long. Seeds curved.

Fl. & Fr. : March - June. Howrah.

5. *Cleome viscosa* L., Sp. Pl. 672, 1753; Hook. f. & Thoms. in Hook. f., *l.c.* 170; Prain, *l.c.* 149; Raghavan in Sharma *et al.*, *l.c.* 317. "Hurburia" (Beng.).

Fig. 24

Erect herbs densely glandular-hairy. Leaves 3-5-foliolate, petiolate; leaflets 1.5-2.5 × 0.8-1.2 cm, elliptic-oblong or obovate, acute, entire. Flowers in axillary or terminal racemes, 7-9 mm long, yellow. Sepals linear-lanceolate, glandular-pubescent outside, 8 mm long. Petals obovate to oblong-obovate, 8-9 mm long. Stamens 10-15, free, 5 mm long. Ovary densely glandular, sessile, 1.5-2.5 mm long. Seeds many, rugose.

Fl. & Fr. : July - Sept. In most of the districts of West Bengal.

The juice of the plant used for cough and to reduce tumours and inflammations. The juice of leaves gives relief in earache.

3. CRATEVA L. (Crataeva)

Small deciduous trees; branchlets terete with distinct leaf scars. Leaves long petioled, trifoliolate; leaflets shortly stalked or sessile; stipules small, caducous. Flowers large, in terminal racemes, sometimes unisexual. Sepals 4, equal, ovate-spathulate, valvate, deciduous. Petals 4, equal, long clawed, more or less ovate to rhomboid, inserted on a fleshy lobed disc. Stamens numerous; filaments connate with the gynophore; gynophore as long as filaments. Ovary 1-locular with numerous ovules; stigma conspicuous. Fruit a berry, large, 1-celled, many-seeded. Seeds embedded within pulp.

A genus with ca 9 species in the tropics; 3 species in West Bengal.

1. Leaflets ovate-lanceolate, 9-15 cm long, sessile or subsessile; flowers borne terminally; fruits either papillose or warty:



Fig. 24. *Cleome viscosa* L.

2. Petals 1-2.5 cm long; filaments 5-6.5 cm long; fruits 2-5 cm in diam, pericarp warty ... 2. *C. religiosa*
2. Petals 2.5-5 cm, long; filaments 2-2.5 cm long; fruits 1.5-3 cm in diam., pericarp minutely papillose ... 3. *C. unilocularis*
1. Leaflets broadly obovate, 5-5.6 cm long, shortly stalked; flowers borne axillary; fruits glabrous ... 1. *C. adansonii* ssp. *odora*

1. *Crateva adansonii* DC. ssp. *odora* (Buch. Ham.) Jacobs in Blumea 12: 198. 1964; Raghavan in Sharma *et al.*, *l.c.* 322. *C. odora* Buch.-Ham. in Trans. Linn. Soc. 15: 118. 1827. *C. religiosa* var. *roxburghii* (R. Br.) Hook. f. & Thoms. in Hook. f., Fl. Brit. India. 1: 172. 1872.

Small trees. Leaves 3-foliolate, broadly obovate to acuminate 5-5.5 × 2.5-3 cm, thin, coriaceous, shortly stalked, entire, acute. Flowers large, showy, borne axillary, 3.5-4 cm, pedicellate. Sepals 1.5-2.5 cm, deciduous. Petals elliptic, 3-3.5 cm, clawed. Stamens numerous; filaments thin, 4-5 cm. Gynophore long, 3.5-4 cm. Ovary subglobose to elliptic, 3-5 × 2-2.5 mm, stigma short, sessile. Fruit globose on gynophore, about 2.5-5 cm, in diam.

Fl. & Fr. : Jan. - April. Bankura.

2. *Crateva religiosa* Forst. f., Pl. Escul. Ins. Occ. Austral. 45. 1786; Hook. f. & Thoms. in Hook. f., *l.c.* 172; Prain, *l.c.* 151; Raghavan in Sharma *et al.*, *l.c.* 325. *C. macrocarpa* Kurz, J. Bot. 12: 195. 1874. "Barun", "Tiktoshak" (Beng.).

Small trees, branches lenticelled. Leaves 3-foliolate, sub-sessile, ovate-lanceolate, thin, 9-15 × 4-6 cm; petiole 9-11 cm. Flowers showy, bracteate, 1.5-2 cm long, pedicellate. Sepals 4.5-6 × 2-2.5 mm. Petals 1-2.5 cm. Stamens numerous, borne on androphore; filaments thin, 5-6.5 cm. Gynophore present. Ovary cylindrical to ovoid, 3.5-4 mm; stigma pressed and short. Fruit a globose berry, 2-5 cm in diam., pericarp warty. Seeds many, embedded within the pulp.

Fl. & Fr. : April - June. Jalpaiguri.

The leaves are used for the remedy of feet swellings. The leaf juice is used for rheumatism. The bark is useful for urinary complaints.

3. *Crateva unilocularis* Buch. Ham. in Trans. Linn. Soc. 15: 121. 1827; Raghavan in Sharma *et al.*, *l.c.* 325. *C. roxburghii* R. Br. in Deuh & Clapp. Narr. Trav. Disc. Afr. App. 224. 1826.

Small trees. Leaves trifoliolate; petiole 7-8 cm; leaflets oblanceolate 10-11 × 3.5-5 cm, thin, coriaceous, acute, with 7-10 pairs of nerves, shortly stalked. Inflorescence terminal, 5-10-flowered. Flowers pedicellate, 2.5-3 cm. Sepal deciduous, 3-7 mm. Petals 2.5-5 cm, narrowly clawed. Stamens 10-15; filament thin, 2-2.5 cm; androphore 2-5 mm. Gynophore 2.5-5 cm in fruits. Ovary small; stigma sessile. Fruits globose, 1.5-3 cm in diam., pericarp minutely papillose. Seeds many within the pulp.

Fl. & Fr. : April - June. Jalpaiguri.

4. MAERUA Forsk.

Small trees or woody climbers. Leaves simple, elliptic to elliptic-lanceolate or 3-5-foliolate. Flowers borne in terminal or axillary racemes. Calyx tubular, 4-fid, valvate. Petals present or absent, when present, ovate, long clawed. Stamens numerous, exerted, arising from the base of gynophore; filaments filiform, thin; anthers small, bilobed, basifixed. Ovary short, ovules numerous on two parietal placentas. Fruits borne on gynophore, either fleshy moniliform or a globose or ovoid berry, 1-seeded; cotyledons fleshy.

A genus of about 100 species distributed in tropical and South Africa to India; 2 species in West Bengal.

1. Trees; leaves 3-5 foliolate; petals absent; fruits globose to ovoid ... 1. *M. apetala*
2. Climbing shrubs; leaves simple; petals present, fruits moniliform ... 2. *M. oblongifolia*

1. **Maerua apetala** (Roth) Jacobs in Blumea 12:207. 1964; Raghavan in Sharma *et al.*, *l.c.* 329. *Capparis apetala* Roth, Nov. Pl. Sp. Ind. Or. 238. 1821. *Niebuhreria linearis* DC., Prodr. 1:244. 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 171. *Niebuhreria apetala* Dunn in Gamble, Fl. Madras Pres, 1:30. 1957 (repr. ed.).

Small trees. Leaves 3-5 foliolate, 4-6.5 × 1-2.5 cm, elliptic - lanceolate, shortly stalked, 6-7 nerved, reflexed, coriaceous; petiole 6-8 cm. Flowers in terminal racemes, 1.5-2 cm. Sepals free, valvate, 0.5-1 cm. Petals absent. Stamens numerous; filaments thin, 2.5-3 cm. Gynophore in fruit 2-3.5 cm. Ovary short, 1-celled; style long, thin, 2.5-3 cm; stigma capitate, 1.5 mm. Fruit a globose to ovoid berry, 1-1.5 cm in diam.

Fl. & Fr. : Feb. - May. Howrah (planted).

2. **Maerua oblongifolia** (Forsk.) A. Rich. in Tent. Fl. Abyss. 1: 32, t. 5. 1847; Raghavan in Sharma *et al.*, *l.c.* 331. *Capparis oblongifolia* Forsk. in Fl. Aegypt. Arab. 99. 1775. *Niebuhreria oblongifolia* (Forsk.) DC., Prodr. 1: 244. 1823. *M. arenaria* Hook. f. & Thoms. in Hook. f., *l.c.* 171.

Climbing shrubs. Leaves simple, elliptic-ovate, 5.5-6 × 3-4 cm, obtuse, petiolate, entire, coriaceous, 5-7 nerved. Flowers in terminal corymbose racemes, 1.5-2 cm, pedicellate, 0.8-1.5 cm. Sepals 8-13 mm. Petals 12-15 mm, free, ovate, clawed. Stamens numerous, exerted; filaments thin, 1.8-2.5 cm. Gynophore 5 mm. Ovary truncate, 2 mm. Fruit moniliform, 2.5-3 cm in diam.

Fl. & Fr. : June - Sept. Howrah (planted).

5. STIXIS Lour

Small unarmed woody climbers, rarely shrubs; branches lenticellate. Leaves simple, acuminate; petiole incrassate at the apex. Inflorescence a raceme or a

panicle, many flowered, axillary or terminal with caducous bracts; pedicels short. Sepals 6, in two series, valvate, the outer sepals covering the margins of the inner ones, strap-shaped, densely fulvous tomentose on both sides, torus persistent. Corolla absent. Stamens on a short cylindrical androgynophore. Gynophore about equalling the filaments. Ovary subglobose, 3-celled with axillary placenta, each bearing 5-8 ovules. Style simple or trifid. Fruits woody, stalked, ellipsoid. Seed 1, large, embedded in pulp with a thin testa; cotyledons unequal.

A genus of about 7 species distributed from E. Himalaya to Indo-China and Hainan, also reported from W. Malaysia and Sunda Islands; 1 species in West Bengal.

Stixis suaveolens (Roxb.) Pierre, Bull. Soc. Linn. Paris 1. 654. 1887; Raghavan in Sharma *et al.*, *l.c.* 333. *Roydsia suaveolens* Roxb. Pl. Corom. 3: 87. t. 289. 1819; Hook. f. & Thoms. in Hook. f., *l.c.* 180.

Small trees; branches lenticelled, slightly pubescent. Leaves simple 10-14 × 5-6 cm, oblanceolate, coriaceous, glabrous, acuminate, entire. Racemes axillary or terminal. Sepals 8-10 in two series, free, pubescent, 4-5 mm. Petals absent. Stamens numerous, 7-8 mm; anthers bilobed. Carpels 8 mm; style thin, linear; stigma capitate, trifid; ovary semiglobose unilocular, 1-ovuled. Fruit an ovoid drupe, 1.5-2 cm in diam., shortly stalked.

Fl. & Fr. : Oct. Feb. Jalpaiguri.

VIOLACEAE

(S.P. Banerjee & B.B. Pramanik)

A family of about 16 genera and 900 species, cosmopolitan in distribution; 3 genera and 17 species in West Bengal.

1. Herbs, sometimes suffruticose; flowers irregular:
 2. Sepals produced at base3. VIOLA
 2. Sepals not produced at base1. HYBANTHUS
1. Shrubs or small trees; flowers regular 2. RINOREA

1. HYBANTHUS Jacq.

Herbs or undershrubs. Leaves alternate or rarely sub-opposite to opposite; stipules persistent, rarely deciduous. Peduncles articulated. Flowers white, orange or purple, solitary, or several in the leaf axil, or racemose. Sepals subequal. Petals unequal, the anterior petal sometimes small or much enlarged than the rest with prolongation beyond the base, umbonate or somewhat pouch like, spurred. Stamens free or coherent; anthers free or more or less united, 2 of them gibbose or spurred. Style clavate, anteriorly incurved; stigma oblique, anteriorly directed. Capsules 3-valved.

A genus of ca 150 species, chiefly in the tropical or sub-tropical areas of America, Africa, Asia and Australia; 1 species in West Bengal.

1. **Hybanthus enneaspermus** (L.) F.v. Muell., *Fragm. Phyt. Austr.* 10: 81. 1876; Banerjee & Pramanik in Sharma *et al.*, *Fl. India* 2:343.1993. *Viola enneasperma* L., *Sp. Pl.* 2: 937. 1753. *Ionidium suffruticosum* (L.) Roem. & Schult. *Syst. Veg.* 5: 394. 1819; Hook. f. & Thoms. in Hook.f., *Fl. Brit. India* 1: 185. 1872; Prain, *Bengal Pl.* 1: 152. 1963 (repr.ed.). "Nunbora" (Beng.); "Ratnapuras" (H); "Tondi-sol", "Bir-surajmukhi" (Sant.). **Fig. 25**

Annual or perennial herbs, spreading or half erect, very variable in habit and in leaf form. Stems pubescent, branched near the base; branches nearly simple. Leaves variable, sessile, oblong-lanceolate, mucronate, crenate or serrate, 2.5- 5(-7) × 0.3 - 0.8 (-1.2) cm, lower leaves broader than upper ones; stipules 1-2 mm long, subulate. Peduncles 1-2.5 mm long, shorter than the leaves, bi-bracteolate. Flowers red, axillary, solitary. Sepals 2- 4 mm long, subequal, triangular, acuminate. Petals variable, 4, oblong, acute or mucronate, 2-4 mm long, the lower petals nearly orbicular, obtuse, reticulate, 6-18 mm long.

Fl. & Fr. : Throughout the year. Throughout the plains of West Bengal.

The plant is reported to possess tonic, diuretic and demulcent properties.

2. RINOREA Aubl.

Shrubs or small trees. Leaves alternate or rarely opposite, entire or serrate; stipules deciduous. Peduncles articulated. Flowers regular, solitary or usually racemose, cymose or paniculate, rarely arranged in axillary or terminal cymes. Sepals almost equal, rigid, ciliate. Petals isomorphic or subequal, free, sessile. Stamens inserted on the margin of an angular disc; connective produced into a long or short often broad membranous appendage. Ovary tricarpellary; ovules 1-3, rarely numerous; style straight; stigma terminal. Capsules 3-valved, few-seeded. Seeds rarely woody with leather like testa.

About 200 species, distributed in Sri Lanka, Bangladesh, Burma, Malaysia, Indonesia to N. Australia, Tropical America, Africa, Malagasy; 1 species in West Bengal.

Rinorea heteroclita (Roxb.) Craib, *Fl. Siam. Enum.* 1 : 89. 1925; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 348. *Vareca heteroclita* Roxb. *Fl. Ind.* 2: 446. 1824. *Alsodeia roxburghii* Hook. f. & Thoms. in Hook. f., *l.c.* 186.

Small shrubs; branchlets fulvous puberulous, spreading, bifarious, striate. Leaves sessile, elliptic-lanceolate, 2.5- 6 × 1.5-2 cm, cuneate at base, obtuse to apiculate at apex, more or less crenate, glabrous, perforate at nerve axils beneath, tertiary nerves obsolete; stipules 2-4 mm long, subulate, keeled, acute. Flowers 2-3 mm long, white, sessile, axillary, fascicled. Sepals 2 mm long, unequal, obtuse. Petals 4-5 mm long, lanceolate, revolute above. Stamens exserted; filaments slender; anthers white, cohering into a cone, tomentose at base; connective appendage oblong. Style as long as stamens, villous in the middle. Capsules subglobose, 5 mm long, tapering towards apex. Seeds 1 - 4, ca 3 mm long, ellipsoid.

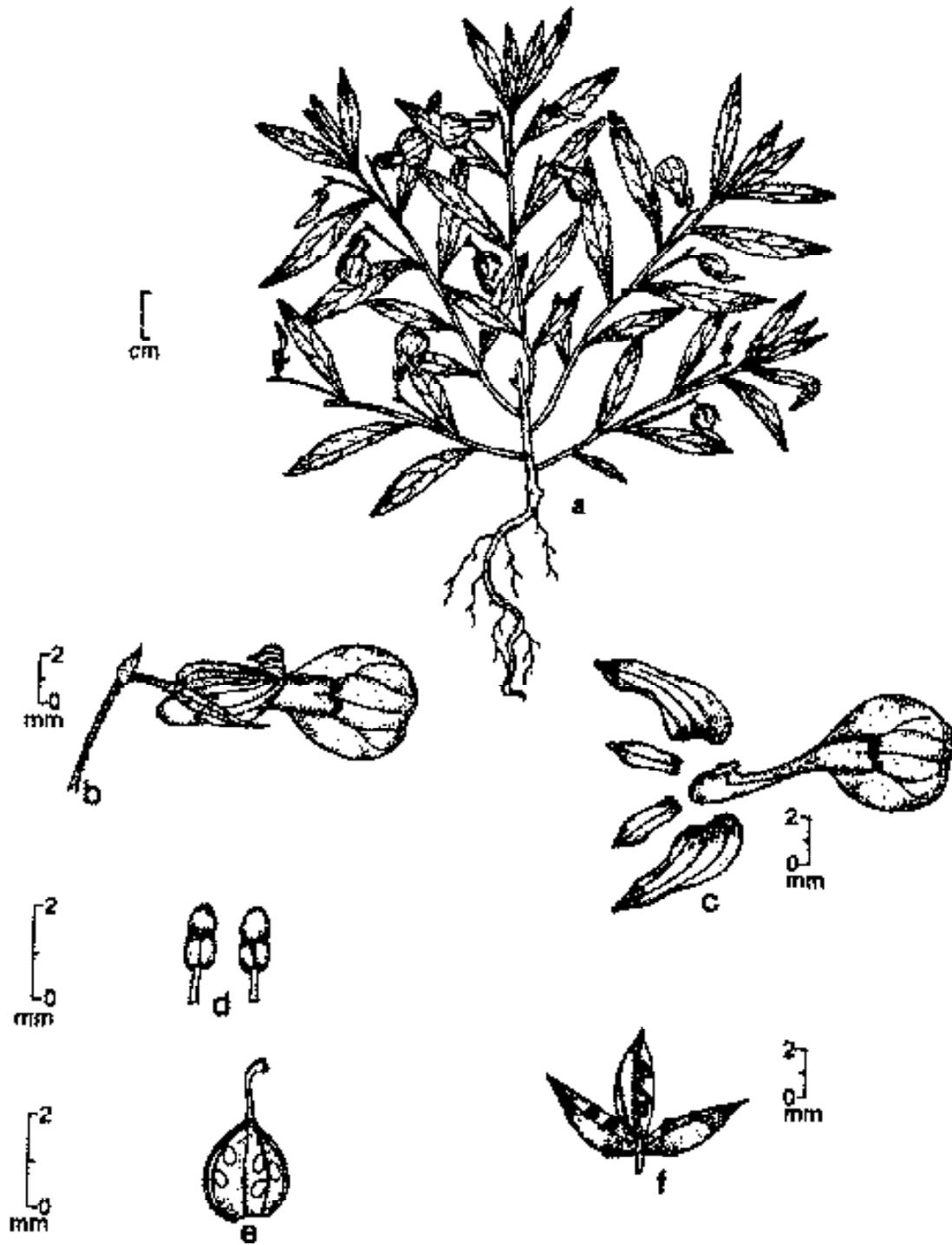


Fig. 25. *Hybanthus enneaspermus* (L.) F. v. Muell. : a. plant; b. flower; c. petals; d. stamens; e. pistil; f. capsule, dehiscent.

Fl. & Fr. : March - Oct. Hooghly.

The occurrence of this species in different localities could not be confirmed due to scanty materials. Kanjilal *et al.*, (*l.c.*) noted it from Bihar although not mentioned in Haine's work. They say "appears to have spread from Bengal to South Shylet, Wallich." In Wallich's Numerical list the place of collection is not mentioned. On a sheet in Cambridge, Jacobs (*l.c.*) found W. Gr. (W. Griffith), Serampore. No other collection is available in K & BM except the type.

3. VIOLA L.

Herbs, often suffruticose, rarely shrubby. Leaves alternate, entire to pinnatisect, free or adnate to petiole. Flowers irregular, 1-2 on long axillary bi-bracteolate non-articulate peduncles, often dimorphic, normal or cleistogamous. Sepals persistent. Petals erect or spreading, the lowest usually largest, spurred. Anthers 2-celled, sub-sessile, connivent around the gynoecium, each tipped with a small triangular appendage, the connectives of the lower two often produced into spurs within the spur of the corolla. Style straight or curved, often geniculate at base, filiform to clavate; stigma obtuse, lobed or triangular marginate. Fruit 3-valved, loculicidal capsule.

About 500 species, chiefly in the temperate regions throughout the world; 14 species and 1 subspecies in West Bengal.

1. Stigma beaked, triangular marginate, truncate or sub-truncate:
 2. Plants with superterranean decumbent or ascending stems or stolon; stipules free from petioles:
 3. Stipules entire or with a few short teeth; top of style with two laterally patent lobes:
 4. Leaves cordate-reniform; petioles not or scarcely winged:
 5. Stems with underground tubers ...3. *V. bulbosa*
ssp. *tuberifera*
 5. Stems without underground tubers ...7. *V. hamiltoniana*
 4. Leaves elliptic ovate to oblanceolate; petioles winged ...5. *V. diffusa*
 3. Stipules with long acute teeth or fimbriate; top of the style without laterally patent lobes:
 6. Leaves ovate or ovate-oblong base deeply cordate:
 7. Peduncles bi-bracteolate at or below the middle :
 8. Leaves canescent, obtuse ...4. *V. canescens*
 8. Leaves pilose or glabrous, acute to long acuminate ...11. *V. pilosa*
 7. Peduncles bi-bracteolate above the middle:
 9. Petal spur up to 2 mm long ...12. *V. plucida*

9. Petal spur 3-5 mm long ...14. *V. thomsonii*
6. Leaves ovate-orbicular, base weakly cordate:
10. Peduncles bi-bracteolate at or below the middle ...6. *V. glaucescens*
10. Peduncles bi-bracteolate above the middle:
11. Lamina silvery white beneath, veins raised below ...13. *V. sikkimensis*
11. Lamina not silvery white beneath, veins not raised below ...8. *V. hookeri*
2. Plants without superterranean stems or stolon; stipules more or less adnate to the petiole:
12. Leaves deltoid or deltoid ovate, rather acute, usually with a truncate shallowly cordate base and widely divergent basal lobes:
13. Calycine appendages up to 5 mm, incised, about 1/2 as long as sepals ...9. *V. inconspicua*
13. Calycine appendages up to 2 mm, rounded, nearly 1/3 as long as sepals ...1. *V. betonicifolia*
12. Leaves ovate-oblong to orbicular, often broadly rounded at apex with a somewhat deeply cordate base and little divergent or subconverging basal lobes ...10. *V. paravaginata*
1. Stigma not beaked, of two laterally patent lobes:
14. Spur 2 mm long; sepals linear-oblong, obtuse ...2. *V. biflora*
14. Spur 5-6 mm long; sepals subulate, acute ...15. *V. wallichiana*

1. ***Viola betonicifolia*** J.E. Smith in Rees, Cyclop. 37, Lno.7, 1817; Jacobs & D.M. Moore in Steenis, Fl. Males. 7:202, 1971; Banerjee & Pramanik in J. Bombay Nat. Hist. Soc. 8(2) : 521, 1984; in Sharma *et al.*, *l.c.* 355. *V. patrinii sensu* Hook.f. & Thoms. in Hook. f., Fl. Brit. India 1: 183, 1872; *p. max. p., non* DC. (1824); Banerjee & Pramanik, *l.c.* 521; Hara in Ohashi, Fl. East. Himal. 2:82, 1971.

Leaves deltoid-ovate to linear lanceolate, 2-8 × 1-3 cm, deeply to shallowly crenate, sub-cordate or truncate at base, glabrous to more or less pubescent; petioles 4-10 cm, usually winged above. Peduncles 5-15 cm, bi-bracteolate at the middle. Flowers up to 1.5 cm across, lilac. Sepals 4-6 mm long, lanceolate. Petals up to 1 cm long, obovate-oblong, laterals bearded at base, spur 2-4 mm long.

Fl. : Jan.-April; *Fr.* : March -June; often throughout the year. Darjeeling, Jalpaiguri.

Plants are bruised and applied to ulcers and sores. Flowers in China, Indo-China and Malaya are said to be used to purify blood.

2. **Viola biflora** L., Sp. Pl. 2: 936. 1753; Hook.f. & Thoms. in Hook. f., *l.c.* 182. (excl. syn. *V. wallichiana* Ging. and *V. reniformis* Wall. ex Royle); Banerjee & Pramanik in Sharma *et al.*, *l.c.* 357.

Herbs, glabrous or pubescent. Root-stock slender. Stem 6-30 cm long, erect or decumbent. Leaves reniform to broadly ovate cordate, crenate, 1-6 × 0.8-4 cm, glabrous to hirsute; petioles 1-6 (-10) cm long, slender; stipules up to 8 mm long, ovate denticulate, sometimes leafy. Peduncles 1-10 cm long, bi-bracteolate above the middle. Flowers 1.5 cm across, spreading, yellow. Sepals up to 7 mm long, linear-oblong, obtuse. Petals 1.5 cm long, elliptic-obovate, the lower petal streaked with black and brown purple nerves, spur 2 mm long, saccate. Stigma 2-lobed, lobes short, spreading. Capsules up to 1 cm, oblong.

Fl. : April - Aug.; *Fr.* : July - Oct. Darjeeling.

Plants medicinal; roots emetic, flowers antiseptic, leaves laxative.

3. **Viola bulbosa** Maxim. ssp. **tuberifera** (Franch.) W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34: 418. 1917; Hara in Fl. East. Himal. 2: 82. 1971; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 358. *V. tuberifera* Franch. in Bull. Soc. Bot. France 33: 410. 1886 et in Pl. Delavay. 70.1.19a. 1889.

Herbs, glabrous to pilose, stem 1-6 cm from a bulb 4-6 mm in diam., stoloniferous. Leaves orbicular reniform, 1-3 cm broad, rounded obtuse or broadly ovate, cordate at base, crenate; petioles 1-4 cm long, somewhat winged above; stipules up to 1 cm, oblong, acuminate, entire somewhat adnate at the base. Peduncles up to 6 cm, bi-bracteolate above the middle. Flowers 7 mm long, lower spurred, spur 2 mm. Style clavate, narrowed downwards from a shortly winged and minutely beaked stigma. Capsules 4 mm in diam., sub-globose.

Fl. & Fr. : May - June. Darjeeling (Hara, *l.c.*).

4. **Viola canescens** Wall. in Roxb. Fl. Ind. 2: 450. 1824; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 359. *V. serpens* var. *canescens* Hook. f. & Thoms in Hook. f., *l.c.* 184.

Herbs, all parts covered with glaucous pubescens (canescent). Rootstock short, cylindric or absent. Stems often none, or producing runners instead of leafy stolons. Leaves ovate-cordate to sub-reniform, 1.5-4 × 1.5-5 cm, obtuse, serrate-crenate, both sides canescent; petioles 2-10 cm long, retrorse-pubescent; stipules up to 1 cm long, lanceolate, deeply fimbriate. Peduncles up to 10 cm long, bi-bracteolate at about the middle. Flowers 1.5 cm in diam, pale violet. Sepals 6 mm long, oblong, acute, pubescent, trinerved. Petals upto 1.6 cm long, obovate - oblong, the lowermost shorter than the rest, terminating in a 3 mm long spurs. Ovary villous; style clavate; stigma truncate, oblique. Capsules 4 mm in diam., subglobose, pubescent.

Fl. & Fr. : March - Oct. Darjeeling.

5. **Viola diffusa** Ging. in DC., Prodr. 1: 298. 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 183; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 361.

Herbs, perennial; more or less hirsute, rarely glabrous. Rhizome slender, fibrillose; stolons up to 15 cm long, producing dense rosettes of leaves and flowers. Leaves elliptic-ovate, oblanceolate or spatulate, hirsute, 1.5-5 cm x 0.8-2 cm, apex obtuse to acute, base decurrent, rarely shallowly cordate; petioles 1.5-7 cm long, winged; stipules 6-10 mm long, lanceolate, acute, dentate to fimbriate. Flowers 8 mm across, pale purple to nearly white; peduncles 1.5-6 mm long, bi-bracteolate about the middle. Sepals 5 mm long, lanceolate, sparsely hairy. Petals ca 1 cm long, ovate-oblong, laterals not bearded, spur 1-2 mm, obtuse. Style clavate, slightly geniculate at base; stigma with two lateral lobes. Capsules 4-6 mm, ellipsoid, glabrous.

Fl. & Fr. : Feb. - Aug. Darjeeling.

6. *Viola glaucescens* Oudem. in Miq. Ann. Mus. Bot. Lugd. Bat. 3:74. 1867; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 362. *V. distans* var. *fimbriata* Hook. f. & Thoms. in Hook. f., *l.c.* 184.

Herbs, almost glabrous. Rootstock slender, articulated; stolons up to 20 cm long, slender. Leaves orbicular-cordate, 2-4.5 x 1.3-3.5 cm, acute to subacuminate, basal sinus moderately wide, margin broadly and evenly crenate, glabrous or sparsely hispid above; petioles up to 10 cm long, slender; stipules up to 1.5 cm long, ovate-oblong, acuminate, lacerate or fimbriate. Peduncles up to 8 cm long, bi-bracteolate at the middle. Flowers 1-1.5 cm across, white or rose-purple. Sepals 5 mm long, lanceolate, acute. Petals 1 cm long, orbicular or obovate, laterals barbate, spur 3 mm long, saccate. Styles clavate, marginate and shortly beaked at the apex. Capsules 8 mm long, oblong, apiculate. Seeds globose, light-brown.

Fl. & Fr. : Throughout the year. Darjeeling.

7. *Viola hamiltoniana* D. Don., Prodr. Fl. Nep. 206. 1825. (Feb.); Banerjee & Pramanik in Sharma *et al.*, *l.c.* 363. *V. distans* Wall. in Trans. Med. Phys. Soc. Cal. 7: 227. 1835; Hook. f. & Thoms. in Hook. f., *l.c.* 183. *V. distans* var. *acaulis* Hook. f. & Thoms. in Hook. f., *l.c.* 184.

Herbs, glabrous. Rootstocks slender. Stems or stolons trailing upto 30 cm, often bearing leaves and flowers. Leaves usually as broad as long, sometimes broader than long, ovate to reniform-cordate, 1-5 x 1-4.5 (-6) cm, basal sinus broad, obtuse or rather acute, crenate-serrate, glabrous to hirsute; petioles 1-8 cm long, glabrous; stipules up to 2 cm long, subentire with a few short teeth to fimbriate. Peduncles 1-8 (-12) cm, bi-bracteolate above the middle. Flowers 1-1.5 cm in diam., white to light violet. Sepals 5 mm long, ovate-lanceolate, acute. Petals 1 cm long, obovate-oblong; spur 4 mm long, saccate. Styles more or less geniculate at base, sub-clavate; stigma of 2 small laterally patent lobes with stigmatic beak projecting anteriorly between lobes. Capsules 1 cm long, glabrous, oblong, many-seeded.

Fl. & Fr. : March - June, often throughout the year. Darjeeling.

8. **Viola hookeri** Thoms. in Hook. f., *l.c.* 183, *p. max. p.* emend. W. Beck. in Beih. Bot. Centralbl. Abt. 2. 34 : 259. 1916; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 364.

Herbs, glabrous or younger parts pilose. Rootstock slender, warted; stems and stolons short. Leaves radical, orbicular-reniform to ovate-cordate, 1.5-4 × 1.5-3.5 cm, apex rounded, rarely sub-acute, broadly crenate, basal sinus deep, lobes touching or overlapping, glabrous; petioles up to 10 cm long, not winged; stipules up to 12 mm long, lanceolate, acuminate, toothed or lacerate, tips glandular. Peduncles up to 7 cm long, bi-bracteolate above the middle. Flowers 1 cm across, white with purple veins. Sepals 5 mm long, lanceolate, obtuse. Petals 1 cm long, oblong-ovate, minutely puberulous, lower spurred, spur 3 mm long, saccate. Styles sub-clavate, narrowed downwards from the obscurely beaked stigma. Capsules 5 mm long, valves apiculate, glandular.

Fl. : April - June; *Fr.* : July - Aug. Darjeeling.

9. **Viola inconspicua** Bl., Cat. Gew. Buitenz. 57. 1823; Hara in Fl. East. Himal. 212. 1966; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 365. *V. apetala* Roxb., Fl. Ind. 2: 449. 1824; Hook. f. & Thoms. in Hook. f., *l.c.* 185.

Herbs, perennial. Rootstock thick, elongate, densely articulated. Stems and stolons absent. Leaves in rosette, triangular hastate or sagittate, 1.5-6 × 1-4.5 cm, subcordate at base, crenulate or serrate, apex acute or roundish obtuse; petioles 1-10 (-13) cm long; stipules 7-9 mm long, lanceolate, acuminate, sparsely dentate, adnate up to above the middle. Peduncles 1-10(-15) cm, 1-flowered, bi-bracteolate above the middle. Flowers generally apetalous and cleistogamous, rarely perfect, up to 1.5 cm across, pale purple. Sepals 5 mm long, ovate-lanceolate, acuminate, glabrous, appendage 1.5 mm long, roundish. Petals when present up to 12 mm long, obovate-oblong, laterals bearded at base, spur 3 mm long, cylindrical, obtuse. Styles geniculate at base, clavate, marginate and beaked at the apex. Capsules up to 1 cm long, ellipsoid to oblong, glabrous.

Fl. & Fr. : Jan. - June. Darjeeling.

10. **Viola paravaginata** Hara in J. Jap. Bot. 43:47. 1968 et Fl. East. Himal. 2: 82. 1971; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 371.

Rootstock 3-7(-12) cm long, 4-7 mm thick, articulated; roots numerous. Stems or stolons absent. Leaves rotundate to ovate-cordate, 2-5.5 (-9) × 2-4 (-7) cm, apex abruptly acuminate, base deeply cordate, pilose above; petioles 3-12 (-16) cm long; stipules oblong-ovate, 6-10 mm long, glandular ciliate, brown. Peduncle 5-8(-13) cm long, bi-bracteolate below the middle. Flowers 1 cm across, white to purplish. Sepals 3-4 mm long, oblong-lanceolate. Petals ca 1 cm long, oblong-obovate, laterals not bearded at base; spur short, 2 mm long. Stigma beaked. Capsules up to 1 cm long; oblong-ovate, apiculate, glabrous, purple spotted. Seeds yellowish brown.

Fl. : April - June; *Fr.* : June - Oct. Darjeeling.

11. **Viola pilosa** Bl., Cat. Gew. Buitenz. 57. 1823 et in Bijdr. 57. 1825; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 371. *V. serpens* Wall. ex Ging. in

DC., Prodr. 1: 296. 1924; Hook.f., and Thoms. in Hook. f., *l.c.* 184. *V. serpens* var. *confusa sensu* Hook. f. & Thoms. in Hook. f., *l.c.* 184. *non* Benth. 1851. "Banalsa" (H. & Purj.).

Herbs, prostrate, variable, pilose to glabrous. Stems or stolons usually long, leafy and flowering. Leaves ovate to deltoid, 1.5-8 × 1-6 cm, cordate, sub-acuminate to long acuminate, serrate, mostly hirsute or pilose, sometimes glabrous; petioles 2-10 cm long, pubescent; stipules 6-15 mm long, ovate, acuminate, subentire to dentate. Peduncles 3-8 cm, pilose, bi-bracteolate at below or rarely above the middle. Flowers 1-2 cm across, white or pale violet. Sepals 5 mm long, linear-lanceolate, acute, appendage 3 mm long, pointed. Petals 1.5 cm long, obovate-oblong, laterals bearded at base, lower spurred up to 5 mm long. Styles sub-clavate, sub-truncate and shortly beaked at apex. Capsules 5 mm in diam., ellipsoid.

Fl. : March-May; *Fr.* : May-July, often throughout the year. Darjeeling, Jalpaiguri

Plants medicinal; febrifuge, flowers used in lung troubles, petals made into a syrup and used as remedy for infantile disorders; root emetic.

12. *Viola placida* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 36-58. 1916; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 372.

Herbs acaulescent, hispid-pilose. Rhizome thick, closely articulated. Leaves radical, rounded-ovate, 1-1.5 cm across, acuminate, densely hispid, deeply cordate at base, margins rotundate-crenate; petioles *ca* 3 cm long, retrorsely hispid-pilose; stipules 6-8 mm long, free, lanceolate to triangular-ovate, hairy on both sides, margins glandulose-fimbriate-ciliate. Peduncles scarcely exceeding the leaves, retrorse-hispid bi-bracteolate above the middle. Flowers small, lilac. Sepals narrowly oblong, hispid, appendages sub-rotundate, hispid. Petals up to 5 mm long, oblong, laterals hairy, lowest petal somewhat boat shaped with 2-3 mm long spur. Ovary glabrous; styles geniculate at base, subclavate, horizontally passing into a submarginate shortly beaked stigma. Fruit not seen.

Fl. : May. Darjeeling.

13. *Viola sikkimensis* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34: 260. 1916; Hara in Fl. East. Himal. 213. 1966; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 374. *V. hookeri* Thoms. in Hook. f., *l.c.* 183. *p.p. (quoad spec. Sikkim. J.D. Hooker).*

Fig. 26

Herbs, stoloniferous, stolons up to 18 cm. Rootstock slender, densely articulated. Leaves ovate-rotundate, deeply cordate, 1.5-5 × 1.5-3.5 cm, rotundate-crenate, glabrous, silvery grey beneath; petioles up to 8 cm long, not winged; stipules up to 1 cm long, scarious, lanceolate, acuminate, long fimbriate. Peduncles up to 9 cm long, bi-bracteolate above the middle. Flowers 1 cm across. Sepals 5 mm long, lanceolate, acute. Petals 1 cm long, oblong or obovate, lower spurred, spur 2 mm long. Styles subclavate, narrowed downwards from the marginate obscurely 3-lobed beaked stigma. Capsules up to 5 mm long, oblong, valves apiculate.

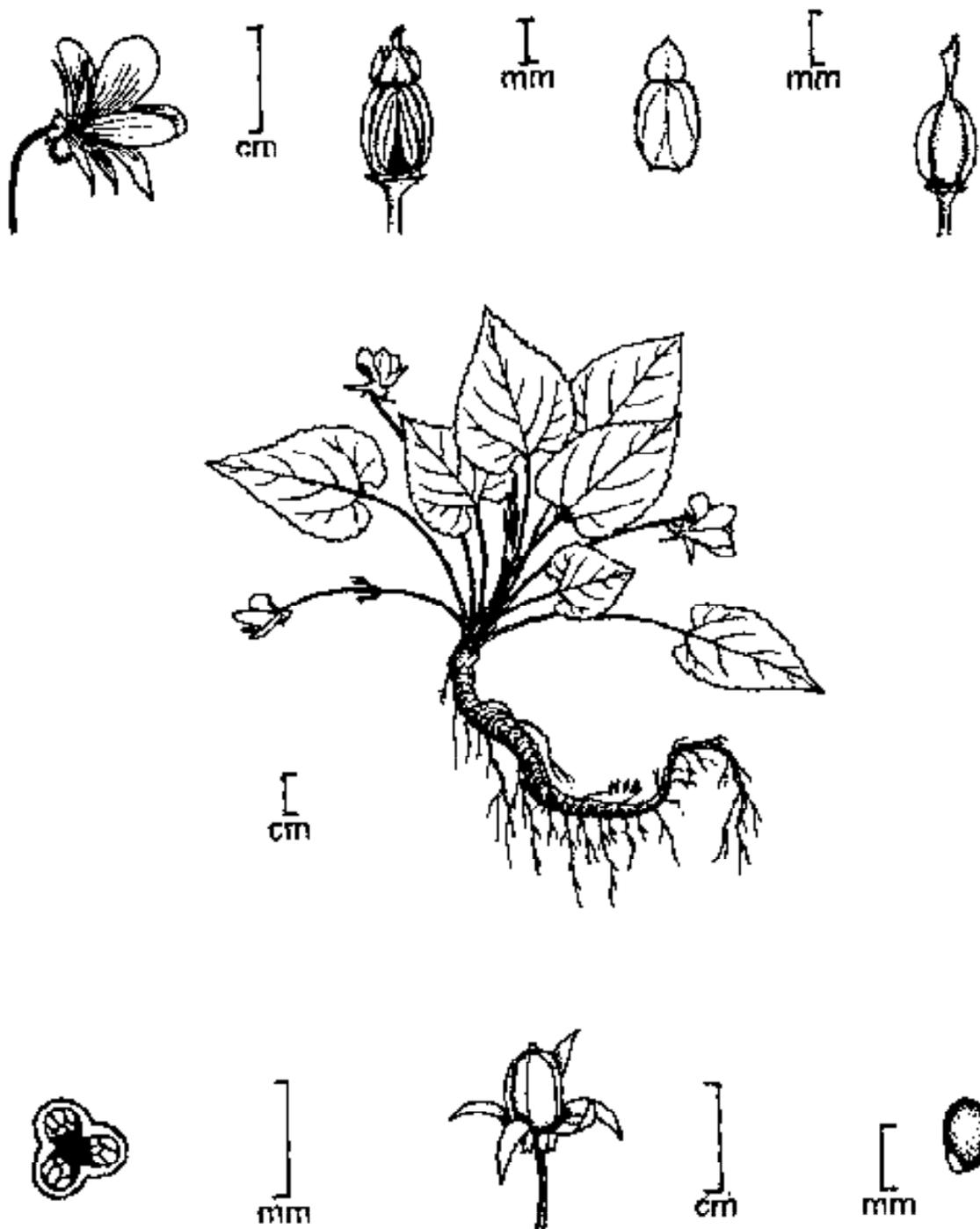


Fig. 26. *Viola sikkimensis* W. Beck.

Fl. : March - June; *Fr.* : July - Oct. Darjeeling.

14. ***Viola thomsonii*** Oudem. in Miq. Ann. Mus.Bot. Lugd. Bat. 3:74. 1867; Hara in Fl. East. Himal. 213. 1966; Banerjee & Pramanik in Sharma *et al.*, *l.c.* 377.

Herbs, glabrous. Rootstock slender, articulated; stolon up to 20 cm long, slender. Leaves ovate-cordate to sagittate, acute, 2-7 × 1.5 - 4 cm, serrate-crenate, glabrous to sparsely strigose; petioles 2-12 cm long, slender, glabrous; stipules up to 1.5 cm long, lanceolate, deeply fimbriate. Peduncles up to 13 cm long, not exceeding leaves, bi-bracteolate above the middle, bracteoles up to 1.5 cm long, linear, acuminate with a few teeth at the margin. Flowers 1.5 cm long. Sepals 6 mm long, lanceolate, acute. Petals 1.5 cm long, pale violet, obovate-oblong, lower petals spurred, spur 3-4 mm long, saccate. Styles geniculate at base, narrowed downwards from dilated apex; stigma marginate and shortly beaked. Capsules 1 cm long, oblong, apiculate.

Fl. & Fr. : March - Sept. : often throughout the year. Darjeeling.

15. ***Viola wallichiana*** Gingi in DC., Prodr. 1:300, 1824; Para in Bull. Univ. Mus. Univ. Tokyo 8:84. 1975; Banerjee & Pramanik in Sharma *et. al.*, *l.c.* 378. *V. reniformis* Wall. in Roxb., Fl. Ind. 2:451. 1824.

Herbs, glabrous. Stems 5 - 15 (-25) cm, erect or decumbent. Leaves cauline, ovate - cordate to reniform, 0.7 - 2.5 (- 4.5) × 1-3 (-5) cm, crenate, glabrous; petioles 0.5 - 6 cm long, slender; stipules 3 mm long, ovate- denticulate. Peduncles 0.8 - 5 cm long, bi-bracteolate above the middle. Flowers 1 cm across, yellow. Sepals 5 mm long, subulate, acute. Petals 1 cm long, elliptic-obovate. Lower spurred; spur 5-6 mm long, linear, obtuse. Stigma bi-lamellate, lobes spreading. Capsules 4 mm long, oblong, apiculate.

Fl. & Fr. : May - Sept. Darjeeling.

BIXACEAE (G. Sen Gupta)

A family with only one genus and 3-4 species, mostly confined to tropical America, but widely naturalised pantropically; 1 species in West Bengal.

1. BIXA L.

Shrubs or small trees with red sap. Leaves simple, palmately-veined, stipulate; petioles long. Flowers in terminal panicles. Sepals 5, imbricate, deciduous. Petals 5, large, white, rose or purplish, imbricate and twisted in bud. Stamens numerous; anthers dehiscing by terminal pores. Ovary 1-celled, with 2 parietal placentas, ovules numerous; style 1, stigmas 2. Fruit a 2-valved loculicidal capsule. Seeds numerous, testa fleshy, bright red.

A genus with 3-4 species naturalised pantropically; 1 species in West Bengal.

***Bixa orellana* L.**, Sp. Pl. 512, 1753; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:190, 1872; Prain, Bengal Pl. 1:153, 1963. (repr. ed.); Balakr. in Sharma *et al.*, Fl. India 2:381, 1993. "Latkan" (Beng.); "Kong, Kuuombi" (Sant.); "Gulbas" (Or.).

Fig. 27

Large spreading shrubs or small trees up to 3 m. Leaves ovate-cordate, acuminate, 10-20 × 6-13 cm; petioles 4-7 cm. Flowers 2.5-5 cm in diam. Sepals 2 smaller concave, 3 larger suborbicular. Petals obovate. Fruit a capsule, ovoid or subglobose, ca 3.5 cm across, with soft prickles. Seeds trigonous, rounded or grooved on back, covered with red pulp.

Fl. : July-Sept.; *Fr.* : Oct.-Nov. In most districts of plains up to Tarai.

A dye obtained from seeds is used for colouring butter, ghee, cheese, wool, paint, varnish and soap.

COCHLOSPERMACEAE

(L.K. Ghura)

A family of 2 genera and about 25 species, mostly pantropical; 1 species in West Bengal.

COCHLOSPERMUM Kunth

Trees or shrubs. Leaves digitately lobed or divided. Flowers large, yellow. Sepals 5. Petals 5, large. Stamens many, on an eglandular disc; anther-cells with pores or short slits. Ovary globose, 3-5 celled; style simple, stigma toothed. Capsules 3-5 valved. Seeds cochleate; testa hard, woolly.

***Cochlospermum religiosum* (L.) Alston** in Trimen, Handb. Fl. Ceylon, 6:14, 1931; Balakr. in Sharma *et al.*, Fl. India 2:383, 1993. *Bombax religiosum* L., Sp. Pl. 552, 1753. *C. gossypium* (L.) DC., Prodr. 1:527, 1824; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:190, 1872; Prain, Bengal Pl. 1:153, 1963 (repr. ed.). "Gahdi, Golgol" (Beng.); "Kumhi" (H); "Kontqalas" (U.).

Fig. 28

Trees. Leaves digitately lobed, petiolate, upper glabrous, lower sometimes pubescent, 8-20 cm in diameter; petiole glabrous, slender. Flowers golden yellow in few-flowered terminal panicles, sometimes umbelled. Sepals greenish, 2-2.5 cm, ovate-lanceolate, silky. Petals obovate, 4-5 cm, yellow, notched at the tip. Stamens numerous, on a disc, anthers basifixed, 4-6 mm, acute. Ovary globose; stigma toothed. Capsules glabrous, five-valved. Seeds reniform, hard, silky hairy.

Fl. Feb.-March; *Fr.* : May-July. Purulia.

The stem yields a gum known as Hog-gum. The seeds yield an oil.

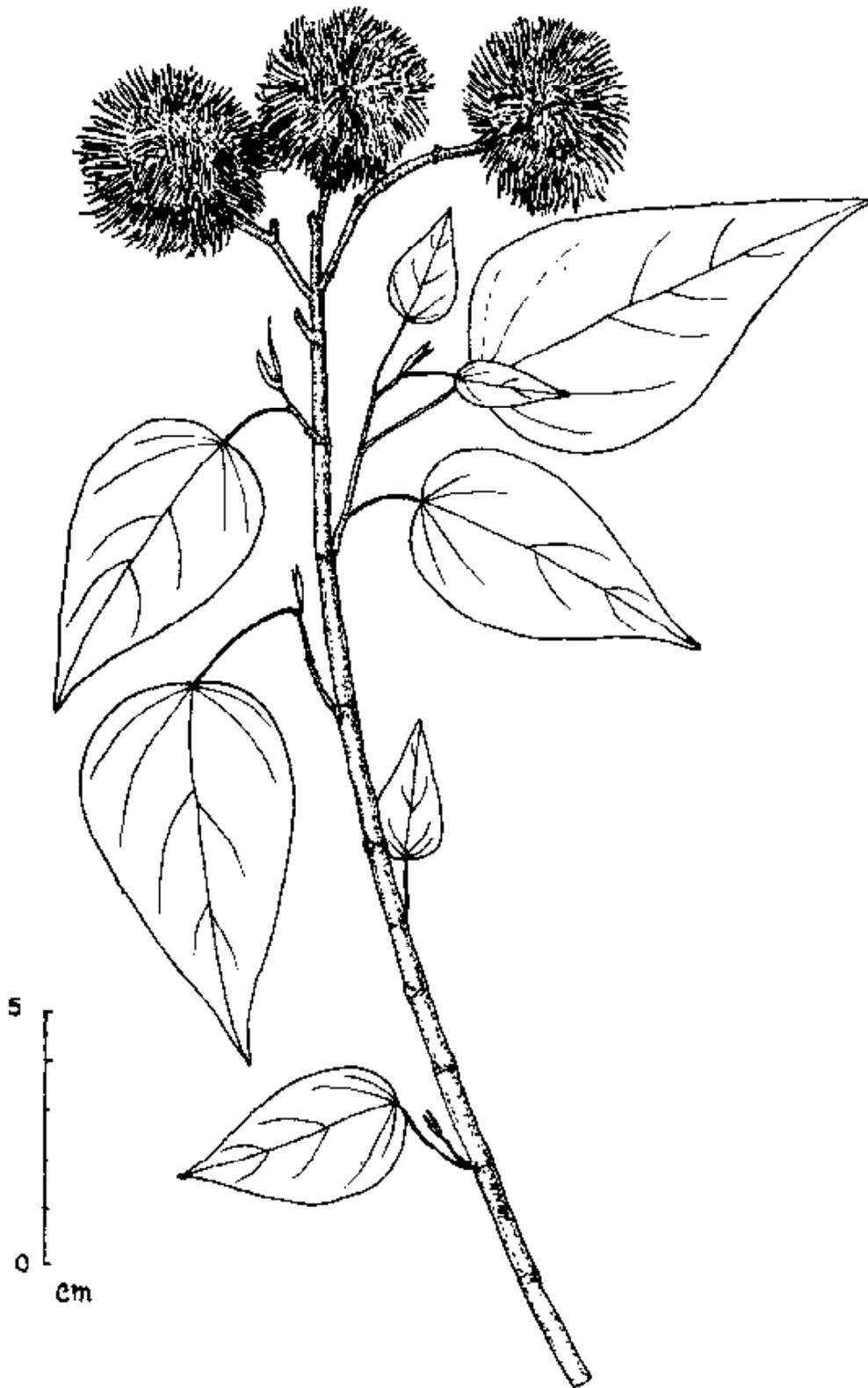


Fig. 27. *Bixa orellana* L.

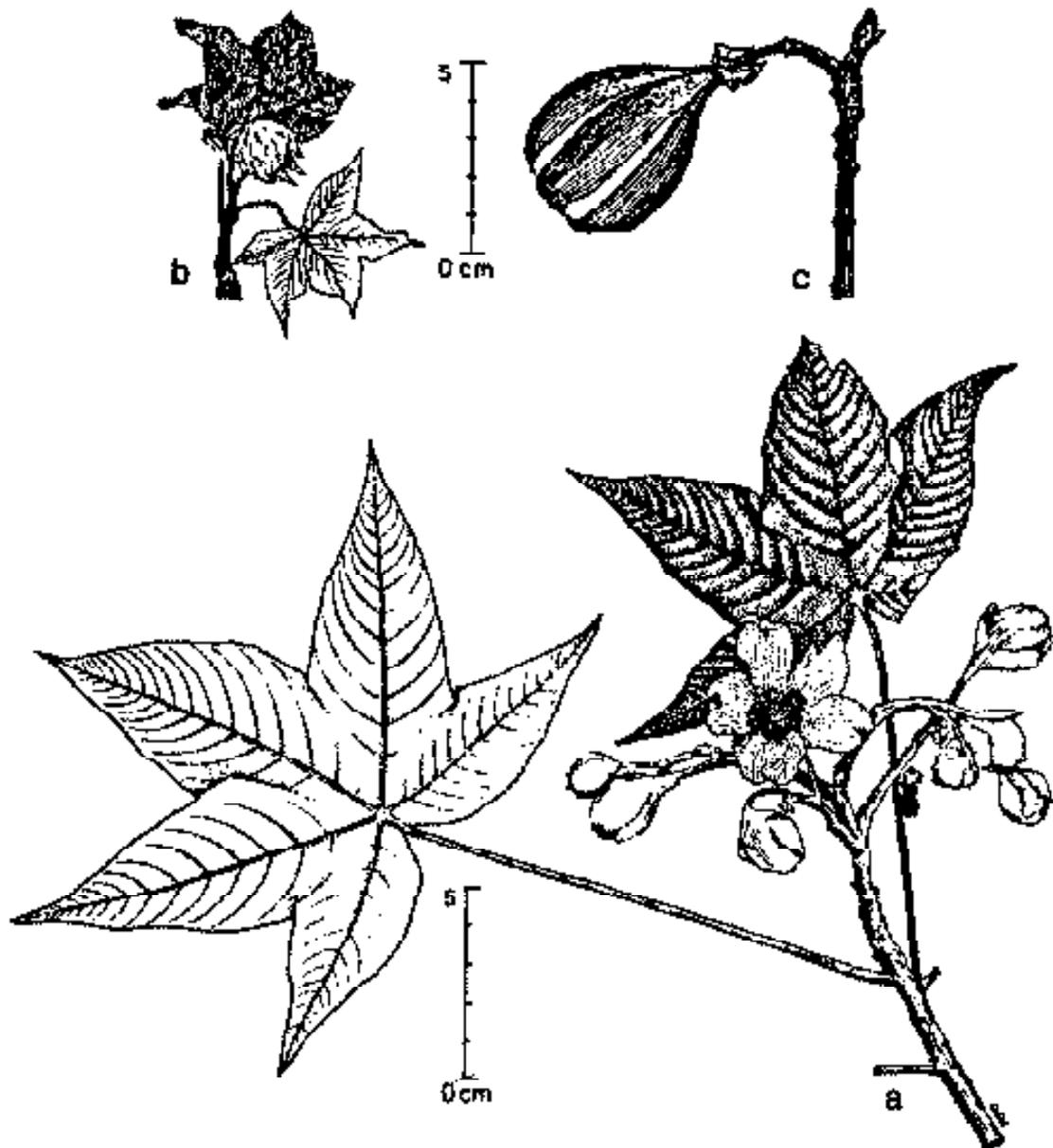


Fig. 28. *Cochlospermum religiosum* (L.) Alston : a. flowering twig; b. new shoot; c. fruit showing dehiscence.

FLACOURTIACEAE

(B.B. Pramanik)

About 84 genera and 1300 species, predominantly in the tropics; 3 genera and 8 species in West Bengal.

1. Plants spinous; ovary 4-6 chambered by false septum ... 2. FLACOURTIA
1. Plants without spines, ovary not as above :
 2. Leaves not gland-dotted; stamens numerous ... 3. GYNOCARDIA
 2. Leaves gland-dotted; stamens 6-10 ... 1. CASEARIA

1. CASEARIA Jacq.

Shrubs or small trees. Leaves alternate, distichous, simple, petioled, pellucid dotted; stipules small, lateral, caducous. Flowers small, greenish yellow, clustered in axillary fascicles; pedicels short, jointed above the base, surrounded by small scales. Calyx 4-5-lobed, persistent, lobes imbricate. Petals absent. Stamens double the number of calyx lobes, united in a tube with staminodes, alternating with the free portion in filaments. Ovary superior, ovoid, unilocular. Capsules globose, ovoid or ellipsoid.

About 160 species in tropical and subtropical America, Africa, Asia, Australia and the Pacific; mostly in lowland rain forest; 5 species in West Bengal.

1. Branchlets downy tomentose :
 2. Leaves lanceolate or oblong-lanceolate ... 3. *C. kurzii*
 2. Leaves oblong :
 3. Pedicels short *ca* 4 mm long, pubescent throughout ... 4. *C. tomentosa*
 3. Pedicels *ca* 6 mm long, glabrous above the articulation ... 5. *C. vareca*
1. Branchlets glabrous :
 4. Pedicels with hairs ... 1. *C. glomerata*
 4. Pedicels without hairs ... 2. *C. graveolens*

1. *Casearia glomerata* Roxb. ex DC., Prodr. 2:49.1825; Clarke in Hook. f., Fl. Brit. India 2:591. 1879; Banerjee in Rec. Bot. Surv. India 19(2) : 25. 1966; White Moore in Hara *et al.*, Enum., Fl. Pl. Nep. 2:48. 1979; Mitra in Sharma *et al.*, Fl. India 2:393. 1993.

Shrubs or trees; branchlets somewhat angular, glabrous, or not but little lenticellate. Leaves lanceolate or elliptic-lanceolate, 10 × 3 cm, denticulate or crenate, often obscurely or minutely, but never quite entire, acute or obtuse; petioles *ca* 15 mm long. Pedicels usually with minute yellow hairs *ca* 4 mm. Calyx small, more or less pubescent in bud. Stamens 7-10; staminodes yellow. Fruits ellipsoid, *ca* 1 cm long.

Fl. : April-May; *Fr.* : Aug.-Sept. Darjeeling.

2. *Casearia graveolens* Dulz. in Hook. J. Bot. 4:107. 1852; Clarke in Hook. f., *l.c.* 592; White Moore in Hara *et al.*, *l.c.* 48; Mitra in Sharma *et al.*, *l.c.* 394.

Shrubs or trees, about 6 m tall; branchlets glabrous. Leaves broadly elliptic, 10 × 6 cm, shortly acuminate, rounded at the base, sometimes leaves narrower, almost lanceolate, and acute at the base; petiole *ca* 2 cm. Pedicels usually short, jointed at or above the base. Calyx always pubescent at base or throughout, or sometimes glabrous. Fruits ellipsoid, *ca* 2 cm long.

Fl. : March-May; *Fr.* : April-Aug. Darjeeling.

3. *Casearia kurzii* Clarke in Hook. f., Fl. Brit. India 2:594. 1879; Mitra in Sharma *et al.*, *l.c.* 396.

Small trees; branchlets minutely pubescent. Leaves lanceolate or oblong-lanceolate, *ca* 12 × 5 cm, narrowed at base with spreading yellow hairs beneath, crenate or nearly entire; petioles *ca* 15 mm long. Pedicels pubescent, very long. Calyx minutely pubescent. Fruits ellipsoid.

Fl. : Oct.-Feb. *Fr.* : Dec.-June. Darjeeling, Jalpaiguri.

4. *Casearia tomentosa* Roxb., Fl. Ind. 2: 421. 1832; Clarke in Hook. f., *l.c.* 593; Mitra in Sharma *et al.*, *l.c.* 397. *Anavinga lanceolata* Lam., Encycl. 1:148. 1783, non *C. lanceolata* Miq. 1844. *C. elliptica* Willd., Sp. Pl. 2:628. 1799, nom. superfl. (based on *A. lanceolata* Lam.). "Maun" (Beng.); "Chilla" "Churcha" (H.).

Small trees, 5-8 m high; young shoots downy tomentose. Leaves oblong, 8-16 × 4-7 cm, glabrous or sparsely puberulent beneath, apex sub-acuminate to obtuse, margin entire or crenulate, base rounded; petioles 4-9 mm long. Flowers in axillary fascicles, greenish white, peduncle *ca* 4 mm long, pubescent. Calyx pubescent or sub-glabrous; tube *ca* 0.7 mm long; lobes usually 5, *ca* 2 mm long, ovate-elliptic, obtuse. Stamens usually 8, rarely 6 or 10; tube very short. Style very short. Fruits ellipsoid, *ca* 15 mm long, shining, 3-valved. Seeds embedded in scarlet pulpy aril.

Fl. : Jan.- April; *Fr.* : March-Oct. Burdwan, Howrah, Murshidabad, Purulia, West Dinajpur.

5. *Casearia vareca* Roxb., Fl. Ind. 2: 418. 1832; Clarke in Hook. f., *l.c.* 593; S.K. Mukerjee in Bull. Bot. Surv. India 7: 135. 1965; Mitra in Sharma *et al.*, *l.c.* 398.

Shrubs; branchlets pubescent. Leaves oblong, *ca* 9 × 4 cm, often somewhat obovate, obtuse, suddenly narrowed but sometimes acuminate, closely serrate, softly hairy beneath; petioles *ca* 6 mm. Pedicels less than 6 mm, glabrous above the articulation, usually jointed above the base. Staminal tube elongate; stamens often 10. Fruits *ca* 1 cm long, broadly ellipsoid, yellow or pinkish yellow. Seeds embedded in bright red pulp.

Fl. : April-June; *Fr.* : Oct.-May. Darjeeling, Jalpaiguri.

2. FLACOURTIA Herit.

Trees or shrubs, often spiny. Leaves simple, toothed or crenate. Flowers small, usually dioecious, rarely hermaphrodite. Sepals 4-5, small, imbricate. Petals absent. Stamens numerous; anthers versatile. Ovary 2-8-celled, on a glandular disc; styles 2 or more; stigmas notched or 2-lobed; ovules usually in pairs on each placenta. Fruit indehiscent with a leathery pericarp; cotyledons orbicular.

About 15 species in Tropical Africa, Asia and Polynesia; 2 species in West Bengal.

1. Spines on the trunk, much branched; fruits more than 1.25 cm across ... 2. *F. jangomas*
1. Spines usually axillary, bearing leaves & flowers; fruits not more than 1 cm across ... 1. *F. indica*

1. **Flacourtia indica** (Burm. f.) Merr., Interpr. Rumph. Herb. Amb. 377.1917; Mitra in Sharma *et al.*, Fl. India 2 : 402. 1993. *Gmelina indica* Burm. f., Fl. Ind. 132, t. 39, f. 5. 1768. *F. ramontchii* L'Herit., Strip. Nov. 3:59, t. 30-30B. 1785; Hook. f. & Thoms. in Hook f., Fl. Brit. India 1:193.1872. *F. sepiaria* Roxb., Pl. Corom. 1:48, t. 68. 1796; Prain, Bengal Pl. 1 : 154. 1963 (repr. ed.). "Boichi" (Beng.). Fig. 29

Much branched dense deciduous thorny shrubs, 1.5-3 m high; thorns 1-4 cm long, simple, sharply pointed, bearing cluster of leaves and flowers. Leaves usually fascicled, in young shoot alternate, very variable in size and shape. 2-7 cm long, glabrous, obovate-orbicular, apex obtuse, margin crenate, base cuneate. Male flowers solitary, or in cluster of 2-3 along with the new shoots coming from the old stem, light yellow due to the many exerted stamens. Sepals usually 5-6, ovate, obtuse. Female flowers solitary, pedicels 4-6 cm long. Sepals orbicular. Disc entire or sub-entire. Styles 3-5, very short, spreading; stigmas bilobed. Fruit ca 1 cm diam., globular, smooth.

Fl. : Jan.-March; *Fr.* : March-May. Hooghly, Howrah, Malda, Midnapur, Purulia.

Plants medicinal.

2. **Flacourtia jangomas** (Lour.) Raeusch., Nom. Bot. ed. 3: 290. 1797; Mitra in Sharma *et al.*, l.c. 403. *Stigmarota jangomas* Lour., Fl. Cochinch. 2: 634. 1790. *F. cataphracta* Roxb. ex Willd., Sp. Pl. 4:830.1806; Hook. f. & Thoms. in Hook. f., l.c. 193; Prain, l.c. 154. "Paniala" (Tripura, Beng., H.).

Shrubs or small spreading trees with smooth brown bark and sharp compound spines, dioecious. Leaves lanceolate, acuminate, toothed with saw like edges, very thin. Flowers minute, greenish. Fruit small, red.

Fl. : March-May (June); *Fr.* : Aug.-Oct. Burdwan.

The fruits are edible.



Fig. 29. *Flavourtia indica* (Burm. f.) Merr.

3. GYNOCARDIA R. Br.

A monotypic genus; distributed in Bhutan, Bangladesh, Myanmar and India.

Gynocardia odorata R. Br. in Roxb., Pl. Corom. 3:95, t. 299, 1820; Hook. f. & Thoms. in Hook. f., l.c. 195; Mitra in Sharma *et al.*, l.c. 407. *Chaulmoogra odorata* Roxb., Fl. Ind. 3: 835, 1832; Prain, l.c. 155.

Large evergreen dioecious trees with slender branches, bark grey and warty outside. Leaves bifarious, oblong, coriaceous, acuminate. Flowers pale yellow in few-flowered axillary fascicles or in large branches from the trunk. Calyx 5-lobed, saucer-shaped, leathery. Petals oblong or ovate, fleshy. Stamens numerous (about 100). Ovary 1-celled; styles 5. Fruit on the trunk, globose with a thick hard rind, minutely lenticelled outside. Seeds *ca* 25 mm long, obovoid or oblong.

Fl. : March-June; *Fr.* : May-Sept. Darjeeling, Jalpaiguri.

Wood used for posts and plankings. Fruit pulp used for poisoning fish. Oil medicinal.

PITTOSPORACEAE

(K.C. Malick)

A family of *ca* 9 genera and 350 species in tropical and subtropical regions; 1 species in West Bengal.

PITTOSPORUM Banks. *ex* Solander, *nom. cons.*

Small trees or shrubs, sometimes epiphytic, branching forked or verticillate. Leaves alternate, often crowded in pseudowhorls towards the ends of branches, exstipulate. Inflorescence terminal, pseudoterminal or lateral. Flowers bisexual, at times functionally unisexual. Sepals free or connate below. Petals free or connivent up to or beyond the middle, segments recurved and spreading. Filaments subulate; anthers opening by longitudinal slits. Ovary 1-locular or incompletely 2-5-locular with parietal placentas or rarely with placentas reaching the middle. Capsules 2-valved or 3-valved; valves thin or woody. Seeds two to many, embedded in pulp.

About 300 species in tropics, subtropics and temperate regions of the old world; 1 species in West Bengal.

Pittosporum napaulensis (DC.) Rehder & Wilson, Pl. Wilson 3:326, 1916; Nayar & Giri in Sharma *et al.*, Fl. India 2:445, 1993. *Senacia napaulensis* DC., Prodr. 1:347, 1824. *Pittosporum floribundum* Wt. & Arn., Prodr. 1:154, 1834; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:199, 1872; non Royle. "Bagh-muta, Kisan" (H.).

Fig. 30

Shrubs or small trees. Leaves elliptic-oblong or elliptic-lanceolate or oblong-lanceolate or oblanceolate, 10-17 × 3-6 cm, glabrous, margins entire or slightly



Fig. 30. *Pittosporum napaulensis* (DC.) Rehder & Wilson

wavy, apex usually acuminate, tapering at base into a slender petiole; petioles 1-3 cm long.

Inflorescence many-flowered, pubescent. Flowers 6-8 mm long; pedicels slender, articulate. Sepals *ca* 2 mm long, broadly ovate or oblong, ciliate. Petals 6-7 × 2 mm, narrowly oblong, apex obtuse. Filaments *ca* 3 mm long; anther 1.5 mm long. Ovary brownish pubescent; styles glabrous. Capsules 6-8 mm in diam., 2-valved, globose, rugose when dry. Seeds 4 to 8 attached to midrib of carpels near base, oblong, flat.

Fl. & Fr. : April-July. Darjeeling.

Decoction of bark has ginger-like smell and is used in skin diseases and chest infections.

POLYGALACEAE

(R. N. Banerjee)

A family of *ca* 12 genera and 800 species, mostly temperate and tropical; 2 genera and 10 species in West Bengal.

1. Flowers pedicellate; sepals unequal, 2 interior sepals alaeform; middle lobe of the petals usually crested; filaments 8, fruits pedicellate; seeds pilose ...1. POLYGALA
1. Flowers sessile; sepals nearly equal, petaloid; petals not crested; filaments 4-5; fruits sessile; seeds glabrous ...2. SALOMONIA

1. POLYGALA L.

Annual or perennial herbs or undershrubs, rarely shrubs. Leaves simple, usually alternate; bracts and bracteoles persistent or caducous. Sepals 5, unequal, sometimes persistent. Petals 3-lobed, adnate to median petal(keel) along with margins, adnate to staminal sheath at base, median petal boat-shaped, usually crested. Filaments united below into a split sheath; anthers dehiscing by apical pore. Ovary 2-loculed; ovule 1 in each locule, pendulous; stigma subapical, generally having dilated hood overhead. Capsules 2-seeded, loculicidal, compressed. Seed solitary in each locule, aril 2-lobed at micropylar end.

About 600 species, distributed throughout the world except New Zealand, Polynesia and arctic zone; 8 species and 1 variety in West Bengal.

1. Shrubs; leaves up to 11 cm long, 4 cm broad ...1. *P. arillata*
1. Herbs; leaves up to 8.5 cm long, 2 cm broad :
 2. Sepals acute to acuminate, base broader :
 3. Sepals acuminate; petals white with purple tips ...3. *P. chinensis*
 3. Sepals acute; petals yellow with dull orange tips :
 4. Lamina obovate ...2. *P. arvensis*

- 4. Lamina linear ...6. *P. linariifolia*
- 2. Sepals rounded at apex, broader above, base narrow :
 - 5. Root woody, tuberous; stems villous; bracts awl-shaped ...4. *P. crotalarioides*
 - 5. Root neither woody nor tuberous; stems pubescent; bracts linear :
 - 6. Inflorescence up to 23 cm long; wing sepals green throughout; ovary glabrous; caruncle membranaceous ...7. *P. longifolia*
 - 6. Inflorescence up to 2 cm long; wing sepals with narrow hyaline margins ; ovary pilose; caruncle crustaceous :
 - 7. Leaves obtuse to rounded at apex; petals purple ...5. *P. erioptera*
 - 7. Leaves acute at apex; petals lavender-blue ...8. *P. sibirica*

1. *Polygala arillata* D. Don, Prodr. Fl. Nep. 199. 1825. Bennett in Hook. f., Fl. Brit. India 1:200. 1872, p.p. Banerjee in Sharma *et al.*, Fl. India 2:457. 1993. *P. angustifolia* (Chodat) R.N. Banerjee in Bull. Bot. Surv. India 26:2. 1985.

Fig. 31

Shrubs. Leaves 6-18 × 2-6 cm glabrous or sparsely hairy on nerves beneath, chartaceous; petioles 8-14 mm long, glabrous. Racemes 5-8 (-12) cm long, sparsely hairy. Flowers bright yellow; pedicel 4-10 mm long. Lateral sepals ca 3.5 × 2.5 mm, keeled. Wings ca 10 × 6 mm. Petals 4-5 mm long. Ovary glabrous; stigma obliquely funnel-shaped. Capsules deeply notched at apex, margined, ca 1 cm long. Seeds 2-4 mm in diam.; aril cupular, covering $\frac{1}{4}$ - $\frac{1}{2}$ of the seed.

- 1. Main nerves of the leaves not impressed above, reticulations obscure; flowers yellow ...var. *arillata*
- 1. Main nerves of the leaves impressed above, reticulations prominent forming distinct areolate structure; flowers purple ...var. *purpurescens*

var. *arillata* Bennett in Hook. f., Fl. Brit. India 1 : 200. 1872. "Marcha" (Nep.), "Karima" (Beng.).

Fl. & Fr. : July. Darjeeling 2000 m.

var. *purpurescens* Clarke ex Mukerjee in Bull. Bot. Soc. Bengal 12 :32. 1958; Banerjee in Sharma *et al.*, l.c. 459. *P. arillata* forma *sikkimensis*, Mukerjee, l.c. 31.

Fl. & Fr. : July. Darjeeling 2000 m.

2. *Polygala arvensis* Willd. Sp. Pl. 3(2) : 876. 1803; Prain, Bengal Pl. 1 : 157. 1963 (repr. ed.); Banerjee in Sharma *et al.*, l.c. 460. *P. chinensis* auct. non Linn. 1753; Bennett in Hook. f., l.c. 207. "Gaighura" (Sant.); "Garaldhoo, Meradu" (Beng.).



Fig. 31. *Polygala arillata* D. Don : a. shoot with flower and fruit; b. flower with 2 outer and one inner sepals removed; c. staminal sheath adnate to keel of petal; d. pistil.

Erect herbs with decumbent-ascending lateral branches. Leaves obovate, lower ones obcordate, 10-25 × 4-9 mm. Flowers brick-red in solitary or 3-flowered racemes. Petals hairy and auricled at base. Capsules 4 × 3 mm, patent hairy on margins. Seeds 3 mm long, oblong. Caruncular appendage nil to 3 fid, rounded at apex, extending $\frac{3}{4}$ of the length of seed.

Fl. & Fr. : July - Sept. Throughout the state.

3. *Polygala chinensis* L., Sp. Pl. 704. 1753; Banerjee in Sharma *et al.*, *l.c.* 464. *Polygala glomerata* Lour., Fl. Cochinch. 426. 1790; Bennett in Hook. f., *l.c.* 206; *P. chinensis* var. *latifolia* (Chodat) Mukerjee in Bull. Bot. Soc. Beng. 12:40. 1958 et var. *hirsuta* Mukerjee *l.c.* 40, *syn. nov.*

Erect branched tomentose perennial herbs, up to 75 cm tall. Leaves 40-85 × 10-20 mm. Flowers white with purple or violet crest. Outer sepals equal, acuminate, wing sepals 6-8 mm long. Petals 4-5 mm long, crest 16-20 segmented. Ovary orbicular; style 4 mm long, stigma bilobed. Capsules orbicular, winged, strongly ciliate. Seeds obovate.

Fl. & Fr. : Oct. - Feb. Darjeeling, Jalpaiguri.

4. *Polygala crotalarioides* Buch.-Ham. ex DC., Prodr. 327. 1824; Bennett, in Hook. f., *l.c.* 201; Prain, *l.c.* 157; Banerjee in Sharma *et al.*, *l.c.* 466. "Lil Kathi" (Sant.).

Stout woody perennial irregularly branched herbs. Stems rusty villous. Leaves villous on both surfaces. Bracts awl-shaped, 2, persistent, 2-3 mm long. Wing sepals hairy, sub petaloid, outer sepals 2.5 - 3 × 1.5 - 2 mm, wing sepal larger. Petals 6-8 mm long, pink. Stamens 4-5 mm long. Capsules orbicular.

Fl. & Fr. : Sept. - Oct. Birbhum, Burdwan, Darjeeling, Midnapur.

5. *Polygala erioptera* DC., Prodr. 1:326. 1824; Bennett in Hook. f., *l.c.* 203; Banerjee in Sharma *et al.*, *l.c.* 467.

Herbs, up to 60 cm tall. Leaves linear-oblong, 20-35 × 2-6 mm, glabrescent above, patent hairy near margins, tomentose beneath, mucronate to acute at apex. Flowers pinkish violet or pink. Petals 3-lobed, 4 mm long, lateral lobes 3 × 4 mm, deltoid.

Fl. & Fr. : Throughout the year. Burdwan, Purulia.

6. *Polygala linariifolia* Humb. ex Willd., Sp. Pl. 3 : 877, 1803; DC., Prodr. 1:326. 1824; Banerjee in Sharma *et al.*, *l.c.* 476. *P. chinensis* L. var. *linariifolia* (Willd.) Chodat in Mem. Soc. Phys. Hist. nat. 31 (2) : 386. 1893; Mukerjee, *l.c.* 40; Kanai in Hara, Fl. East. Himal. 173. 1966.

Erect herbs, up to 35 cm tall. Leaves sessile, linear, 40-50 × 5-10 mm, pale beneath, strongly single-veined, margins incurved, glabrous above, apiculate at apex. Racemes leaf-opposed, 2 cm long; rachis glabrous, many-flowered. Flowers 5-7 mm long; pedicels 2-3 mm long, glabrous. Outer paired sepals 2 mm long, obovate-oblong, outer solitary sepal 2 mm long, alae 7 mm long, ovate-lanceolate, ciliate outside, glabrous within. Middle lobe of petal 5 mm long, lateral lobes 3 mm long. Ovary ciliate at apex, 1.5 mm long, obovate,

sessile. Capsule 4×3 mm, obcordate, unequal at apex, winged, glabrous on the surface, patent ciliate on the margins. Strophiole 3-lobed.

Fl. & Fr. : April-Nov. Darjeeling, 2000 m.

7. ***Polygala longifolia*** Poir. in Lamk., Encycl. 5: 501. 1804; Banerjee in Sharma *et al.*, *l.c.* 176. *P. leptalea* DC., Prodr. 1 : 325. 1824; Bennett in Hook. f., *l.c.* 202; Prain *l.c.* 157.

Perennial herbs, about 30 cm tall. Stems sharply angular or deeply furrowed, glabrous. Leaves $15-30 \times 2-2.5$ mm margins revolute, acute to mucronulate at apex, sub-amplexicaule at base. Bracts up to 3 mm long, caducous on maturity. Flowers pinkish red.

Fl. & Fr. : Sept. - Oct. Purulia.

In Bihar it is used as a glactagogue (Breasers, J.-The Botany of Ranchi District, Behar 1951).

8. ***Polygala sibirica*** L., Sp. Pl. 702. 1753; Bennett in Hook. f., *l.c.* 205, *p.p.*; Mukherjee in Bull. Bot. Soc. Bengal 12 (1 & 2) : 44. 1958; Banerjee in Sharma *et al.*, *l.c.* 481.

Much branched perennial erect herbs, 12-36 cm high. Leaves elliptic-lanceolate, $13-32 \times 3-8$ mm, scabrid above, densely hairy on nerves beneath, acute at apex, attenuate at base, coriaceous. Flowers in 6-7 cm long racemes; bracts caducous; pedicels 3-4 mm long, pubescent. Sepals tomentose, green with purple edges, *ca* 3×1 mm, linear-lanceolate; alae 8×1 mm, obovate, obtuse to rounded at apex, glabrous, ciliate on margins. Petals lavender blue or purple violet or pink, lobes 4-7 mm long. Ovary glabrous; style 6 mm long; stigma bidentate. Capsules *ca* 4×6 mm, winged (1-2 mm) all around, glabrous. Seed strophiole 3-fid (longer arm 2.5 mm, shorter arms 1.5 mm).

Fl. & Fr. : March - Dec. Darjeeling.

2. SALOMONIA Lour. *nom. cons.*

Annual herbs, sometimes root parasites. Leaves ovate or oblong-lanceolate, petiolate or sessile, sub-cordate, sometimes amplexicaule. Spikes terminal or axillary. Sepals 5, 2 inner larger, persistent. Petals 3-lobed, adnate to staminal tube at base. Stamens 4-5, filaments connate; anthers in one rectangular mass (confluent). Capsule laterally compressed, 2-locular, margins cristato-dentate or ciliate. Seeds glabrous, black, orbicular; strophiole gelatinous or absent.

About 12 species in India, Mynmar, Eastern Asia (China, Japan), Malesia, Vietnam, Europe and N. Mexico; 2 species and one variety in West Bengal.

1. Leaves sessile, oblong-lanceolate; fruits winged,
long-spinulose; seeds gelatinously strophiolate ...2. *S. ciliata*

1. Leaves petiolate, ovate; fruits neither winged, nor
spinulose; seeds estrophiolate ... 1. *S. cantoniensis*

1. ***Salomonina cantoniensis*** Lour., Fl. Cochinch. 17. 1790; Banerjee in Sharma *et al.*, *l.c.* 489.

Much-branched annual herbs, 6-15.5 cm tall, dichotomous at the top producing spikes. Leaves 5-23 × 6-13 mm, 3-nerved; petiole 4 mm long, winged. Spikes lax below, denser above. Flowers 1.5- 2 mm long. Petals 1.5 mm long, light violet or pink. Style 2 mm long, hyaline. Capsule 1.5 × 2 mm, sessile, orbicular, not winged, having a row of curved triangular teeth. Seeds estrophiolate.

1. Spikes 5-11 cm long; lateral petals shorter than the keel ... var. *cantoniensis*

1. Spikes up to 4.5 cm long; lateral petals as long as the keel ... var. *edentula*

var. *cantoniensis* Bennett in Hook. f., Fl. Brit. India 1 : 206, 1872; Banerjee in Sharma *et al.*, *l.c.* 489.

Fl. & Fr. : July - Sept. Birbhum, Darjeeling, 24-Parganas.

var. *edentula* (DC.) R.N. Banerjee, *comb. nov.*; Banerjee in Sharma *et al.*, *l.c.* 490. *Salomonium edentula* DC., Prodr. 1 : 334, 1824; Bennett in Hook. f., *l.c.* 207.

Darjeeling.

This shade-loving variety also differs from var. *cantoniensis* in having minutely toothed or microscopic hairs on margins of the fruits, as seen on critical examination of Types (Wallich, Num. List Nos. 4194 & 1821, Nepal, in CAL).

2. *Salomonium ciliata* (L.) DC., Prodr. 1 : 334, 1824; Bennett in Hook. f., *l.c.* 206; Banerjee in Sharma *et al.*, *l.c.* 490. *Polygala ciliata* L., Sp. Pl. 705, 1753. *S. oblongifolia* DC., Prodr. 1 : 334, 1824; Bennett *l.c.* 207; Prain, *l.c.* 156. **Fig. 32**

Slender erect herbs, 6-36 cm tall. Leaves 4-14 × 3-8 mm, margins ciliate or with a few long distant hairs, or smooth. Inflorescence 15-17 cm long, terminal or axillary. Flowers 2-3 mm long, opposite superposed. Bracts 2 mm long, linear. Sepals 1.5-2 mm long, 2 inner ones larger. Petals 3 mm long, pink or purplish. Stamens monadelphous. Capsule 1 × 2 mm long, bilobed, red, spinulose at margins.

Fl. & Fr. : July - Dec. Bankura, Burdwan, Birbhum, Hooghli, Jalpaiguri, Purulia, West Dinajpur.

Common in damp waste places and also on the borders of cultivated fields, up to 912 m.

CARYOPHYLLACEAE

(N.C. Majumdar)

A family of ca 70 genera and 1750 species, cosmopolitan, but chiefly in the temperate regions; 12 genera and 24 species are reported from West Bengal, excluding garden plants.

1. Sepals united to form a distinct calyx tube :
2. Calyx tube with commissural veins alternating with midrib of sepals

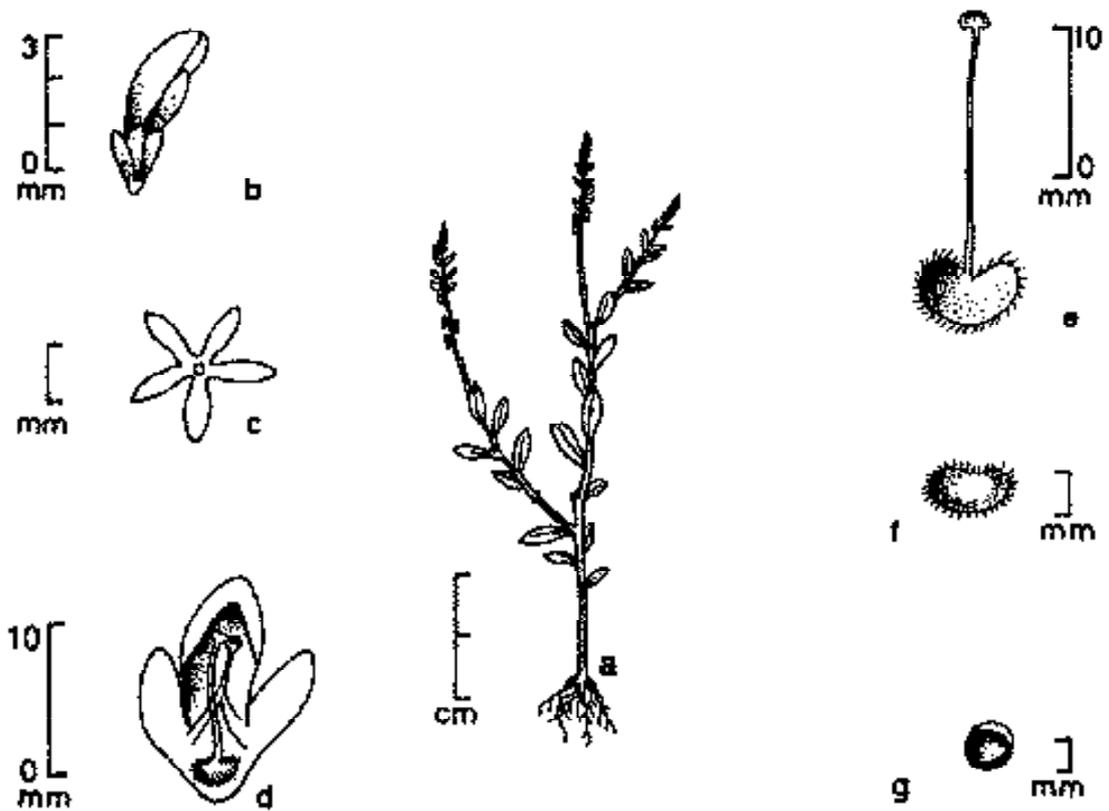


Fig. 32. *Salomonina ciliata* (L.) DC. : a. habit; b. flower; c. calyx, spread out; d. corolla, spread out showing stamens and pistil; e. pistil; f. fruit; g. seed.

2. Calyx tube without commissural veins and without scarious interval between nerves ... 12. VACTARIA
1. Sepals free or united at base only :
3. Leaves with stipules :
4. Styles free to the base ... 10. SPERGULIA
4. Styles united at the base :
5. Petals deeply 2-fid; leaves broadly ovate-orbicular, cordate at base; styles 3, united below ... 4. DRYMARIA
5. Petals entire or subentire; leaves linear to oblong, narrowed at base; styles united below or throughout :
6. Diffuse herbs; sepals keeled; styles 3, united below ... 6. POLYCARPON
6. Erect herbs; sepals not keeled; styles united throughout ... 5. POLYCARPAEA
3. Leaves without stipules :
7. Capsule valves as many as styles ... 8. SAGINA
7. Capsule valves twice as many as styles :
8. Petals bifid to halfway or more ... 11. STELLARIA
8. Petals bifid to one-third or emarginate or lacerate :
9. Herbs with napiform tubers ... 7. PSEUDOSTELLARIA
9. Herbs without tubers:
10. Petals bilobed to one-third way down, sometimes emarginate; capsules cylindrical ... 3. CERASTIUM
10. Petals entire or submarginate; capsules not cylindrical :
11. Capsules ovoid or oblong, many-seeded ... 1. ARENARIA
11. Capsules globose, 1-seeded ... 2. BRACTYSTEMMA

1. ARENARIA L.

Annual or perennial herbs with slender branched ascending stems. Leaves opposite, castipulate ovate, lanceolate or linear. Flowers solitary, terminal or in dichasial terminal or axillary cymes, usually pentamerous. Sepals free. Petals white or pink, entire or slightly emarginate. Stamens 10, on a hypogynous disc. Ovary 1-locular. Styles 2 or 3 (-4). Capsules opening by twice as many teeth as styles. Seeds many, globose to reniform, reddish-brown or black.

A genus with about 250 species distributed in the temperate and arctic regions; 1 species in West Bengal.

Arenaria debilis Hook. f., Fl. Brit. India 1:242. 1874; Majumdar in Sharma *et al.*, Fl. India 2:509. 1993. *A. blinkworthii* McNeill in Notes Roy. Bot. Gard. Edinb. 24: 128. 1962. *Arenaria benthami* Edgew. in Hook. f., Fl. Brit. India 1: 242. 1874; non Fenzl *ex* Torrey & Gray, 1840.

Herb, glandular pilose. Leaves ovate, hairy, 15-30 mm long. Ciliate at margin. Pedicels divaricate ciliate. Flowers 12 mm diam. Sepals oblong or linear-lanceolate, 4-5 × 2 mm, glandular with narrow scarious margin. Petals white, obovate, spatulate, lacerate, *ca* 6 × 2 mm. Styles 2. Capsule 4-valved, smaller than sepals. Seeds ovate-rounded; flat, brownish, *ca* 1.5 × 2 mm.

Fl. : May - Sept.; *Fr.* : Oct. Darjeeling.

2. BRACHYSTEMMA D. Don

Profusely branched climbers. Leaves large, lanceolate. Flowers numerous, in axillary and terminal panicles. Sepals 5, scarious, more than twice as long as petals. Petals 5, small, narrow, entire. Stamens 5. Staminodes 5. Styles 2. Capsules 4-valved. Seed 1, reniform or globose, reticulate.

Monotypic, in Himalayas (West Bengal) and China.

Brachystemma calycinum D. Don, Prodr. Fl. Nepal. 216. 1825; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1:235. 1874; Majumdar in Sharma *et al.*, *l.c.* 519. Fig. 33

Climbing herbs, up to 6 m, stems 5-angular, apex pilose. Leaves opposite, elliptic-oblong to lanceolate, 27-35 × 7 mm, crenulate or serrulate; petioles glabrous or pilose. Panicles axillary and terminal. Pedicels and bracts glandular-hairy. Sepals shining. Petals elliptic, *ca* 2 × 1 mm. Ovary 1-locular, 1.2 mm diam., styles revolute. Capsules globose.

Fl. & Fr. : Dec. - May. Darjeeling.

3. CERASTIUM L.

Annual or perennial herbs. Leaves small, entire, sessile. Flowers usually in terminal dichotomous cymes, 5-merous, some times 4-merous. Sepals, free, with membranaceous margins. Petals as many as sepals, white, bifid or emarginate, rarely absent. Stamens usually, 10, rarely fewer, hypogynous, nectaries present. Ovary 1-locular; styles usually 5, opposite the sepals. Fruit a cylindrical capsule, exceeding the sepals, usually curved, opening by twice as many short teeth as styles. Seeds many, rough, compressed, spherical or reniform.

About 60 species, cosmopolitan; 1 species in West Bengal.

1. Flowers in compact clusters; fruiting pedicels not exceeding sepals; sepals with long white hairs projecting beyond apex ... 2. *C. glomeratum*
1. Flowers in dichasia, lax in fruit; fruiting pedicels exceeding sepals; sepals with scarious margin and glabrous apex ... 1. *C. fontanum* ssp. *triviale*

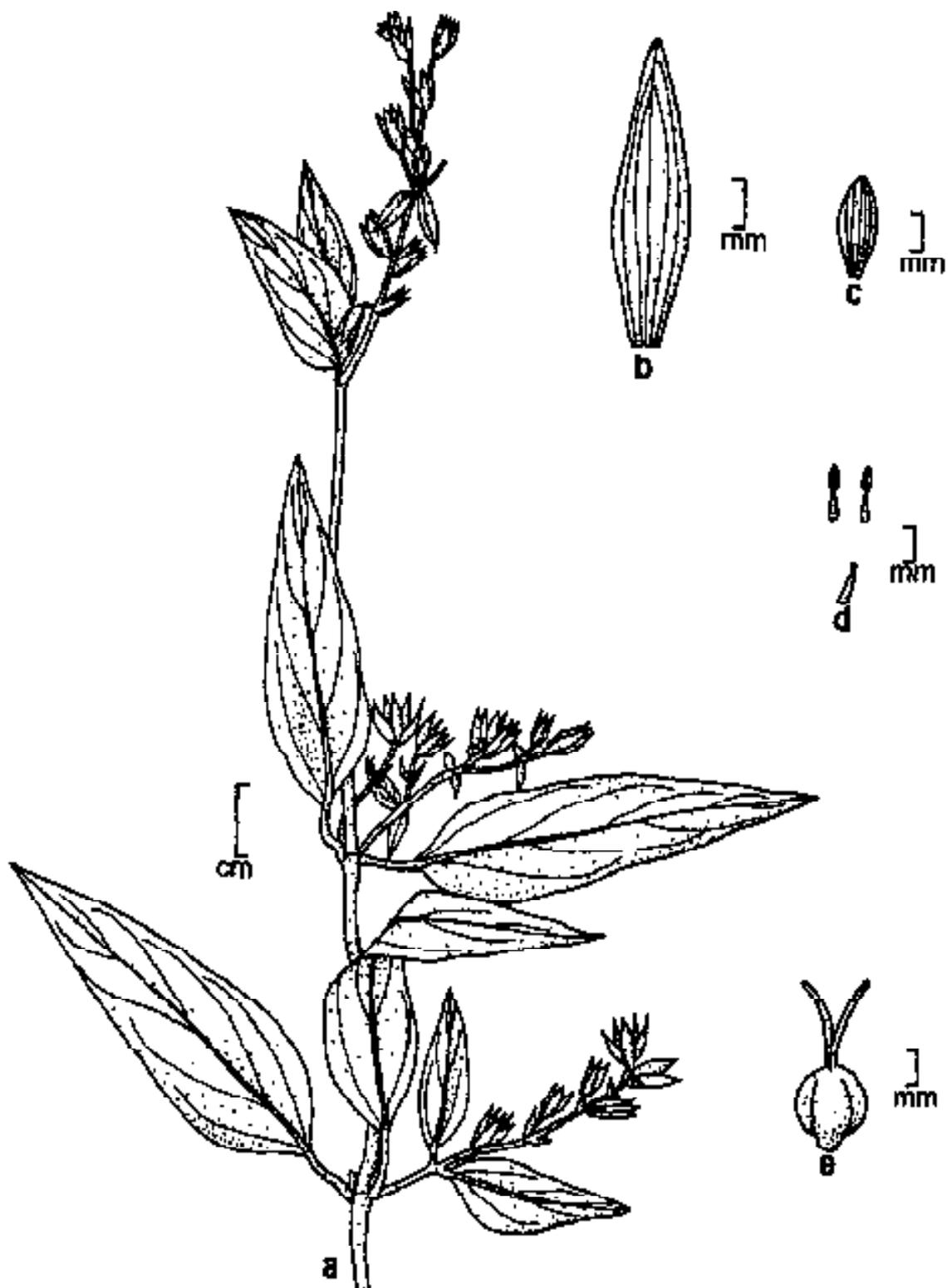


Fig. 33. *Brachystemma calycinum* D. Don : a. flowering shoot; b. sepal; c. petal; d. stamens and staminodes; e. pistil.

1. **Cerastium fontanum** Baumg. subsp. **triviale** (Link) Jalas in Arch. Soc. Zool. Bot. Fenn. "Vanamo" 18:63, 1963; Mazumdar in Sharma *et al.*, *l.c.* 523. *C. vulgatum* L. var. *triviale* (Link) Edgew. & Hook. f. in Hook. f., *l.c.* 228.

Laxly caespitose herbs, hirsute throughout of glandular hairy upwards. Leaves oblong to ovate, 10-30 × 3-10 mm, white puberulent. Cymes glandular, puberulent; bracts green. Sepals 3-5 mm long, ovate-lanceolate, hairy margins scarious, apices glabrous. Petals white, as long as sepals or slightly exceeding. Stamens 10. Capsules 9-12 mm long, narrowly cylindrical. Seeds reddish-brown.

Fl. & Fr. : April - Sept. Darjeeling.

2. **Cerastium glomeratum** Thuill., Fl. Env. Paris, ed. 2: 226, 1799; Majumdar in Sharma *et al.*, *l.c.* 523. *C. vulgatum* var. *glomeratum* (Thuill.) Edgew. & Hook. f. in Hook. f., *l.c.* 228.

Annual herbs, 10-40 cm tall, glandular pubescent. Leaves 10-25 × 6-9 mm, lanceolate, ovate or elliptic oblong, apiculate, white-hairy. Cymes clustered; pedicels 2-4 mm; bracts green, hairy. Sepals 4-5 mm long, lanceolate, acuminate. Petals white, as long as sepals. Stamen (5-) 10. Capsules 7-9 mm long, cylindrical, curved upwards, teeth 10. Seeds 0.5-0.6 mm, pale brown.

Fl. & Fr. : July - Oct. Darjeeling.

4. DRYMARIA Willd.

Annual herbs, diffuse, procumbent or suberect, dichotomously branched. Leaves opposite, flat; stipules small, persistent or deciduous. Flowers in cymes or panicles, axillary or terminal. Sepals 5, free, herbaceous. Petals 3-5, white, usually bifid. Stamens 5, rarely fewer; filaments slightly connate at base. Ovary 1-locular; styles 3, more or less united below. Capsules ovoid to globose, 3-valved. Seeds tuberculate, reniform, cochleate or compressed.

A genus of ca 48 species, cosmopolitan, mainly tropical; 2 species in West Bengal.

1. Plants glabrous or glandular papillate; petals usually without auricles; sepals carinate; pedicel glandular pubescent; seeds 1-2 mm diam ... 1. *D. diandra*

1. Plants villous with long hairs; petals with auricles; sepals not carinate; pedicels villose; seeds less than 1 mm diam ... 2. *D. villosa*

1. **Drymaria diandra** Blume, Bijdr. 62, 1825; Majumdar in Sharma *et al.*, *l.c.* 533. *D. cordata* sensu Edgew. & Hook. f. in Hook. f., *l.c.* 244, Prain, Bengal Pl. 1: 159, 1963 (repr. ed.) *excl. syn.* **Fig. 34**

Annual herbs, glabrous to glandular-pubescent. Leaves deltoid-ovate to subreniform, 5-25 × 3-20 mm; stipules lacerate. Cymes terminal, bracteate. Outer sepals strongly carinate, 3-ribbed. Petals 3-5, 1.5-3 mm long, bifid. Stamens 2-3; anthers suborbicular. Styles bifid or trifid. Capsules 2-3-valved. Seeds 1-2, cochleate, 1.4-2 mm diam, densely tuberculate.

Fl. & Fr. : Throughout the year. Birbhum, Jalpaiguri.

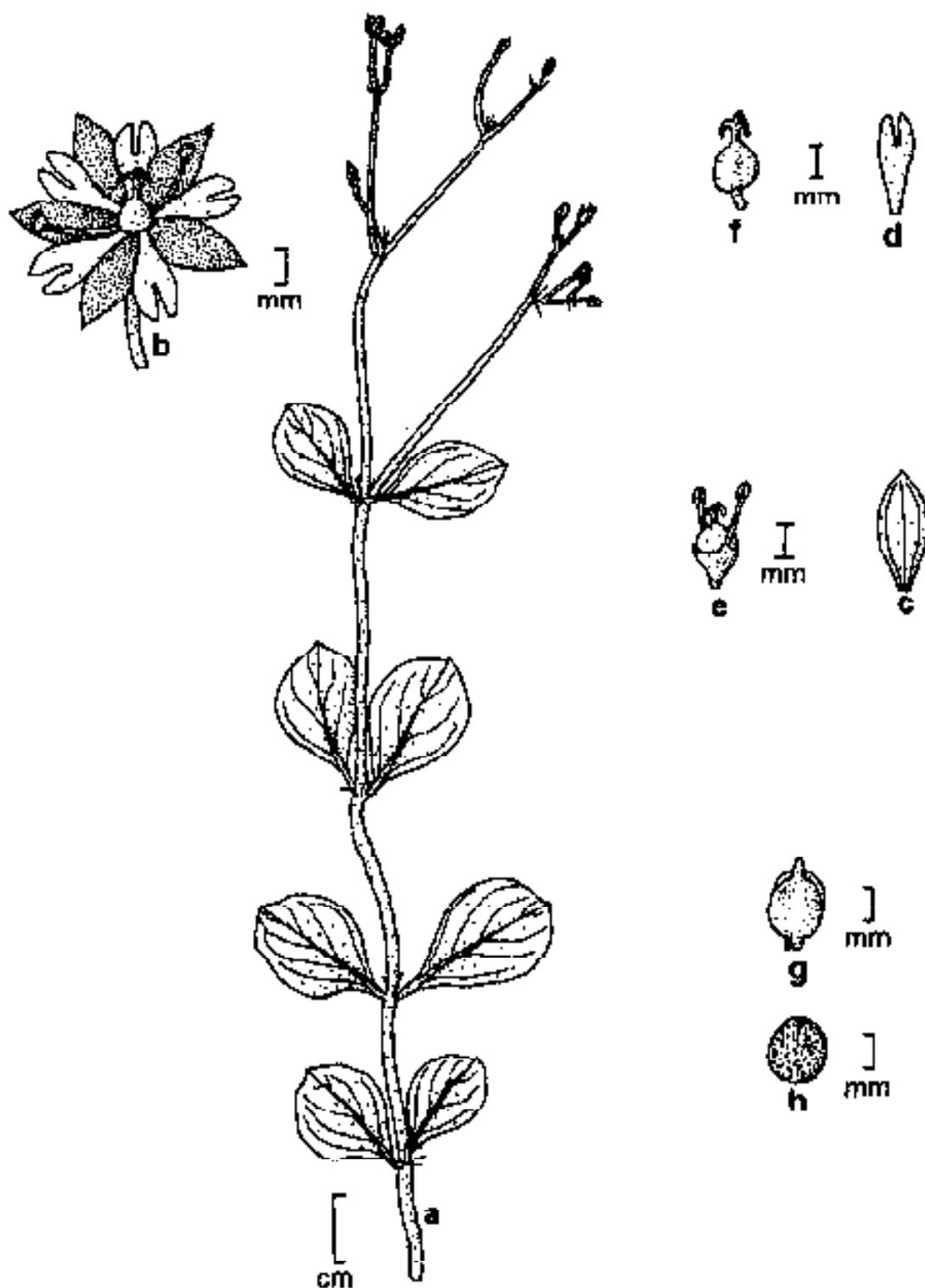


Fig. 34. *Drymaria diandra* Blume : a. flowering shoot; b. flower; c. sepal; d. petal; e. stamens with pistil; f. pistil; g. capsule; h. seed.

2. **Drymaria villosa** Cham. & Schlecht. in *Linnaea* 5: 232. 1830; Ohba in *Fl. East. Himal.* 3: 31. 1975; Majumdar in *Sharma et al., l.c.* 533.

Annual herbs, villous or glabrescent. Leaves orbicular to reniform, villous to hirsute, 5-15 × 5-15 mm; stipules usually entire. Cymes bracteate. Sepals with margins scarious. Petals 5, 2-3.6 mm long, bifid, 4-nerved with filiform auricles at base. Stamens 5, 2-3.5 mm long; styles 1-1.5 mm long, trifid to half its length. Capsules 2-3.5 mm long. Seeds many, cochleate, 0.5-1 mm diam., tuberculate.

Fl. : April - June; *Fr.* : July - Oct. Darjeeling.

5. POLYCARPAEA Lamk. *nom. cons.*

Annual or perennial erect herbs. Leaves narrow, linear, flat, opposite; stipules scarious. Flowers numerous, in spreading or condensed cymes. Sepals 5, scarious, sometimes coloured, rarely scarious only at margin. Petals 5, entire, 2-toothed or with crose margins. Stamens 5. Ovary 1-locular; ovules many; style slender, 3-fid. Capsules 3-valved. Seeds ovoid or flat.

A genus of ca 24 species; 1 species in West Bengal.

Polycarpaea corymbosa Lamk. *Tabl. Encycl.* 2: 129. 1798; Edgew. & Hook. f. in *Hook. f., l.c.* 245; Prain, *l.c.* 160; Majumdar in *Sharma et al., l.c.* 549.

Erect decumbent branched herbs, 15-30 cm tall, tomentose to glabrescent. Leaves 5-25 mm long, pseudo-verticillate, narrow, linear or subulate; stipules fimbriate, 3-5 mm long. Flowers 4 mm diam. Sepals 2.5-5 mm long, white, lanceolate, glabrous. Petals obtuse, 0.5-1 mm long, slightly emarginate. Stamens 5, filaments flat. Ovary with 5-13 ovules. Capsules ellipsoid, 3-valved. Seeds light brown, reniform, minutely corrugated.

Fl. : July - Sept.; *Fr.* : Aug. - Nov.

6. POLYCARPON L.

Small herbs, dichotomously branched. Leaves ovate or oblong, opposite or whorled; stipules scarious. Flowers small, in terminal dichasial cymes; bracts scarious. Sepals 5, keeled and hooded. Petals 5, narrow, smaller than sepals, hyaline. Stamens 3-5. Ovary unilocular styles 3-fid with 3 stigmas; ovules many. Fruit a capsule opening by 3 valves. Seeds many, ovoid.

A genus of about 36 species in warm and temperate regions; 1 species in West Bengal plains.

Polycarpon prostratum (Forsk.) Aschers. & Schweinf. in *Oesterr. Bot. Zeitschr.* 39:128. 1889; Majumdar in *Sharma et al., l.c.* 553. *Alsine prostrata* Forsk., *Fl. Aeg.-Arab.* *P. loeflingiae* Edgew. & Hook. f. in *Hook. f., l.c.* 245; Prain, *l.c.* 160.

Prostrate or suberect herbs; branching shoots 15-25 cm long. Leaves linear-oblong, obovate or spatulate, 6-18 mm long. Cymes paniculate. Flowers 3 mm diam. Sepals 2-3 mm long, with broad scarious margins. Petals linear-lanceolate, dentate at apex, 1.3 mm long, rarely absent. Stamens 3.

Capsules 1.8-2 mm long. Seeds subcylindric, pale brown, minutely tuberculate, 0.3 - 0.6 mm.

Fl. : March - June; *Fr.* : July - Sept. Bankura, Birbhum, Burdwan, Hooghly, Howrah, Murshidabad, Purulia, 24-Parganas.

7. PSEUDOSTELLARIA Pax

Small herbs with habit of *Stellaria* but roots with bulbs or tubers. Chasmogamic flowers in axils of upper leaves. Petals 5, large, entire or rarely bifid, longer than calyx. Stamens 10, fertile; anthers wine-purple. Ovary ovoid. Cleistogamous flower sometimes in lower axils. Petals small or absent. Sepals 5 or 4. Stamens 10 or 0. Style long; stigma capitellate. Ovules many. Capsules many-seeded. Seeds white, turning dark purple when mature, with appendaged tubercles.

About 15 species in East Asia; 1 species in West Bengal.

Pseudostellaria heterantha (Maxim.) Pax ex Pax & Hoffm, var. *himalaisa* Ohwi in Jap. J. Bot. 9: 102. 1937; Majumdar in Sharma *et al.*, *l.c.* 555. *Stellaria bulbosa* non Wulfen, *sensu* Edgew. & Hook. f. in Hook. f., *l.c.* 231. *p.p.*

Perennial slender herbs with napiform tubers. Stem 10 cm tall, with a line of hairs. Leaves opposite, decussate, ovate-lanceolate, glabrous or hairy at base and margin. Pedicel not or slightly surpassing the subtending leaf. Sepals 5, glabrous, margins scarious. Petals white, obovate or elliptic, acute, round or slightly emarginate. Stamens 10; anthers black purple. Ovary ovoid; styles 2-3. Cleistogamous flowers not seen.

Fl. : April - June. Darjeeling.

8. SAGINA L.

Annual or perennial herbs. Flowering shoot slender, ascending or prostrate. Leaves opposite, connate, exstipulate, subulate. Flowers 4-5 merous, in dichasial cymes. Sepals free. Petals, if present, entire, white. Stamens as many as or twice as many as sepals. Ovary 1-celled, ovules many; styles 4-5, alternate to sepals. Capsules 4-5 valved, splitting up to base. Seeds minute.

1. Flowers 4-merous; petals minute or absent ... 2. *S. procumbens*

1. Flowers 5-merous; petals present ... 1. *S. japonica*

1. *Sagina japonica* (Swartz) Ohwi in J. Jap. Bot. 13, 438. 1937; Majumdar in Sharma *et al.*, *l.c.* 558. *Spergula japonica* Sw. in Ges. Naturf. Freunde Berlin Neue Schriften 3:164. 1801.

Usually annual herbs. Leaves linear, glabrous, mucronate, upper sometimes glandular at base. Pedicels 8-15 mm long, glabrous to glandular pilose. Sepals 5, elliptic or ovate, scarious-margined, 2-2.5 mm long. Petals 5, ovate or oblong, rounded at apex. Stamens 5-8. Capsules longer than calyx, globular or ovate, 5-valved. Seeds dark brown, swollen, reniform, 0.5 mm across, papillate.

Fl. & Fr. : Feb.-Oct. Darjeeling.

2. *Sagina procumbens* L., Sp. Pl. 1:128. 1753; Majumdar in Sharma *et al.*, *l.c.* 558.

Perennial glabrous herbs, lateral branches first prostrate, then ascending. Leaves in dense central rosette, linear, 5-10 mm long, mucronate. Pedicels recurved near top after anthesis. Sepals 4, broadly ovate, obtuse, 2 mm long. Petals white, minute or absent. Stamens 4. Capsules longer than sepals, valves 4, obtuse. Seeds smooth, ca 0.4 mm, blackish brown, deltoid, dorsally grooved.

Fl. & Fr. : May - July. Darjeeling (vide Mizushima in J. Jap. Bot. 35:193. 1960).

9. *SILENE* L.

Annual or perennial herbs, viscid, erect, caespitose or climbing. Leaves opposite, entire, exstipulate. Cymes in large panicles or reduced to single flower. Calyx 5-lobed, variable, often inflated. Petals 5, long clawed, often crowned with 2 coronal scales at the base of blade. Gynophore usually conspicuous. Stamens 10; 5 usually adnate to petals. Ovary 1-locular above. Styles 3 or 5. Capsules opening by twice as many teeth as styles, usually on a carpophore. Seeds reniform, numerous, variously tubercled.

A genus with about 450 species in temperate regions; 1 species in West Bengal.

Silene indica Roxb. ex Otth in DC. Prodr. 1: 368. 1824; Majumdar in Sharma *et al.*, *l.c.* 568. *Lychmus indica* (Roxb. ex Otth) Benth. in Royle. III. Bot. Himal. 1:81. 1834; Edgew. & Hook. f. in Hook. f., *l.c.* 225.

Perennial herbs, 40-90 cm tall, glandular hirsute upwards. Leaves lanceolate, sometimes elliptic-ovate, 20-70 × 10-20 cm. Cymes lax. Calyx hardly inflated, membranous, 11-14 × 4-8 mm; teeth triangular. Anthophore ca 2 mm. Petals 3-4 mm, exceeding the calyx, limb bilobed, brown purple. Ovary ovoid; styles 4-5. Capsule teeth 8-10, recurved. Seeds brownish, tuberculate or papillate.

Fl. & Fr. : July - Oct. Darjeeling.

10. *SPERGULA* L.

Annual or rarely perennial herbs, ascending or decumbent. Leaves opposite, linear, obtuse; stipules small, scarious, deciduous, not united to surround the node; axillary fascicles of leaves borne on each node on both sides. Flowers in terminal lax dichasial cymes; pedicels at first deflexed, then erect. Sepals 5, free, with scarious margins. Petals 5, white, entire. Stamens 5-10. Styles 5(3 in *S. fallax*). Capsules ovoid to subglobose, dehiscing by 5 entire valves (3 valves in *S. fallax*). Seeds often winged.

A genus with ca 5 species in the temperate regions; 2 species in West Bengal plains.

1. Styles 5; capsule 5-valved; seeds sharply keeled or with a very narrow wing

... 1. *S. arvensis*

1. Styles 3, capsule 3-valved; seeds compressed, broadly winged

... 2. *S. fallax*

1. ***Spergula arvensis* L.**, Sp. Pl. 440. 1753; Edgew & Hook. f. in Hook. f., *l.c.* 243; Prain, *l.c.* 159; Majumdar in Sharma *et al.*, *l.c.* 578. "Muchmuchia" (H).

Fig. 35

Annual herbs, 7-40 cm tall. Leaves 1-3 cm, linear, fleshy, glandular hairy, channelled beneath. Flowers 4-7 mm diam., in cymose panicles; bracts small, scarious. Sepals 5, ovate, 3-5 mm long, obtuse, with narrow scarious margins. Petals 5, white, obovate-obtuse, slightly larger than sepals. Stamens 10 or fewer. Capsules ovoid, 7-10 mm long, 5-valved. Seeds 1.5 mm across, dark grey, papillose, keeled or very narrowly winged.

Fl. & Fr. : Throughout the year. Birbhum, Darjeeling.

2. ***Spergula fallax* (Lowe) E.H.L. Krause** in Sturm. Fl. Deutschl. ed. 2, 5: 21, 1901; Majumdar in Sharma *et al.*, *l.c.* 578. *S. pentandra sensu* Edgew. & Hook. f. in Hook. f., *l.c.* 243; Prain *l.c.* 159. *Spergularia fallax* Lowe in Hooker, J. Bot. and Kew Gard. Misc. 8:289. 1856.

Annual herbs, 4-40 cm, branched at base. Leaves linear, opposite, 0.5-3 cm, in axillary fascicles, appearing whorled. Flowers 4-7 mm diam., in cymose panicles; bracts 1 mm, scarious. Sepals ovate, subacute, 4-5 mm, with a narrow scarious margin. Petals white, ovate, entire, ca 3 mm long. Stamens 6-7. Styles 3. Capsules ovoid, 4-5 mm. Seeds glossy black, ca 1.5 mm diam., including the scarious wing.

Fl. & Fr. : Dec. - April. Bankura, Burdwan.

The species is characterised by having 3 styles and a 3-valved capsule (characters of *Spergularia*). As its habit is that of a *Spergula*, it is placed in *Spergula* by most authors.

11. STELLARIA L.

Slender herbs, often diffuse, tufted or ascending. Leaves simple, opposite, exstipulate, entire. Flowers solitary, or usually in dichasial cymes, pentamerous. Sepals 5, rarely 4, free. Petals white, as many as sepals, usually deeply bifid. Stamens 10 or fewer, hypogynous or perigynous; nectaries present. Styles 3, rarely 2-5. Ovary unilocular; ovules many. Capsules globose or ovoid, opening by twice as many teeth as styles. Seeds many, globose to reniform granulate or smooth.

About 120 species, mostly in temperate regions; 9 species in West Bengal.

1. Ovary 1-locular; capsule few-to many-seeded :

2. Sepals free to base :

3. Plants glabrous; seeds tuberculate

... 3. *S. media*

3. Plants ciliate hairy; seeds smooth

... 6. *S. sikkimensis*

2. Sepals connate at base forming funnel-shaped calyx base :

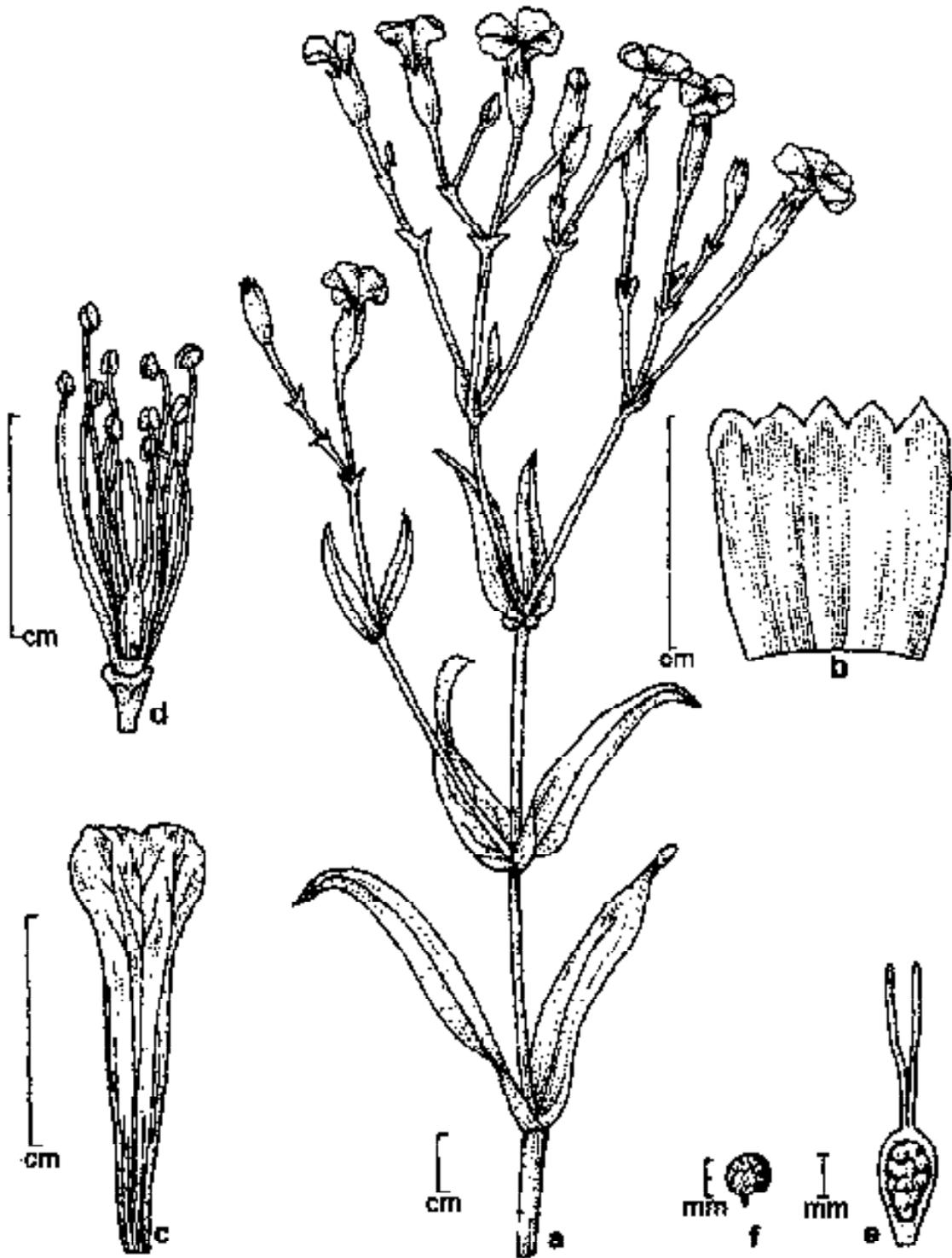


Fig. 35. *Spergula arvensis* L. : a. flowering shoot; b. flower; c. sepal; d. petal; e. stamens; f. pistil.

- 4. Plants laxly tufted:
 - 5. Plants hairy:
 - 6. Stellate hairs present ... 9. *S. vestita*
 - 6. Stellate hairs absent :
 - 7. Plants with long silky hairs ... 5. *S. patens*
 - 7. Plants densely woolly upwards ... 2. *S. lanata*
 - 5. Plants glabrous or only leaf base ciliolate .
 - 8. Capsule twice as long as sepals ... 7. *S. subumbellata*
 - 8. Capsule equal to or shorter than sepals ... 8. *S. uliginosa*
 - 4. Plants densely tufted ... 1. *S. decumbens* var. *minor*
 - 1. Ovary 3-locular; capsule 1-2-seeded ... 4. *S. monosperma*

1. ***Stellaria decumbens*** Edgew. var. ***minor*** Edgew. & Hook. f. in Hook. f., *l.c.* 234; Majumdar in Sharma *et al.*, *l.c.* 583.

Small tufted cushion like shining herbs. Stems many, decumbent or erect, somewhat quadrangular, laxly or densely fascicled, glabrous or puberulous in a line. Leaves in axillary fascicles, 3-5 mm long, lanceolate or linear-lanceolate, ciliolate. Flowers solitary, or in 1-3-flowered cymes. Sepals 4-5, oblong-lanceolate, 3 mm or more long. Petals very short, narrow, bipartite. Stamens 10. Capsules shorter than sepals. Seeds 2-8, dark brown.

Fl. : July - Oct. Darjeeling.

2. ***Stellaria lanata*** Hook. f., *Fl. Brit. India* 1:232. 1874; Majumdar in Sharma *et al.*, *l.c.* 584.

Herbs, 20-30 cm tall. Stems slender, decumbent, terete, shining below. Leaves linear-oblong, 6-25 mm long, spreading, recurved, sessile, 1-nerved, acute, white woolly beneath. Cymes terminal. Flowers few, 4-5 mm diam.; pedicel erect, 1-12 mm long. Sepals oblong, acute, 2.5-3 mm long. Petals minute, 2-partite, lobes narrow. Stamens 8. Styles 3. Capsules oblong-ovoid, 4-6-valved. Seeds dark brown, reniform.

Fl. & Fr. : June - Oct. Darjeeling.

3. ***Stellaria media*** (L.) Vill., *Hist. Pl. Dauph.* 3 : 615. 1789, *p.p.*; Edgew. & Hook. f. in Hook. f., *l.c.* 230; Prain, *l.c.* 159; Majumdar in Sharma *et al.*, 585.

Herbs, 15-60 cm tall, suberect or procumbent. Leaves 5-28 x 5-15 mm, lower petioled, ovate or cordate, upper sessile, elliptic or lanceolate. Flowers many, white, 6-8 mm diam., in cymes; pedicels slender. Sepals 5, ovate-lanceolate, green, glandular pubescent, 4-5 mm long, margins scarious. Petals 5, shorter than sepals. Stamens 3 to 10. Styles 3. Capsules ovoid, longer than sepals. Seeds reddish brown, tuberculate.

Fl. & Fr. : Throughout the year. Birbhum, Darjeeling, Murshidabad, 24-Parganas.

4. ***Stellaria monosperma*** Buch.-Ham. ex D. Don, Prodr. Fl. Nep. 215. 1825. *S. crispata* Wall. ex Edgew. & Hook. f. in Hook. f., l.c. 229.

Straggling herbs, 60-120 cm tall. Stem quadrangular, shining, nodes often hairy. Leaves glabrous, sessile, oblong or lanceolate, 3-20 × 1-4 cm, acuminate, margin crisped. Flowers white, in cymes, bracteate; peduncles and pedicels divaricate slender, glandular pubescent, sepals 5, oblong-lanceolate, 5-6 mm long, margins scarious, petals 5, bifid, stamens 10. Styles 3. Capsules 4 mm in diam., 6-valved. Seeds 1 or 2, dark-brown, notched, tuberculate.

1. Leaves sessile; sepals 5-6 mm long ... var. *monosperma*

1. Leaves petioled; sepals 3-4 mm long ... var. *paniculata*

var. ***monosperma***

Fl. : July - Sept.; *Fr.* : Sept. - Oct. Darjeeling.

var. ***paniculata*** (Edgew.) Majumdar in J. Indian Bot. Soc. 44 : 144. 1965. *Stellaria paniculata* Edgew. in Trans. Linn. Soc. 20 : 35. 1846; Edgew. & Hook. f., l.c. 229.

5. ***Stellaria patens*** D. Don, Prodr. Fl. Nepal. 215. 1825; Mizushima in Fl. East Himal. 1 : 84. 1966; Majumdar in Sharma *et al.*, l.c. 587. *S. longissima* Wall. ex Edgew. & Hook. f. in Hook. f., l.c. 232.

Decumbent herbs, laxly tufted. Stems slender, 15-45 cm tall, with dense long silky hairs. Leaves [2-2] mm long, sessile, lanceolate, acute, 1-nerved. Flowers 12 mm diam., solitary axillary or in terminal cymes; peduncles erect, long. Sepals 5-6 mm long, narrowly lanceolate, glabrous, with broad scarious margins. Petals white, as long as sepals. Stamens 10. Capsules 5-valved, shorter than sepals. Seeds dark-brown, tubercled.

Fl. : May - Sept.; *Fr.* : Sept. - Nov. Darjeeling.

6. ***Stellaria sikkimensis*** Hook. f., l.c. 230; Mizushima l.c. 84.; Majumdar in Sharma *et al.*, l.c. 588.

Decumbent, caespitose, with brown patent hairs. Stems shining below, branched, villous. Leaves ovate or ovate-lanceolate, spreading, 6-18 × 2-5 mm, ciliate. Cymes terminal. Flowers 5-6 mm diam., pedicellate. Sepals 4-5 × 1 mm, lanceolate, acuminate, pilose with broad scarious margins. Petals 2.5 mm long. Stamens 10. Styles 3. Capsules pvoid-oblong, 5-6 mm long, 5-valved. Seeds 0.7 mm, smooth, dark-brown.

Fl. : June - Aug. ; *Fr.* : Aug. - Oct. Darjeeling.

7. ***Stellaria subumbellata*** Edgew. in Hook. f. in Hook. f., l.c. 233; Majumdar in Sharma *et al.*, l.c. 589.

Glabrous herbs, 15 cm tall. Stem slender, ascending. Leaves linear or elliptic-oblong, 3-18 mm long. Flowers 4 mm diam., solitary axillary or in terminal subumbellate cymes; pedicels capillary; bracts membranous. Sepals ovate-lanceolate, acute, green, 3-nerved, 2-2.5 mm long, with scarious margins. Petals absent. Stamens 5. Styles 3. Capsules subcylindric or narrowly ovate, 4 mm long, 5-valved. Seeds angular-ovate, pale brown, rough.

Fl. & Fr. : Aug. - Sept. Darjeeling.

8. *Stellaria uliginosa* Murray, Prodr. Stirp. Goetting. 55. 1770. Edgew. & Hook. f. in Hook. f., *l.c.* 233; Majumdar in Sharma *et al.*, *l.c.* 590.

Annual glabrous herbs; stem slender, 4-angled, 10-40 cm tall. Leaves sessile, ovate-lanceolate to linear-lanceolate, 8-25 mm long, margin undulate, apex mucronate; stipules lacerate; bracts 1 mm, scarious. Sepals 2.5-3.5 mm, lanceolate, acuminate. Petals equalling the sepals, lobes oblong and broad. Stamens 5-8. Capsules ovoid, 6-valved. Seeds covered with low manillae.

Fl. : March - July ; *Fr.* : Aug. - Sept. Darjeeling.

The name *S. alaine* Grimm. (1767) is illegitimate, since the Linnaean system of binomial nomenclature was not consistently used by Grimm. (Rauschert in Fedde Reper. 83 : 645. 1973).

9. *Stellaria vestita* Kurz in Journ. Bot. 11 : 194. 1873. *S. saxatilis* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 215. 1825; Edgew. & Hook. f. in Hook. f., *l.c.* 232; Majumdar in Sharma *et al.*, *l.c.* 590.

Herbs, laxly tufted, up to 90 cm tall. Stem shining below, upwards woolly, with stellate hairs. Leaves subsessile, ovate, elliptic or oblong, acute, 4-24 (-54) × 3-15 mm. Cymes axillary and terminal; pedicels 8-25 mm long, bracts linear, subulate. Sepals oblong, acute, 4-5 mm long. Petals slightly shorter. Stamens 10. Styles 3. Capsules 5-valved, as long as sepals, ovoid-oblong. Seeds 1 mm diam., black, rough.

Fl. : March - May; *Fr.* : May-June. Darjeeling.

12. VACCARIA Medik.

Herbs with opposite leaves. Inflorescence a dichasial cyme. Epicalyx absent. Sepals joined below into a winged calyx-tube, with 5 teeth above. Coronal scales absent. Stamens 10. Styles 2.

A genus with *ca* 3 species in the Mediterranean region; 1 species in West Bengal plains.

Vaccaria pyramidata Medik. Phil. Bot. 1 :96. 1789. *Saponaria vaccaria* L., Sp. Pl. 409. 1753; Edgew. & Hook. f. in Hook. f., *l.c.* 217; Prain, *l.c.* 158; Majumdar in Sharma *et al.*, *l.c.* 593.

Robust annual herbs, branched, glabrous, 30-60 cm tall. Leaves 25-75 × 8-18 mm, acute, sessile, glabrous. Cymes lax, corymbose. Flowers erect; pedicels slender. Epicalyx absent. Calyx tube inflated, 12 mm broad, with 5 sharp angles or wings; teeth 5, triangular. Petals rose coloured; limb cuneate, rounded or somewhat emarginate. Capsules included, globular, 4-valved. Seeds 2 mm diam., globose, black, granulate.

Fl. : Jan. - March; *Fr.* : April - May. Birbhum (often a weed in cultivated fields), 24-Parganas.

CULTIVATED SPECIES

- Dianthus chinensis** L. - 'China Pink'
Dianthus barbatus L. - 'Sweet William'
Dianthus caryophyllus L. - 'Carnation'
Gypsophila elegans Bieb.
Saponaria officinalis L. - 'Bouncing Bet'
Silene armeria L. - 'Sweet William Catchfly'
Lychnis coronaria Desr. - 'Rose Champion'

EXCLUDED SPECIES

Silene conoidea L. has only been once collected from Shibpur, Howrah by A. K. Mukherjee and N.C. Majumdar 10555 (CAL) on 29.1.1976 from a rubbish dump. The species is a common weed of wheat fields in Kashmir, Himachal Pradesh, Uttar Pradesh, Punjab and Rajasthan. However, in Howrah it appears to be a case of chance introduction with foodgrains.

PORTULACACEAE

N. Dam & K.C. Malick

A family of *ca* 19 genera and 580 species, cosmopolitan, chiefly American; 1 genus and 3 species in West Bengal.

PORTULACA L.

Mostly succulent or subsucculent annual or perennial diffuse herbs, often with tuberous tap root. Stipules appendage like. Flowers terminal or axillary, solitary or in clusters, surrounded by a whorl of leaves. Sepals occasionally keeled or hooded, persistent or caducous, connate below, adnate to ovary. Petals 4- 6, yellow or pinkish-yellow. Stamens 4 to many, in one whorl. Ovary semi-inferior; styles with 2 to many stigmatic divisions. Capsules usually finely tuberculate.

About 40 species in tropics and sub-tropics; 3 species in West Bengal.

1. Nodes without hairy appendages; flowers more than 1 in terminal clusters ...1. *P. oleracea*
1. Nodes with a ring of hairy appendages; flowers solitary, terminal:
 2. Leaves alternate; roots tuberous ...2. *P. pilosa*
 2. Leaves opposite; roots slender ...3. *P. quadrifida*

1. **Portulaca oleracea** L., Sp. Pl. 1, 445, 1753; Dyer in Hook.f., Fl. Brit. India 1: 246, 1874; Prain, Bengal Pl. 1: 161, 1963 (repr.ed.); Rao in Sharma *et al.*, Fl. India 3: 4, 1993. "Boro nunya" (Beng.).

Fig. 36

Sub-succulent, prostrate glabrous annual or perennial herbs, 15- 30 cm long with slender tap root, reddish, swollen at the nodes with scales. Leaves spiral to sub-opposite, 2-4 × 0.5-2 cm, obovate or spatulate, apex entire, rounded or truncate, base cuneate; stipules minute or absent. Flowers sessile, in terminal clusters, surrounded by bracteoles. Sepals 2.5 mm long, green, with scarios margins, keeled at back. Petals 4, obovate, mucronate, 4.5 × 2 mm. Stamens 8-10, adnate to the petals by the base of filaments. Ovary spindle-shaped; styles 4-5-armed. Capsules 3-5 × 2-4 mm, ovoid-oblong, circumsciss. Seeds many, up to 1 mm in diam., sub-reniform, finely reticulate.

Fl. & Fr. : Almost throughout the year. Throughout the State in the plains.

2. **Portulaca pilosa** L., Sp. Pl. 639, 1753; Geesink in Blumea 17, 295, 1959; Rao in Sharma *et al.*, *l.c.* 6. *P. tuberosa* Roxb. Fl. Ind.ed. Carey, 2, 464, 1832; Dyer in Hook.f., *l.c.* 247; Prain, *l.c.* 161.

Perennial succulent herbs with thick tuberous tap roots; branches prostrate, spreading, 10-30 cm long. Leaves alternate, more or less congested, 1.5 -2 × 0.2 cm, elliptic-linear, rough, warty with white hairs, base and apex obtuse or acute. Flowers terminal, solitary, sessile, surrounded by a ring of hairs and whorl of leaves. Sepals 3-4 mm long, without keel. Petals 5, reddish-purple, apiculate, *ca* 4 mm long. Stamens 7 or more. Capsules 5-6 × 3 mm, smooth and polished. Seeds up to 1 mm in diam., subglobose, tuberculate.

Fl. & Fr. : July - Sept. Burdwan, Midnapur.

3. **Portulaca quadrifida** L., Mant. 1: 75, 1767; Dyer in Hook. f., *l.c.* 247; Prain, *l.c.* 161; Rao in Sharma *et al.*, *l.c.* 6. "Chota-nunya" (Beng.).

Much branched prostrate annual herbs with numerous ascending branches, rooting at nodes; nodes with whorl of hairs. Leaves subsessile, opposite, 5-20 × 3-7 mm, ovate-elliptic or ovate-lanceolate, thick, fleshy, glabrous, entire, apex and base acute or obtuse. Flowers small, solitary, terminal, surrounded by a whorl of leaves and white hairs. Sepals 3 mm long, connate at base, sunk into the swollen end of branches, broadly elliptic to oblong-obovate. Petals 4, obovate, *ca* 5 × 4 mm, yellow within and yellowish-pink outside. Stamens 8 or more. Capsules 3 mm in diam., circumsciss. Seeds little, above 1 mm, subreniform, distinctly tuberculate.

Fl. & Fr. : Throughout the year. Almost throughout the plains of West Bengal.

The plant is said to have antiseptic properties.



Fig. 36. *Portulaca oleracea* L.

TAMARICACEAE

(B. Safui, B. C. Banerjee & C.R. Das)

A family of 4 genera having ca 120 species, distributed chiefly in temperate and subtropical zones; found also in desert, steppe and shore areas.

1 genus and 3 species in West Bengal.

TAMARIX L.

Shrubs or small trees. Leaves alternate, scale-like, sessile, amplexicaul or sheathing, closely appressed; exstipulate. Flowers in lateral or terminal spikes or in racemes or panicles, bracteate, mostly hermaphrodite. Sepals and petals usually 4-5. Stamens 5-10, free, inserted on or below the disc; anthers apiculate. Disc variously shaped, ovary free, narrowed upwards; style 3-4; stigmas spatulate. Capsules pyramidal, 3-valved. Seeds many, exalbuminous, with coma.

About 54 species throughout the world; 3 species in West Bengal.

1. Flowers unisexual; leaves amplexicaul or sheathing ...1. *T. dioica*

1. Flowers bisexual; leaves semi- or not sheathing:

2. Stamens 5; capsules 3-5 mm ...3. *T. indica*

2. Stamens 10; capsules 8.5-15 mm ...2. *T. ericoides*

1. ***Tamarix dioica*** Roxb. ex Roth. Nov. Pl. Sp. 185, 1821; Dyer in Hook. f., Fl. Brit. India 1: 249, 1874; Prain, Bengal Pl. 1: 162, 1963; (repr. ed.); Shetty & Pandey in Sharma *et al.*, Fl. India 3:24, 1993. "Lal-Jhau" (Beng.).

Shrubs or small trees. Leaves vaginate, upper free part triangular-ovate, acute to acuminate at apex, 0.75-3.00 mm long. Racemes simple or compound. Bracts broadly ovate-lanceolate, acuminate at apex, 2-3 mm long, mostly persistent. Flowers pink or pinkish-red. Male fl.: Sepals 5, small, ovate or sub-orbicular, keeled. Petals 5, obovate or oblong-obovate. Stamens 5. Disc 5-lobed. Ovary abortive. Female fl.: staminodes 5; style 3. Capsules 3-5 mm, with persistent sepals and staminodes. Seeds with coma.

Fl.: Apr.- Dec.; *Fr.*: July - Jan. Coochbehar and Malda mainly along river banks.

2. ***Tamarix ericoides*** Rottl. & Willd., Ges. Naturf. Fr. Berlin Neue Schr. 4: 214, 1803; Dyer in Hook. f., *l.c.* 249; Prain, *l.c.* 162; Shetty & Pandey in Sharma *et al.*, *l.c.* 25.

Undershrubs or shrubs. Leaves ovate-lanceolate to triangular-ovate-lanceolate, acuminate or acute at apex, keeled, 1.0-5.5 mm long. Racemes mostly simple. Bracts triangular-ovate-lanceolate, acuminate at apex, 2.5-5.5 mm long. Flowers pinkish. Sepals 5, free, ovate. Petals 5, obovate to oblong-ovate. Stamens 10, outer 5 longer, antisealous, inner 5 shorter, antipetalous. Disc 10-lobed. Capsules 9-15 mm long. Seeds small with coma.

Fl. & Fr.: Almost throughout the year. Along the river-beds of West Bengal.

Leaves are used in the treatment of cough and enlarged spleen. Paste of tender shoots is applied on skin rashes.

3. *Tamarix indica* Willd., Ges. Naturf. Fr. Berlin Neue Schr. 4: 214. 1803; Shetty & Pandey in Sharma *et al.*, *l.c.* 25. *T. gallica auct. non L.* Dyer in Hook. f., *l.c.* 248; Prain, *l.c.* 162. *T. gallica* var. *indica* (Willd.) Ehrenb. Dyer in Hook. f., *l.c.* 248. *T. troupii* Hote in Ind. For. 45:248. 1919. "Jhau" (Beng.).

Fig. 37

Shrubs or small trees. Leaves triangular-ovate-lanceolate to triangular-ovate, apex abruptly acute to acuminate, 0.5-3.0 mm long. Racemes simple or densely compound. Bracts ovate lanceolate, acuminate at apex, 1.5-2.5 mm long, deflexed, mostly persistent. Flowers pinkish. Sepals 5, ovate or suborbicular, persistent. Petals 5, obovate or obovate-elliptic. Stamens 5, filaments twice the length of petals, inserted in between the lobes of the disc. Disc 5-lobed, notched. Capsules 3.0-4.0 mm long. Seeds small with coma.

Fl. & Fr. : Almost throughout the year. Howrah, 24-Parganas along the coasts of Bhagirathi.

Occasionally planted in gardens.

Wood used in making agricultural instruments.

ELATINACEAE

(J. Bhattacharya & R.B. Ghosh)

A family of 2 genera and 8 species, cosmopolitan; 1 genus and 2 species in West Bengal.

BERGIA L.

Annual or perennial herbs or undershrubs. Stems erect, ascending or decumbent. Leaves opposite or pseudo-verticillate, shortly petioled, minutely serrate or entire, oblong-elliptic; stipule denticulate. Flowers solitary or in dense axillary fascicles, pedicellate or sessile, mostly bracteate. Sepals ovate-oblong to lanceolate, midrib distinct; margin pellucid. Petals ovate-oblong, thinly membranous. Stamens mostly 5, or twice the number of petals; filaments dilated; anther small, dorsifixed. Ovary globose or ellipsoid, 5-loculed; style short, straight or curved; stigma capitate. Capsule globose, septicidal. Seeds numerous, oblong, with rounded ends, smooth.

About 20 species throughout the world; 2 species in West Bengal.

- | | |
|--|------------------------------|
| 1. Plants glabrous; flowers sessile; stamens 10 | ...2. <i>B. capensis</i> |
| 1. Plants puberulous; flowers pedicelled;
stamens 3-5 | ...1. <i>B. ammannioides</i> |

1. *Bergia ammannioides* Roxb. *ex* Roth, Nov. Pl. 219. 1821; Dyer in Hook. f., Fl. Brit. India 1: 251. 1874; Prain, Bengal Pl. 1: 163. 1963 (repr.ed.); Bhattacharya in Sharma *et al.*, Fl. India 3. 33. 1993. "Lal Keshuriya" (Beng.).

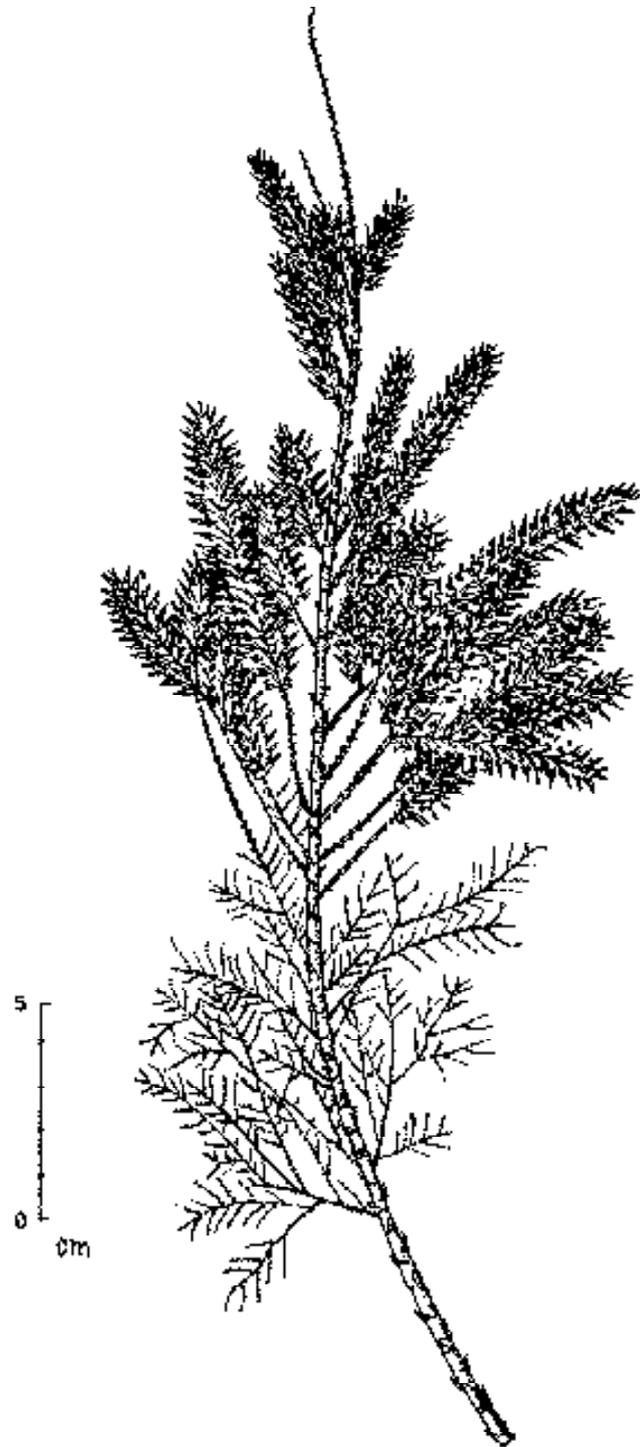


Fig. 37. *Tamarix indica* Willd.

Erect much-branched annual herbs. 10-35 cm long; base reddish purple, woody. Stems terete, glandular-pubescent with capitate hairs, swollen at nodes, leaves 15-30 × 3-8 mm, oblanceolate, tapering at base, acute, upper half sparsely serrate, lower half entire, glabrescent, subsessile; stipules 2-3 mm long, lanceolate, serrate, hairy. Flowers reddish-pink, few to many in axillary fascicles, 0.5-2.5 mm long, 2 mm across; pedicel 1-3 mm long, thin, pubescent. Sepals 1.4-3.2 mm, linear-lanceolate, keeled, ciliolate, often reddish-pink. Petals ca 1.3 mm, free, elliptic or oblong, reddish-pink, subacute or obtuse. Stamens ca 1 mm long. Ovary subglobose, sulcate, glabrous; styles 0.5-1 mm long, straight or shortly recurved; stigma thick, capitate. Capsules 0.2-4 mm long, subglobose, reddish. Seeds numerous, dark-brown, with shiny reticulations.

Fl. & Fr. : Aug. - Dec. Throughout West Bengal.

2. *Bergia capensis* L., Mant. 2: 241. 1771; Bhattacharya in Sharma *et al.*, *l.c.* 34. *B. verticillata* Willd., Sp. Pl. ed. 4. 2: 770. 1799; Dyer in Hook.f., *l.c.* 252; Prain, *l.c.* 163. "White Keshuriya" (Beng.). **Fig. 38**

Perennial glabrous herbs: branches ascending, rooting at lower nodes. Stems 10-35 cm tall, terete, with reddish striations, nodes constricted. Leaves 2.5 × 0.8-2 cm, oblong-lanceolate, base attenuate, acute or sub-obtuse; stipules 2-3 mm long, ovate-triangular, pectinate, membranous, acute. Flowers many, in axillary cymes, 2.5 mm across. Sepals 1.5-2.5 mm, erect, broadly elliptic, acuminate, light green with red tip. Petals slightly shorter than sepals, oblong or subspathulate, creamy, hyaline, suberect or spreading. Stamens 10, equal, 0.8-1.5 mm long, base dilated. Ovary 5-7 mm long, ellipsoid; styles shortly recurved; stigma 5-notched. Capsules 2-2.5 mm, subglobose. Seeds numerous, with strong reticulation.

Fl. & Fr. : Aug. - Oct. Birbhum, Burdwan, Hooghly, Howrah, 24- Parganas.

In plains and marshy coasts, abundant in fallow paddy-fields or in humid pastures.

HYPERICACEAE

(S.N. Biswas)

A family of ca 8 genera and ca 556 species in tropical, subtropical and temperate regions: 1 genus with 10 species and 1 subspecies in West Bengal.

HYPERICUM L.

Herbs or shrubs with translucent black or brown glands. Leaves sessile or shortly petiolate, opposite. Flowers yellow, solitary or in terminal dichasial to monochasial cymes or panicles. Sepals 5, rarely 4, imbricate, punctate to glandular. Petals 5, or rarely 4, yellow, often oblique, caducous or persistent. Stamens free or in fascicles of 3-5, variously united, caducous or persistent; filaments slender, free or connate; anthers dorsifixed, often black punctate on the

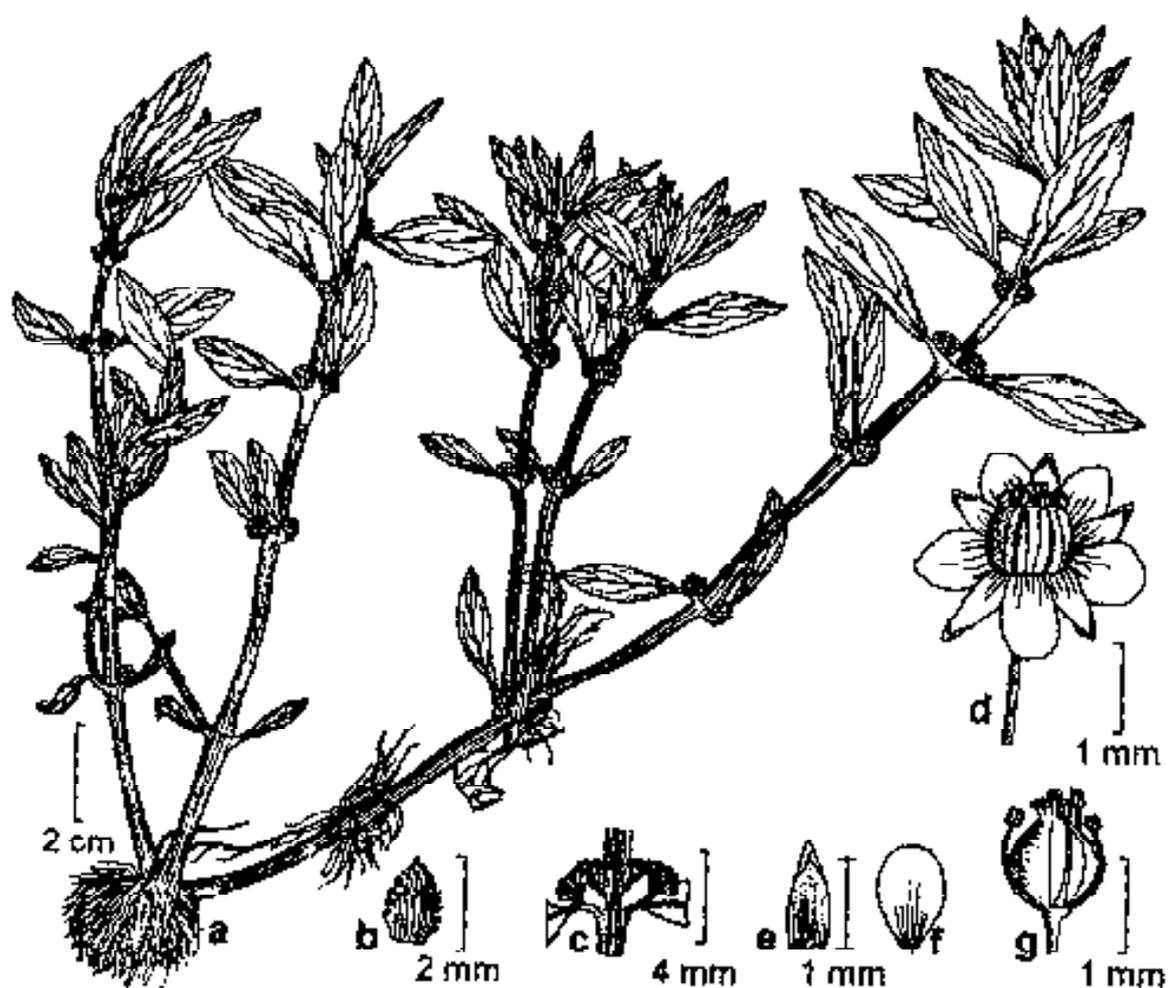


Fig. 38. *Bergia capensis* L. : a. habit; b. stipule; c. nodal part of branch showing inflorescences; d. flower; e. sepal; f. petal; g. flower with sepals and petals removed.

connective. Ovary 1-5 locular, with parietal, axile or pseudo-central placentas; styles 3-5, free or slightly connate, slender, often recurved at apex; ovules many, rarely few. Fruit a septicidal capsule or dehiscent along the placentas. Seeds mostly numerous, testa prominently or obscurely striated.

A genus with ca 400 species, mostly cosmopolitan; 10 species & 1 subspecies in West Bengal.

Note. The family Hypericaceae is sometimes treated as subfamily of Guttiferae (Clusiaceae).

1. Herbs 6-60 cm tall:
 2. Stamens in one fascicle; ovary 1-celled; capsule valve without vittae or vesicle; stems 4-striate ...7. *H. japonicum*
 2. Stamens in 3 fascicles; ovary 3-celled; capsule valve with vittae or vesicle; stems terete to 2-striate:
 3. Plants ± pubescent; sepals with ciliate glands along margin:
 4. Styles longer than ovary; ciliate glands on margin of sepals and bracts closely set:
 5. Leaves oblong-lanceolate to linear, apex acute or subacute; capsule ovoid to ovoid-oblong ...3. *H. elodeoides*
 5. Leaves ovate-oblong or elliptic-obovate, apex sub-obtuse to rotund; capsule globose to ellipsoid ...11. *H. wightianum*
 4. Styles shorter than or sub-equalling the ovary; ciliate glands on margin of sepals and bracts distantly set ...8. *H. monanthemum*
 3. Plants more or less glabrous; sepals without ciliate glands along margin:
 6. Leaves sessile, suborbicular 3.5 - 9 × 3-8 mm; sepals 2.5 - 2.7 × 1.2 - 1.5 mm ...6. *H. humifusum*
ssp. *suborbiculatum*
 6. Leaves petiolate, ovate to ovate-elliptic or elliptic-lanceolate, 1-2.5 × 0.6-1.3 cm; sepals 2.7-3.5 × 1 -1.2 mm ...9. *H. petiolulatum*
1. Shrubs or undershrubs, 0.8-2.5 m tall:
 7. Styles ± equalling (within 0.5-1 mm) or equalling to ovary or styles half as long as ovary:
 8. Flowers 2-4 cm across; petals narrowly to broadly obovate:
 9. Sepals 3.5-8 × 2.8-5 mm, ovate-oblong to elliptic-oblong, obtuse to sub-obtuse at apex ...10. *H. uralum*

9. Sepals 7.8 × 1.7-2 mm, lanceolate to oblanceolate, acute to subacuminate at apex ...4. *H. gracilipes*
8. Flowers 4.5-6 cm across; petals obliquely obovate ...5. *H. hookerianum*
7. Styles longer, one-third or twice or more longer than ovary:
10. Leaves subsessile, petiole up to 2 mm long with cuneate to rounded leaf base, sepals 1.2 × longer than stamens; ovary & capsule ellipsoid-oblong to globose ...2. *H. dyeri*
10. Leaves sessile with subattenuate leaf base; sepals shorter than stamens; ovary & capsule ovate-oblong ...1. *H. benghalense*

1. ***Hypericum benghalense*** S.N. Biswas in Bull. Bot. Surv. India 29(1-4): 53. 1989; S.N. Biswas in Sharma *et al.*, Fl. India 3:52. 1993. **Fig. 39**

Glabrous shrubs; branches spreading, stout reddish-brown. Leaves sessile, 1.6-4 × 0.7-1.6 cm, chartaceous, ovate to elliptic-lanceolate, acute or rarely subapiculate at apex, subattenuate at base, glabrous, rarely punctate. Flowers showy, yellow, in 1-2(-3)-chotomous corymbose cymes, 1.5 cm across. Sepals 5, elliptic to elliptic-oblong, 6-8 mm long. Petals 5, 1.9-2.9 cm long. Stamens 5-adelphous, 18-21 mm long, ca 22 in each fascicle. Ovary 6-8 mm long. Capsules 1.5-1.6 cm long, ovate-oblong. Seeds 1 mm, apiculate at both ends, testa finely reticulate.

Fl. & Fr. : June - Oct. Darjeeling.

2. ***Hypericum dyeri*** Rehder in Journ. Arn. Arbor. 20: 422. 1939; S.N. Biswas in Sharma *et al.*, l.c. 54. *H. lysimachioides* Wall. ex Dyer in Hook.f., Fl. Brit. India 1: 254. 1874; non Boiss. et Neo. 1853. 'Mehandiphul' (H. & Nep.).

Glabrous shrubs; stem stout, 2-lined to terete. Leaves 1.5-5 × 0.6-2.8 cm, ovate to ovate-lanceolate or elliptic-lanceolate, acute to obtuse at apex, punctate with black to brown dots. Flowers in 2-3(-4)-chotomous corymbose to subcorymbose cymes, 1.8-7 cm across. Sepals 5-11 × 2-3 mm, lanceolate to linear lanceolate, spreading in buds. Petals 11-20 × 3-4 mm. Ovary 3.5-5 mm long; styles longer than ovary. Capsules 7-9 mm, with persistent styles. Seeds ca 1 mm long, testa scarcely reticulate.

Fl. : June - Aug.; *Fr.* : Sept. - Nov. Darjeeling, Jalpaiguri.

3. ***Hypericum clodeoides*** Choisy in DC., Prodr. 1: 551. 1824; Dyer, l.c. 235; S.N. Biswas in Sharma *et al.*, l.c. 56. *H. napaulense* Choisy, l.c. 552.

Perennial herbs. Stems erect, usually simple as well as stoloniferous, mostly unbranched below inflorescence. Leaves sessile, clasping the stem, glabrous above, glaucescent beneath. Flowers 1.2-6 cm across, in terminal corymbose racemes. Sepals 5-7 mm long, lanceolate to linear-lanceolate. Petals 6-10 mm long, oblanceolate-spathulate. Stamens 6-7 mm long, in 3 fascicles. Ovary ovoid-oblong, 2.5-3 mm long. Seeds ca 0.6 mm, oblong, rounded at both ends; testa scalariform-reticulate.

Fl. : June - Aug.; *Fr.* : Oct. - Nov. Darjeeling.

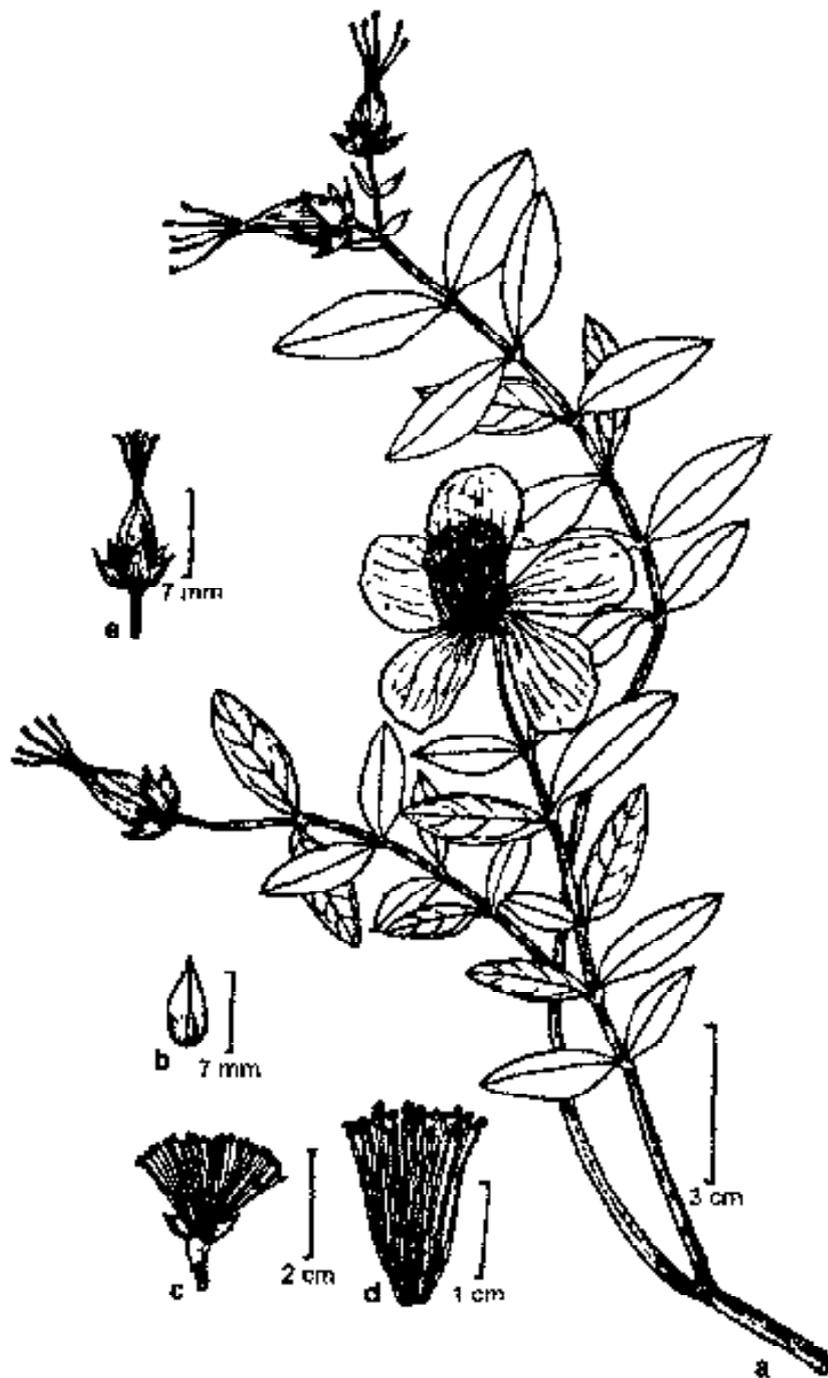


Fig. 39. *Hypericum benghalense* S. N. Biswas : a. flowering and fruiting branch; b. sepal; c. flower with petals removed; d. fascicle of stamens; e. pistil.

4. ***Hypericum gracilipes*** Stapf ex C.E.C. Fischer in Kew Bull. 32. 1940; S.N. Biswas in Sharma *et al.*, *l.c.* 61.

Glabrous branched undershrubs; stems and branches terete, suffused with deep brown colour. Leaves 2-3.5 × 0.8-1.5 cm, lanceolate to narrowly ovate, acute to subacute at apex & base. Flowers in 3-5-flowered dichotomous cymes, 2.8-3.5 cm across; bracts 1 cm long, linear-lanceolate. Petals 1-1.5 × 1-1.2 cm, broadly obovate, apex round. Stamens numerous, 6-6.5 mm long in 5 fascicles; filaments 27-30 in each fascicle, unequal, shorter than petals. Ovary ellipsoid, 6-6.5 mm long. Capsules 1.2-1.3 cm, with persistent styles. Seeds 0.8 mm long; testa ribbed-scalariform.

Fl. & Fr. : June - July. Darjeeling.

5. ***Hypericum hookerianum*** Wt. & Arn., Prodr. 99. 1834; Dyer, *l.c.* 254 *pro parte* excl. var. ***leschenaultii***; S.N. Biswas in Sharma *et al.*, *l.c.* 64.

Glabrous shrubs, 1.8-2.5 m tall; branches stout, terete. Leaves subsessile, 2-9 × 1-3.5 cm ovate or ovate-oblong to broadly lanceolate with subrotund to cuneate base, obtuse to subacute with mucronate to mucronulate at apex. Flowers showy, yellow, in 1-3-chotomous corymbose subcorymbose cymes. Sepals 7-9 mm long, obovate to elliptic-oblong, sub-obtuse to rotund at apex. Petals yellowish, 1.7-2.5 cm long, punctate with few black and brown glands. Ovary 0.7-1 cm long, oblong to ovate-oblong. Capsules 1.2-1.4 cm long, tipped with persistent styles. Seeds *ca* 0.5 mm shortly apiculate.

Fl. : April - June; *Fr.* : Oct. - Nov. Darjeeling.

6. ***Hypericum humifusum*** L. subsp. ***suborbiculatum*** S.N. Biswas in Bull. Bot. Surv. India 29 : 53-54. 1989; S.N. Biswas in Sharma *et al.*, *l.c.* 67.

A glabrous decumbent or procumbent herb, 5-15 cm tall, rooting at the base; stems sub-terete to 2-lined, unbranched. Leaves suborbicular. Inflorescence in terminal cymes, 1-3-flowered, 3-8 mm across. Bracts leafy, entire, with translucent or brown dots. Petals 3.2-3.5 mm long, black dots at the margins or at the apex. Ovary 2.5-2.7 mm long, ovoid-elliptic. Seeds *ca* 0.6 mm oblong, rounded at both ends, testa reticulate-scalariform.

Fl. & Fr. : July - Sept. Darjeeling.

7. ***Hypericum japonicum*** Thunb. ex Murr., Syst. Veg. ed. 14. 702. 1784; Dyer, *l.c.* 256; Prain, Bengal Pl. 1: 164 (repr. ed.) 1963; S.N. Biswas in Sharma *et al.*, *l.c.* 69.

Annual herbs, 6-30 cm tall, erect or decumbent, rooting at the base. Stems dichotomously branched above. Leaves sessile, 4-9 × 1.3-5 mm, elliptic to ovate or oblanceolate, rounded, amplexicaul, not clasping with stem, obtuse at both ends. Flowers 0.8-1 cm across, in elongate dichotomous cymes. Sepals 3-4.5 × 1-2.5 mm, punctate with black dots at margins. Petals as long as sepals. Stamens obscurely united into a ring at base, 2.5-2.8 mm long, ovary 2-3 mm long, ovate-oblong. Capsules 4-4.5 mm long. Seeds oblong, testa ribbed.

Fl. & Fr. : Throughout the year. Almost all the districts.

8. **Hypericum monanthemum** Hook.f. & Thoms. ex Dyer, *l.c.* 256; S.N. Biswas in Sharma *et al.*, *l.c.* 69.

Slender, perennial, often unbranched, erect herbs, 10-30 cm tall; branches subterete to 2-lined, suffused with pale reddish brown colour. Leaves 7-17 × 4-11 mm, elliptic to elliptic-oblong, obtuse to rotund at apex, base sub-amplexicaul, entire, sessile or petiolate; petiole up to 1.5 mm long. Flowers solitary or in 2-3-flowered cymes. Sepals 5-6 × 2-3 mm, broadly lanceolate. Petals 8.5-9.5 mm long, oblanceolate or broadly lanceolate. Stamens longer than pistil. Ovary ovoid or subglobose, 2.5-3 mm long; styles 1.8-2 mm long. Capsules ovoid to subglobose, 8-9 × 4-4.5 mm. Seeds oblong ± 0.5 mm, rounded at both ends; testa scalariform reticulate.

Fl. & Fr. : June - Aug. Darjeeling.

9. **Hypericum petiolulatum** Hook.f. & Thoms. ex Dyer in Hook.f., *l.c.* 255; S.N. Biswas in Sharma *et al.*, *l.c.* 75.

Slender prostrate or decumbent glabrous herbs, 20-40 cm tall, branches usually suffused with reddish-purple colour. Leaves 1-2.5 × 0.6-1.3 cm, punctate with pale black glands more profusely below; apex obtuse to rotund, base cuneate. Cymes in lax flowers, 4-10 mm across, on slender 8-15 mm long pedicels. Sepals 2.7-3.5 × 1-1.2 mm, lanceolate to linear-lanceolate, eglandular, entire, apex acute. Petals 4.5-5 mm long, oblanceolate-spathulate, apex subobtuse to obtuse. Ovary 1.5-2.8 mm, ellipsoid to ellipsoid-oblong; styles erect. 1-1.7 mm long. stigma capitate. Capsules 4-5 mm, elliptic-oblong. Seeds 0.6-0.7 mm, oblong, with obtuse to sub-rotund ends.

Fl. : May - June; *Fr.* : July - Sept. Darjeeling.

10. **Hypericum uralum** Buch.-Ham. ex D. Don in Sims. Bot.Mag. t. 2375. 1823; S.N. Biswas in Sharma *et al.*, *l.c.* 77. *H. patulum* auct. non Thunb. ex Murry; Dyer in Hook. f., *l.c.* 254. "La-syn-rit" (Assm.); "Dieng-syn-tiwaana" (Kh.); "Urilo" (Nep.); "Thumbul" (Bhoj.).

Shrubs up to 2.5 m tall. Leaves subsessile, 1.3-2.6 × 0.35-1.5 cm, lanceolate to ovate-lanceolate, apex subacute to obtuse minutely apiculate, base cuneate. Flowers yellow, in few flowered corymbose or subcorymbose cymes, 1.7-3.8 cm across. Stamens much shorter than petals, 40-50 in each fascicle. Ovary 3-4.5(-5.5) mm long; styles recurved near apex, connate at base. Capsules 6-10 mm long, ovoid to globose, without vittae or vesicles. Seeds ca 0.6 mm long, testa linear-reticulate.

Fl. & Fr. : July - Oct. Darjeeling.

The seeds are employed as aromatic stimulant. In Indo-China (Vietnam) these are used for dog bites and bee stings. The wood is hard and close-grained and can be worked to a smooth surface.

11. **Hypericum wightianum** Wall. ex Wt. & Arn., Prodr. Fl. Ind. Or. 99. 1834; S.N. Biswas in Sharma *et al.*, *l.c.* 78. *H. napaulense sensu* Dyer., in Hook. f., *l.c.* 256, non Choisy.

Perennial herbs. Stems decumbent to prostrate with rooting base, slender, occasionally branched at the middle. Leaves sessile or subsessile; petiole 1-1.5 mm long. Inflorescence a 20-25-flowered sub-corymbose cyme. Flowers 1.5 cm across; pedicels *ca* 3 mm long, with glandular ciliate auricles. Sepals 4-5 mm, narrowly oblong to lanceolate. Petals 5.5-9 mm, oblanceolate-spathulate, prominently veined. Stamens equalling the petal. Ovary 1.7-2.5 mm long, ellipsoid-oblong. Capsules 4-8 mm long. Seeds 0.6-0.7 mm long, sometimes concave at one side, rounded at both ends, testa scalariform-reticulate.

Fl. & Fr. : June- Aug. Darjeeling.

CULTIVATED SPECIES

***Hypericum androsaemum* L.**

***H. calycinum* L.**

***H. cistifolium* Lam.**

***H. cordifolium* Choisy**

***H. densiflorum* Pursh**

***H. monogynum* L.**

***H. olympicum* L.**

CLUSIACEAE

(Guttiferae)

(R. B. Ghosh)

A family of *ca* 40 genera and 1000 species chiefly in the tropics of the world; 4 genera and 8 species in West Bengal.

1. Leaves with numerous, very close, straight, parallel lateral veins with no minor veins; ovary unilocular with a solitary ovule. ...1. CALOPHYLLUM
1. Leaves with lateral veins often arcuate and forking, minor veins present; ovary otherwise:
 2. Style short or absent; stigma broadly peltate; fruits berry ...2. GARCINIA
 2. Style distinct; stigma small peltate or 2-4 fid; fruits drupe:
 3. Sepals 2; ovary 2-4 locular; drupe pulpy ...3. MAMMEA
 3. Sepals 4; ovary 1-2 locular; drupe not pulpy ...4. MESUA

1. CALOPHYLLUM L.

Trees with opposite shining coriaceous leaves having numerous parallel slender secondary nerves at right angle to the midrib, no minor veins. Flowers paniced, polygamous. Sepals and petals 4-12, imbricate, in 2-3 series. Stamens numerous, free; filaments slender. Stigma peltate. Fruit a drupe.

A genus of ca 112 species, chiefly tropical Asiatic with a few American; 2 species in West Bengal.

1. Racemes few-flowered ...1. *C. inophyllum*

1. Racemes many-flowered ...2. *C. polyanthum*

1. **Calophyllum inophyllum** L., Sp. Pl. 513. 1753; T. Anders in Hook.f., Fl. Brit. India 1 : 273. 1874; Prain, Bengal Pl. 1 : 166. 1963 (repr. ed.) ; Singh in Sharma *et al.*, Fl. India 3:92. 1993. "Sultan Champa" (Beng.); "Punang" (Or.).

A very handsome small or middle-sized glabrous tree generally with a short crooked trunk; bark grey, smooth. Leaves 15-20 × 5-9 cm, broadly elliptic, rounded at apex, often emarginate with sub-repand margin. Flowers pure white, fragrant, in lax few-flowered racemes. Sepals 4, ovate-orbicular, concave, reflexed. Petals 4, oblong, obtuse. Stamens numerous, filaments united into 4-6 bundles. Style long, twisted; stigma large, peltate. Fruits globose.

Fl. & Fr. : April - Nov. Throughout the plains, often planted.

Wood is good. Seeds yield an oil known as Pinney oil or Domba oil used for burning. It is a good lubricant in place of castor oil.

2. **Calophyllum polyanthum** Wall. ex Choisy, Descr. Guttif. Ind. 43. 1849; T. Anders in Hook. f., *l.c.* 274; Prain, *l.c.* 166; Singh in Sharma *et al.*, *l.c.* 94. *C. elatum* Bedd. Fl. Sylv. 1:2. 1869. "Kandeb" (Beng.), "Kiroli" (Nep.), "Cach" (Telo). **Fig. 40**

A medium-sized to large evergreen tree. Leaves 10-15 × 3-4 cm shining on both surfaces, margin waved, apex acute or obtuse, base acute or cuneate. Inflorescence terminal or axillary racemes. Flowers white, polygamous, tetramerous. Sepals 4, outer ones suborbicular, very small, inner twice as long, petaloid. Petals 4, longer than the inner sepals, obovate, reflexed, concave. Stamens with short filaments. Fruit a berry, almost globular.

Fl. & Fr. : April - July. In Terai regions of all hilly districts and also in Sunderbans (24-Parganas).

The timber is hard, durable, strong and elastic. It is useful for various purposes of house building.

2. GARCINIA L.

Trees with yellow resinous sap. Flowers polygamous, solitary or cymose. Sepals 4-5. Petals 4-5, imbricate. Male flowers : stamens many, free or connate in various manners; anthers sessile, on staminal column or short thick filaments. Female flowers : staminodes 8-numerous, free or connate; ovary 2-12-celled;

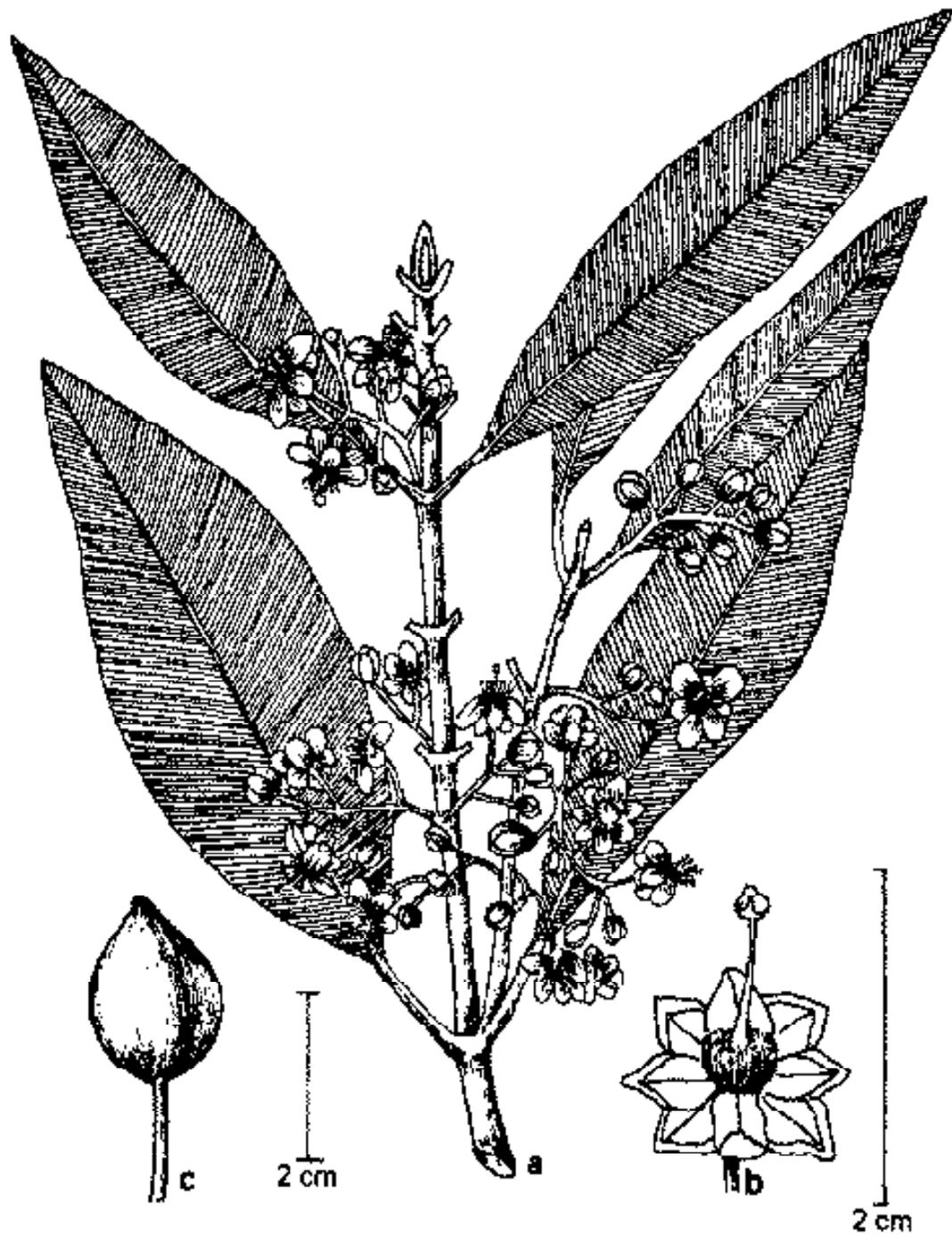


Fig. 40. *Calophyllum polyanthum* Wall. ex Choisy : a. flowering branch; b. flower; c. fruit.

stigma peltate, entire or lobed; ovule 1 in each cell, axile. Fruit with a thick coat berry. Seeds arillate.

A genus of ca 100 species distributed in tropics of the old world; 3 species in West Bengal.

- 1. Stamens 15-20 in 3- 5 bundles ...3. *G. xanthochymus*
- 1. Stamens numerous in a ring or on angular torus :
 - 2. Flowers in cymes ...2. *G. stipulata*
 - 2. Flowers in umbels ...1. *G. cowa*

1. ***Garcinia cowa*** Roxb., Fl. Ind. 2 : 622. 1820; T. Anders, in Hook. f., l.c. 262; Prain, l.c. 166; Singh in Sharma *et al.*, l.c. 108. "Cow" (Beng.), "Sarbona" (Or.).

A large tree with drooping branches. Leaves 10-12.5 cm long membranous, broadly lanceolate. Flowers yellow or reddish yellow. Male flowers : 3-8 in umbels; stamens numerous, densely covering a fleshy almost 4-cornered central mass; anthers 4-celled, pistil rudimentary or 0. Female flowers : ovary globose, 6-8 celled; style grooved; stigma broad, granular. Fruit small, orange-shaped, yellow or dark purple, 6-8 grooved, terminated by a nipple-shaped protuberance.

Fl. & Fr. : April - Aug. Often cultivated, but also common in North Bengal districts.

2. ***Garcinia stipulata*** T. Anders, in Hook. f., l.c. 267, Singh in Sharma *et al.*, l.c. 126. "Borthukera" (Assm.).

A middle sized tree 18-20 m high. Leaves 15-30 × 4-9 cm, thickly coriaceous, elliptic-oblong or elliptic-lanceolate; stipules small, deciduous. Male flowers : 3-7 in cymes, axillary or above the scars of fallen leaves; bracts acute or rounded; stamens many, in an annular mass enclosing the rudimentary pistil. Female flowers : single or in pairs. Fruits yellow, oblong, 2-celled and 2 seeded.

Fl. & Fr. : July - Sept. Only in the lower hill forests of Darjeeling.

Used as timber-yielding plant mainly for making light wooden furniture.

3. ***Garcinia xanthochymus*** Hook. f., l.c. 269; Prain, l.c. 167; Singh in Sharma *et al.*, l.c. 129. "Dampel", "Tamal" (Beng.); "Siambu" (Or.).

A large tree, covered with rough bark. Leaves coriaceous 23-45 × 7-10 cm, linear-oblong or oblong-lanceolate, acute to acuminate, smooth, shiny. Male flowers : in fascicles; sepals 5, fleshy, unequal; petals 5, orbicular, spreading; stamens 15-20 in 3-5 bundles; anther 2-celled. Female flowers : ovary ovoid, pointed, usually 5-celled; stigma 5-lobed, oblong, spreading, entire. Fruits large subglobose, pointed, smooth, deep yellow when ripe.

Fl. & Fr. : March - July. In all the plain districts of the State.

Fruits edible, tree often planted for fruits. A decoction of the dried fruit is used as a medicine for bilious condition. The gum of the bark is one inferior kind of gamboge. Sometimes vinegar is prepared from the fruits.

3. MAMMEA L.

Trees, medium-sized. Leaves opposite or ternately whorled, coriaceous. Flowers in short cymes in lateral or axillary fascicles, polygamous. Sepals 4, closed before flowering. Petals 4 or more. Stamens numerous: filaments filiform, free or shortly connate below; anthers erect, oblong, 2-celled. Carpels 2; ovary 2-celled with 2 ovules in each cell; style short or 0; stigma 3-lobed. Berry 1-4 seeded. Seeds large, enclosed in pulp.

A genus of *ca* 48 species in Madagascar, West Africa; 1 species in West Bengal.

Mammea suriga (Buch.-Ham. ex Roxb.) Kostermans in Commun. Forest Res. Inst. 72:23, f. 10, 1961; Singh in Sharma *et al.*, *l.c.* 132. *Calophyllum suriga* Buch.-Ham. ex Roxb., Fl. Ind. 2 : 608, 1832. *Ochrocarpus longifolius* (Wt.) Benth. ex T. Anders. in Hook. f., Fl. Brit. India 1 : 270, 1874; Prain, *l.c.* 165. "Nageswar" (Beng.); "Chiuriana" (Or.).

A large or middle-sized evergreen tree. Leaves thickly coriaceous, oblong, obtuse or shortly or bluntly pointed. Flowers white or rose, male and bisexual, numerous in short fascicles; bracts subulate. Calyx bursting into 2 valves. Petals 4, ovate-oblong, acute, thin, deciduous. Stamens numerous, sterile in the female flowers; style short, stout; stigma broad, peltate. Fruit obliquely ovoid, 1-seeded.

Fl. & Fr. : Feb. - June. Throughout the plains.

Flowers are used as stimulant, analgesic and carminative. Sometimes the plant is used in leprosy.

4. MESUA L. emend Kosterm.

Shrubs or trees. Leaves polymorphic, usually lanceolate, entire, pellucid-dotted. Flowers bisexual or polygamous, solitary or many, subsessile or in panicles. Sepals 4, imbricate usually accrescent in fruit. Petals 4, imbricate, alternate with sepals. Stamens numerous, filaments filiform, free or connate at base. Ovary uni or bilocular; stigma small peltate or 2-4 fid. Fruits drupaceous or capsular nut.

A genus of *ca* 40 species distributed in Tropical Asia and Indo-Malesia to Australia; 2 species in West Bengal.

1. Flowers solitary or in paired, ebracteate, stigma small peltate

...1. *M. ferrea*

1. Flowers many, bracteate, stigma 4-fid

...2. *M. floribunda*

1. *Mesua ferrea* L., Sp. Pl. 515, 1753; T. Anders. in Hook. f., *l.c.* 277; Prain, *l.c.* 165; Singh in Sharma *et al.*, *l.c.* 136. "Nageswar" (Or., Beng.). **Fig. 41**

A middle-sized glabrous tree. Leaves oblong-lanceolate, acute or acuminate. Flowers very fragrant, axillary or terminal, solitary or in pairs, subsessile; bracts absent. Sepals 4, orbicular, cupped, persistent. Petals 4, pure white, spreading, ovate, cuneate. Stamens numerous, golden-yellow, much shorter than petals.

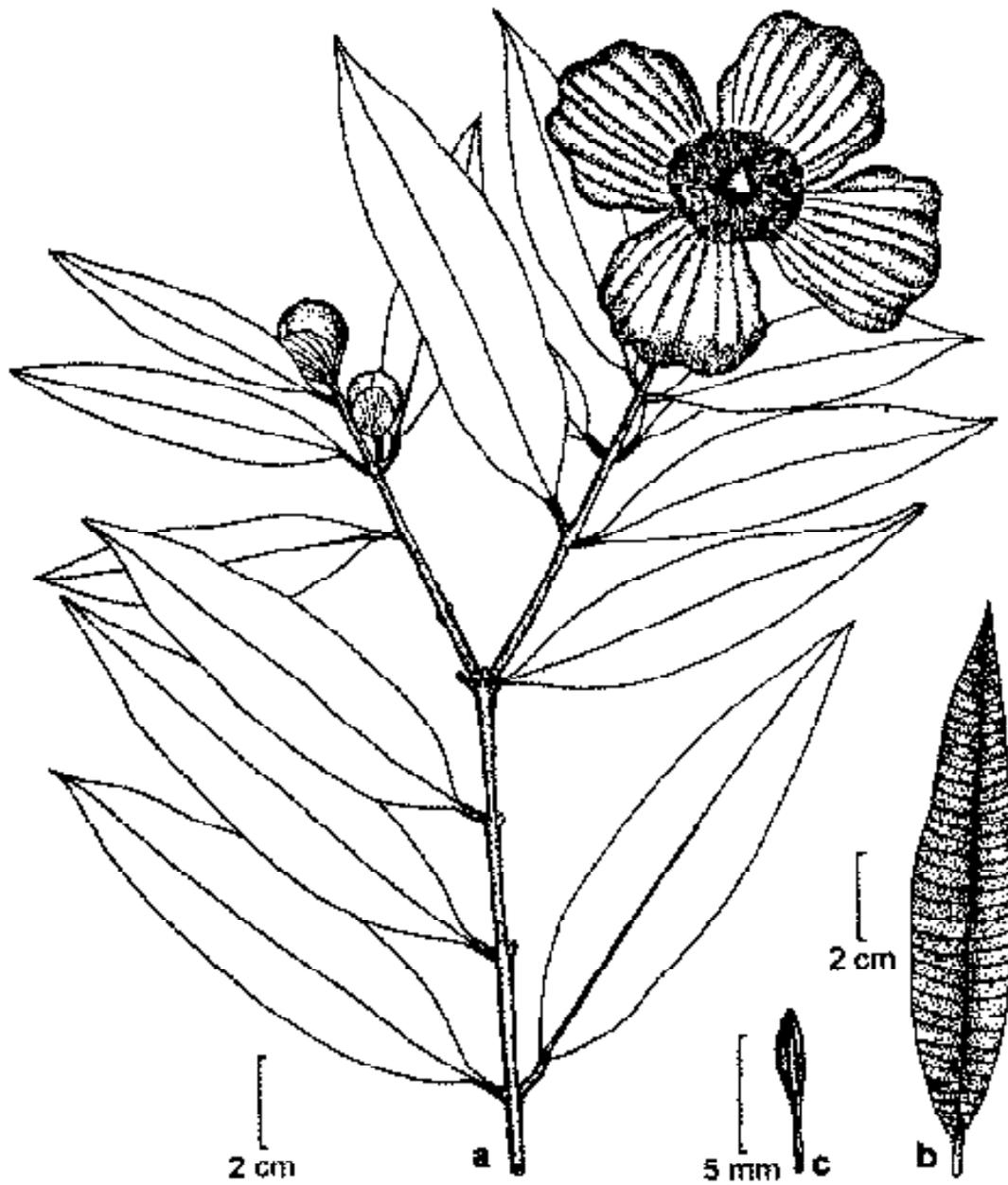


Fig. 41. *Mesua ferrea* L. : a. flowering branch; b. leaf; c. seed.

slightly united at base; anthers oblong. Style twice as long as stamens; stigma peltate. Fruits long, ovoid with a conical apex. Seeds 1-4, angular, smooth.

Fl. & Fr. : April - Nov. Semi-naturalised in the plains of all the districts of the state. Sometimes planted near temples as ornamental plant.

The plant yields a valuable timber. Its flowers are used in perfumery. A paste made of flowers with butter and sugar is used in bleeding piles and burning of the feet.

2. **Mesua floribunda** (Wall.) Kusterm. in *Reinwardtia* 7 :427, 1969; T. Anders. in Hook. f., *l.c.* 276; Singh in Sharma *et al.*, *l.c.* 139. *Keya floribunda* Wall. Pl. Asiat. Rar. 3 : 5, t. 210, 1832.

A large evergreen tree with greenish-grey or brown bark. Leaves 12-35 cm long, oblong to lanceolate, acuminate, coriaceous, glabrous. Flowers in terminal panicles, white, bracts and bracteoles small, opposite, deciduous. Sepals 7-8 mm, suborbicular, broader than long, accrescent in fruit. Petals about 11-13 mm long, white with pink edges, oblong-obovate or obovate. Stamens free; anthers golden yellow. Ovary 1-celled with 4 ovules; styles slender; stigma 4-cleft. Fruits sub-drupaceous, 1-4-seeded.

Fl. & Fr. : April- July. In the lower hill forests of Darjeeling; also in Jalpaiguri.

Used as timber-yielding plant.

THEACEAE

(Ternstroemiaceae)

(A. Bhattacharyya)

A family of ca 10 genera and 350 species in the tropics; 4 genera and 6 species in West Bengal.

1. Shrubs; flowers many; bracts persistent:

2. Flowers unisexual; indehiscent, not with persistent calyx ... 2. EURYA

2. Flowers bisexual; dehiscent with persistent calyx ... 4. TERNSTROEMIA

1. Trees, flowers solitary or 3 to 4 flowered; bracts deciduous:

3. Flowers in terminal racemes; seeds flat, kidney shaped, winged on the back ... 3. SCHIMA

3. Flowers axillary, solitary or fascicled; seeds irregularly globose, wingless ... 1. CAMELLIA

1. CAMELLIA L.

Evergreen trees or shrubs. Leaves coriaceous or membranous, serrate. Flowers usually showy, axillary, solitary or subfasciculate; sessile or shortly pedicelled. Sepals 5-6, unequal, within a series of subsimilar bracts. Petals 5 or more, slightly connate below. Stamens numerous, outer many-seriate, more or less connate and

monadelphous, also adnate to base of petals, inner 5-12 free, 1-2-seriate. Ovary 3-5-locular; styles as many as loculi, free or more or less connate; ovules 4-5 in each cell, pendulous from inner angle. Fruit a short woody capsule, dehiscing loculicidally. Seeds usually solitary in each cell, without wing; albumen absent; embryo straight, cotyledons thick.

A genus with ca 82 species distributed in Indomalaysia, China and Japan; 1 species cultivated in West Bengal.

Camellia sinensis (L.) O. Kuntze in Acta Hort. Petrop. 10: 195, 1887; Sealy, Rev. gen. *Camellia* 112-116, 1958; Chauhan & Paul in Sharma *et al.*, Fl. India 3:159, 1993. *Thea sinensis* L., Sp. Pl. 515, 1753; *Camellia thea* Link, Enum. Hort. Berol. II. 73; Prain, Bengal Pl. 1:168, 1963 (repr. ed.); *C. theifera* Griff., Notul. 4: 558, 1854; Dyer in Hook. f., Fl. Brit. Ind. 1:292, 1874. "Chha" (Beng.).

Fig. 42

Shrubs or small trees. Leaves shortly stalked, elliptic, obtuse, 4-10 × 2-4 cm, bluntly serrulate to sinuate-serrulate. Flowers showy, white, solitary, axillary. Sepals 5-6, unequal. Petals 5 or more, slightly connate below, cup-shaped. Stamens many, adnate to base of the petals, free. Ovary 3-5-locular; styles as many as loculi; ovules 4-5 in each locule. Fruit a short woody capsule, opening loculicidally. Seed one in each locule, albumen absent.

Fl. & Fr. : Sept. - Feb. Darjeeling, Jalpaiguri.

Tea is an accepted wholesome and stimulating beverage. Infusions of tea leaves are used in conjunctivitis.

2. EURYA Thunb.

Shrubs. Leaves usually crenate-serrate, glabrous. Flowers dioecious, small, sessile or shortly pedicelled, in axillary fascicles, or rarely solitary; bracts persistent. Sepals 5, imbricate. Petals 5, imbricate, connate at base. Stamens 15 or less (rarely 5), adnate to base of the corolla; anthers glabrous, basifixed. Ovary 3-(rarely 2-5)-celled; ovules many in inner angle of each cell; styles 3(rarely 2-5) free or connate. Fruit baccate. Albumen fleshy.

A genus with ca 130 species; 3 species in West Bengal.

1. Young parts hairy; flowers two bracteolate; fruit crowned with persistent style:

2. Stamens 15 or more; fruit globose ... 1. *E. acuminata*

2. Stamens 15 or less; fruit ovoid ... 3. *E. japonica*

1. Young parts glabrous; flowers three bracteolate; fruit without persistent style

... 2. *E. cerasifolia*

1. **Eurya acuminata** DC, in Mem. S. Phys. Geneve 1: 418, 1822; Dyer, in Hook. f., *l.c.* 285; Prain, *l.c.* 167; Hara, Fl. East. Himal. 208, 1966; Chauhan & Paul in Sharma *et al.*, *l.c.* 178.

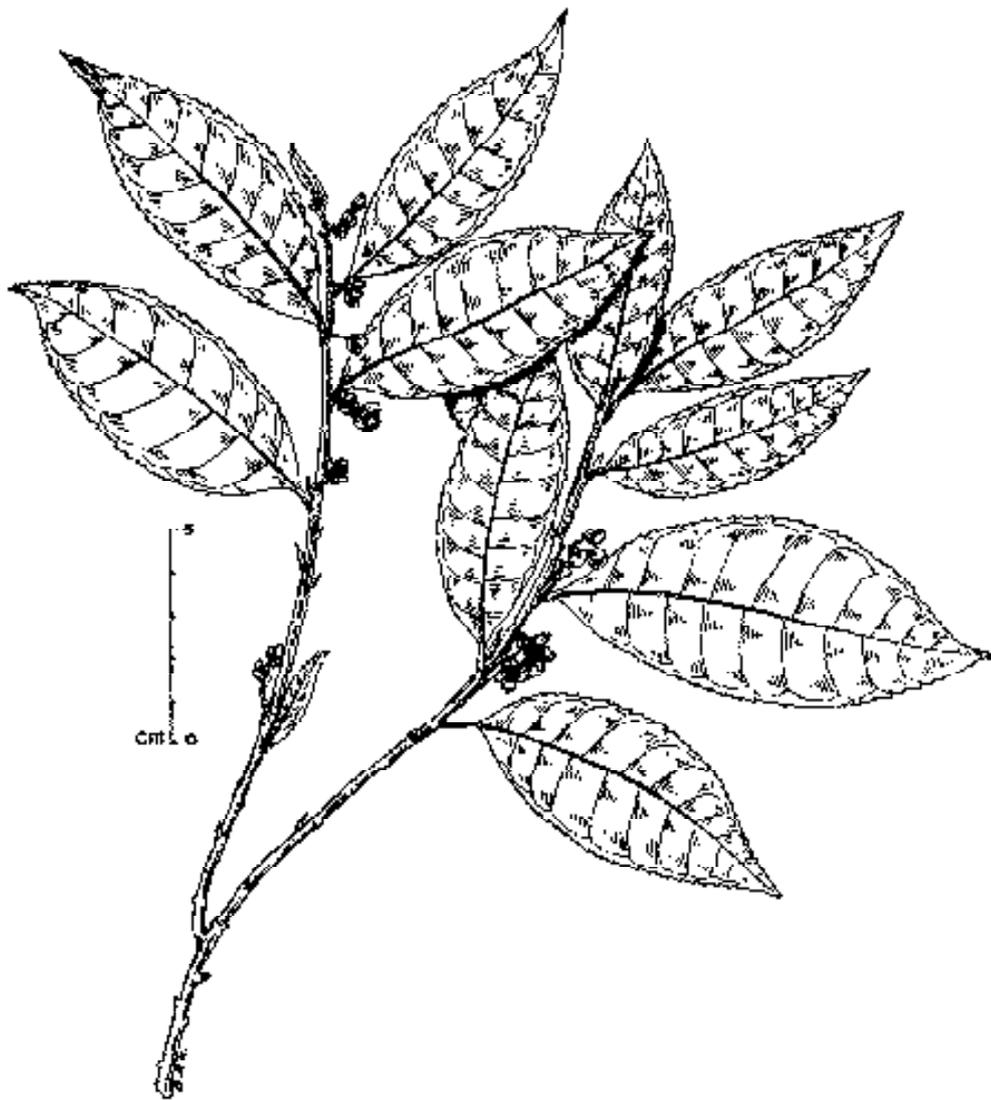


Fig. 42. *Camellia sinensis* (L.) O. Kuntze

A small evergreen tree, young parts hairy. Leaves subcoriaceous, 5-10 cm long, oblong to linear-lanceolate, caudate-acuminate, closely crenate-serrate, glabrous, petiole short. Flowers white, foetid, 2-bracteolate. Sepals concave, pubescent outside, outer two smallest. Petals white, alternating with sepals. Stamens more than 15, shorter than petals. Ovary pubescent; styles 3-5. Capsules globose, crowned with remnants of style. Seeds bluntly trigonous.

Fl. & Fr. : April - Aug. Jalpaiguri.

The wood is used as fuel.

2. *Eurya cerasifolia* (D. Don) Kobuski in Ann. Mis. Bot. Gard. 25: 326, 1938; Hara, *l.c.* 209; Chauhan & Paul in Sharma *et al.*, *l.c.* 182. *Diospyros cerasifolia* D. Don, Prodr. 144, 1825. *Eurya symplocina* Bl., Mus. Bot. Lugd. Bat. 2: 114, 1856; Dyer in Hook. *f.*, *l.c.* 284.

A small tree, branches striate-silky at apex. Leaves usually membranous, 10-13 cm long, oblong-elliptic, entire or serrulate, obtusely acuminate, appressed pubescent beneath. Flowers in crowded fascicles; peduncles 3-bracteolate, silky. Sepals concave, white, alternating with sepals. Stamens 15, shorter than petals. Ovary pubescent; styles united. Capsules globose. Seeds numerous, trigonous.

Fl. & Fr. : Aug. - Oct. Jalpaiguri.

The wood is used as fuel.

3. *Eurya japonica* Thunb., Fl. Jap. 191. t. 25. 1784; Dyer, in Hook. *f.*, *l.c.* 284; Chauhan & Paul in Sharma *et al.*, *l.c.* 184. "Baunra", "Gonte", "Deura" (Beng.).

Shrubs, branches glabrous, striate. Leaves petiolate, 5-10 cm long, lanceolate, acuminate, serrate, acute at base. Flowers 2 in axillary fascicles, small, bracteate and bracteolate pedicels short. Sepals unequal, outer 2 smaller, ovate or suborbicular, glabrous, persistent. Petals white, elliptic-oblong, about twice the length of sepals. Stamens 5-15. Ovary 3 celled, styles 3. Fruits ovoid or subglobose, tipped with persistent style, glabrous.

Fl. & Fr. : Throughout the year. Jalpaiguri.

The plant is sometimes called "Wild tea" on account of its resemblance to cultivated tea plant. The leaves of the species are used as leaf-manure in Sikkim.

3. SCHIMA Reinw. ex Bl.

Evergreen trees. Leaves chartaceous. Flowers axillary, solitary or the uppermost in 3-5-flowered racemes, showy, 2-bracteolate, hermaphrodite. Sepals 5, free. Petals 5, connate at base, the outermost concave, subcucullate. Stamens numerous, adnate to base of petals. Ovary 4-6-locular; styles simple or lobed above; stigma broad spreading; ovules 2-6 in each locule. Fruit a woody depressed globose capsule. Seeds flat, reniform, winged on back; albumen scanty.

A genus with ca 15 species; 1 species in West Bengal.

Schima wallichii (DC.) Korthals in Temminck, Verh. Nat. Gesch. Bot. 143. 1839-1842; Dyer in Hook. f., l.c. 289; Prain, l.c. 168; Chauhan & Paul in Sharma *et al.* l.c. 168. *Gordonia wallichii* DC., Prodr. 1: 528. 1824. "Makrishal" (Beng.).

Large trees; branches lenticelled; buds and young parts adpressed pubescent or villous. Leaves 6-8.5 × 2.5-4.5 cm, oblong or elliptic-lanceolate, acute or acuminate, entire, petiolate, glabrous. Flowers white, scented, solitary, axillary; bracts small, caducous, alternate. Sepals 5, imbricate, subequal, orbicular or rounded, silky inside. Petals 5, connate and silky pubescent outside. Stamens many; filaments adnate to the base of petals; anthers yellow. Ovary hairy below. Capsules 5-locular, depressed globose, with persistent calyx. Seeds 2-6 in each cell, surrounded by a wing except along the straight ventral edge.

Fl. & Fr. : April - Sept. Jalpaiguri.

The presence of *S. wallichii* is a good indicator of the very fine quality of Sal forest.

4. TERNSTROEMIA Mutis. ex L.f.

Glabrous evergreen trees or shrubs, usually dioecious. Leaves leathery, entire or crenate-serrate. Flowers 2-bracteate; peduncles lateral, recurved. Sepals 5, subequal, imbricate. Petals 5, imbricate, connate at base. Stamens many. Ovary 2-3-celled; style simple or absent; stigma broadly 2-3-lobed or subentire; ovules 2 in each cell, rarely 1 or 3-6, pendulous from apex. Seeds oblong with horse-shoe shaped cavity, testa osseous.

A genus with ca 100 species; 1 species planted in West Bengal.

Ternstroemia gymnanthera (Wt. & Arn.) Bedd. in Fl. Sylv. 91. Pl. 91. 1871; Chauhan & Paul in Sharma *et al.*, l.c. 190. *Clevera gymnanthera* Wt. & Arn. Prodr. Fl. Ind. Or. 87. 1834. *Ternstroemia japonica* auct. non Thunb. Dyer in Hook. f., l.c. 280. "Panibakul" (B.).

Trees. Leaves coriaceous, petiolate 4.5-7 cm long, oblong-obovate, lanceolate or elliptic, bluntly apiculate or rounded at apex. Flowers yellowish white, solitary. Sepals 5, imbricate. Petals 5, subequal, imbricate, connate at base, orbicular to broadly elliptic-oblong. Stamens numerous in male and bisexual flowers; filaments short, anthers linear, apiculate, glabrous. Ovary 2-3 celled; ovules 2 in each cell; style simple; stigma with 2-3 broad lobes. Fruit 1-1.5 cm long ovoid-globose, shortly beaked, with persistent sepals. Seeds 3-4, red.

Fl. & Fr. : July - Sept. Planted as an ornamental.

The bark and roots have astringent properties and used in dysentery.

ACTINIDIACEAE

(T. K. Paul & R. B. Ghosh)

A family of ca 3 genera and 47 species in subtropical Asia; 1 genus and 2 species in West Bengal.

ACTINIDIA Lindl.

Climbing shrubs. Leaves petiolate, exstipulate, alternate, simple, penninerved. Flowers in axillary cymes or fascicles; rarely solitary, polygamous or dioecious, bracteate; bracts minute, 1 or 2 at the apex of peduncles. Sepals 5, free or subconnate, imbricate, persistent. Petals 5, imbricate or subconnate, deciduous. Stamens numerous; anthers versatile, dehiscing by slits. Ovary many celled; styles 15-30, free, persistent. Fruit a berry, globose to oblong, glabrous or hairy, spotted with lenticels. Seeds numerous, oblong, immersed in pulp.

A genus ca 36 species; 2 species in West Bengal.

1. Young branches, petioles and midribs beneath
with dense brownish strigose hairs ... 2. *A. strigosa*
1. Young branches, petioles and midribs beneath
glabrous or minutely tomentose ... 1. *A. callosa*

1. ***Actinidia callosa*** Lindl. Nat. Syst. ed. 2 : 439. 1836; Dyer in Hook. f. Fl. Brit. India 1: 286. 1872; Paul in Sharma *et al.*, Fl. India 3 : 195. 1993.

Shrubs; stems and branches glabrous or minutely tomentose. Leaves ovate, obovate to broadly elliptic, rarely ovate-lanceolate, 3-12 × 1.5-7 cm; petioles 1.5-5 cm long. Flowers solitary, or 2-5 in cymes or pseudo-umbels; peduncles 1-1.5 cm long; pedicels 5-15 mm long; bracts minute or obsolete. Sepals ovate to oblong, connate below the middle, 3-4 × 2-3 mm. Petals obovate, 5-7 × 3-4 mm. Stamens 3-4 mm long. Ovary subglobose; styles numerous, 2-3 mm long. Berry obovoid to ellipsoid. Seeds ovoid, brownish-black.

Fl. : May - June; *Fr.* : July - Nov. Darjeeling; 1500-2700 m.

Ripe fruit is edible.

2. ***Actinidia strigosa*** Hook. f. & Thoms. ex Benth. in Journ. Linn. Soc. 5: 55. 1861; Dyer in Hook. f. *l.c.* 286; Paul in Sharma *et al.*, *l.c.* 196. **Fig. 43**

Shrubs; stems and branches with dense brownish strigose hairs. Leaves ovate to oblong-ovate, 4-15 × 2-8 cm; petioles 1-3.5 cm long. Flowers 2-4 in axillary cymes, sometimes solitary; peduncles up to 1 cm long; pedicels 5-12 mm long; bracts linear. Sepals ovate, 4-6 × 3-5 mm. Petals obovate, 5-15 × 6-10 mm. Stamens 4-7 mm long. Ovary subglobose; styles numerous, 1.5-4 mm long. Berry ovoid. Seeds oblong, brownish black.

Fl. : May - June; *Fr.* : Aug. - Sept. Darjeeling, 2000 - 2700 m.

Ripe fruit is edible, mucilaginous.

SAURAUACEAE

(T. K. Paul & R. B. Ghosh)

A family of 1 genus and ca 300 species in tropical and subtropical America, Asia and Australia; 1 genus and 4 species are reported from West Bengal.

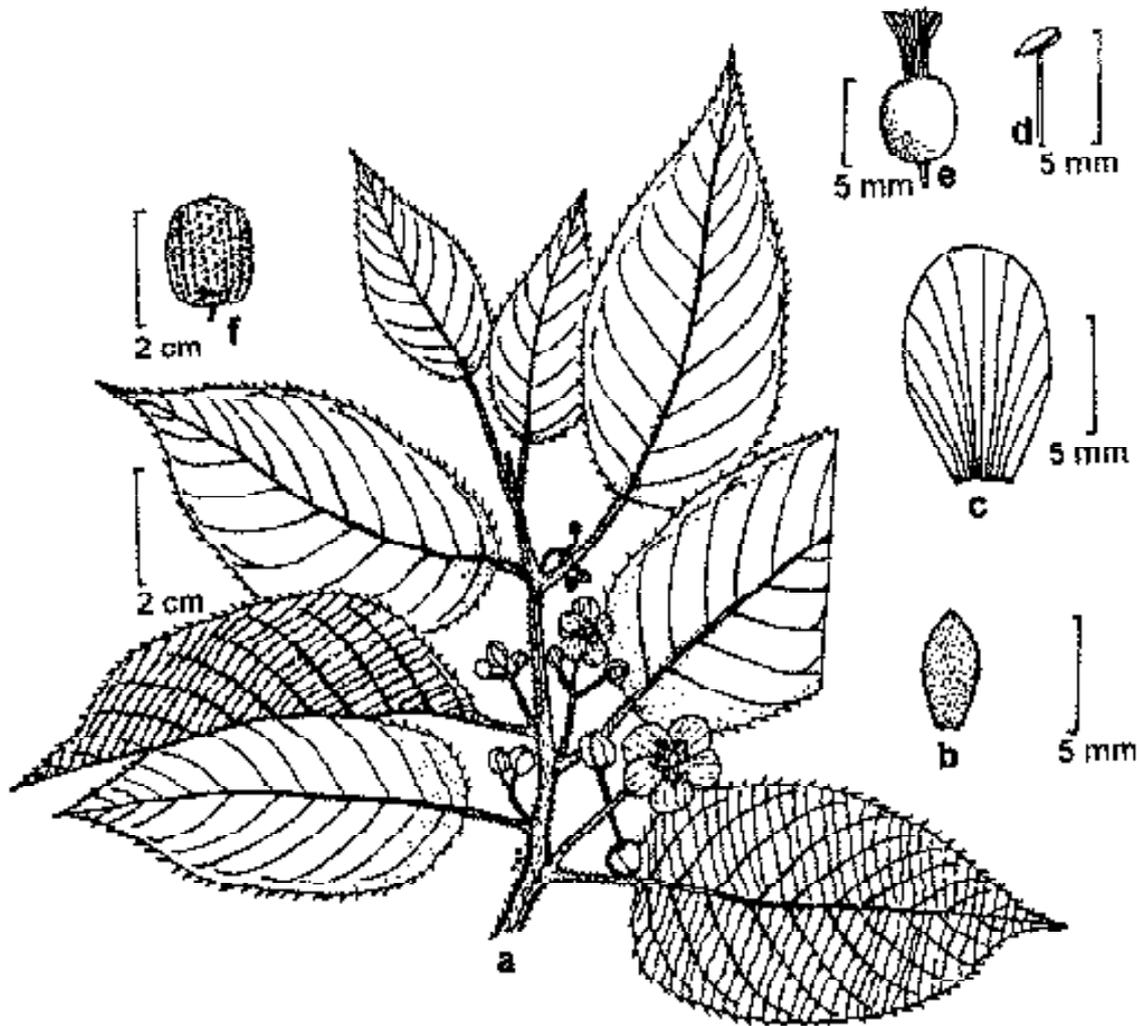


Fig. 43. *Actinidia strigosa* Hook. f. & Thoms. ex Benth. : a, flowering branch; b, sepal; c, petal; d, stamen; e, pistil; f, fruit.

SAURAUIA Willd.

Shrubs or trees. Leaves petiolate, exstipulate, alternate, simple, usually serrate with prominent veins diverging from the midrib, often with hairs and scales. Flowers axillary, solitary or in lateral panicles, bisexual, bracteate. Sepals 5, free, imbricate, persistent. Petals 5, free or connate at base, imbricate. Stamens numerous, adnate to the base of petals; anthers versatile, dehiscing through apical pore or short slit. Ovary 3-5-locular; ovules numerous in axile placentation; styles 3-5, free or variously united, sometimes completely so, usually persistent in young fruit; stigmas simple. Fruit a berry, globose, rarely dry and slightly dehiscent. Seeds small, albuminous.

- 1. Flowers in 15-30 cm long panicles ... 2. *S. napaulensis*
- 1. Flowers in less than 10 cm long cymes:
 - 2. Mature leaves glabrous beneath ... 4. *S. roxburghii*
 - 2. Mature leaves densely rusty puberulous beneath:
 - 3. Peduncles and pedicels glabrous; bracts narrow lanceolate to deltoid, ca 1 mm long; petals white, turning pink ... 1. *S. fasciculata*
 - 3. Peduncles and pedicels with scales and hairs; bracts elliptic, 4-6 mm long; petals pink ... 3. *S. punduana*

1. **Saurauia fasciculata** Wall., Pl. Asiat. Rat. 2 : 40, t. 148. 1831; Dyer in Hook. f., Fl. Brit. India 1 : 287. 1874; Paul in Sharma *et al.*, Fl. India 3 : 200. 1993.

Shrubs or trees up to 6 m high; young stem and branches rusty tomentose, with scattered scales. Leaves elliptic-oblong, lanceolate or ovate, 10-25 × 3-8 cm; petioles 0.5-2 cm long. Flowers in axillary cymes; bracts narrow lanceolate to deltoid. Sepals orbicular, ovate, 3-5 × 3 mm. Petals obovate, 6-9 × 5 mm, white, ultimately pink. Stamens numerous. Ovary ovoid; styles 5, connate below the middle, apex spreading. Berry globose. Seeds minute, brownish.

Fl. & Fr. : May - June, Darjeeling, Jalpaiguri, 500-1500 m.

Leaves used as fodder.

2. **Saurauia napaulensis** DC. in Mem. Soc. Phys. Hist. Nat. Genev. 1 : 421. 1822; Dyer in Hook. f., *l.c.* 286; Paul in Sharma *et al.*, *l.c.* 201.

Shrubs or trees, 5-30 m high; young stem and branches rusty tomentose, scaly. Leaves elliptic, oblanceolate or oblong-lanceolate, 10-40 × 5-12 cm; petioles 1-5 cm long. Flowers in long axillary panicles; peduncles 15-30 cm long; bracts elliptic-lanceolate. Sepals ovate or suborbicular, 4-6 × 3-4 mm. Petals ovate-rounded to obovate, 5-10 × 3-7 mm, pinkish. Stamens numerous. Ovary ovoid; styles 5, connate below. Berry subglobose to ovoid. Seeds obovoid, reddish-brown.

Fl. & Fr. : Throughout the year, mainly April - Aug. Darjeeling, Jalpaiguri, 1500-2000 m.

Leaves used as fodder, ripe fruit is edible.

3. *Saurauia punduana* Wall., Pl. Asiat. Rar. 2: 40. 1831, Dyer in Hook. f., l.c. 287; Paul in Sharma *et al.*, l.c. 202.

Trees up to 6 m high; young stem and branches rusty tomentose, with scattered scales. Leaves elliptic, obovate or oblanceolate, 12-35 × 6-15 cm; petioles 1.5 - 5.5 cm long. Flowers in axillary cymes; bracts elliptic. Sepals elliptic, ca 10 × 6 mm. Petals ovate to obovate, ca 10 × 5 mm, pink. Stamens numerous. Ovary ovoid or globose; styles 5, connate above middle, spreading. Berry globose. Seeds minute, brownish.

Fl. : April - June; Fr. : Sept. - Nov. Darjeeling, 800 - 1500 m.

Ripe fruit is edible.

4. *Saurauia roxburghii* Wall., Pl. Asiat. Rar. 2:40. 1831; Dyer in Hook. f., l.c. 287; Prain, Bengal Pl. 1:168. 1963 (repr. ed.); Paul in Sharma *et al.*, l.c. 203.

Shrubs or trees, up to 10 m high, young stem and branches rusty tomentose, with scattered scales. Leaves elliptic, elliptic-oblong, oblanceolate, 8-27 × 2.3-9 cm; petioles 1-6 cm long. Flowers in axillary cymes; cymes up to 6 cm long; bracts deltoid. Sepals ovate to ovate-rounded, 2-3 × 2-3 mm. Petals ovate, 4-5 × 3-4 mm, white, fading pink. Stamens numerous. Ovary ovoid; styles 5, connate below. Berry subglobose. Seeds minute, obovoid brown.

Fl. : March - May; Fr. : Sept. - Feb. Darjeeling, Jalpaiguri; 300-1200 m.

Leaves used as fodder, ripe fruit is edible.

STACHYURACEAE

(L. K. Ghata)

A family of one genus and ca 10 species, mostly in the Himalaya to Formosa and Japan; 1 species is reported from West Bengal.

STACHYURUS Sieb. & Zucc.

Glabrous shrubs or small trees, sometimes climbing. Flowers small, in short lateral pendent spikes or racemes; bracts 2, connate at the base. Sepals 4, strongly imbricate. Petals 4, free. Stamens 8; anthers dehiscing by slits. Ovary 4-celled; style simple, stigma capitate - peltate; ovules many. Berry 4-celled. Seeds many.

Stachyurus himalaicus Hook. f. & Thoms. ex Benth. in J. Linn. Soc. 4:55. 1861; Dyer in Hook. in Hook. f., Fl. Brit. India 1:288. 1874; Raju & Singh in Sharma *et al.*, Fl. India 3:204. 1993.

A small tree with straggling branches. Leaves pale beneath, ovate-elliptic or elliptic-oblong, 9-15.5 × 3.5 - 5 cm, base somewhat rounded, apex acuminate, lateral veins 4-7 pairs; margin finely serrate. Flowers small in lateral up to 12 cm long spikes. Sepals 4, ovate, acuminate, 3-4 mm long. Petals 4, free. Stamens 8; anthers reniform. Ovary 4-celled; style simple; stigma ovoid. Berry more or less globose.

Fl. : March; Fr. : May-July. Darjeeling.

DIPTEROCARPACEAE
(R. B. Ghosh and U.P. Samaddar)

A family of about 15 genera and 580 species, mainly palaeotropical; 3 genera and 3 species in West Bengal.

- | | |
|--|---------------|
| 1. Stamens 30-50; fruits with 3 enlarged calyx lobes | .. 2. SHOREA |
| 1. Stamens 10-15; fruits with 2 enlarged calyx lobes: | |
| 2. Leaves with 15 pairs of lateral nerves,
up to 30 cm long; calyx lobes subvalvate | ... 3. Vatica |
| 2. Leaves with 12 pairs of lateral nerves, up to
15 cm long; calyx lobes imbricate | .. 1. HOPEA |

1. HOPEA Roxb.

Small or large trees. Leaves penni-nerved; stipules very small, deciduous. Panicles many-flowered, axillary and terminal. Flowers small. Sepals imbricate, segments obtuse. Petals contorted. Stamens 15, rarely 10; filaments compressed at the base; anthers ovate, connective enlarged into a long awn. Ovary 3-celled, cells 2-ovuled style short; stigma simple or lobed. Fruit closely enclosed by the bases of calyx-lobed, outer 2 enlarged into wings. Cotyledons subequal.

A genus with about 90 species, Indo-Malaysian; 1 species in West Bengal.

Hopea odorata Roxb., Fl. Indica 2: 609. 1832; Dyer in Hook. f., Fl. Brit. India 1: 308. 1874; Janardhanan in Sharma *et al.*, Fl. India 3: 226. 1993. **Fig. 44**

A large evergreen tree, with dark brown bark; branchlets slender. Leaves short petioled, ovate or oblong-lanceolate, obtusely acuminate, base usually obtuse. Flowers small, fragrant, pale yellow, in one-sided racemes. Calyx tube short; lobes unequal. Stamens 15 or 10, anthers oblong, appendaged; ovary 3 celled style straight; stigma simple. Fruit small; two calyx-lobes enlarged into two oblong blunt finely veined wings larger than seeds.

Fl. : March; *Fr.* : May - June. Hooghly.

Wood is very durable, specially in use for making canoes, boats and houses.

2. SHOREA Roxb. ex Gaertn.

Large resinous trees. Leaves coriaceous with strong parallel nerves, stipulate. Flowers in axillary or terminal lax cymose panicles, with or without caducous bracts. Calyx 5-lobed; tube short, adnate to torus; lobes imbricate. Petals 5. Stamens 15-many; anthers generally with a subulate-cuspidate connective. Ovary 3-celled, each cell 2-ovuled; style subulate stigma entire or 3-toothed. Fruits coriaceous, mostly indehiscent or 2-valved, usually 1-seeded, lightly enclosed by accrescent calyx-segments, 3 of which are developed into prominently veined wings. Cotyledons fleshy, unequal.

About 180 species in tropical regions from Sri Lanka to S.E. Asia; 1 species in West Bengal.

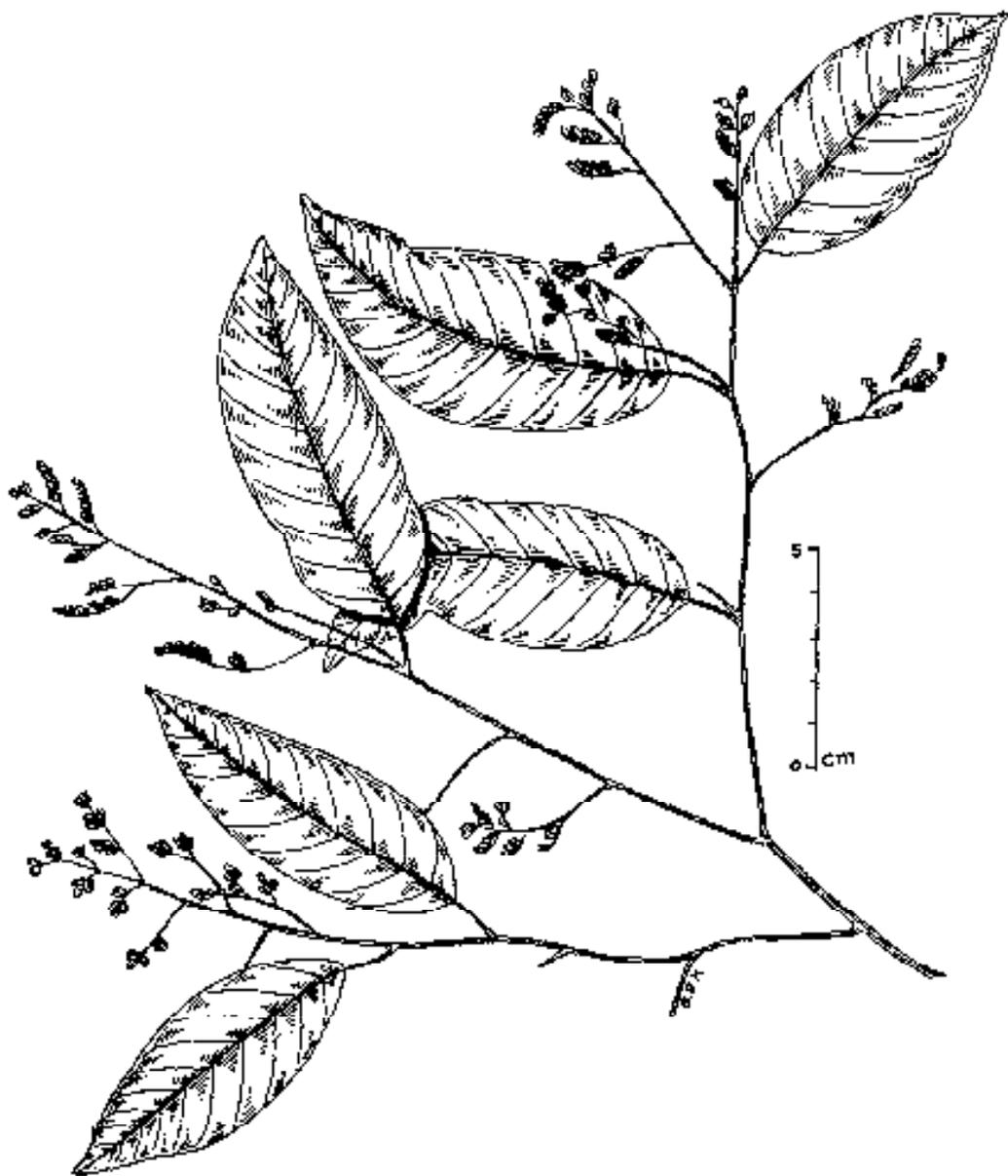


Fig. 44. *Hopea odorata* Roxb.

Shorea robusta Gaertn. f., Fruct. 3: 48, t. 186, 1805; Dyer in Hook. f., l.c. 306. Prain, Bengal Pl. 1:172, 1963 (repr. ed.). Janardhanan in Sharma *et al.*, l.c. 237. "Sal" (Beng.); "Sakhu" (H.).

Fig. 45

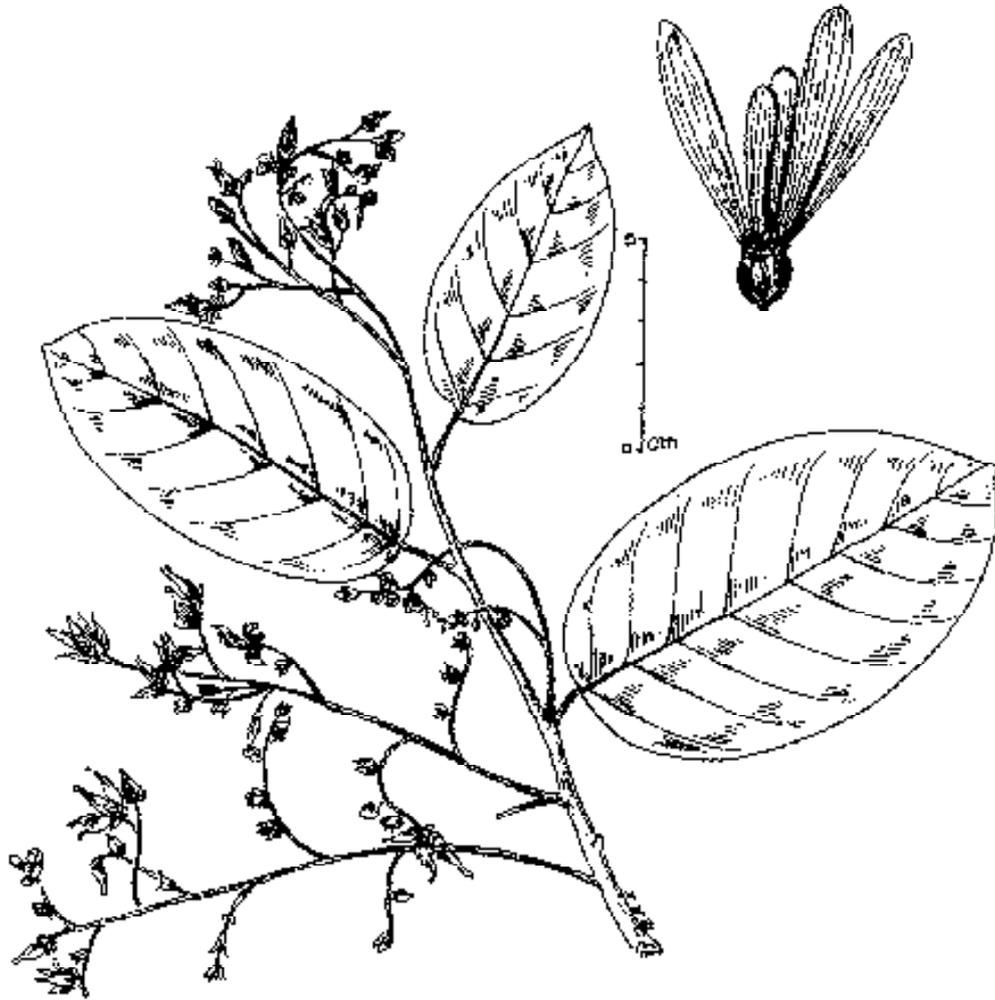


Fig. 45. *Shorea robusta* Gaertn. f.

A gregarious tree, often 22 m high, wood tough, strongly fibrous. Leaves oblong, 10-28 cm long, entire, apiculate, base cordate or rounded, lateral nerves 10-15 on each side; stipule caducous. Flowers creamy, subsessile, ca 15 mm long, in terminal or axillary panicles. Stamens many; anthers with bearded appendage. Ovary pubescent. Fruits ca 1 cm long, ovoid, with unequal linear-oblong or spatulate wings, three of which much enlarged.

Fl. : March - April; *Fr.* : May - June. Widely distributed: Burdwan, Darjeeling, Hooghly, Jalpaiguri, Midnapur, Purulia.

Sal is an important timber extensively used for pillars, beams, plankings, door and window posts and railway sleepers.

3. VATICA L.

Small to moderate-sized trees. Leaves coriaceous. With prominent reticulate venation; stipules small, fugaceous, sometimes inconspicuous. Flowers cream-white, often fragrant, in axillary and terminal panicles. Calyx segments acute, velvety, at length sub-valvate; tube short. Petals 5. Stamens 15; anthers oblong, connective tapering to a pointed tip. Ovary 3-celled, ovules 2 in each cell; style short, somewhat stout, capitate, clavate; stigma entire, or 3-toothed. Capsules leathery; 2 calyx-lobes equally enlarged. Seeds 1-2.

A genus with about 75 species distributed in Indo-Malayan region; 1 species in West Bengal.

Vatica lanceaefolia (Roxb.) Bl. in Mus. Bot. Lugd. Bat. 2:31, 1852; Dyer in Hook. f., Fl. Brit. India 1:302, 1874; Prain, *l.c.* 172; Janardhanan in Sharma *et al.*, *l.c.* 250. *Vateria lanceaefolia* Roxb., Fl. Ind. 2:601, 1832.

Small evergreen trees, young shoots mealy-pubescent. Leaves oblong-lanceolate, 10.5 - 22.5 × 3-8 cm, tapering towards base, acuminate at tip; petiole ca 12 mm long; stipules ca 5 mm long. Panicles axillary 5-13 cm long. Flowers ca 15 mm long, white to light yellow, fragrant. Ovary pubescent; style clavate at the apex; stigma 3-toothed. Fruit ovoid-globose, brown velvety, up to 2.5 cm long, supported by enlarged calyx lobes.

Fl. : April - May ; *Fr.* : July - Aug. Jalpaiguri.

MALVACEAE

(T. K. Paul)

A family of ca 88 genera and 2300 species mainly in the tropics and subtropics, occasionally in temperate regions of the World; 17 genera and 53 species in West Bengal.

1. Style branches as many as carpels or style undivided:
2. Fruit a capsule; staminal column 5-partite at apex :
3. Epicalyx segments winged during fruiting, ultimately spreading:

4. Flowers small (0.8-1.5 cm across) in dense more than 20- flowered panicles; staminal column short (ca 3 mm), 5-armed; style 3-branched or 3 cleft at the apex; fruit loculicidally dehiscent ... 7 KYRIA
4. Flowers large (2-2.5 cm) solitary or in short panicles of 2-5 flowers; staminal column long (ca 10 mm), unarmed; style 2- branched; fruit indehiscent ... 12. NAYARIOPHYTON
3. Epicalyx segment not winged, rarely spreading :
 5. Style distally divided into 5 arms; stigma more or less capitate or globose:
 6. Calyx regularly 5-toothed or 5-lobed, not spathaceous, persistent:
 7. Capsule winged ... 4. FLOREA
 7. Capsule not winged ... 6. HIBISCUS
 6. Calyx irregularly 2-3 lobed, spathaceous, deciduous ... 1. ABELMOSCHUS
 5. Style undivided, stigma ribbed or lobed:
 8. Epicalyx segments leafy, cordate, persistent ... 5. GOSSYPIMUM
 8. Epicalyx segments linear-lanceolate, mostly caducous ... 15. THESPESIA
2. Fruit a schizocarp breaking into mericarps at maturity; staminal column without any tooth, apex split up into numerous anthers:
 9. Stigma decurrent on the adaxial side of the style; style branches filiform to narrowly clavate but not clearly expanded at the tip:
 10. Epicalyx segments free ... 9. MALVA
 10. Epicalyx segments connate at base ... 3. ALCEA
 9. Stigma apical or nearly so, capitate, discoid or obliquely truncate, usually distinctly broader than rest of the style branches :
 11. Seeds 2 or more in each mericarp:
 12. Carpels 1-locular, ovules 2 or more per mericarp; flowers solitary, axillary, rarely in panicles ... 2. ABIETUM
 12. Carpels more or less divided into 2-superposed locules, ovules 3 per locule; flowers in lax panicles ... 17. WISSADOLA
 11. Seed one in each mericarp:

- | | |
|---|-----------------|
| 13. Epicalyx present | 11. MALVASTRUM |
| 13. Epicalyx absent | 14. SIDA |
| 1. Style branches twice as many as carpels: | |
| 14. Flowers in dense heads intermixed with foliaceous bracts; epicalyx absent | 8. MALACDIRA |
| 14. Flowers solitary, axillary or in axillary clusters without foliaceous bracts, epicalyx present: | |
| 15. Fruit berry-like, fleshy, mericarps without glochidia; petals auriculate | 11. MALVAVISCUS |
| 15. Fruit a schizocarp, not fleshy, with or without glochidia, petals not auriculate: | |
| 16. Mericarps usually with glochidia, rarely glochidia absent; leaves always with a nectary on midrib beneath | .. 16. URENA |
| 16. Mericarps never glochidiate, sometimes muricate or with 1-3 retrorsely barbed awns at apex; leaves rarely with a nectary. | ... 13. PAVONIA |

1. ABELMOSCHUS Medikus

Herbs, undershrubs or trees. Leaves petiolate, stipulate, palmilobed to parted, often hastate or sagittate or with pennilobed to parted segments, rarely entire. Flowers axillary or in terminal racemes by replacement of upper leaves. Epicalyx segments 4-16, usually free, persistent or caducous. Calyx spathaceous, lobed or toothed at the apex, split to the base on one side, falling together with the corolla. Corolla mostly yellow with dark purple base, sometimes creamy white or pink; petals 5. Staminal column antheriferous throughout. Ovary 5-locular, ovules numerous; style 1, distally 5-armed; stigmas discoid. Capsules ovoid to oblong or cylindrical, beaked or mucronate, loculicidally dehiscent with longitudinal slits towards the base. Seeds numerous in each locule, reniform.

A genus with ca 15 species in the tropics, sub-tropics and temperate regions of the old World; 5 species in West Bengal.

- | | |
|--|-----------------------------|
| 1. Epicalyx segments 6-16, linear to lanceolate, caducous after dehiscence of the capsule: | |
| 2. Capsule not exceeding the epicalyx; epicalyx segments 10-16, each 20-50 mm long | ... 1. <i>A. crinitus</i> |
| 2. Capsule exceeding the epicalyx; epicalyx segments 6-10 (rarely 12), each 5-15 mm long: | |
| 3. Capsule ovoid to oblong, up to 8 cm long | ... 5. <i>A. moschatus</i> |
| 3. Capsule long fusiform, up to 25 cm long | ... 2. <i>A. esculentus</i> |

1. Epicalyx segments 4-6, ovate, caducous after dehiscence of the capsule (rarely linear to lanceolate, but then caducous before expansion of the corolla):
 4. Epicalyx segments linear to lanceolate, deciduous before expansion of the corolla; calyx in bud lageniform; capsule oblong with a short beak, covered with short stiff hairs ... 3. *A. ficulneus*
 4. Epicalyx segments ovate, deciduous after dehiscence of the capsule; calyx in bud ovoid; capsule oblong-ovoid, hispid and usually prickly with long stiff hairs ... 4. *A. manihot*

1. **Abelmoschus crinitus** Wall., Pl. Asiat. Rar. 1: 89, t. 44, 1830; Paul & Nayar in Fasc. Fl. India 19: 70, 1988; Paul in Sharma *et al.*, Fl. India 3: 302, 1993. *Hibiscus cancellatus* Roxb., Fl. Ind. ed. Carey 3: 201, 1832 *non* L.f. 1781; Mast. in Hook. f., Fl. Brit. India 1: 342, 1874; Prain, Bengal Pl. 1: 181, 1963. (repr. ed.).

Annual herbs 0.5–1.5 m high with tuberous tap root. Leaves orbicular to elliptic in outline, angular or shallowly 5-7-palmatilobed to palmiparted with triangular or oblong to ovate segments, sometimes sagittate 5-8 cm across, usually hirsute, hairs simple or stellate. Flowers solitary axillary or forming raceme replacing upper leaves. Epicalyx segments 10-16, linear, 2-5 cm long. Calyx 2-5 cm long. Petals obovate, 4-9 × 2-4 cm. Staminal column ca 2 cm long. Capsules ovoid to globular, 2-4 × 2-3 cm. Seeds reniform, 3-5 mm long, rusty tomentose, rarely glabrous.

Fl. & Fr. : July - Dec. Purulia. A new record for West Bengal.

2. **Abelmoschus esculentus** (L.) Moench, Meth. Pl. 617, 1794; Paul & Nayar, *l.c.* 71; Paul in Sharma *et al.*, *l.c.* 385. *Hibiscus esculentus* L., Sp. Pl. 696, 1753; Mast. in Hook. f., *l.c.* 343; Prain, *l.c.* 180. "Dheras" (Beng.); "Bhindi" (H.).

Annual herbs, up to 2 m high. Leaves broadly ovate to orbicular, 4-20 × 4-25 cm, lamina variously dissected, usually 5-7-lobed. Flowers solitary, axillary. Epicalyx segments 7-10, linear to lanceolate, 5-10 × 1-2.5 mm. Calyx 2-3 cm long. Staminal column 2-3 cm long. Capsules fusiform, 7-20 (-25) cm long. Seeds globose to reniform, 3-5 mm long, glabrous, minutely warty.

Fl. & Fr. : Throughout the year. Cultivated throughout West Bengal.

Unripe fruits are used as vegetable.

3. **Abelmoschus ficulneus** (L.) Wt. & Arn. ex Wt. Cat. 14, 1833 et in Prodr. Fl. Pen. Ind. Or. 1: 53, 1834; Paul & Nayar, *l.c.* 73; Paul in Sharma *et al.*, *l.c.* 304. *Hibiscus ficulneus* L., Sp. Pl. 695, 1753; Mast. in Hook. f., *l.c.* 340; Prain, *l.c.* 180. "Ban Dheras" (Beng.), "Junglee Bhindi" (H.).

Annual herbs or undershrubs, up to 2 m high. Leaves orbicular, 3-5-lobed, 2-12 cm across. Flowers axillary, solitary or in terminal racemes by replacing the upper leaves. Epicalyx segments 5-6, linear to lanceolate, 5-10 × 1-1.5 mm. Calyx lageniform in bud ca 1.8 cm long. Petals obovate, 2-3 × 1-2 cm white with

rose centre. Seeds glabrous, ca 3 mm long, stellate hairy, hairs in concentric rings.

Fl. : Sept. - Nov.; *Fr.* : Nov. - March. Drier parts of Central and Southern West Bengal.

4. **Abelmoschus manihot** (L.) Medik., Malv. 46. 1787; Paul & Nayar, *l.c.* 74; Paul in Sharma *et al.*, *l.c.* 304. *Hibiscus manihot* L., Sp. Pl. 696. 1753; Mast. in Hook.f., *l.c.* 341; Prain, *l.c.* 181.

Annual or perennial herbs or undershrubs. Leaves orbicular, 5-30 cm across, 3-9-lobed or parted. Flowers solitary axillary or in racemes by replacing the upper leaves. Epicalyx segments 4-6, ovate-oblong, segments 1-2.5 × 0.5-1 cm. Calyx 2-3 × 0.5-2 cm. Petals obovate to orbicular, 3.5-8 × 2.5-6 cm. Staminal column 1.5-2.5 cm long. Capsules oblong-ovoid, 3-7 × 1.5-2.5 cm. Seeds globular to reniform, 3-4 mm long, stellate hairy.

1. Stems without prickly hairs ...1. ssp. *manihot*

1. Stems densely covered with prickly hairs ...2. ssp. *tetraphyllus*

1. ssp. *manihot*

Fl. & Fr. : July - Dec. Occasionally cultivated, sometimes naturalized in the central parts of West Bengal.

2. ssp. **tetraphyllus** (Roxb. ex Hornem) Borss. in *Blumea* 14: 98. 1966; var. **tetraphyllus** Paul & Nayar, *l.c.* 75; Paul in Sharma *et al.*, *l.c.* 306. *Hibiscus tetraphyllus* Roxb. ex Hornem, Hort. Haln. 661. 1815; Mast. in Hook.f., *l.c.* 341; Prain, *l.c.* 181.

Fl. & Fr. : July - Dec. In Southern plateau of West Bengal.

5. **Abelmoschus moschatus** Medik. Malv. 46. 1787; Paul & Nayar, *l.c.* 77. *Hibiscus abelmoschus* L., Sp. Pl. 696. 1753; Mast. in Hook.f., *l.c.* 342; Prain, *l.c.* 181. "Musk-dana" (Beng, Guj. & H.). **Fig. 46**

Herbs or undershrubs, up to 3 m high. Leaves orbicular-elliptic, 4-18 × 3-20 cm, angular or 3-7-palmilobed to parted. Flowers solitary axillary. Epicalyx segments 6-10, linear to lanceolate, rarely oblong, segments 10-15 × 1-2 mm. Calyx 15-30 mm long. Petals obovate. Staminal column 2.5 cm long. Capsules ovoid to oblong, 4-8 × 2.5-3.5 cm. Seeds reniform, 3-4 mm long, glabrous or minutely stellate hairy, often musk scented.

Fl. : July - Oct.; *Fr.* : Oct. - Dec. Cultivated in some districts of West Bengal.

Plants utilised for stem fibre and oil from seeds is used in high grade perfumery.

2. ABUTILON Mill.

Herbs, undershrubs or shrubs. Leaves petiolate, stipulate, simple, angled or lobed. Flowers axillary, solitary, sometimes in loose panicles by replacement of the upper leaves. Epicalyx absent. Calyx usually campanulate, 5-lobed. Corolla rotate, campanulate, usually yellow, white, orange or pink. Staminal column

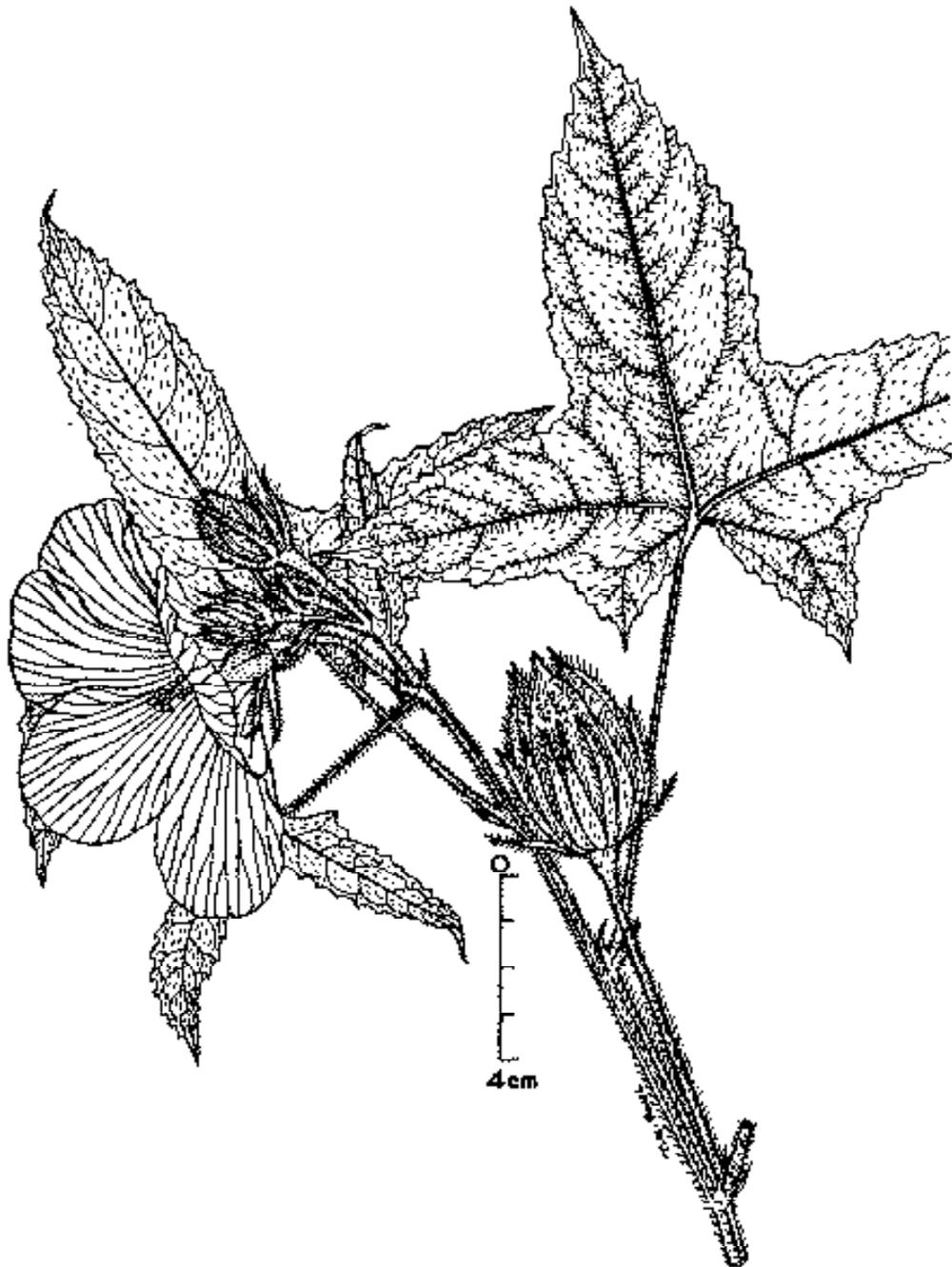


Fig. 46. *Abelmoschus moschatus* Medik.

shorter than corolla, widened at base. Carpels 5-40, style branches as many as carpels, filiform to clavate, stigmatose only at apex; stigmas capitate; ovules 2-9 in each locule, occasionally uniovulate by reduction. Schizocarps globular, campanulate or rarely discoid; mericarps 5-40. Seeds 2-9 per mericarp, reniform to sub-reniform.

A genus with ca 150 species in the tropical and subtropical regions of the world; 4 species in West Bengal.

1. Carpels 5-12:

- 2. Carpels 5; staminal column ca 5.5 mm long, stellate hairy in upper part; awns of mericarp ca 3 mm long ...3. *A. persicum*
- 2. Carpels 8-12; staminal column 2-3 mm long, glabrous; awns of the mericarp 3-7 mm long ...4. *A. theophrasti*

1. Carpels more than 15:

- 3. Stems, petioles and pedicels with dense long patent simple hairs and with few minute stellate and short viscid glandular hairs; corolla yellow with a purple centre ...1. *A. hirtum*
- 3. Stems, petioles and pedicels densely stellate pubescent and with few simple hairs; corolla without a purple centre ...2. *A. indicum*

1. **Abutilon hirtum** (Lamk.) Sweet, Hort. Brit. ed. 1: 53, 1826, Paul & Nayar, *l.c.* 84; Paul in Sharma *et al.*, *l.c.* 264. *Sida hirta* Lamk. Eneycl. 1: 7, 1783. *A. graveolens* var. *hirtum* (Lamk.) Mast. in Hook.f., *l.c.* 327. *A. graveolens* (Roxb. ex Hornem.) Wt. & Arn. ex Wt. Cat. 13, 1833; Mast. in Hook.f., *l.c.* 327. **Fig. 47**

Annual herbs or undershrubs up to 2 m high. Leaves orbicular to orbicular-ovate, 2.5-12 × 3.5-13 cm. Flowers solitary, axillary. Calyx campanulate, lobes ovate or deltoid, 5-10 × 4-6 mm. Corolla orange yellow with a purple centre, petals obovate, longer than calyx lobes, apex rounded, often emarginate. Staminal column 5-7 mm long. Schizocarps 1-2 cm across; mericarps 20-25, broadly ovate reniform, each 10-15 mm long, radially 7-10 mm shortly acuminate. Seeds 3 per mericarp, reniform, 2.5 mm across, with minute stellate hairs.

Fl. & Fr. Oct. - April. In central and southern parts of West Bengal.

2. **Abutilon indicum** (L.) Sweet, Hort. Brit. 54, 1824; Mast. in Hook.f., *l.c.* 326; Prain, *l.c.* 176; Paul & Nayar, *l.c.* 87; Paul in Sharma *et al.*, *l.c.* 266. *Sida indica* L. Cent. Pl. 2: 26, 1756. *S. populifolia* Lamk., Eneycl. 1: 7, 1783. *A. populifolium* (Lamk.) Sweet, Hort. Brit. ed. 1: 53, 1826. *A. indicum* var. *populifolium* (Lamk.) Wt. & Arn. ex Mast. in Hook.f., *l.c.* 326.

Annual or perennial herbs or undershrubs up to 3 m high. Leaves ovate to suborbicular, 1.5-11 × 1-10 cm. Flowers solitary, axillary. Calyx 5-8 mm across. Corolla yellow to orange; petals broadly obovate, truncate, rounded or

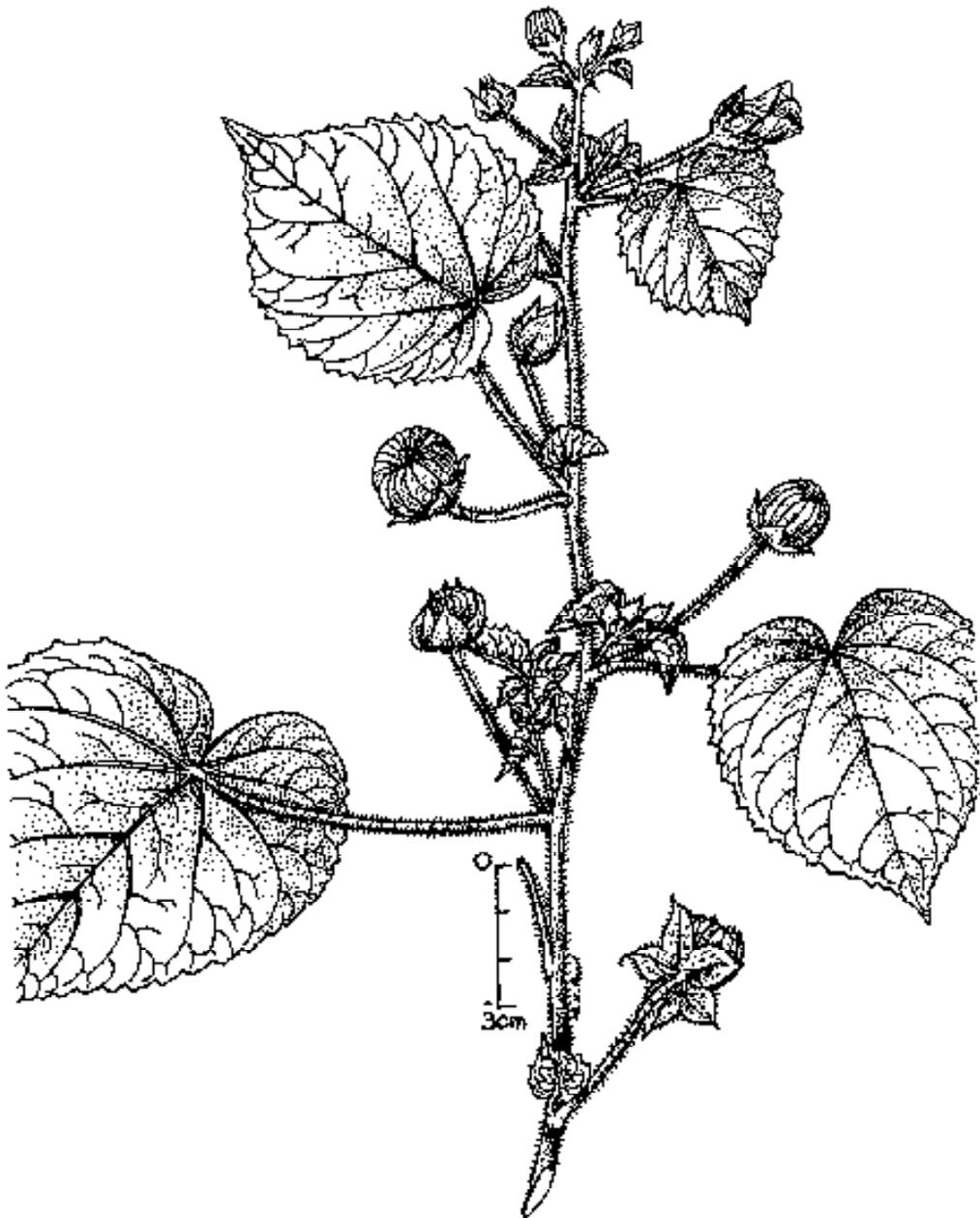


Fig. 47. *Abutilon pictum* (Lamk.) Sweet

emarginate at apex. Staminal column 5-7 mm long. Schizocarp 1.5-2.5 cm across; mericarps 15-22, reniform, apex shortly acuminate, the acumen erectopatent. Seeds 2-3 per mericarp, reniform, 2-3 mm across, minutely stellate hairy to glabrescent.

Fl. & Fr. : Sept. - April. Throughout West Bengal.

Stem, root and leaf are medicinal.

3. *Abutilon persicum* (Burm. f.) Merr. in Philip. J. Sc. 19: 364. 1921; Paul & Nayar, *l.c.* 91; Paul in Sharma *et al.*, *l.c.* 269. *Sida persica* Burm. f., Fl. Ind. 148. t. 47. f. 1. 1768. *S. polyandra* Roxb., Fl. Ind. ed. Carey 3: 173. 1832. *A. polyandrum* (Roxb.) Wt. & Arn. ex Wt. Cal. 12. 1833, non G. Don 1831; Mast. in Hook. f., *l.c.* 325; Prain, *l.c.* 176.

Undershrubs or herbs 1-3 m high. Leaves ovate to ovate-lanceolate, 2-30 × 1-25 cm. Flowers solitary, axillary or partly in terminal panicles or racemes by replacing the upper leaves. Calyx 4-6 mm across, lobes ovate to lanceolate. Corolla yellow; petals obovate, 2-3.5 × 1.5 cm. Staminal column ca 5.5 mm long, filaments 15 mm long. Schizocarp 12-20 mm across; mericarps 5, reniform, each 15 mm long and radially 5 mm with two stout erecto-patent awns. Seeds 4-6 in each mericarp, reniform, 2 mm across, glabrous or minutely stellate hairy.

Fl. & Fr. : Nov. - April. Only a single specimen is collected from the plains of W. Bengal, now housed in CAL without mentioning any particular locality. Prain (*l.c.*) recorded this species from Chotanagpur of Bihar.

4. *Abutilon theophrasti* Medik., Malv. 28. 1787; Paul & Nayar, *l.c.* 97; Paul in Sharma *et al.*, *l.c.* 274. *Sida abutilon* L., Sp. Pl. 685. 1753. *A. avicennae* Gaertn., Fruct. 2: 251. t. 135. f. 1. 1791; Mast. in Hook. f., *l.c.* 327; Prain, *l.c.* 176.

Annual herbs or undershrubs, up to 1 m high. Leaves orbicular, cordate, 3.5-16 × 4-13 cm. Flowers solitary, axillary. Calyx 1 cm across, lobes ovate, 7-10 × 4-6 mm. Corolla yellow; petals obovate to orbicular, 1.5-0.6 cm, apex rounded. Staminal column 2-3 mm long. Schizocarps 1-2 cm across; mericarps 10-16, reniform, each 10-15 × 4-7 mm, apex with 2 stout, sharp erecto-patent awns 3-7 mm long. Seeds 1-2 per mericarp, reniform, 3-4 mm across, minutely stellate.

Fl. & Fr. : May - Aug. 24-Parganas; rare.

Cultivated in the Indian Botanic Garden, Howrah. Stem yields fibre known as 'China Jute' or 'Tientsin Jute'

3. ALCEA L.

Biennial or perennial herbs. Leaves entire to parted, stellate hairy. Flowers axillary, solitary or in terminal racemes by replacing the upper leaves. Epicalyx segments 6-9, connate at base. Calyx 5-lobed. Corolla more than 3 cm long. Staminal column 5-angled, glabrous. Fruit schizocarp; mericarps 18-40, each incompletely 2-loculed by false septum lower locule with 1 seed, upper one without seed, dorsally grooved, often winged. Seeds reniform.

A genus with ca 60 species mainly in E. Mediterranean region; 1 species in India as well as in West Bengal.

Alcea rosea L., Sp. Pl. 687. 1753; Paul & Nayar, *l.c.* 98; Paul in Sharma *et al.*, *l.c.* 386. *Althaea rosea* (L.) Cav. Diss. 2. 91. t. 28. f. 1. 1786; Mast. in Hook. f. *l.c.* 319.

Erect herbs, up to 2 m high. Leaves 3-13 × 3.5-12 cm, orbicular-cordate, deeply 3-7-lobed. Flowers solitary, axillary or in terminal raceme by replacing the upper leaves. Epicalyx segments 6-7, ovate to lanceolate. Petals of various colour, usually red. Staminal column 10-15 mm long, 5-angled. Schizocarps depressed globose, 2 cm across; mericarps 20-40, suborbicular, 4 mm, longitudinally sulcate.

Fl. & Fr. : March - Sept. Cultivated as an ornamental.

4. FLORIA Mattei

Perennial herbs or undershrubs. Leaves broadly ovate to orbicular, entire or 3-5-lobed, apex acute, base subcordate to rounded, margin serrate. Flowers solitary, axillary or seemingly in raceme by reduction of upper leaves. Epicalyx segments 7-12, linear, free. Calyx 5-lobed. Corolla yellow with purple centre; petals obovate. Staminal column shorter than petals, antheriferous throughout or nearly so. Ovary ovoid, 5-angular, 5-loculed; stigmas clavate. Capsules globular, shorter than calyx, with 5 strongly veined wings. Seeds 2-4 per locule, reniform, verruculose, glabrous.

A genus with ca 4 species in tropical and sub-tropical regions of the World; 1 species in India as well as in West Bengal.

Floria vitifolia (L.) Mattei, Bol. R. Orto Bot. Palermo 2:71, 1916; Paul & Nayar, *l.c.* 109; Paul in Sharma *et al.*, *l.c.* 310. *Hibiscus vitifolius* L., Sp. Pl. 696. 1753; Mast. in Hook. f., *l.c.* 338; Prain, *l.c.* 182. "Ban-Kapus" (Beng.).

Herbs or undershrubs, up to 2 m high. Leaves 2.5-15 × 2-12 cm, lower leaves orbicular, 3-lobed, lobes deltoid, middle leaves ovate, cordate with small lateral lobes, upper leaves ovate to oblong. Flowers solitary, axillary or clustered at the tip. Epicalyx segments 7-12, linear, each segment 6-12 × 0.5 mm, ultimately spreading or reflexed. Calyx lobes 0.5-1.5 × 0.6-1 cm, ovate to deltoid. Petals obovate, 2.5-5 × 1-3 cm, yellow with dark purple base. Staminal column 1-1.6 cm long. Capsules globular, 1.5-2 cm across, with a short beak and conspicuous, scarious and strongly veined wings. Seeds reniform 2-3 across, glabrous.

Fl. & Fr. : Throughout the year, particularly after rainy season. Throughout West Bengal.

5. COSSYPRUM L.

Annual herbs, undershrubs or shrubs, rarely small trees, all parts dotted with black oil glands. Leaves palmately lobed, sometimes entire. Flowers axillary, solitary. Epicalyx segments 3, foliaceous, entire to deeply parted. Calyx

campanulate, smaller than epicalyx, truncate to 5-dentate or lobed, persistent. Corolla yellow to white, sometimes red or purple with a deep purple centre; petals 5. Staminal column included. Ovary 3-5-loculed, style 1, stigma clavate, 5-sulcate. Capsules ovoid to sub-globular. Seed with unicellular convoluted hairs two different types of hairs; the dense short hairs, called "fuzz" and 10-65 mm long hairs called "lint"

A genus with ca 35 species in tropics and sub-tropics of the World 3 species are cultivated in West Bengal.

1. Epicalyx segments entire to serrate :
 2. Epicalyx segments connate at the base for 1 cm or more, entire or 3-4 toothed near the apex, closely embracing the flower; leaves with linear to lanceolate segments with an extra tooth in the sinus; capsules tapering ...1. *G. arboreum*
 2. Epicalyx segments connate at the very base, 7-9 toothed or lobed at apex, flaring widely from the flower; leaves with ovate to oblong or elliptic lobes without any extra tooth; capsules oblong or rounded ...2. *G. herbaceum*
1. Epicalyx segments laciniate ...3. *G. barbadense*
var. *acuminatum*

1. **Gossypium arboreum** L., Sp. Pl. 693, 1753; Mast. in Hook.f., *l.c.* 347; Paul & Nayar, *l.c.* 112; Paul in Sharma *et al.*, *l.c.* 387. "Kapas Tula" (Beng.).

Annual or perennial shrubs up to 2 m high. Leaves ovate to orbicular, 3.5 or 7-lobed or parted. Flowers solitary, axillary. Epicalyx segments ovate, 1.5-3 × 1-2.5 cm, entire or toothed. Calyx cupular, 5 mm long, apex somewhat 5-dentate. Petals obovate, 3-4 cm long, yellow, occasionally red or purple. Capsules rounded to ovoid or globular with a beak, 1.5-3 cm long. Seeds 5-17 per locule, each 5-7 mm across with floss and fuzz, floss white or rusty.

Fl. & Fr. Nov.-April. Occasionally cultivated.

2. **Gossypium herbaceum** L., Sp. Pl. 693, 1753; Mast. in Hook.f., *l.c.* 346; Prain, *l.c.* 184; Paul & Nayar, *l.c.* 115; Paul in Sharma *et al.*, *l.c.* 389.

Annual herbs or undershrubs up to 1.5 m high. Leaves ovate-rounded in outline, palmately 3.5 or 7-lobed. Flowers solitary, axillary. Epicalyx segments 1-2 cm long and broad. Calyx cup-shaped, 7-10 mm long, undulate or truncate. Petals obovate, 2.5-3.5 × 2.5-4 cm, yellow with purple base. Capsules oblong or rounded, 3-4 cm long, 4-loculed. Seeds 5-7 in each locule, each 5.8 × 3.6 mm, ovoid with floss and fuzz, floss greyish-white, fuzz grey.

Fl. & Fr.: Nov.-April. Occasionally cultivated.

3. **Gossypium barbadense** L. var. *acuminatum* (Roxb.) Mast. in Hook.f., *l.c.* 347; Prain, *l.c.* 184; Paul & Nayar, *l.c.* 115; Paul in Sharma *et al.*, *l.c.* 388. *G. acuminatum* Roxb., Fl. Ind. ed. Carey, 3: 186, 1832.

Annual or perennial undershrubs, shrubs or small trees. Leaves orbicular to ovate, deeply palmiparted, lobes ovate to oblong, stipules auricled at base.

Flowers solitary, axillary. Epicalyx segments orbicular to ovate, lancinate, teeth 10-15. Calyx cupular, truncate or with obtuse teeth. Petals obovate, yellow with crimson base. Capsules ovoid, 5-8 cm long, beaked. Seeds adhering with each other firmly in a solid column, with white floss and fuzz.

Fl. & Fr.: Feb.-April. Usually cultivated in gardens and homeyards, the lint is used for spinning the sacred thread used by some Hindus.

6. HIBISCUS L. *nom.cons.*

Herbs, shrubs or trees. Leaves petiolate, stipulate, simple, palmilobed to parted, rarely pennilobed. Flowers solitary, axillary or in terminal lax raceme or panicles by reduction of the upper leaves. Epicalyx segments 3 to many, rarely absent, free or shortly connate at base. Calyx 5-lobed or 5-parted, usually campanulate, rarely cyathiform or tubular, persistent. Corolla mostly large and showy, rotate or contortate, campanulate or cylindrical. Staminal column truncate or 5-toothed at apex, antheriferous throughout or only in the upper half. Ovary 5-loculed or 10-loculed by 5 false partition; style 1, distally 5-branched; stigma usually discoid. Capsules loculicidally dehiscent. Seeds 3 to many in each locule, reniform, subglobose or obovoid, glabrous or variously pubescent.

A genus with ca 250 species mainly in the tropical and subtropical regions of the world; 17 species in West Bengal.

1. Capsule often 10-loculed by false partitions; trees :
 2. Leaves unlobed, stipules foliaceous, epicalyx segments connate at base; seeds hairy:
 3. Capsule spuriously 10-loculed; seeds well developed ...16. *H. tiliaceus*
 3. Capsule 5-loculed; seeds abortive ...13. *H. similis*
 2. Leaves 3-5 palmilobed; stipules linear-lanceolate; epicalyx segments free; seeds glabrous ...8. *H. platanifolius*
1. Capsule 5-loculed; herbs, undershrubs or shrubs :
 4. Herbs or undershrubs; stems with prickles or bristles or both; segments of epicalyx linear or bifurcate at the tip or spatulate; calyx lobes with 3 prominent veins:
 5. Epicalyx bifurcate or spatulate at tip:
 6. Stipules foliaceous ...14. *H. strattensis*
 6. Stipules not foliaceous:
 7. Rambling or trailing undershrubs ...1. *H. aculeatus*
 7. Erect undershrubs ...9. *H. radiatus*
 5. Epicalyx neither bifurcate nor spatulate at tip:
 8. Epicalyx adnate to calyx; calyx without tomentum, becoming fleshy after flowering ...11. *H. sabdariffa*

8. Epicalyx not adnate to calyx; calyx with white arachnoid tomentum, never fleshy ...2.*H. cannabinus*
4. Shrubs or undershrubs; stem unarmed; segments of epicalyx not bifurcate or spatulate; veins on calyx not prominent:
9. Staminal column longer than corolla, antheriferous towards apex; fruits rarely formed, shrubs:
10. Petals entire; staminal column slightly longer than petals ...10.*H. rosasineensis*
10. Petals lacinate; staminal column twice as long as petals ...12.*H. schizopetalous*
9. Staminal column shorter than corolla, antheriferous throughout; fruits well developed; herbs undershrubs or shrubs:
11. Segments of epicalyx very short or absent in mature flower; flowers small ...4.*H. lobatus*
11. Segments of epicalyx well developed, persistent; flowers medium to large :
12. Calyx not inflated:
13. Seeds with an auricle of long silky ferruginous hairs epicalyx segments linear to lanceolate or filiform:
14. Corolla more than 4 cm in diameter; pedicel equal to or shorter than petiole ...15.*H. syriacus*
14. Corolla less than 3 cm in diameter; pedicel longer than petiole:
15. Leaves unlobed; epicalyx segments filiform, calyx divided up to the middle ...5.*H. micranthus*
15. Leaves 3-lobed; epicalyx segments lanceolate to linear; calyx divided nearly to the base ...3.*H. hirtus*
13. Seeds tomentose with short hairs; epicalyx segments linear- spatulate ...7.*H. panduraeformis*
12. Calyx more or less inflated in fruits:
16. Capsule subglobose; seeds densely hairy ...6.*H. mutabilis*
16. Capsule oblong; seeds glabrate ...17.*H. trionum*

1. *Hibiscus aculeatus* Roxb., Fl. Ind. ed. Carey 3: 206, 1832; Paul & Nayar in Fasel, Fl. India 19: 123, 1988; Paul in Sharma *et al.*, *l.c.* 323. *H. furcatus* Roxb. ex DC. Prodr. 1: 449, 1824, *non* Willd. 1809; Mast. in Hook.f., *l.c.* 335; Prain, *l.c.* 182.

Undershrubs, trailing or suberect, up to 1.5 m high. Stems, petioles and pedicels with stiff recurved bristles. Leaves entire or 3-5-lobed, 2.5-10 × 3-8 cm. Flowers 5-10 cm across, solitary, axillary. Epicalyx segments 8-12, 1-2 cm long. Calyx 5-parted. Petals obovate, yellow with purple base. Capsules ovoid, 1.5 cm long. Seeds reniform, 4-5 mm across, sparsely covered with scale like structures.

Fl. : Sept. - Jan.; *Fr.* : Nov. - Feb.

Cultivated in gardens, sometimes as escape.

2. **Hibiscus cannabinus** L., Syst. Nat. ed. 10, 2: 1149. 1759; Mast. in Hook. f., *l.c.* 339; Prain, *l.c.* 182; Paul & Nayar, *l.c.* 127; Paul in Sharma *et al.*, *l.c.* 324. "Mestapar" (Beng.).

Herbs, up to 4 m high. Upper leaves 3-5 or 7-lobed; leaflets linear, elliptic to lanceolate, 3-8 × 0.4-2 cm, lower leaves undivided. Flowers solitary, axillary or in raceme by replacing the upper leaves. Epicalyx segments 7-8, each up to 1.5 cm long. Calyx lobes free up to the middle, lobes deltoid. Petals obovate, yellow with crimson base, 4-6 × 1-3 cm. Staminal column 1-2.5 cm long. Capsules ovoid 2 × 1.5 cm, beaked. Seeds reniform, 4 mm across, deltoid with brownish scale like hairs.

Fl. & Fr. : Aug. - Nov. Cultivated.

Stem yields fibre used for making fishing nets and coarse textiles.

3. **Hibiscus hirtus** L., Sp. Pl. 694. 1753; Mast. in Hook. f., *l.c.* 335; Prain, *l.c.* 181; Paul & Nayar, *l.c.* 130; Paul in Sharma *et al.*, *l.c.* 329. "Lai-surgumini" (Beng.).

Undershrubs up to 1.5 m high. Lower leaves ovate, entire or 3-lobed, 3.5-6 × 1.5-3 cm, upper leaves ovate-lanceolate, 2-3 × 0.5-2 cm. Calyx 5-fid, 3-10 × 0.5-1.5 mm. Petals obovate, pink or white. Staminal column shorter or as long as petals. Capsules globose, shorter than calyx. Seeds 2-3 per locule, reniform, 2 mm across densely covered with long woolly hairs.

Fl. & Fr. : Nov. - June. Bankura and Purulia.

4. **Hibiscus lobatus** (J.A. Murray) O. Kuntze, Rev. Gen. Pl. 3, 2:19. 1898; Paul & Nayar, *l.c.* 133; Paul in Sharma *et al.*, *l.c.* 336. *Solandra lobata* J.A. Murray, Comm. Soc. Reg. Sc. Goetting 6: 20, t. 1. 1785. *H. solandra* L' Herit. Strip. Nov. 1: 103, t. 49. 1788 *nom. illeg.*; Mast. in Hook. f., *l.c.* 336; Prain, *l.c.* 182.

Herbs up to 1 m high. Lower leaves 3-lobed, lobes linear, lanceolate, ovate, deltoid or obovate, upper leaves lanceolate to linear, occasionally lyrate, serrate, 2-9 × 1.5-7.5 cm. Flowers solitary, axillary, rarely in raceme by replacing upper leaves. Epicalyx segments 6-8, 1 mm in bud, caducous. Calyx deltoid to lanceolate. Petals obovate, 10-15 × 6-10 mm, white or yellow. Staminal column 6 mm long. Capsules oblong-ovoid, 10-15 mm long with 1-2 mm long rostrum. Seeds tetragonous to globose, 3-4 in each locule, 1.3 mm across, glabrous or indistinctly tuberculate.

Fl. & Fr. : July - Jan. Bankura, Purulia.

5. **Hibiscus micranthus** L.f., Suppl. 308. 1781; Mast. in Hook.f., *L.c.* 335; Prain, *L.c.* 181; Paul & Nayar, *L.c.* 137; Paul in Sharma *et al.*, *L.c.* 330.

Undershrubs, up to 2.6 m high. Leaves ovate to oblong, 1.5-4.5 × 0.5-3.5 cm. Flowers solitary, axillary. Epicalyx segments 6-8, each 1-2 mm long. Calyx lobes 5 mm long, lanceolate filiform. Petals oblong, obtuse, 12 × 4 mm, purplish white or pink. Capsules globose. Seeds reniform, hirsute with long white silky hairs.

Fl. & Fr. : Throughout the year. 24-Parganas.

6. **Hibiscus mutabilis** L., Sp. Pl. 694. 1753; Mast. in Hook.f., *L.c.* 344; Paul & Nayar, *L.c.* 140; Paul in Sharma *et al.*, *L.c.* 390. "Sthal Padma" (Beng.).

Shrubs, up to 6 m high. Leaves suborbicular, 10-22 cm across, palmately 3-7-lobed. Flowers solitary, axillary or sub-corymbose at the top. Epicalyx segments 8-12, each 2-2.5 × 1-2 mm, linear-lanceolate. Calyx lobes 3-4 × 1 cm, ovate-lanceolate. Petals obovate, 6-8 cm long, white to pink, changing colour to more or less red in late evening. Staminal column shorter than corolla. Capsules subglobose, 2-2.5 cm long. Seeds reniform, 2 mm long, the dorsal and dorsi-lateral wall with radiating simple to 6 armed long hairs up to 2 mm long.

Fl. & Fr. : Sept. - Dec. Cultivated as an ornamental.

7. **Hibiscus panduraeformis** Burm. f., Fl. Ind. 151, t. 47, f. 2. 1768. Mast. in Hook.f., *L.c.* 338; Prain, *L.c.* 182; Paul & Nayar, *L.c.* 142; Paul in Sharma *et al.*, *L.c.* 339.

Herbs or undershrubs up to 4 m high. Leaves 2-15 × 0.5-10 cm, lower ovate-cordate, palmilobed, upper oblong lanceolate. Flowers solitary, axillary, often in terminal raceme replacing upper leaves. Epicalyx segments 6-10, spatulate. Calyx lobes 15-20 × 3-5 mm, ovate. Petals obovate, 15-30 × 20-25 mm, yellow with dark purple base. Staminal column 10-15 mm long, dark purple. Capsules ovoid, shorter than calyx. Seeds reniform, 2-2.5 mm long, densely hairy or glabrous.

Fl. & Fr. : Oct. - Jan. In the plains of West Bengal.

8. **Hibiscus platanifolius** (Willd.) Sweet, Hort. Brit. 2:51. 1827; Paul & Nayar, *L.c.* 143. Paul in Sharma *et al.*, *L.c.* 338. *Pavonia platanifolia* Willd. Berol. Mag. Ges. Natur. f. Fr. 4: 220. 1810. *H. collinus* Roxb., Fl. Ind. ed. Carey 3. 1832; Mast. in Hook.f., *L.c.* 338.

Small trees or shrubs, up to 2 m high. Leaves palmately 3-5-lobed, 8-15 cm across, lobes elliptical. Flowers solitary, axillary. Epicalyx segments 5, 8 or 10, lanceolate, 12-18 mm long. Calyx lobes 2-3.2 × 0.6-0.9 cm ovate or lanceolate. Petals obovate 4-6 × 3-4 cm, pink with deep purple centre, occasionally yellow. Staminal column 2-2.5 cm long. Capsules 2-3.5 cm long and broad, depressed globose, shortly beaked. Seeds sub-spherical, 4-5 mm long, glabrous.

Fl. & Fr. : Aug. - April.

Cultivated in the garden as an ornamental.

9. **Hibiscus radiatus** Cav., Diss. 3: 150, t. 54, f. 2. 1787; Mast. in Hook.f., *L.c.* 335; Paul & Nayar, *L.c.* 146; Paul in Sharma *et al.*, *L.c.* 327.

Undershrubs, up to 1.8 m high. Leaves 2-12 × 1.5-12 cm, lower broadly ovate to oblong, upper orbicular in outline, ovate, linear to lanceolate. Flowers solitary, axillary. Epicalyx segments 8 or 10, each 15-18 × 1.5-2 mm, linear, bifurcate to one-third from the apex. Calyx segments ca 10 × 3-4 mm, ovate to deltoid. Petals obovate, yellow with dark purple base. Staminal column 1.5-2.2 cm long antheriferous throughout. Capsules ovoid, 2-2.5 × 1.5 cm, with a short beak. Seeds trigonous, 4 mm across, scabrous.

Fl. & Fr. : Aug. - Feb.

Cultivated as an ornamental, sometimes running wild.

10. *Hibiscus rosa-sinensis* L., Sp. Pl. 694, 1753; Mast. in Hook.f., *l.c.* 334; Paul & Nayar, *l.c.* 147; Paul in Sharma *et al.*, *l.c.* 391. "Jaba" (Beng.).

Shrubs, up to 4 m high. Leaves ovate to ovate-lanceolate, 5-11 × 3-6 cm. Flowers solitary, axillary. Epicalyx segments 5-8, lanceolate. Calyx campanulate, lobes 1.5-2 cm long, lanceolate. Petals obovate, red. Staminal column 4-9 cm long. Capsule rounded, rarely formed.

Fl. & Fr. : Throughout the year.

Cultivated as an ornamental.

10. *Hibiscus sabdariffa* L., Sp. Pl. 695, 1753; Mast. in Hook.f., *l.c.* 340; Prain, *l.c.* 182; Paul & Nayar, *l.c.* 148; Paul in Sharma *et al.*, *l.c.* 391. "Lal-mesta", "Patwa", "Chukar" (Beng.).

Herbs, up to 2 m high. Leaves polymorphic, 4-11 × 0.5-1.8 cm, entire or palmately 3-5 fid or partite or lobed, lobes lanceolate, ovate or oblong. Flowers solitary, axillary or in raceme, or in panicles by reduction of the upper leaves. Epicalyx segments 8-12, each 5-10 × 2-3 mm, lanceolate to oblong-elliptic. Calyx cup-shaped, 1.5-4 cm long, fleshy after flowering. Petals obovate, 4-5 cm long, yellow with purple base. Staminal column shorter than petals. Capsules ovoid, 1.5 cm across. Seeds reniform, 2-3 mm long.

This species is cultivated for its fibre known as tozelle hemp of "commerce" used for all purposes for which jute is used. Calyx is used as vegetable and also in preparation of jelly and drinks.

12. *Hibiscus schizopetalous* (Mast.) Hook. f. in Curtis Bot. Mag. III. 36, t. 6524, 1880; Paul & Nayar, *l.c.* 150; Paul in Sharma *et al.*, *l.c.* 392. *H. rosa-sinensis* L. var. *schizopetalous* Mast. Gard. Chron. n.s. 12.272 f.45, 1879. "Lanthan Jaba" (Beng.).

Shrubs, up to 3 m high. Leaves ovate-elliptic, 2-8 × 1-4 cm. Flowers axillary, solitary, pendulous. Epicalyx segments 6-7, very short, 1-2 mm long. Calyx tubular, spathaceous, irregularly 2-4-lobed, 15 mm long. Petals deeply lacinate into many linear-oblong 4-7 cm long segments scarlet or whitish red. Staminal column twice as long as the petals. Capsules 3-4 cm long.

Fl. & Fr. : Throughout the year.

Cultivated as an ornamental.

13. *Hibiscus similis* Blume, Bijdr. 2:73, 105. 1825; Paul & Nayar, *l.c.* 152; Paul in Sharma *et al.*, *l.c.* 320. *H. tortuosus* Wall. ex Prain, *l.c.* 183 non Roxb. 1832.

Trees. Leaves orbicular-ovate, 10-21 × 9-20 cm. Flowers solitary, axillary or in terminal panicles by replacing upper leaves. Epicalyx segments 8-11-fid, each 15-20 × 4-5 mm, linear-lanceolate. Calyx lobes lanceolate, 2-2.5 × 0.5-0.7 cm. Petals obovate, 6.5-7 cm long, yellow with dark purple centre. Capsules orbicular, with a short beak, 2.5 cm across. Seeds abortive.

Fl. & Fr. : Throughout the year. Sundarbans (24-Parganas).

14. *Hibiscus surattensis* L., Sp. Pl. 696. 1753; Mast. in Hook.f., *l.c.* 334; Prain, *l.c.* 182; Paul & Nayar, *l.c.* 153; Paul in Sharma *et al.*, *l.c.* 327. **Fig. 48**

Undershrubs or herbs. Leaves suborbicular or ovate, lower ones 3-4-palmilobed, upper ones 5-palmiparted with linear-lanceolate segments; stipules foliaceous, ovate, semilunar, auricled at base. Flowers solitary axillary. Epicalyx segments 10 each 15-20 × 2.5-3 mm spatulate. Petals obovate calyx lobes 10-25 × 5-10 mm ovate to deltoid. Petals obovate, 3-5 × 1.5 cm. Staminal column 5-15 mm long. Capsules ovoid *ca* 1.2 × 1 cm, acute. Seeds reniform, 3-4 mm across, with white scale like emergences.

Fl. & Fr. : Sept. - Feb. Darjeeling, rare.

15. *Hibiscus syriacus* L., Sp. Pl. 695. 1753; Mast. in Hook.f., *l.c.* 344; Prain, *l.c.* 182; Paul & Nayar, *l.c.* 155; Paul in Sharma *et al.*, *l.c.* 393. "Sweet Java" (Beng.).

Shrubs, up to 6 m high. Leaves deltoid-ovoid to rhombic-ovate, 4-7 × 1.5-5 cm, often 3-lobed, cuneate at base. Flowers solitary axillary. Epicalyx segments 6-8, each 1-1.5 × 1 mm, linear. Calyx 1.2-2 cm long, lobes oblong or ovate-lanceolate. Petals obovate. Staminal column 2-4 cm long. Capsules 1.4-2.5 cm long, obtuse, abruptly beaked. Seeds pilose.

Fl. & Fr. : June-Oct.

Cultivated as an ornamental.

16. *Hibiscus tiliaceus* L., Sp. Pl. 694. 1753; Mast. in Hook.f., *l.c.* 343; Prain, *l.c.* 183; Paul & Nayar, *l.c.* 157; Paul in Sharma *et al.*, *l.c.* 322. "Bola" (Beng.).

Trees, up to 15 m high. Leaves orbicular to ovate, 3-17 × 1.5-16 cm. Flowers solitary, axillary, or in terminal clusters by replacement of upper leaves. Epicalyx cupular, 9-11 dentate. Calyx lobes 2-3 × 0.5-1 cm, with 3 prominent veins. Petals obovate, yellow with dark purple centre turning red in afternoon. Staminal column shorter than petals. Capsules globose to ovoid, 1-2 cm across, with a short beak. Seeds reniform, 4-5 mm long, stellulate hairy, dark brown.

Fl. & Fr. : Throughout the year. Hooghly, Howrah, Midnapore, 24-Parganas (Sunderbans).

Frequently grows in the coastal areas, river sides, bank of lakes and marshes. The seeds can float in sea for several months (Guppy, observ. Natursn. Pacif.

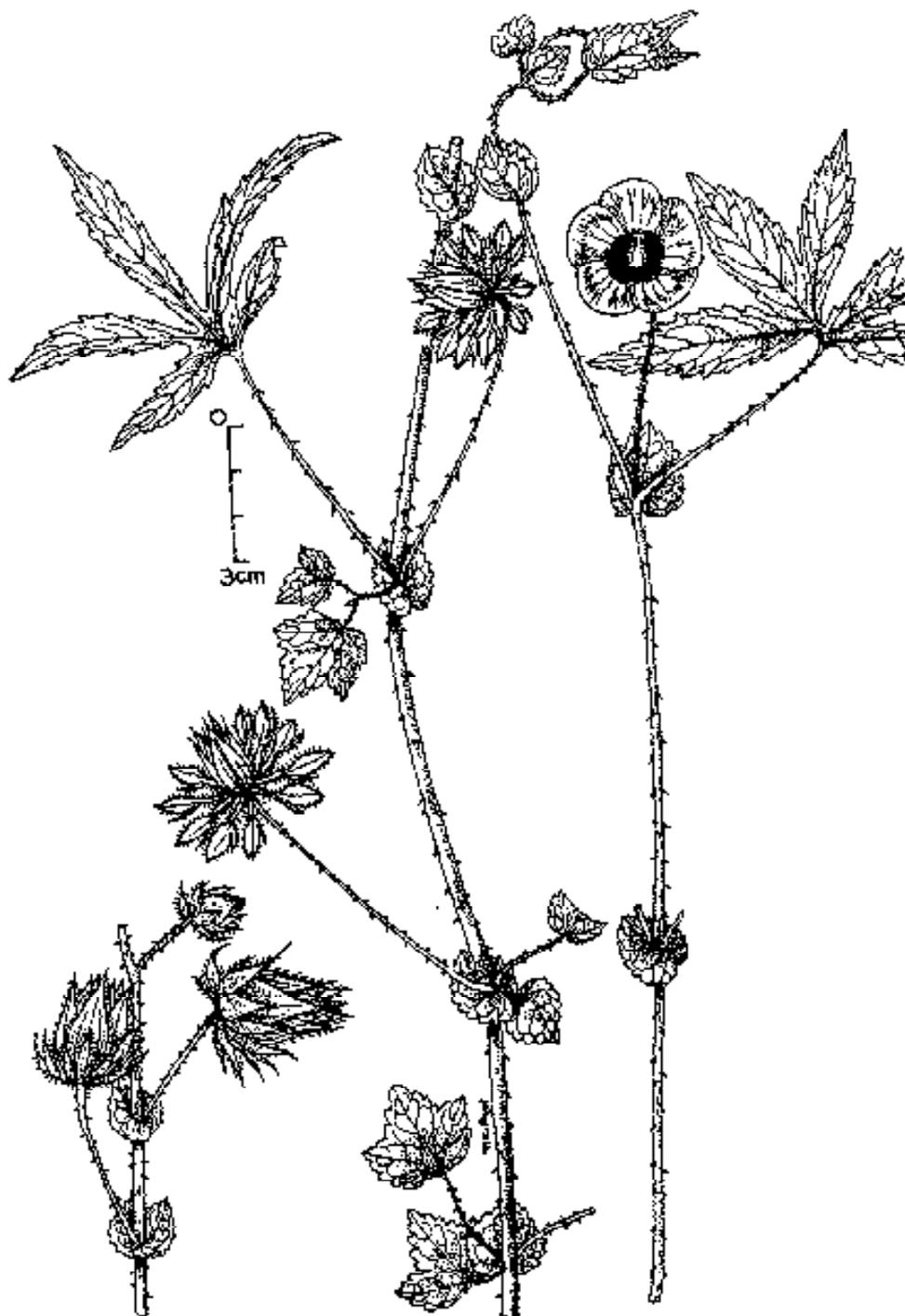


Fig. 48. *Hibiscus surattensis* L.

2:529, 1906; Muir, Dep. Agr. For. Bot. Surv. Mem. 16:43, 1937), thus dispersal takes place easily.

17. *Hibiscus trionum* L., Sp. Pl. 697, 1753; Mast. in Hook. f., *l.c.* 354; Prain, *l.c.* 181; Paul & Nayar, *l.c.* 158; Paul in Sharma *et al.*, *l.c.* 341.

Erect or decumbent herbs. Leaves orbicular-ovate, lobed or unlobed. Flowers solitary, axillary. Epicalyx segments 8-12, linear. Petals obovate, yellowish pink with dark purple centre. Staminal column 5-8 mm long. Capsules oblong, obtuse. Seeds reniform, minutely tuberculate or glabrate.

Fl. & Fr. : July - Jan. Cultivated.

7. KYDIA Roxb.

Trees, young branches stellate pubescent. Leaves lobed or angled, with nectary on the veins beneath. Flowers axillary or in terminal panicles, polygamous. Epicalyx segments 4-6, spatulate-oblong, accrescent and spreading in fruit, persistent. Calyx 5- lid. Petals 5, obovate, adnate to the staminal tube at base. Male fls. : staminal column branched distally into 5 arms, each tipped by a cluster of 4-6 connate anthers, ovary abortive with a short style. Female fls.: branches of the staminal column short with imperfect anthers; ovary 3-locular, with 2-3 ovules in each locule; styles 3 with stigmatose arms. Capsules loculicidally 3-valved, subglobose. Seeds reniform, furrowed.

A genus with ca 3 species in tropical and sub-tropical regions of India as well as S.E. Asia and Brazil; 1 species in West Bengal.

Kydia calycina Roxb., Pl. Corom 3: 11, t. 215, 1819 et in Fl. Ind. ed. Carey 3: 188, 1832; Mast. in Hook. f., *l.c.* 348; Paul & Nayar, *l.c.* 160; Paul in Sharma *et al.*, *l.c.* 344. *K. fraterna* Roxb., Pl. Corom. 3:12, t. 216, 1819, "Pola, Bonukpos" (Beng.).

Trees, up to 20 m high. Leaves suborbicular to ovate-rounded, 4-12 × 3-15 cm. Flowers in close panicles, axillary or terminal, polygamous. Epicalyx segments 4-6, oblong or obovate, 4-15 × 5-7 mm, ultimately spreading. Calyx cup-shaped, lobes 0.5 × 0.4 cm. Petals obovate, shorter than the epicalyx. Staminal column 3 mm long, pistillode absent in male flower. Capsules 5 mm across, subglobose, hard, depressed. Seeds 3 × 2 mm, more or less reniform-ellipsoid, glabrous, glandular striate, brown.

Fl. : Sept. - Nov.; *Fr.* : Nov. - Feb. Bankura.

8. MALACIIRA L.

Annual or perennial herbs or undershrubs, hirsute or prickly hairy. Leaves angular, palmilobed to palmiparted. Flowers in large condensed racemes surrounded by large deeply cordate leafy bracts, axillary or terminal. Epicalyx segment absent, rarely present. Calyx cupular, 5-dentate. Petals 5, red, yellow or white. Staminal column as long as or shorter than the petals, 5-toothed, antheriferous throughout. Carpels 5; style branches 10, stigma capitate, papillose.

Fruit a schizocarp, globular; mericarps 5, reticulately veined, indehiscent. Seed 1 in each mericarp.

About 10 species, all indigenous to tropical America. Only 2 or 3 species have been introduced in the old world; 1 species in West Bengal.

Malachra capitata (L.) L. Syst. Nat. ed. 12, 2:458 L., 1767; Mast. in Hook f., *l.c.* 329; Prain, *l.c.* 262; Paul & Nayar, *l.c.* 163; Paul in Sharma *et al.*, *l.c.* 367
Sida capitata L., Sp. Pl. 685. 1753.

Fig. 49

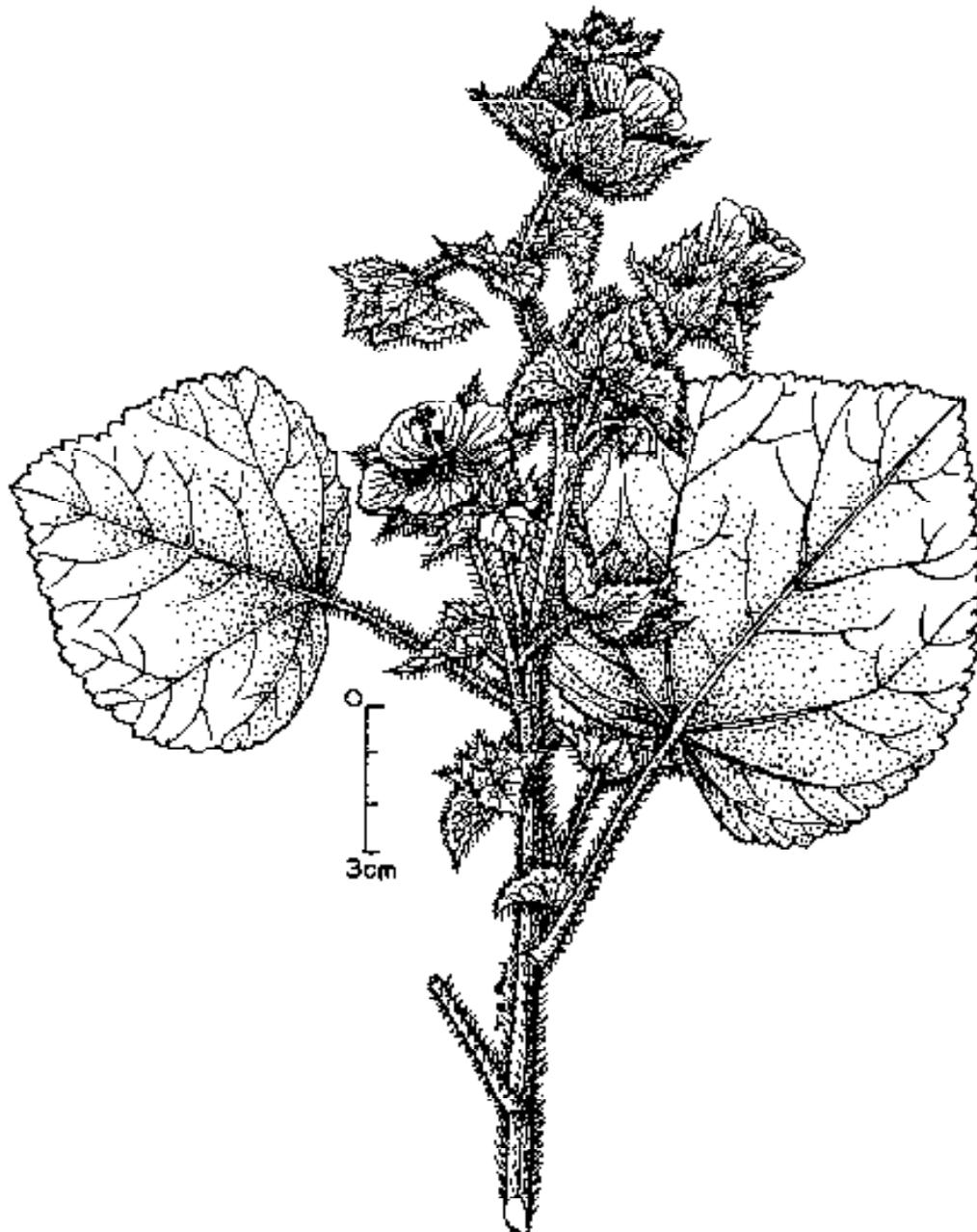


Fig. 49. *Malachra capitata* (L.) L.

Annual or perennial bright green herbs or undershrubs, up to 1.5 m high. Leaves orbicular, suborbicular or ovate, angled or lobed, 3-14 × 4-20 cm. Inflorescence axis 0.5-1.5 cm long, stout, bearing 3-7 peduncles with heads, each head with 2-5 flowers encircled by 3-4 leafy bracts; bracts ovate to orbicular 0.5 × 2 cm across, folded along the midrib. Petals obovate, 1.5 × 1 cm, bright yellow. Staminal column 1 cm long. Schizocarp obpyriform, 5-6 mm across, each 3 × 2 mm, trigonous. Seeds ca 2.5 mm long, trigonous, covered with minute stellate hairs, brownish black.

Fl. & Fr. : April - Dec. Throughout West Bengal.

9. MALVA L.

Annual, biennial or perennial herbs, or undershrubs, erect or procumbent. Leaves reniform to suborbicular, lobed or dissected. Flowers axillary, fasciculate. Epicalyx segments 3, free. Calyx cupular to rotate, 5-lobed. Petals 5, notched at apex. Ovary 10-14 carpellate; styles as many as the carpels; stigma decurrent on the adaxial surface. Schizocarp enclosed in persistent calyx, discoid; mericarps round-reniform, awnless, separating at maturity, indehiscent. Seeds reniform.

A genus with ca 40 species in temperate and subtropical regions of the world, several species are naturalized in the New World, some species are cultivated of which a few are hybrid; 2 species in West Bengal.

1. Pedicels 1-3 mm long; petals at least twice the length of calyx lobes; calyx slightly accrescent ...1. *M. neglecta*
1. Pedicels 0.3 - 0.5 (-1) cm long; petals less than twice the length of calyx lobes; calyx strongly accrescent ...2. *M. verticillata*

1. **Malva neglecta** Wallr., Syll. Pl. Nov. Ratisbon 1 : 140, 1824; Paul & Nayar, *l.c.* 169; Paul in Sharma *et al.*, *l.c.* 359.

Herbs, 15-60 cm long; erect or prostrate. Leaves reniform to suborbicular, 0.6-2.2 × 1.5-5 cm. Shallowly 5-7-lobed, more or less rounded at apex; stipules 4-6 × 2-3 mm, obliquely triangular. Flowers 2-5 in axillary loose fascicles. Epicalyx segments 3, linear to lanceolate, 2-4 × 1-1.5 mm. Calyx lobes 4-6 × 2-3 mm, deltoid, connate in the middle. Petals twice the length of the calyx lobes, notched at apex, pale lilac to whitish. Staminal column 4-6 mm long. Mericarps 12-14, each 2 mm across, reniform, faintly ridged. Seeds 1.5 mm across, reniform, glabrous, brownish black.

Fl. & Fr. : Apr. - Sept. Darjeeling.

2. **Malva verticillata** L., Sp. Pl. 689, 1753; Mast. in Hook. f., *l.c.* 320; Prain, *l.c.* 174; Paul & Nayar, *l.c.* 176; Paul in Sharma *et al.*, *l.c.* 363. "Lapha" "Napha" (Beng.).

Annual or perennial herbs, 30-120 cm high. Leaves suborbicular, 3-12 × 2-10 cm, 5-6-lobed, lobes rounded. Stipules 3-5 × 2-4 mm, lanceolate to deltoid. Flowers axillary, glomeratus; pedicels all hidden by the flowers and fruits. Epicalyx segments 3, up to 4 mm long, linear. Calyx lobes 5, accrescent up to

1-1.5 cm, deltoid-lanceolate. Petals 7-8 mm long, oblong, lobed at apex, purplish. Staminal column 3-4 mm long. Schizocarp discoid, ca 5 mm across, mericarps 10-12, each ca 2 mm across, reniform, laterally prominently radially veined, indehiscent, glabrous. Seeds ca 1.5 mm across, reniform, glabrous, brownish black.

Fl. & Fr. : Sept - Jan. Cultivated in North Bengal.

Leaves used as vegetable.

10. MALVASTRUM A. Gray, *non cons.*

Herbs or undershrubs. Leaves entire, rarely shallowly or deeply lobed. Flowers axillary, solitary, terminal or in axillary spikes; pedicel short, not jointed. Epicalyx segments 3. Calyx campanulate, 5-lobed. Corolla rotate, yellow. Staminal column shorter than corolla. Carpels filiform or clavate, truncate or capitate-stigmatose at apex. Schizocarps discoid; mericarps separating from axis leaving a short columnella, reniform, indehiscent with or without awns. Seeds reniform.

A genus with ca 3 species indigenous to tropical and subtropical America, 2 of them are naturalized in most tropical countries; 2 species in West Bengal.

- 1. Flowers solitary, axillary or in axillary clusters,
without any bract; mericarps with 3 awns ...2. *M. coromandelianum*
- 1. Flowers in dense spike subtended by bracts;
mericarps without awns ...1. *M. americanum*

1. *Malvastrum americanum* (L.) Torr., Rep. U.S. Mex. Bound. Surv. 2: 38. 1859; Paul & Nayar, *l.c.* 180; Paul in Sharma *et al.*, *l.c.* 277. *Malva americana* L., Sp. Pl. 687. 1753. *Malvastrum spicatum* (L.) A. Gray, Mem. Am. Acad. Sc. II.4(Pl. Fendl.) 22. 1849; Mast. in Hook.f., *l.c.* 321; Prain, *l.c.* 174.

Annual herbs or undershrubs, 0.5 - 2 m high. Leaves ovate to oblong, occasionally 3-lobed, 2.5-6 × 1-5 cm. Flowers in terminal or axillary condensed spikes; bracts ovate, bifid to biparted. Epicalyx segments linear to lanceolate. Calyx segments triangular. Petals obliquely obovate, apex emarginate. Staminal column 2-3 mm long. Mericarps 10-15, strongly curved, awnless. Seeds glabrous, brown/grey.

Fl. & Fr. : Aug. - Dec. Calcutta, Howrah; rare.

2. *Malvastrum coromandelianum* (L.) Garcke in Bonplandia 5:295. 1857; Paul & Nayar, *l.c.* 180; Paul in Sharma *et al.*, *l.c.* 277. *Malva coromandelianum* L., Sp. Pl. 687. 1753. *Malva tricuspidatum* A. Gray, Pl. Wright 1: 16. 1852; Mast. in Hook. f., *l.c.*; Prain, *l.c.* 174.

Annual herbs or undershrubs, up to 1 m high. Stems, petioles and pedicels with 4 armed appressed stellate hairs, two arms pointing upwards and two arms downwards. Leaves ovate to oblong, sometimes lanceolate, 1.5-6.5 × 0.5-3.5 cm, serrate. Epicalyx segments 4-7 × 0.5 - 1 mm, linear to lanceolate. Calyx lobes 5-10 × 3-5 mm, deltoid to ovate. Petals obliquely obovate, apex rounded or

emarginate. Staminal column 2-3 mm long. schizocarps 5-8 mm across; mericarps 10-14, strongly curved with one apical and 2 dorsal awns. Seed ca 1.5 mm across, glabrous, brownish black.

Fl. & Fr. : June - Dec. Throughout West Bengal.

11. MALVAVISCUS Cav.

Perennial shrubs, often climbing, or suberect. Leaves entire or palmilobed or angular-lobed. Flowers solitary, axillary, pedicel not jointed. Epicalyx segments 5-10, shortly connate at base, lanceolate to spatulate. Calyx campanulate, 5-fid. Petals erect-connivent, not spreading. Staminal column usually longer than corolla, antheriferous towards the apex. Carpels 5, ovule 1 in each carpel; style branches 10; stigma capitate. Schizocarp subglobose, berry like, finally drying and separating into indehiscent mericarps.

About 3 species in tropical America and West Indies; 1 species with two varieties in India as well as in West Bengal.

Malvaviscus arboreus Cav., Diss. 3:13, t. 48.f.1.1787; *ampl.* Schery in Ann. Miss. Bot. Gard. 29 : 209. 1942; Paul et Nayar, *l.c.* 179; Paul in Sharma *et al.*, *l.c.* 393. "Lanka Jaba" (Beng.).

Perennial shrubs, often climbing, or suberect. Leaves entire to 3-5-lobed. Flowers solitary, axillary. Epicalyx segments 5-10, shortly connate at base, lanceolate to spatulate. Calyx campanulate, 5-fid. Petals erect-connivent, contorted, red or white. Staminal column usually longer than corolla. Carpels 5, one ovule in each carpel, style branches 10; stigmas capitate. Schizocarp subglobose, berry like.

- | | |
|---|------------------------------|
| 1. Leaves 3-5 lobed, corolla less than 3 cm long | ...var. <i>arboreus</i> |
| 1. Leaves unlobed to 3-lobed; corolla more than 4 cm long | ...var. <i>penduliflorus</i> |

var. **arboreus**. *Hibiscus malvaviscus* L., Sp. Pl. 694. 1753.

Cultivated as an ornamental.

var. **penduliflorus** (DC.) Schery in Ann. Miss. Bot. Gard. 29: 223. 1942. *M. penduliflorus* Mocino & Seese ex DC. Prodr. 1: 445. 1824.

Cultivated as an ornamental.

12. NAYARIOPHYTON T.K. Paul

Monotypic, occurs in India, Bhutan, Myanmar and China (Yunnan).

Nayarophyton zizyphifolium (Griff.) D. G. Long & A. G. Miller in Edin. J. Bot. 47(3): 357. 1990. *Kydia zizyphifolia* Griff., Itin. Notes 108. 1848. *K. jujubifolia* Griff., Notul. 4: 534. 1859. *Dicellostyles jujubifolia* (Griff.) Benth. in Benth. & Hook. f. Gen. Pl. 1: 207. 1862. *Nayarophyton jujubifolia* (Griff.) T.K. Paul in T.K. Paul et Nayar, *l.c.* 185; Ortho. et in Bot. Jahrb. Syst. 110 (1): 43. 1988; Paul in Sharma *et al.*, *l.c.* 345.

Trees, 5-8 m high. Leaves ovate to suborbicular, 7-15 × 4-9 cm entire or shallowly 3-lobed, 5-7-nerved at the base; stipules subulate. Flowers axillary, solitary or in short panicles of 2-5 flowers. Epicalyx segments 4-6, 1-1.5 × 0.5 cm, oblong-lanceolate, persistent. Calyx lobes 5.1 × 0.4-0.5 cm, triangular. Petals 5, oblong, 1-2.5 × 1-1.5 cm. Staminal column 1 cm long. Ovary ovoid, 2-locular; style 2.5 cm long, 2-branched towards the apex; stigmas capitate. Capsules subglobose, 8 mm across. Seed one in each locule, 4 × 3 mm, reniform, glabrous.

Fl. & Fr. : May - Dec. Darjeeling (Kurseong to Pankhabari).

13. PAVONIA Cav., *nom. cons.*

Herbs or undershrubs. Leaves simple or lobed to parted, palminerved. Flowers axillary, solitary or fascicled. Epicalyx segments 5-12. Calyx 5-lobed or toothed. Petals 5, yellow, pink or pinkish white. Staminal column shorter than corolla. Carpels 5; styles 10; stigmas capitate. Schizocarps globular to oblate; mericarps more or less trigonous, apex mucinous or with two beaks or awns. Seeds ovoid-oblong to reniform.

A genus with ca 200 species, pantropical ; 2 species in West Bengal.

1. Leaves with nectaries on veins beneath; epicalyx segments 5, connate in middle ...2. *P. repanda*

1. Leaves without nectaries; epicalyx segments 10-12, free ...1. *P. odorata*

1. *Pavonia odorata* Willd., Sp. Pl. 3: 837. 1800; Mast. in Hook. f., *l.c.* 331; Prain, *l.c.* 177; Paul & Nayar, *l.c.* 193; Paul in Sharma *et al.*, *l.c.* 373.

Erect odorous herbs. Leaves orbicular-ovate, 2-10 × 1.5-4 cm; stipules linear, deciduous. Flowers solitary, axillary. Epicalyx segments 10-12, free, 0.5-1 cm long, ciliate. Calyx lobes ovate-lanceolate, 4 × 1.5 mm. Petals glabrous, 1-2 cm long, pink. Staminal column shorter than petals. Mericarps 5, each 4 × 2 mm, reniform, unarmed, wingless, glabrous. Seeds reniform, 2 mm long, minutely papillose.

Fl. & Fr. : Aug. - Feb. Occasionally cultivated in garden for its scented flowers.

2. *Pavonia repanda* (Roxb. ex J.E. Smith) Spreng., Syst. III. 98. 1828; Paul & Nayar, *l.c.* 196; Paul in Sharma *et al.*, *l.c.* 377. *Urena repanda* Roxb. ex Sm. in Rees, Cyclop. 37, n.6. 1819; Mast. in Hook. f., *l.c.* 330; Prain, *l.c.* 178.

Perennial herbs. Leaves ovate to ovate-rounded, 3-8 × 2.5-10 cm, rarely 3-5 or 7-lobed; stipules linear. Flowers solitary, axillary, ultimately in terminal clusters. Epicalyx segments 5, connate in middle, 1-1.5 × 0.5-1 cm. Calyx lobes shorter than epicalyx. Petals oblong-ovate, twice the length of epicalyx. Staminal column 1.5-2 cm long. Mericarps oblong-ovoid, 4 × 2.5 mm, appressed on two sides, unarmed, glabrous. Seeds oblong-ovoid, 3 × 2 mm, glabrous.

Fl. & Fr. : Sept. - Dec. Darjeeling.

14. SIDA L.

Herbs or undershrubs. Leaves simple, ovate, rhomboid or lanceolate, palmi or peinnerved, rarely lobed or divided. Flowers axillary, solitary or in axillary cluster by the development of axillary buds or in racemes or panicles by replacing upper leaves. Epicalyx absent. Calyx mostly campanulate, lobes 5. Petals 5, connate below and also adnate to the staminal column. Staminal column shorter than petals. Carpels 5-14, ovule one in each carpel; styles as many as the carpels, stigma capitate. Schizocarps globular to oblate, depressed; mericarps more or less trigonous, apex mucous or with two beaks or awns. Seeds ovoid-oblong to reniform.

A genus with ca 200 species distributed in tropical and subtropical zones with the primary centre in the New World tropics and a secondary centre in Australia; 7 species in West Bengal.

1. Mericarps without prominent reticulation; seeds dispersed by withering of the wall; leaves palminerved :
 2. Erect herbs with glandular hairs; flowers in axillary, solitary or terminal condensed racemes or panicles ...5. *S. mysorensis*
 2. Prostrate or semi-prostrate herbs without glandular hairs; flowers solitary, axillary or in few flowered racemes ...3. *S. cordata*
1. Mericarps with prominent reticulation; seeds dispersed by dehiscing the mericarps at apex ; leaves penninerved :
 3. Stipules of each pair dissimilar, one linear to lanceolate, 3-6-nerved and the other linear to filiform, 1-4-nerved; green parts sparsely hairy, soon glabrescent1. *S. acuta*
 3. Stipules of each pair similar; green parts usually more or less densely stellate hairy :
 4. Styles and mericarps 5 :
 5. Stem with 1-2 spiny emergences at the base of petiole; mericarps with 2 divergent apical awns ...7. *S. spinosa*
 5. Stem without any spiny emergence; mericarps with a pair of convergent apical awns ...2. *S. alba*
 4. Styles and mericarps (6-) 7-10 :
 6. Mericarps with retrorsely hairy awns; calyx 5-8 mm across, tomentose ...4. *S. cordifolia*
 6. Mericarps with or without awns, never retrorsely hairy; calyx 9-12 mm across, velutinous to glabrous ...6. *S. rhombifolia*

1. *Sida acuta* Burm. f., Fl. Ind. 147. 1768; Prain, l.c. 175; Paul & Nayar, l.c. 202; Paul in Sharma et al., l.c. 281. *S. Carpinifolia* (non L.f. 1781) Mast. in Hook.f. l.c. 323. "Kureta" (Beng.).

Annual undershrubs or herbs, up to 2 m high. Leaves lanceolate to linear, elliptic-lanceolate or ovate-oblong, 1.9 × 0.5–2.5 cm. Flowers solitary, axillary or in clusters of 2-3. Calyx 5-6 mm across, lobes 7 × 3 mm. Petals obliquely obovate, usually emarginate, yellow, as long as the calyx lobes or slightly exceeding. Staminal column 4 mm long with simple and glandular hairs. Seeds triangularly ovoid, 2 mm long, glabrous except the short hairy hilum, dark brown.

Fl. & Fr. : Sept. - May.

Throughout West Bengal.

2. *Sida alba* L., Sp. Pl. ed. 2. 960. 1763; Paul & Nayar, *l.c.* 206; Paul in Sharma *et al.*, *l.c.* 283. *S. alnifolia* var. *obovata* sensu Hu, Fl. China, fam. 153.22, t.16.f.5. 1955 non *S. rhombifolia* var. *obovata* Wall, ex Mast. in Hook. f. *l.c.* 324.

Undershrubs or herbs, up to 1 m high, stellate pubescent. Leaves elliptic-obovate, 1-2.5 × 0.5-2 cm; stipules filiform. Flowers axillary, solitary or paired. Calyx 3-6 mm across, lobes 2-4 × 1-2 mm, deltoid. Petals exceeding the calyx, yellow. Mericarps 5, 2 × 1.5 mm, stellate pubescent with 2 convergent apical awns, awn 0.8 mm long. Seeds 1.5 mm long, dark brown to black.

Fl. & Fr. : Sept. - Dec. Throughout the plains of West Bengal.

3. *Sida cordata* (Burm. f.) Borss. in Blumea 14 : 182. 1966; Paul & Nayar, *l.c.* 206; Paul in Sharma *et al.*, *l.c.* 283. *Melochia cordata* Burm. f., Fl. Ind. 143. 1768. *S. veronicifolia* Lamk., Encycl. 1: 5. 1783; Prain, *l.c.* 175. *S. humilis* Cav. Diss. 5, t. 134. f. 2. 1788; Mast. in Hook. f., *l.c.* 322. *S. humilis* Cav. var. *veronicifolia* (Lamk.) Mast. in Hook. f., *l.c.* 322.

Prostrate or semi-prostrate herbs, up to 1 m high. Leaves ovate to orbicular, 0.5-8 × 0.3-5.5 cm; stipules linear-filiform. Flowers axillary, solitary, ultimately in few-flowered racemes. Calyx 3 mm across. Petals obovoid, lobes 4-6 × 2 mm, tetrahedral with rounded angles, slightly longitudinally keeled on the back, awnless. Seeds obovoid, 2 × 1 mm, glabrous brownish black.

Fl. & Fr. : Throughout the year, mainly at the end of rainy season. Throughout West Bengal.

4. *Sida cordifolia* L., Sp. Pl. 684. 1753; Mast. in Hook. f., *l.c.* 324; Prain, *l.c.* 175; Paul & Nayar, *l.c.* 207; Paul in Sharma *et al.*, *l.c.* 285. "Berela, Sweet Berela" (Beng.).

Herbs or undershrubs, up to 1 m high. Leaves ovate-oblong or orbicular, 0.5-6 × 0.4-5 cm; stipules filiform. Flowers solitary, axillary or in axillary clusters of 2-5 flowers. Calyx 5-9 mm across, lobes deltoid. Petals obliquely obovate, yellow or whitish yellow, apex truncate, base ciliate. Staminal column 2.5 mm long. Mericarps 8-10, flattened-trigonous with a pair of 3-4.5 mm long retrorsely hairy awns, 3-5 mm long, radially 2 mm. Seeds flattened reniform, 2 mm across, glabrous, dark brown or black, hilum with short hairs.

Fl. & Fr. : Throughout the year. Throughout West Bengal.

5. *Sida mysorensis* Wt. & Arn., Prodr. Fl. Pen. Ind. Or. 59. 1834; Mast. in Hook. f., l.c. 322; Paul & Nayar, l.c. 209; Paul in Sharma *et al.*, l.c. 286. *S. glutinosa* Roxb., Fl. Ind. ed. Carey 3: 172, 1832, non Cav. 1785; Prain, l.c. 175.

Annual or perennial herbs, up to 90 m high. Leaves ovate, occasionally the upper leaves oblong, 1.5-8 × 1-7 cm; stipules filiform. Flowers axillary, solitary initially, ultimately in condensed racemes or panicles by the development of accessory buds. Calyx 3-4 mm across, lobes 2.5 × 2-2.5 mm. Petals obtriangular slightly exceeding the calyx, yellow. Staminal column 4 mm long. Mericarps 5, tetrahedral with rounded angles, 2.5-3 mm long, apex bicuspidate. Seeds ovoid to obtriangular, 2 mm long, glabrous, brown-black.

Fl. & Fr. : Oct. - Feb. Throughout West Bengal.

6. *Sida rhombifolia* L., Sp. Pl. 684. 1753; Prain, l.c. 176; Paul & Nayar, l.c. 212; Paul in Sharma *et al.*, l.c. 289; *S. rhombifolia* var. *rhomboidea* Mast. in Hook. f., l.c. 324; Prain, l.c. 176. *S. rhombifolia* var. *obovata* Wall. ex Mast. in Hook. f., l.c. 324; *S. microphylla* Cav., Diss. 1:22, t.12, f.2. 1785. *S. rhombifolia* var. *microphylla* (Cav.) Mast. in Hook. f., l.c. 324, "Lal Berala" (Beng.).

Undershrubs, up to 1.5 m high. Leaves ovate to oblong, often more or less rhomboid, lanceolate or obovoid, 0.5-8 × 0.3-5 cm; stipules filiform. Flowers solitary, axillary or sometimes in clusters of 2-5. Calyx 3-5 mm across. Petals oblique, yellow to pale orange. Staminal column shorter than petals. Mericarps (6-) 7-12, flattened trigonous, at apex mucous with 2 short awns. Seeds flattened reniform, 2 mm across, glabrous, brown or black.

Fl. & Fr. : Aug. - Feb. Throughout West Bengal.

Sida spinosa L., Sp. Pl. 683. 1753; Mast. in Hook. f., l.c. 323; Prain, l.c. 175; Paul & Nayar, l.c. 218; Paul in Sharma *et al.*, l.c. 292. "Ban Methi" (Beng.).

Herbs or undershrubs up to 60 cm high. Stems with 1-2 spiny emergences at the base of petioles. Leaves oblong, ovate or lanceolate, 6-30 × 4-25 mm, stipules linear. Flowers axillary, solitary or in clusters of 2-5. Calyx 3-5 mm across, lobes 1-2 × 1.5-2 mm, deltoid. Petals yellow or yellowish white. Mericarps 5, trigonous, 2-3 mm long, with 2 divergent awns. Seeds ovoid, 1-1.5 mm long, obscurely trigonous, glabrous, brown black.

Fl. & Fr. : March - Dec. Throughout West Bengal.

15. THESPESIA Sol. ex Corr. *nom.cons.*

Trees or shrubs. Leaves simple or palmilobed, often with extra-floral nectaries on the veins beneath, petiolate; stipules soon caducous. Flowers solitary, axillary or in racemes by replacing the upper leaves. Epicalyx segments 3 or 5, free, caducous. Calyx cyathiform, nearly truncate, remotely denticulate, persistent. Corolla large, yellow. Staminal column shorter than petals, antheriferous throughout. Ovary 5-loculed or 10-loculed by 5 false dissepiments; style unbranched; stigma elongate, coherent. Capsules, globose or pyriform, indehiscent or partly dehiscent. Seeds 2 to many in each locule, obovoid, pubescent or tomentose, glabrous.

A genus with about 12 species in tropical and sub-tropical regions of the world; 3 species in West Bengal.

1. Leaves 3-5-lobed, densely stellate hairy; seeds 8-15 in each locule; shrubs up to 2.5 m high ...1. *T. lampas*
1. Leaves unlobed, with lepidots; seeds 2-4 in each locule; shrubs or trees, 3-10 m high :
 2. Leaves deeply cordate, green pedicels 2-5 cm long, erect, jointed near the base; seed with long simple hairs ...2. *T. populnea*
 2. Leaves shallowly cordate or sub-truncate, bronze-coloured; pedicels 8-12 cm long, tending to droop, without any joint; seeds with short clavate or bulbous hairs ...3. *T. populneoides*

1. ***Thespesia lampas*** (Cav.) Dalz. & Gibs., Bombay Fl. 19. 1861; Mast. in Hook.f., *L.c.* 345; Prain, *L.c.* 184; Borss. in *Blumea* 14: 116. 1966; Paul & Nayar, *L.c.* 222; Paul in Sharma *et al.*, *L.c.* 350. 1988. *Hibiscus lampas* Cav., Diss. 3: 154, t. 56.f.2. 1987. *H. tetralocularis* Roxb., Fl. Ind. ed. Carey 3: 198. 1832. "Bankapas" (Beng.).

Shrubs up to 2.5 m high. Leaves orbicular, 3-5-lobed, 6-12 cm across, upper leaves ovate to oblong; stipules lanceolate to subulate. Flowers solitary, axillary or in long stalked raceme of 1-5 flowers by replacing the upper leaves. Epicalyx segments 5. Petals obovate, yellow with dark-purple base. Staminal column 1-2 cm long. Capsules ovoid to globose, dehiscent into 5 valves. Seeds densely appressed with short simple hairs, glabrescent, black.

Fl. & Fr. : Aug. - Dec. Bankura, Burdwan, Midnapore and Purulia.

2. ***Thespesia populnea*** (L.) Sol. ex Corr., Ann. Mus. Herb. Paris 9: 290. t.8.f.1. 1807; Mast. in Hook.f., *L.c.* 345; Prain, *L.c.* 184; Paul & Nayar, *L.c.* 225; Paul in Sharma *et al.*, *L.c.* 352. *Hibiscus populneus* L., Sp. Pl. 694. 1753. "Paraspipal" (Beng.).

Trees, up to 10 m high. Leaves orbicular, deltoid, ovate or oblong, 5-20 × 5.5-15 cm, shortly acuminate; stipules lanceolate to linear. Flowers solitary, axillary. Epicalyx segments 3. Petals obliquely obovate, yellow with dark purple base. Staminal column 1.5-2.5 cm long. Capsules globose, irregularly crumpled at maturity, indehiscent, 4-5-loculed. Seeds obovoid, angular, densely covered with yellowish brown long simple hairs more dense on the angles.

Fl. & Fr. : Aug. -Jan. Coastal areas of South Bengal. Sometimes cultivated on road sides.

3. ***Thespesia populneoides*** (Roxb.) Kostel. Allg. Med. Pharm. Fl. 5:1861. 1836; Paul & Nayar, *L.c.* 226; Paul in Sharma *et al.*, *L.c.* 353. *Hibiscus populneoides* Roxb., Fl. Ind. ed. Carey 3 : 190. 1832.

Trees, up to 8 m high. Leaves ovate or oblong, long acuminate, 5- 20 × 5.5-15 cm; stipules subulate to lanceolate. Epicalyx segments 3. Petals obliquely

obovate, yellow with dark purple base. Staminal column 1.5-2.5 cm long. Capsules globose, exocarp separated from the tough endocarp by mesocarp consisting of loose fibrous-spongy tissue, dehiscent into 5 valves. Seeds obovoid, angular, densely covered with short clavate or bulbous hairs.

Fl. & Fr. : May - Jan. Coastal areas of South 24-Parganas (Sunderbans).

16. URENA L.

Annual or perennial undershrubs or shrubs, densely stellate pubescent, sometimes mixed with simple hairs. Leaves variable in shape and size, palmilobed to parted or undivided, angular, palminerved with nectaries on the nerves beneath. Flowers axillary, usually solitary, sometimes fasciated. Epicalyx segments 5, connate at the base. Calyx 5 parted. Petals 5. Staminal tube with subsessile anthers below the apex. Ovary 5-loculed; style branches 10; stigmas discoid. Schizocarps subglobose; mericarps 5, indehiscent, with glochidiate spines.

Monotypic, pantropical, possibly of Asiatic origin.

Urena lobata L., Sp. Pl. 692, 1753, *sensu lato*; Prain, *l.c.* 178; Paul & Nayar, *l.c.* 228; Paul in Sharma *et al.*, *l.c.* 380.

Annual or perennial undershrubs, 0.5-2 m high. Leaves 1-12 × 0.5-12.5 cm, ovate to orbicular, angular or shallowly lobed or deeply irregularly incised below the middle, stellate hairy, petioles 0.5-12 cm long; stipules 2-4 mm long, linear to lanceolate. Flowers axillary, solitary or in clusters of 2-3. Epicalyx segments 5, linear to lanceolate: 3-10 × 1-3 mm, appressed or spreading at maturity. Calyx lobes 5, ovate to deltoid, 4-6 × 1.5-2 mm, free to the base. Petals obovate, 10-15 × 5 mm, pink. Schizocarps globular, 5-8 mm across, covered with glochidia (spine with 4-5 retrorse short sharp hooks at the top); mericarps 5, triangularly obovoid, 4-5 mm long, indehiscent. Seeds reniform, 2-3 mm across, minutely hairy, glabrescent.

- | | |
|---|-------------------------|
| 1. Leaves angled or shallowly lobed; epicalyx always appressed, segments long triangular | ... <i>ssp. lobata</i> |
| 1. Leaves palmatilobed or fid; epicalyx spreading or reflexed in fruit, segments linear to lanceolate | ... <i>ssp. sinuata</i> |

ssp. lobata Mast. in Hook.f., *l.c.* 329. "Bun-okra" (Beng.).

Fl. & Fr. : Oct. - Dec. Throughout West Bengal.

ssp. sinuata (L.) Borss. in *Blumea* 14 : 142, 1966; Paul & Nayar, *l.c.* 230; Paul in Sharma *et al.*, *l.c.* 382. *U. sinuata* L., Sp. Pl. 692, 1753; Mast. in Hook.f. *l.c.* 320. "Kunguiya" (Beng.). Fig. 50

Fl. & Fr. : Oct. - Dec. Throughout West Bengal.

17. WISSADULA Medik.

Annual or perennial herbs, undershrubs or shrubs. Leaves ovate, ovate-oblong to long triangular or lanceolate, palminerved. Flowers solitary, axillary or in

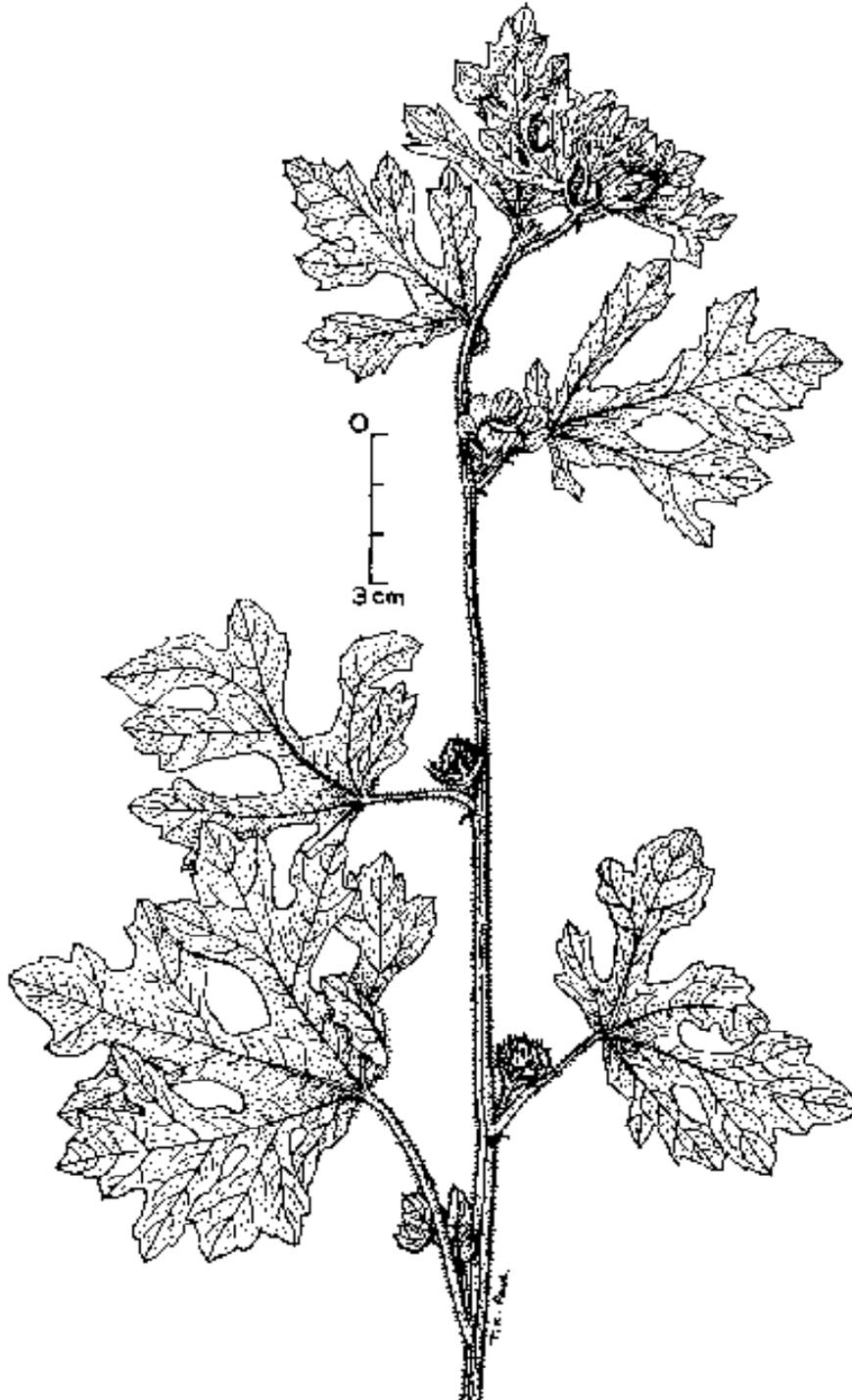


Fig. 50. *Urena lobata* L. ssp. *sinuata* (L.) Borss.

loose or condensed terminal panicles. Epicalyx absent. Calyx cupular, 5-fid. Corolla small, rotate, yellow. Staminal column short. Carpels 5, 1-3-ovuled; styles 5, capitate-stigmatose at apex. Schizocarps globular to obconical; mericarps beaked, dehiscent, usually with a trans-verse constriction, thus seemingly bilocular. Seeds 3 in each mericarp, sometimes 2 or 1, reniform.

About 60 species in America, Africa and Asia; 1 species in West Bengal.

17. *Wissadula periplocifolia* (L.) Presl. ex Thw., En. Pl. Zeyl. 27. 1853; Paul & Nayar, *l.c.* 233; Paul in Sharma *et al.*, *l.c.* 389. *Sida periplocifolia* L., Sp. Pl. 684. 1753. *W. rostrata* Planch. in Hook., Niger Fl. 229. 1349; Mast. in Hook.f., *l.c.* 325. "Pan vasma, Sahasravedi" (Beng.).

Annual or perennial undershrubs, up to 2 m high. Leaves ovate-oblong to long triangular or lanceolate, 4-11 × 1-4.5 cm; stipules filiform. Flowers axillary, solitary or in long lax panicles by replacing the upper leaves. Epicalyx absent. Calyx 5 fid, ovate to triangular, 2 × 1.5 mm. Petals yellow. Schizocarps globular to obconical; mericarps 5; dorsally round with a 0.5 mm long mucro. Seeds 3 in each mericarp, upper two seeds falling out of mericarp, tetrahedral to globular, lower seed persistent within the mericarp, obconic to globose.

Fl. & Fr. : Nov. - March. Central and Southern parts of West Bengal.

BOMBACACEAE

(M.C. BISWAS)

A pantropical family of about 26 genera and 225 species; 3 genera and 3 species in West Bengal.

1. Fruits dehiscent; seeds globose embedded in exogenous cotton :
 2. Stem and branches aculeate; flowers red or pink; stamens numerous; valves of capsule woody 2. BOMBAX
 2. Stem smooth (aculeate when young); flowers white; stamens 5; valves of capsule thickly coriaceous 3. CILOBA
1. Fruits indehiscent; seeds reniform, not embedded in cotton 1. ADANSONIA

1. ADANSONIA L.

Deciduous trees; trunk greyish. Leaves digitate, 3-9-foliolate, petiolate, stipulate. Flowers large, solitary, axillary, pendulous; peduncles with indumentum of tufted hairs; pedicel apically with 2 caducous bracteoles. Calyx cupular, coriaceous, 5-lobed, tomentose outside. Petals 5, ovate to obovate, pubescent on both sides, adnate at the base of androecium. Stamens many, united for about half of their length forming cylindrical staminal tube, anthers oblong reniform, one-celled. Ovary 5-10 loculed, ovules axile, many in each locule, style long exerted, divided above into 5-10 spreading branches. Capsules

oblong-ovoid, woody, indehiscent, covered with dense velvety tomentum, pendulous on long stalk. Seeds many, reniform, covered with farinaceous pulp.

A paleotropical genus with 6 species distributed in Madagascar, Australia and tropical Africa; 1 species introduced in West Bengal.

Adansonia digitata L., Sp. Pl. 1190. 1753; Mast. in Hook.f., Fl. Brit. India. 1:348. 1874; Prain., Bengal Pl. 1:185.1963 (Repr.ed.); Nayar & Biswas in Sharma *et al.*, Fl. India 3:404. 1993. "Gadhagachh" (Beng.), "Gorakh-imli" (H.).

Trees, up to 25 m; trunk short, very thick, up to 10 m in diam., with widely spreading branches; bark smooth, grey. Flowers with new leaves. Petioles 10-25 cm long. Leaflets 4-7, digitate, oblong to obovate, entire, about 15 × 7 cm, apex caudate-acuminate, base cuneate, pubescent when young, ultimately glabrous, deciduous. Flowers together with new leaves, solitary, axillary pedunculate. Petals obovate. Staminal tube cylindrical, 5-7 cm long; filaments numerous, as long as the tube; anthers reniform. Ovary 5-10-loculed, ovules numerous, axile. Style base hirsute, stigma 5-10-lobed. Capsules oblong, indehiscent, tomentose. Seeds reniform, dark-brown.

Fl. : April -May; *Fr.* : Sept. -Oct. Planted in the gardens as well as near tombs of the Muslim saints.

Wood used as fuel; young leaves used as green vegetables and capsules as floats for nets by the fisherman.

2. BOMBAX L. *nom. cons.*

Deciduous trees; trunk buttressed or not; branches spreading, more or less whorled in early stages. Leaves palmately compound, petiolate, 5-9-foliolate, alternate; stipules small. Flowers when leafless, axillary or subterminal, solitary or in clusters, pedicellate, bracteoles fugacious. Calyx cupular, irregularly 5-lobed, coriaceous, caducous. Petals 5, linear to oblong-ovate, adnate to base of the staminal tube, caducous. Stamens many, polyadelphous, with numerous long filaments; anthers reniform, one-celled. Ovary 5 celled; ovules many in each cell; style clavate; stigma 5-fid. Capsules cylindrical, tapering at both ends, loculicidally dehiscing by 5 deciduous woody valves. Seeds ovate, covered with white cotton; albumen scanty; cotyledons crumpled.

A genus with about 8 species in tropical America, Africa and Asia; 1 species in West Bengal.

Bombax ceiba L., Sp. Pl. 511. 1753. *p.p.*; Robyns in Taxon 10: 160. 1961; Nayar & Biswas in Sharma *et al.*, *l.c.* 398. *B. malabaricum* DC., Prodr. 1: 479. 1824; Mast. in Hook. f., *l.c.* 349. 1874. *Salmalia malabarica* (DC.) Schott in Schott & Endl., Melet Bot. 35. 1832. "Simul" (Beng.); "Sermal" (H.); "Salmali" (Sans.).

Fig. 51

Tall deciduous trees, up to 30 m high; trunk aculeate with woody conical prickles. Leaves long petioles; leaflets 5-7, digitate, lanceolate-acuminate, 12-19 × 5-7 cm. Flowers solitary or in clusters of 2-4 towards the end of the branchlets, bright red or pink. Calyx slightly 3-5-lobed, coriaceous, silky inside. Petals

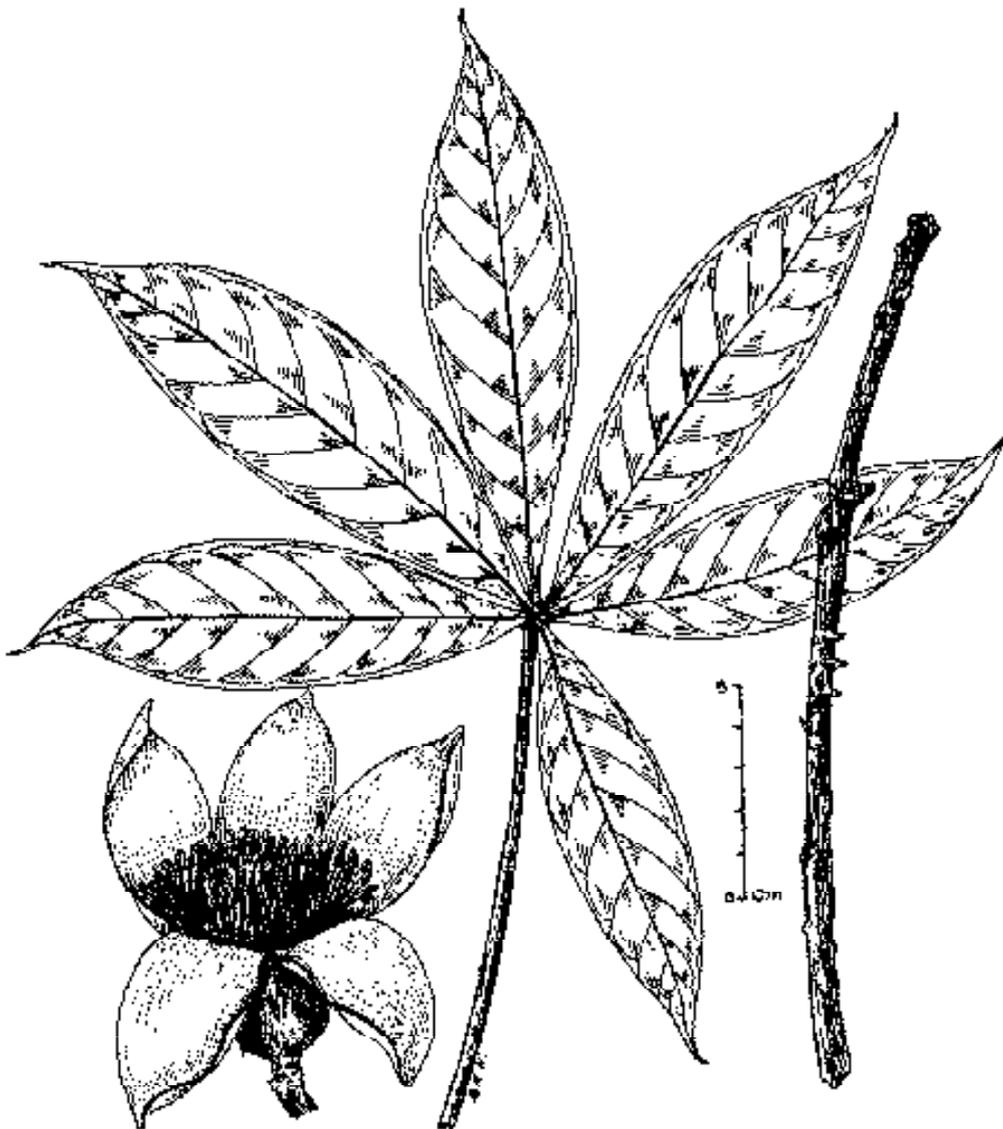


Fig. 51. *Bombax ceiba* L.

oblong, 8.5-10 × 3.3-4 cm. Stamens numerous, in 5 lateral bundles and one central bundle pressing the style; filaments unequal, 3-5 cm long. Ovary conical; ovules axile; styles filiform, up to 6 cm long; stigma 5-lobed, recurved. Capsules oblong, up to 15 × 5 cm dehiscing by 5 woody valves. Seeds dark-brown, embedded in cotton.

Fl. : Feb. - March; *Fr.* : April - May. Throughout the plains and lower hills.

Wood is light and spongy, used for building sea-faring boats and in ply & match industries. Cotton from fruits is used for stuffing beds, pillows and quilts.

3. *CEIBA* Mill. *emend* Gaertn.

Deciduous trees trunk prickled when young; branches whorled. Leaves compound, digitate. Flowers solitary, axillary or fasciculate on terminal branchlets. Bracteoles vestigial. Calyx persistent, campanulate, irregularly 3-12-lobed. Petals 5, white, oblanceolate, base jointed with staminal tube. Staminal tube conical and cylindrical, short, divided into 5 filiform branches bearing 1-3-celled anthers at the top. Ovary 5-loculed; ovules many axile; style filiform, dilated shortly into 5-lobed stigma. Capsules oblong, dehiscing by 5 coriaceous valves. Seeds numerous, ovoid or globose, embedded in cotton, albumen absent or scanty.

A genus with about 3 species in America and tropical Africa; 1 species introduced and naturalized in warmer parts of S. E. Asia as well as in West Bengal.

Ceiba pentandra (L.) Gaertn. *Frucl. Sem. Pl.* 2: 244, t. 133, 1791; Nayar & Biswas in Sharma *et al.*, *l.c.* 400. *Bombax pentandrum* L., *Sp. Pl.* 511, 1753. *Eriodendron anfractuosum* DC., *Prodr.* 1: 479, 1824; Mast. in Hook. *f.*, *l.c.* 350; Prain, *l.c.* 185. "Swet simul" (Beng.), "Safed savara" (H.), "Seta salmali" (S.).

Deciduous trees, up to 40 m tall; trunk greenish when young and with basal buttresses when mature; branches in horizontal groups of 5-7. Leaves digitately compound; petiole long; leaflets 5-7, 10-12 × 4 cm, elliptic-lanceolate. Flowers in clusters, axillary or at the end of branchlets. Calyx cupular, persistent, apex irregularly 5-lobed. Petals oblanceolate, contorted, yellowish white. Staminal tube short, split above into 5 filaments, each bearing 1-2-celled sinuate anthers. Ovary ovoid, ovules many in each locule; style filiform, 4 cm; stigma 5-lobed. Capsules oblong, coriaceous, 12 × 3.5 cm, 5-valved, grey. Seeds many, globose, black, with woolly cotton.

Fl. : Dec. - Feb.; *Fr.* : Feb. - April. Calcutta, Hooghly, Howrah, 24-Parganas, Jalpaiguri.

Wood is light and durable in water, used in ply-wood industry, in the preparation of packing boxes and match sticks. The cotton produced is of high quality and used for stuffing pillows and quilts. Roots reportedly used in diarrhoea and scorpion-sting and also as a cure for diabetes.

STERCULIACEAE

(K. C. Malick)

A family of about 60 genera and nearly 700 species, chiefly tropical; 14 genera and 23 species in West Bengal.

1. Trees or shrubs:
 2. Stamens on columns; ovaries on androgynophore:
 3. Staminal column always remaining inside the flowers:
 4. Leaves digitate or lobed, (or simple in *Pterygota*); flowers unisexual or polygamous:
 5. Anthers in a ring on the column below the sterile ovaries; fruits samaroid ...6. HERITIERA
 5. Anthers in ring at the top of the staminal column enclosing the sterile ovaries; fruits capsular:
 6. Leaves digitate or lobed; anthers not in groups ...13. STERCULIA
 6. Leaves simple (irregularly lobed in cultivated form); anthers in 4 groups ...11. PTERYGOTA
 4. Leaves simple; flowers bisexual:
 7. Staminoles present; fruits not inflated:
 8. Staminoles club-shaped; fruits straight ...10. PTEROSPERMUM
 8. Staminoles scale-like; fruits spirally twisted ...5. HEICTHES
 7. Staminoles absent; fruits inflated ...7. KLEINOVIA
 3. Staminal column exerted from the flowers:
 9. Petals absent; fruits opening before maturity ...3. FIRMIANA
 9. Petals present; fruits opening after maturity ...12. REEVESIA
 2. Stamens on a basal staminal cup; ovaries not on androgynophore:
 10. Petals spatulate, entire; capsules 5-winged ...1. ABROMA
 10. Petals bifid into two strap-shaped segments; capsules tubercled ...4. GUAZUMA
1. Herbs or undershrubs:
 11. Staminoles present :

12. Petals neither with hooded bases nor with appendaged tips; staminodes club-shaped, equalling the petals ...9. PLINTAPETES
12. Petals with hooded bases and appendaged tips; staminodes ovate, much shorter than petals ... 2. BYTTNERIA
11. Staminodes absent:
13. Staminal cup narrowed at the mouth; ovaries 5-celled ...8. MELOCHIA
13. Staminal cup wider at the mouth; ovaries 1-celled ...14. WALTERIA

1. ABROMA Jacq.

Trees or shrubs. Leaves simple, cordate or ovate-oblong, denticulate. Flowers bisexual, in few-flowered cymes, opposite the leaves. Sepals 5, connate at base. Petals 5, spatulate. Stamens on a basal staminal cup, 5 groups of anthers alternating with staminodes. Ovaries sessile, 5-locular, 5-lobed. Fruits membranaceous, 5 angled septicidally dehiscent 5-valved capsules with villous margins and truncate apex. Seeds numerous.

2 or 3 species in tropical Asia; 1 species in West Bengal.

Abroma augusta (L.) L.F., Suppl. Pl. 341, 1781; Mast, in Hook. f., Fl. Brit. India 1 : 375, 1874; Prain, Bengal Pl. 1 : 191, 1963 (repr. ed.); Malick in Sharma *et al.*, Fl. India 3 : 409, 1993. *Theobroma augusta* L., Syst. Nat. ed. 12, 233, 1770. "Ulatkambal" (Beng.) & (H).

Large shrubs, 2-4 m high, or small trees; branches downy. Leaves ovate-lanceolate, ovate-oblong or repand-denticulate, 10-20 × 5-15 cm, glabrescent above, tomentose beneath, margins entire, apex acute or acuminate, base cordate; petioles 1.5 - 2.5 cm long; stipules linear, as long as the petioles, deciduous. Flowers in few-flowered axillary peduncled cymes. Sepals 15 × 5 mm, lanceolate, hairy, persistent. Petals 5, clawed, claws 5 mm long, hairy, more so on the margins. Anthers in 5 groups of 3 on the staminal cup alternating with 5 staminodes. Staminodes 5, 2 × 1 mm, emarginate, hairy. Ovaries oblong, ridged, 5-lobed. Capsules 3.5-4 cm in diam., membranous, 5-angled, 5-winged, truncate at the apex, septicidally 5-valved, valves villous at the edges. Seeds many.

Fl. & Fr. : June - Feb. Often planted in different districts.

Roots are medicinally used.

2. BYTTNERIA Loeff. *nom. cons.*

Herbs, shrubs or trees, sometimes climbing, frequently prickly. Leaves simple, entire or lobed. Flowers bisexual and female, minute, in axillary or terminal umbellate cymes. Sepals 5, connate at base. Petals 5 with hooded base and 2-fid appendages. Stamens in a basal staminal cup. Staminodes present. Ovaries 5-celled, cells 2-ovuled; styles 5-lobed. Capsules globose, more or less echinate

septicidally 5-valved; valves breaking away from the central column; cells 1-seeded. Seeds ascending.

About 75 species, mainly tropical; 2 species in West Bengal.

1. Bushy herbs with persistent rootstock; leaves entire, sparsely hairy ...1. *B. herbacea*
1. Large woody climbing shrubs; leaves lobed, pilose ...2. *B. pilosa*

1. **Byttneria herbacea** Roxb., Pl. Corom. 1, t. 29, 1795; Mast. in Hook. f., *l.c.* 376; Prain, *l.c.* 191; Malick in Sharma *et al.*, *l.c.* 412. "Kambraj" (Beng.).

Small sparsely branched bushy herbs with perennial woody rootstock. Stems terete in older portions furrowed in younger portions, tomentose. Leaves ovate-lanceolate, 2-6 × 1.5-3 cm, irregularly dentate, sparsely hairy, more so along the margins and on veins below; apex acute or acuminate, base obtuse, rounded or sub-cordate; petioles 2-3.2 cm long, pubescent; stipules minute. Flowers in 2-3 flowered cymes arising from a short peduncle, sometimes twice cymose; huds rotund, suddenly beaked. Peduncles more than 1 cm long; bracts 2-4. Sepals up to 4 × 1.5 mm, ovate-lanceolate, hairy. Petals up to 4 mm long with long slender claw and a pair of pouch at base which enter into the staminal cup and cover the anther cells. Stamens 5, alternating with staminodes; anthers 2-celled, cells reniform, divergent. Staminodes 5. Ovaries 5-celled. Capsules septicidal.

Fl. & Fr. : May - Dec. Midnapore, Purulia.

Rootstock used medicinally.

2. **Byttneria pilosa** Roxb., Fl. Ind. 2 : 381, 1824; Mast. in Hook. f., *l.c.* 377; Prain, *l.c.* 192; Malick in Sharma *et al.*, *l.c.* 414.

Large woody climbing shrubs; branches grooved, hispid with spreading hairs or thinly stellate-hairy. Leaves 10-18 × 5-13 cm, often broader than long, orbicular or ovate, membranous, somewhat stellate-pilose, closely serrulate-denticulate, 3-5-lobed, lobes deltoid, entire to serrulate, abruptly acuminate, 7-9-nerved at base; petioles 5-15 cm long, shaggy tomentose while young. Flowers in much branched pubescent axillary compound cymes; bracteoles subulate. Sepals 5, ovate-lanceolate, acute, *ca* 3 × 1 mm. Petals shorter than the sepals with a slender claw and a hooded limb, the apex of which cover the fertile anthers, a long process develops from the upper side of the hood. Staminodes ovate, alternating with stamens in the inner series. Anther lobes reniform, divergent. Ovary 1 mm long; style equally long. Capsules spherical, 12 mm in diam., densely covered with barbed prickles, septicidally 5-valved. Seed 1 in each cell, *ca* 5 × 3 mm, triangular.

Fl. : Sept. - Nov.; *Fr.* : Nov. - May, Darjeeling.

3. FIRMIANA Marsig.

Trees. Leaves often cordate, lobed, palmately nerved; petioles long. Flowers unisexual, in coralliform panicles, covered with stellate hairs. Calyx tubular,

4-5-toothed. Corolla absent. Androgynophore exerted after anthesis. Stamens 10; filaments attached to the sunken top of the long androgynophore. Ovaries 5, conglutinate; styles short; stigmas curved outside; after anthesis ovaries separate soon and expand. Follicles membranaceous, opening before maturity. Seeds 2-4. Flowers hermaphrodite in appearance but one sex remains sterile. Male and female differ only in development of androecium or gynoecium. In male, anthers are smaller than that in the females but in latter the anthers do not open.

About 15 species in eastern Africa, Indo-malaya, southeast and eastern Asia; 1 species in West Bengal.

Firmiana colorata (Roxb.) R.Br. in Benn. & Brown, Fl. Java Rar. 235. 1844 (quad var. a); Mast. in Hook. f. *L.c.*, 359 (as syn. of *Sterculia colorata* Roxb.); Kosterm. in Reinwardt. 4 : 205, f. 1, 2 & 3, 1957; Malick in Sharma *et al.*, *L.c.* 420. *Sterculia colorata* Roxb., Pl. Cor. 1:26. 1795 (quad tab. 25, descript. excl.); Fl. Ind. 3. 145. 1832; Mast. *L.c.*, 359; Prain, *L.c.* 187. "Samarri Pisi" (Beng.).

Trees up to 25 m tall, buttressed, lenticelled. Leaves 15-20 cm in diam., 3-7-lobed, lobes shallow to deep, apex acuminate, lobes up to 15 cm long; petioles up to 25 cm long, pulvinate. Flowers in axillary coralliform panicles or racemes from the axils of fallen leaves. Calyx funnel-shaped, stellately hairy, 2-3 cm long, sometimes slightly curved. Androgynophore up to 3 cm long when exerted. Anther cells curved. Follicles up to 7 cm long, membranous, glabrous, veined. Seeds globose.

Fl. & Fr. : March - May, Howrah (Bot. Gard.), Jalpaiguri, Purulia.

Yield fibres.

4. GUAZUMA MILL

Trees, stellately tomentose or pubescent. Leaves simple, alternate, often oblique at base. Flowers small, in axillary cymes. Sepals 5, connate below. Petals 5, clawed, concave at base, apex terminating in two slender ligulate appendages. Staminal cups bearing 5 staminodes alternating with 5 groups of fertile anthers. Ovaries 5-lobed. Capsules woody, tubercled. Seeds many.

4 species in tropical America and India; 1 species in West Bengal.

Guazuma ulmifolia Lam., *Encycl.* 3:52. 1789; Malick in Sharma *et al.*, *L.c.* 424. *G. tomentosa* Kunth in H.B.K. *Nov. Gen. Sp.* 5: 320. 1823; Mast. in Hook. f., *L.c.* 375; Prain, *L.c.* 191. "Niapl-tunth" (Beng.).

Fig-52

Trees, herbaceous portions tomentose; bark fissured in older parts. Leaves ovate-oblong or oblong-lanceolate, 6-17.5 × 3-9 cm, tomentose, more so on lower surface, irregularly serrate, apex rounded, sub-rounded or shortly acuminate, base obliquely cordate; petioles 1-2 cm long, tomentose. Flowers small, in axillary cymes bisexual; pedicels up to 5 mm long. Sepals up to 3 × 2 mm, stellate-tomentose outside, apex acute, hooded. Petals 3.5 mm long (excluding the process), 3 mm broad, bifurcated, the lobes up to 4 mm long, strap-shaped; hoods finely tomentose outside. Staminal cups bearing 3 anthers alternating with one staminode. Staminodes 5, limbriate. Ovaries 1 mm long, tubercled, neck

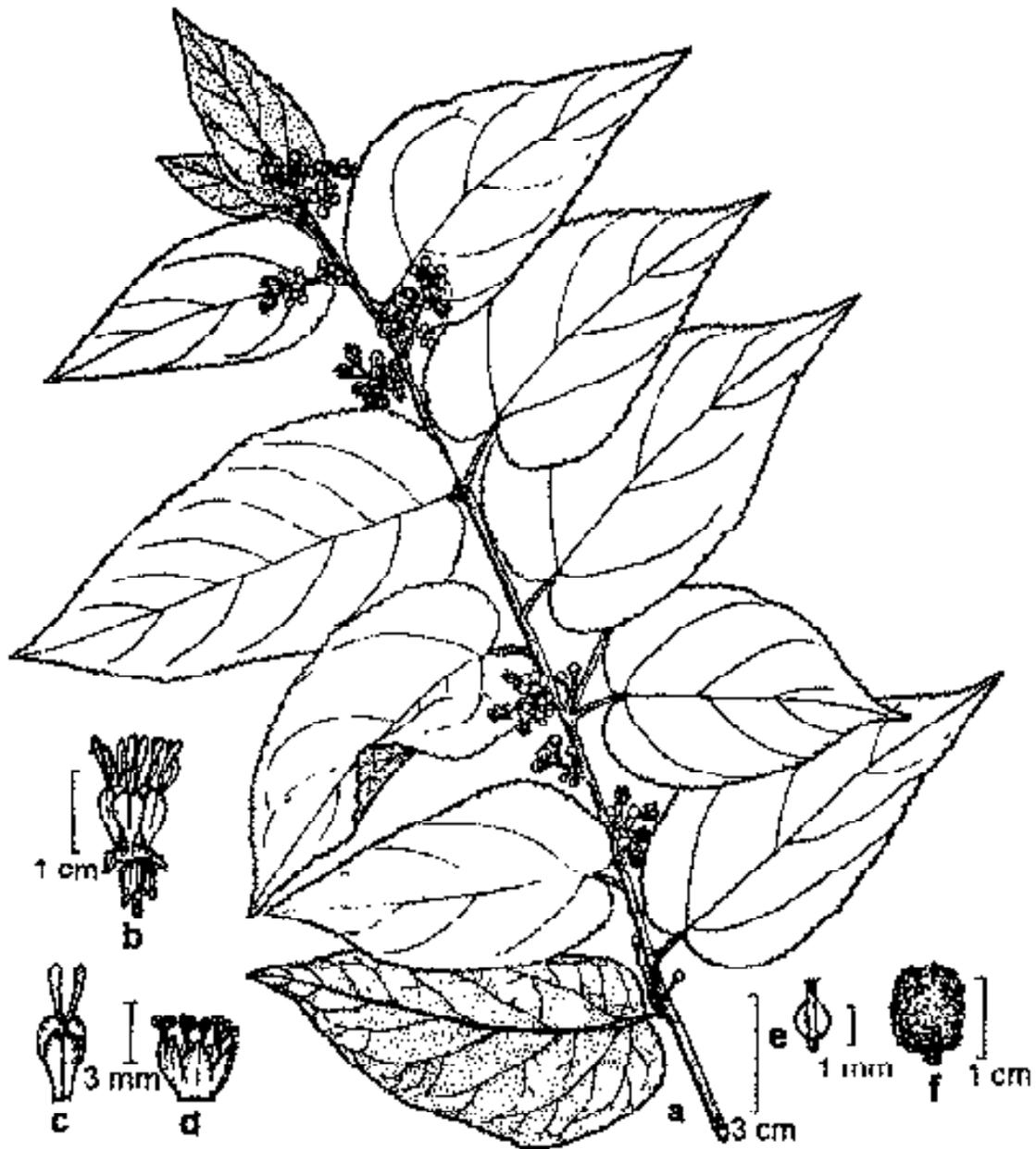


Fig. 52. *Guazuma ulmifolia* Lam. : a. flowering part of branch; b. flower; c. petal; d. staminal column; e. pistil; f. fruit.

bottle-like; styles 2 mm long, compressed, of 5 adherent styles not borne on androgynophore. Capsules up to 2 cm in diam., tubercled.

Fl. : March–Dec.; *Fr.* : Dec.–June. Howrah, Murshidabad, Nadia; usually planted often self-sown.

5. HELICTERES L.

Shrubs or trees, more or less stellately pubescent. Leaves simple. Flowers bisexual, axillary, solitary or in fascicles. Calyx tubular, 5-lobed, lobes often unequal. Petals 5, entire or somewhat 2-lipped with long claws, often with ear-shaped appendages. Staminal column adnate to gynophore, slightly curved at apex, exserted, dilated above which is 3-lobed, each lobe again bifurcated bearing an anther on each tooth. Anthers 2-celled. Stamminodes arising from the inner wall of the staminal column between two fertile lobes and alternating with them. Ovary at the top of the androgynophore. Fruits capsular.

About 60 species in tropical Asia and America; 2 species in West Bengal.

1. Leaves up to 5 cm broad; fruits straight ... 1. *H. hirsuta*

1. Leaves more than 5 cm broad; fruits spirally twisted ... 2. *H. isora*

1. ***Helicteres hirsuta*** Lour., Fl. Cochinch. 2:530. 1790; Malick in Sharma *et al.* *L.c.* 425. *H. spirata* Colebr. ex G. Don, Gen. Syst. 1:507. 1813; Mast. in Hook.f., *L.c.* 366 (incl. var.).

Shrubs. Leaves ovate-oblong or lanceolate, 5-15 × 2.5-5 cm, stellate hairy above, downy beneath, unequally serrate at margins, acuminate at apex, base obliquely sub-cordate; petioles 12-15 mm long; stipules setaceous, as long as the petioles. Flowers in elongated spike-like axillary cymes; cymes shorter than the leaves. Pedicels shorter than the flowers. Calyx nearly 1-2 mm long, bell-shaped, curved; downy. Petals nearly twice as long as abruptly toothed claws. Stamens 10. Ripe carpels 3.5-4 cm long, on glabrous stalks, densely covered by stellate villous hairs, oblong-lanceolate beaked; stalks exserted from the persistent calyx.

Fl. : June. Darjeeling.

2. ***Helicteres isora*** L., Sp. Pl. 2: 963. 1753; Mast. in Hook f., *L.c.* 365; Prain, *L.c.* 189. "Almora" (Beng.). "Maror phali" (H.).

Shrubs; young branches rough with scattered hairs. Leaves alternate, broadly elliptic or elliptic-obovate, 15-23 × 11-17 cm, scabrous with stellate hairs mixed with simple hairs, more so on the margins, stellate pubescent beneath, margins serrate and double serrate towards the apex; apex shortly acuminate, base slightly obliquely cordate, main nerves 5-7, arising from the base; petioles 1-1.5 cm long, pubescent; stipules up to 1 cm long, subulate, deciduous. Flowers 4-5 cm long, axillary, solitary or in clusters often supra-axillary. Calyx 2 cm long, covered with dense stellate hairs, gibbose. Petals 4-5 cm long, reflexed, 2 lower shorter and broader than the 3 upper ones; claws winged. Staminal column 4 cm long, slightly bent on one side at the tip, exserted. Anthers 10, surrounding the ovary and alternating in pairs with 5 minute scaly staminodes to the staminal tube.

Styles united as long as the ovary, deflexed. Ovary 5-celled, 5-lobed. Fruits 4-6 × 0.5-1 cm, spirally twisted with an apical beak up to 1 cm long, on a long androgynophore. Seeds many.

Fl. & Fr. : April - Dec. Bankura, Malda, Purulia

Roots, bark and fruits are medicinal.

6. HERITIERA Ait.

Usually lofty trees, buttressed; bark black or grey. Leaves simple; lower surface of leaves and young branchlets covered with adpressed small scales; stipules lanceolate or acicular, caducous. Flowers small, in axillary short lax panicles, unisexual. Peduncles adpressed-lepidote. Calyx campanulate, 4-5-toothed, stellate-pubescent. Corolla absent. Male florets with 8-10 anther cells, clustered in a ring at the top of the androgynophore with a sterile ovary on the top of the androgynophore. Female florets with 4-5 sessile laterally compressed ovaries encircled by sterile anthers at base; styles conglutinate, stigmas 4-5, radiating, free. Fruits apocarpous, samara with an ellipsoid glabrous nut, winged or keeled.

About 35 species in West tropical Africa, Indomalaya, tropical Australia and Pacific Islands; 1 species in West Bengal.

Heritiera fomes Buch. Ham. in Symes, An Account of an Embassy to the Kingdom of Ava, ed. 2, 3: 319. 1800; Mast. in Hook. f., *l.c.* 363. *H. minor* Roxb., Fl. Ind. 3: 142. 1832, *p.p. non* Lamk. 1797; Prain, *l.c.* 188. "Sundri" (Beng.).

Trees. Leaves coriaceous pseudo-peltate, 10-17 × 3-6 cm, upper surface glabrous, lower surface scaly, margins entire, base tapering, sub-rounded or acute; petioles up to 1 cm long. Panicles rusty tomentose. Calyx 2.5 - 3.5 × 2.5-3 mm, 4-5-lobed. Male flowers : androgynophores 1 mm long, white glandular at base. Female flowers : styles 1 mm long. Samaras 4-5 mm in diam., glossy with obliquely transverse circular ridges and an apical beak.

Fl. : Nov. - June; *Fr.* : Aug. - Oct. 24-Parganas.

7. KLEINHOVIA L.

Trees. Leaves simple, palm-nerved. Inflorescence a terminal lax panicle. Sepals 5, nearly free, deciduous. Petals unequal, upper with longer claw. Staminal column columnar, elongated, adnate to the androgynophore, dilated above into 5-fid bell-shaped dilated cup. Anther cells divergent. Staminodes absent. Ovary 5-lobed, 5-celled, inserted in the staminal cup; stigmas 5-fid. Capsules membranous, inflated.

1 species in tropical Asia.

Kleinhovia hospita L., Sp. Pl. ed. 2, 1365. 1763; Mast. in Hook. f., *l.c.* 364.

Trees; bark smooth; young shoots and inflorescences tomentose. Leaves alternate, simple, 10-13 × 8-16 cm, ovate, sub-reniform, deltoid, base cordate, truncate, cuneate or rounded, apex shortly acuminate or obtuse, glabrous except

at the base of the nerves; petioles 6-8 mm long. Flowers in lax terminal cymose panicles, tomentose; bracteoles linear. Flowers on up to 2 mm long pedicels. Sepals 5, thick, 6-7 mm long, stellate tomentose outside connate at the base. Petals 5, unequal, 5-6 × 1.5 mm, 4 petals gibbous at base on the bent side of the staminal column folded. Staminal column 6-7 mm long with a thin 1.5 mm long striated disc at base, apex divided into 5 teeth bearing 15 divergent anthers. Ovary seated on top of staminal column, hairy. Capsules 1.5-2 × 2-2.5 cm, pyriform, 5-winged, inflated, loculicidally 5-valved. Seed usually 1 in each valve, tubercled.

Fl. & Fr. : Oct. - Jan. Commonly planted.

8. MELOCHIA L.

Herbs, undershrubs or shrubs, more or less pubescent. Leaves simple serrate. Flowers small, in axillary or terminal clusters. Calyx with 5 fine teeth. Petals 5, free, persistent. Stamens 5, filaments united to form the basal staminal cup. Staminal cups subspindle-form. Staminodes absent. Ovaries 5-celled. Capsules loculicidally 5-valved globose or sub-globose. Seed 1 in each cell angular.

About 60 species, tropical, specially tropical American; 2 species in West Bengal.

1. Herbs or undershrubs; flowers in terminal peduncled clusters; filaments half-way or more united; capsules globose ... 1. *M. corchorifolia*
1. Shrubs or undershrubs; flowers in axillary sessile clusters; filaments almost entirely united; capsules sub-globose ... 2. *M. nodiflora*

1. **Melochia corchorifolia** L., Sp. Pl. 675. 1753; Mast. in Hook.f., *l.c.* 374; Prain, *l.c.* 190. "Tiki-Okra", "Thuik" (Beng.).

Herbs or undershrubs; stems slender ridged in young parts, glabrous except 2 lines of hairs along internodes. Leaves 3-7 × 1.5-3.5 cm, variable in size, ovate, oblong-ovate or sub-orbicular rarely lobed, coarsely irregularly serrated on margins apex acute or rounded, base rounded or cordate, glabrous or very rarely hairy on the nerves beneath; petioles up to 2.5 cm long. Flowers in densely crowded terminal peduncled heads, surrounded by 4-5 bracteoles. Calyx 1-2 mm in length, teeth lanceolate, ciliate at the margins. Petals spatulate, 3-4 mm long. Anther-cells sub-divergent; filaments united half way or little more. Ovaries 1 mm long, 5-celled, hairy. Capsules 3-5 mm in diam., depressed-globose, hispid. Seeds 2 mm, trigonous.

Fl. & Fr. : May - Oct. Throughout the plains of West Bengal.

Yields fibre.

2. **Melochia nodiflora** Swartz, Prodr. 97. 1768; Baker & Bakh. Fl. Java 1:406. 1963; Sreekumar & Nair, J. Bombay Nat. Hist. Soc. 78: 424. 1981; Malick in Sharma *et al.*, *l.c.* 442. *M. borbonica* Cav. Diss. 7. 321. 1788.

Shrubs or undershrubs, 0.5-2.5 m tall; branches drooping, stellately pubescent. Leaves broadly ovate or ovate-lanceolate, 7-13 × 0.7-7 cm, sparsely pubescent on both surfaces, margins serrate, apex acuminate, base cordate or rounded; stipules 5-6 × 2 mm, lanceolate, ciliate. Flowers in subsessile dense axillary clusters; bracts foliaceous, hirsute. Calyx 2-3 × 1-1.5 mm, teeth ovate-lanceolate, sparsely pubescent. Petals 3-4 × 1.5-2 mm, margins hyaline. Filaments united throughout, hispid. Capsules sub-globose, 3-4 mm in diam., hispid. Seeds 2 mm long, trigonous.

Fl. & Fr. : Oct. - April. Howrah.

Before Sreekumar and Nair (1981) recorded this weed from India, specimens were collected from Howrah in 1961 and also from Ranchi districts of Bihar in 1966. This weed is slowly occupying larger areas.

9. PENTAPETES L.

Annual herbs. Leaves simple, hastate-lanceolate. Flowers in axillary few-flowered cymes; bracteoles 3, caducous. Sepals 5, lanceolate, connate below. Petals 5. Stamens 15, in groups of 3, alternating with 5 staminodes on staminal basal cup. Staminodes as long as the petals. Ovaries 5-locular. Capsules loculicidally 5-valved. Seeds 8-12, 2 seriate in each cell.

1 species, Indomalayan.

Pentapetes phoenicea L., Sp. Pl. 2: 698, 1753; Mast. in Hook. f., *l.c.* 371; Prain, 199. Malick in Sharma *et al.*, *l.c.* 443. "Kat-lata Bandhuli." (Beng.) **Fig. 53**

Herbs up to 1.5 m high, thinly scattered with stellate hairs. Leaves alternate, 7-11 cm long, deltoid or hastate to linear, strongly crenate-serrate, apex acute, base deltoid, often broad up to 3 cm, glabrous above, stellate hairy on the veins beneath; petioles 1-3 cm long; stipules subulate, linear, equalling the petioles. Flowers on axillary 1-3-flowered peduncles. Sepals up to 1 cm long, stellate and bristly, connate at base. Petals 1 cm long, obovate. Staminal cup bearing 5 groups of 3 anthers alternating with 5 staminodes. Staminodes 5, equal to petals, spatulate, granular on the inner surface. Ovaries 5 celled, hairy; style 1-2 cm long, twisted. Capsules up to 1.5 × 1 cm, terete, 5-valved, stellate-tomentose with scattered simple long hairs. Seeds 8-12 in two series with blackish spots.

Fl. & Fr. : Aug. - Nov. 24-Parganas.

Roots are medicinal.

10. PTEROSPERMUM Schreb.

Trees, lepidot or stellate-tomentose. Leaves simple or lobed coriaceous, often peltate, entire or serrate. Flowers regular, bi-sexual, large, 1-3, axillary or terminal; bracts entire or lacinate, or absent. Calyx tubular, 5-toothed. Petals 5, deciduous. Staminal column adnate to the gynophore bearing 5 groups of 3 stamens; staminodes between two groups of anthers. Ovaries inserted at the apex of the staminal column, 5-locular; styles entire; stigmas furrowed. Capsules

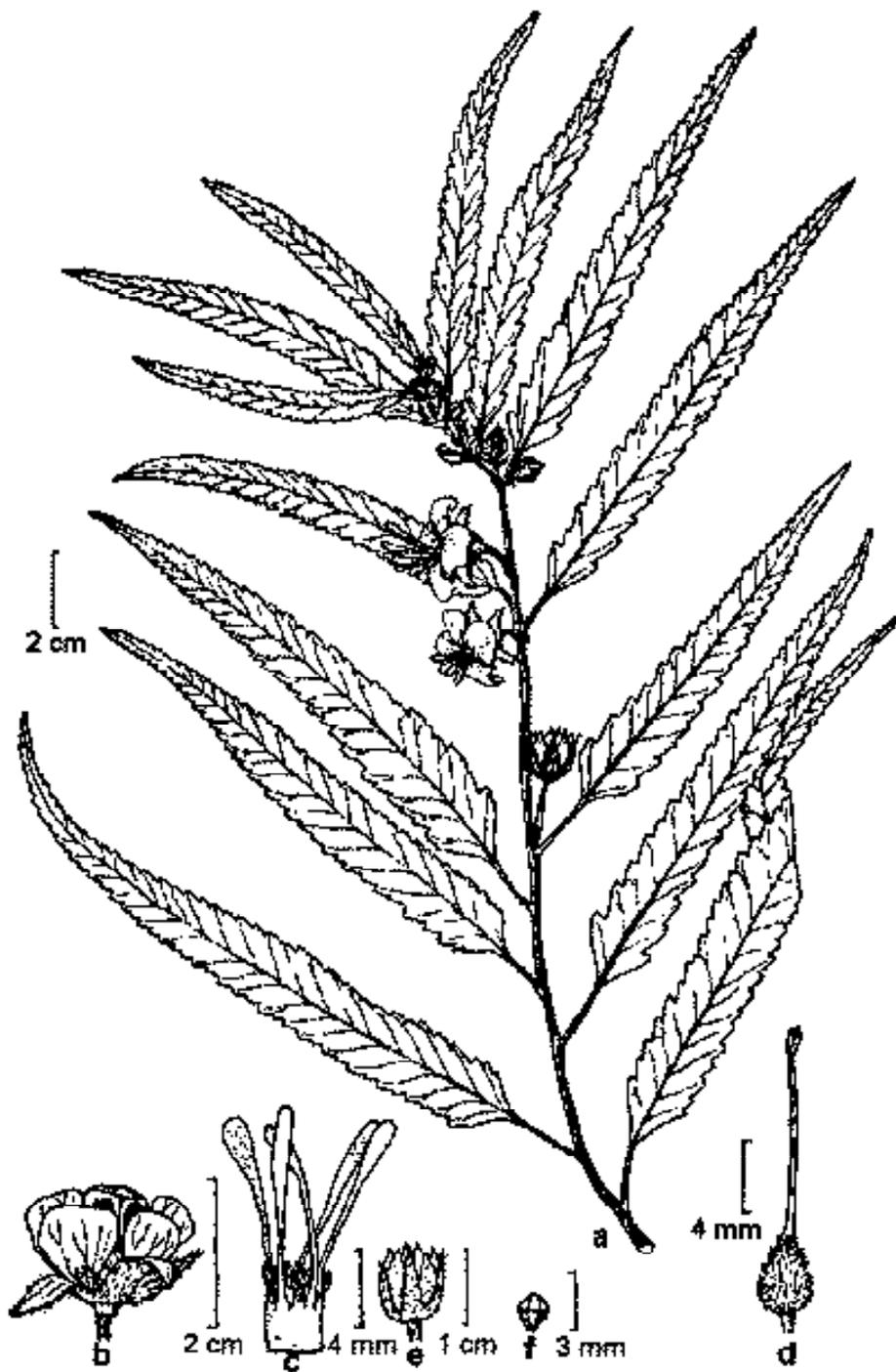


Fig. 53. *Pentapetes phoenicea* L.: a. flowering part of branch; b. flower; c. staminal column showing stamens and staminodes; d. pistil; e. fruit; f. seed.

woody, coriaceous, terete or angled. Loculicidally 5-valved. Seeds winged above, attached to the inner angles of loculus in two rows.

About 40 species in eastern Himalayas, southeast Asia and Western Malasia; 2 species in West Bengal.

1. Flowers about 15 cm long; capsules oblong, tapering only at the top, covered with brown tubercles ...1. *P. acerifolium*
1. Flowers up to 6 cm long; capsules oblong, tapering at both ends, rusty stellate tomentose ...2. *P. xylocarpum*

1. ***Pterospermum acerifolium*** Willd., Sp. Pl. 3: 799, 1800; Mast. in Hook.f., *Lc.* 368; Prain, *Lc.* 189. "Kanak-champa" (Beng.).

Medium sized to large trees; bark smooth, ash coloured; young parts floccose pubescent. Leaves 25-35 × 15-30 cm, polymorphous, orbicular or oblong, entire or variously lobed, cordate and sometimes peltate, glabrous above, clothed with white tomentum beneath; petioles 10-30 cm long; stipules multifid, caducous. Sepals 8-13 × 0.5-0.9 cm, linear, densely tomentose outside, pubescent within. Petals 6-9 cm long, linear-oblong, sometimes cuneate. Stamnodes club-shaped. Stamens 6-8 cm long; anthers 1-1.5 cm long. Ovaries 1-1.5 cm long, 5-locular, 5-angled. Capsules 8-10 × 4-6 cm, 5-angled, pubescent outside. Seeds obliquely ovoid compressed up to 0.9 × 0.6 cm, wing up to 3 × 1.5 cm, thin

Fl.: March - Sept.; *Fr.*: Jan. - March. Calcutta, Dinajpur, Hooghly.

2. ***Pterospermum xylocarpum*** (Gaertn.) Santapau & Wagh in Bull. Bot. Surv. India 5:108, 1963; Malick in Sharma *et al.*, *Lc.* 454. *Velago xylocarpa* Gaertn., *Fruct.* 2: 245, t. 133, 1791. *P. heyneanum* Wall. ex W. & A., *Prodr.* 1: 69, 1834; Mast. in Hook.f., *Lc.* 369.

Medium sized trees up to 10 m tall; young parts covered with ferruginous pubescence. Leaves oblong-ovate, coriaceous, 8-16 × 5-10 cm, glabrous above, greyish-pubescent beneath, entire, acuminate, more or less coarsely toothed towards apex, base cordate, petioles 0.6 - 1 cm long, stout, pubescent. Flowers 5 cm across white, fragrant; bracteoles ca 10 × 7 m, broadly ovate, deeply and variously lobed, imbricated round the base of the flower stellately tomentose. Sepals 5, ca 5 × 0.5 cm, linear, rusty-stellate outside, silky villous within. Petals 5, obovate, 2.5-4 × 0.6-1 cm, white stellate pubescent outside. Stamens 15, ca 1.3 cm long; anthers 1 cm long with long produced connective; staminodes 5, ca 3 cm long, filiform. Ovaries hairy. Capsules 5-7 × 2-3 cm, oblong, narrowed at both ends, rusty-stellate tomentose. Seeds 8-10 in each cell, ca 1 × 0.8 cm, wing ca 2.2 × 0.8 cm, papery.

Fl. & Fr.: Sept. - Jan. Bankura.

11. PTERYGOTA Schott & Endl.

Trees. Leaves simple, undivided. Flowers unisexual or polygamous, in panicles in the axils of fallen leaves. Calyx deeply 5-partite. Corolla absent. Staminal column cylindric, bearing 4-5 group of about 4-5 anthers in each male

flower. Ovaries 5, sessile; styles short, recurved; stigmas 2-lobed. Follicles large, woody. Seeds many, winged at apex, compressed.

2 species, in both hemispheres: 1 species planted in West Bengal.

Pterygota alata R. Br. in Benn. Pl. Java Rar. 234. 1844; Malick in Sharma *et al.*, *l.c.* 455. *Sterculia alata* Roxb., Pl. Corom. 3, t. 287, 1819 et Pl. Ind. 3, 152. 1832; Mast. in Hook.f., *l.c.* 360; Prain, *l.c.* 187. "Buddha-Narikel" (Beng.).

Large trees with root buttresses; young parts covered with dense golden pubescences; bark fissured. Leaves clustered at the end of the branches, ovate or broadly oblong, 10-16 × 7-12 cm, sometimes irregularly lobed, margins entire, apex acute or broadly acuminate, base cordate. Flowers in few-flowered panicles. Calyx 5-6-lobed, 15 mm long. Corolla absent. Male flowers: staminal column half to three-fourth the length of the calyx bearing 4-6 group of 4 anthers. Females or hermaphrodite flowers: ovaries 5, 2.5 mm long. Follicles 12-14 cm in diam., shortly beaked, woody. Seeds numerous, compressed, 2.5 cm long with white spongy terminal wing.

Fl. : Dec. -June; *Fr.* : Nov. Planted in gardens and on roadsides.

Seeds are eaten after roasting.

var. **irregularis** (Smith) Deb & Basu, Bull. Bot. Surv. India 24(1-4) : 203. 1982; Malick in Sharma *et al.*, *l.c.* 455. *Sterculia alata* Roxb. var. *irregularis* Smith in J. Asiat. Soc. Bengal (N.S.) 7: 85. 1911. "Paglagach" (Beng.).

Plants grow in Indian Botanic Garden, Howrah and in Agri Horticultural Garden, Calcutta; leaves show irregular in shape and variously lobed.

12. REEVESIA Lindl.

Shrubs or trees. Leaves simple, alternate, coriaceous. Flowers bisexual, white, in much branched terminal cymes. Calyx clavate-campanulate, irregularly 3-5-lobed. Petals clawed. Staminal column elongated and long exserted, adnate to the gynophore, shortly dentate, cup at the apex bearing about 15 anthers in a globose head; cells divaricate. Ovary at the top of the gynophore almost covered by the anthers, 5-locular; styles short; stigmas sessile, 5-lobed. Capsules woody, septicidally 5-valved. Seeds 1 or 2, superposed, ascending, oblong, compressed winged downwards.

About 23 species from Himalaya to China; 1 species in West Bengal.

Reevesia wallichii Br. in Benn. Pl. Java Rar. 231. 1844.f.; Malick in Sharma *et al.*, *l.c.* 456; *R. wallichii* forma *pubescens* (Mast.) Malick, comb. et stat. nov. *R. pubescens* Mast. in Hook.f., Fl. Brit. India 1: 364. 1874. "Chiplipath" (Beng.).

Trees, attaining about 16 m in height; bark grey, somewhat smooth, exfoliating in round flakes. Leaves coriaceous, oblong, ovate, ovate-oblong, elliptic or elliptic-oblong, 8-10 × 5-6 cm, with very few stellate hairs on upper surface and large stellate hairs beneath, entire, apex acuminate, base subcordate, rounded, truncate or obtuse; main lateral nerves 6-8 on either side; petioles 2-3 cm long, thickened at both ends; stipules early deciduous. Flowers in dense

corymbose terminal panicles; pedicels 5-8 mm long, jointed; bracteoles 2. Calyx ca 1 cm long, clavate-campanulate, 5-fid, persistent, brown stellate hairy. Petals 1-1.5 cm long, spatulate, exceeding the calyx. Staminal column 1.8-2.3 cm long, slender to stout, adnate to gynophore; anther-cells parallel. Ovary 5-lobed, covered by anthers; stigmas 5-lobed. Capsules 3-5 cm long, obovoid-oblong, brown-velvety outside, 5-celled, valves woody, dorsally slightly keeled, dehiscing septically. Seeds 1-2, 2-3 cm long, winged below; wings membranaceous.

Fl. : May - Aug.; *Fr.* : Aug. - Oct. Darjeeling, 1300 m.

13. STERCULIA L.

Trees; bark grey to whitish, warty, cracked or peeling off like paper. Leaves simple, palmately lobed or digitate. Flowers unisexual or polygamous, in terminal or axillary erect or drooping panicles from the axils of fallen leaves, or supra-axillary. Male and female flowers intermixed. Calyx 5-lobed, usually broadly ovate spreading, sometimes linear or lanceolate, conniving at the tips. Corolla absent. Staminal column bearing at the top a ring of 10-15, 2-celled sessile anthers. Staminodes in pairs at the base of the ovaries in a ring. Carpels 5. Ovaries on long gynophore; styles united; stigmas as many as carpels, free, radiating. Follicles coriaceous, woody, glabrous to hairy, dehiscent. Seeds many.

About 300 species in the tropics; 5 species in West Bengal.

1. Leaves simple:

- | | |
|--|----------------------------|
| 2. Calyx-lobes broadly ovate, spreading | ...3. <i>S. roxburghii</i> |
| 2. Calyx-lobes linear or linear-lanceolate, conniving at the tip | ...2. <i>S. hamiltonii</i> |

1. Leaves digitate, or palmately lobed:

- | | |
|--|-------------------------|
| 3. Leaves palmately lobed; follicles pubescent or villous: | |
| 4. Leaves shallowly 5-lobed, lobes entire; follicles radiating | ... 4. <i>S. urens</i> |
| 4. Leaves deeply 5-7-lobed, lobes 3-fid; follicles spreading | ...5. <i>S. villosa</i> |
| 3. Leaves digitate; follicles almost glabrous | ...1. <i>S. foetida</i> |

1. *Sterculia foetida* L. Sp. Pl. 1008. 1753; Mast. in Hook.f., *l.c.* 354; Prain, *l.c.* 187; Malick in Sharma *et al.*, *l.c.* 459, "Jungli badam" (Beng.). **Fig. 54**

Barks whitish; branchlets with scars of fallen leaves. Leaves digitate; leaflets 5, elliptic-lanceolate, 12-14 × 4.5-5 cm, entire, glabrous, base tapering, apex acuminate; petioles up to 1 cm long. Panicles crowded at the ends of the branchlets in the axils of the fallen leaves, female flowers more than the males; pedicels up to 4 mm long, hairy. Calyx campanulate, 1.5 cm long, 5-lobed, lobes more than half its length, stellately hairy outside and inside. Male flowers: staminal column 5 mm long, hairy, bearing cluster of almost sessile pairs of anthers. Female flowers: gynophore 7 mm long; styles united, 3 mm long; ovaries

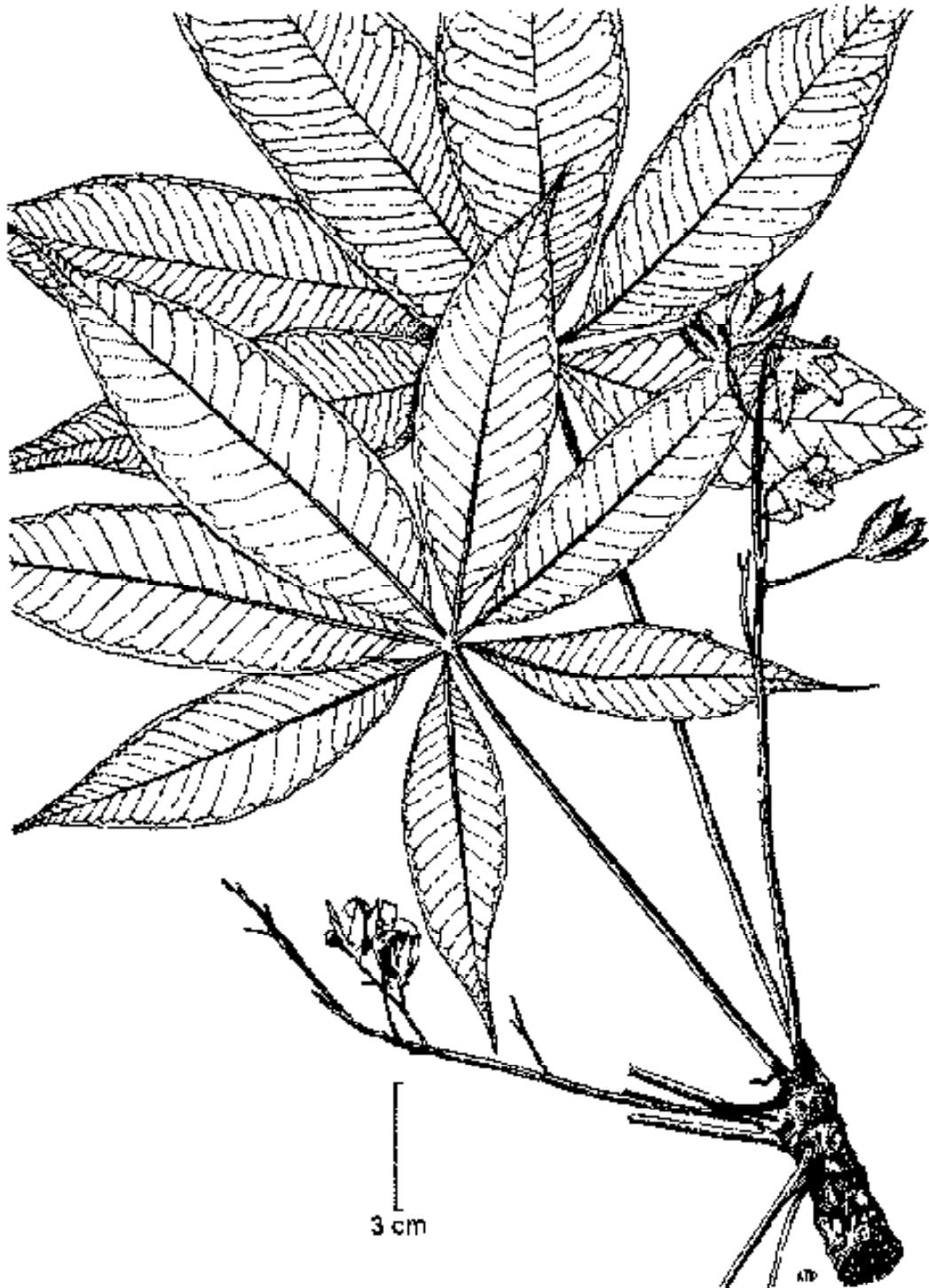


Fig. 54. *Sterculia foetida* L.

5-angled, hairy. Follicles 1-5, 8-10 × 4-6 cm. Seeds many, oblong, 1 cm long, nearly glabrous.

Fl. : Feb.; *Fr.* : In march, maturing, following Feb., deciduous in January. Burdwan, Howrah (planted).

Seeds are eaten after roasting.

2. *Sterculia hamiltonii* (O.Ktze.) Adelh. in Backer & Beckn. Fl. Java Aufl. 46, Fam. 107, 23, 1944; Malick in Sharma *et al.*, *l.c.* 464. *Cloupanus hamiltonii* O. Ktze. Rev. Gen. 77, 1891. *Sterculia coccinea* Roxb., Fl. Ind. 3, 151, 1832 (non Jack, 1820); Mast. in Hook.f., *l.c.* 357. *S. indica* Merr. in Jour. Arn. Arb. 35: 246, 1952.

Shrubs or small trees; bark thin, grey, warty, whitish inside. Leaves simple, elliptic-lanceolate, oblanceolate or narrowly oblong chartaceous or sub-coriaceous, 10-33 × 5-15 cm, glabrous above, generally with stellate or simple minute adpressed hairs beneath, abruptly acuminate, base tapering; lateral nerves 7-12 pairs; petioles 2.5-3 cm long; stipules *ca* 5 mm long, caducous, rusty pubescent. Flowers in 10-15 cm long axillary (rarely supra-axillary) generally peduncled panicles; pedicels *ca* 5 mm long. Flowers pale, *ca* 2.5 cm in diam. Calyx tube *ca* 3 mm teeth 12-15 mm long, linear-lanceolate, incurved and connived at the tip. Male fls.: stamens on about 5 mm long glabrous curved staminal column. Female fls.: gynandrophore *ca* 2 mm long; ovary 2 mm long, hairy, bearing sterile anthers at base; styles *ca* 2 mm long, curved; stigmas 5-lobed. Follicles 2-5, oblong-lanceolate, thinly coriaceous, 7.5-10 × 1.5-2 cm, velvety outside. Seeds 4-8, ovoid.

Fl. : April-Jan.; *Fr.* : May - March. Coochbehar, Darjeeling, Jalpaiguri.

3. *Sterculia roxburghii* Wall., Pl. Asiat. Rat. 3, t. 262, 1832; Mast. in Hook.f., *l.c.* 356; Prain, *l.c.* 187; Malick in Sharma *et al.*, *l.c.* 468.

Small or medium sized tree; bark dark brown or grey; somewhat rough outside. Leaves simple, 10-22 × 4.5-12 cm, variously shaped, ovate, obovate, elliptic-oblong, lanceolate or oblanceolate, chartaceous or sub-coriaceous, glabrous, margins entire, apex shortly acuminate, base tapering, rounded to truncate; main lateral nerves 6-11 on either side; petioles 2-7 cm long, terete, swollen and at both ends stipules subulate. Flowers in 5-10 cm long axillary few-flowered erect racemes; pedicels up to 1 cm long; bracteoles slender, hirsute. Calyx campanulate, 4-6 mm long, 5-partite, segments 2 mm broad; tube 2 mm long. Male fls.: staminal column 1 mm long. Female fls.: ovary 1 mm long on 1 mm long gynandrophore; style about 1.5 mm long; stigmas 5. Follicles 3-5, curved, long-beaked, 5-9 × 2-3 cm, obscurely striated. Seeds 4-6 in each follicle, *ca* 15 × 8 mm, oblong, shining black.

Fl. : Feb. - Sept.; *Fr.* : March - June, Jalpaiguri.

4. *Sterculia urens* Roxb., Pl. Corom. 1: 25, t. 24, 1795 et Fl. Ind. 3: 145, 1832; Mast. in Hook.f., *l.c.* 355; Prain, *l.c.* 187; Malick in Sharma *et al.*, *l.c.* 470.

Large to moderate sized tree; young parts more or less pubescent; trunk straight; bark white, smooth, the outer surface thin, peeling off, inner fibrous.

Leaves simple, 11-30 cm in diam., crowded at the ends of the branches, shallowly palmately lobed, glabrous above or nearly so, velvety beneath, base cordate, lobes 5 or obscurely 2 or more, entire, caudate-acuminate; petioles 9 cm long, terete, tomentose; stipules caducous. Flowers yellow, 5-9 mm across, numerous, males and females mixed in much branched glandular pubescent terminal panicles appearing before the leaves at the ends of the branchlets. Bracts deciduous, lanceolate. Calyx campanulate, hairy on both sides, ca 5 mm long, tube about as long as the lobes, lobes oblong-lanceolate, glandular hairy inside at base. Male fls.: staminal column ca 3 mm long, bearing 10-15 anthers at the top. Female fls.: ovaries 2 mm in diam., on 3 mm long gynandrophore; sterile anthers at the base of the ovary; styles as long as the ovaries; stigmas radiating. Follicles 5, spreading, usually oblong, ca 4 × 1.5 cm, densely pubescent, often with stinging hairs. Seeds 3-5, oblong, black, glossy, ca 7 × 5 mm.

Fl.: Nov. - March; *Fr.*: Feb. - April. Midnapore, N. Bengal, Terai.

Yield gum "Kouila", used as medicine. Seeds are roasted and eaten.

5. *Sterculia villosa* Roxb., *Fl. Ind.* 3: 153. 1832; Mast. in Hook.f., *Lc.* 355; Prain, *Lc.* 187; Malick in Sharma *et al.*, *Lc.* 472. "Odlā" (Beng.).

Trees, bark whitish; branchlets with scars of fallen leaves; young parts, petioles and inflorescences brown tomentose with stellate or spreading hairs. Leaves 15-40 cm in diam., 5-7-lobed; lobes again 3-4-lobed or entire; petioles up to 40 cm long. Flowers in 20-30 cm long hairy panicles; panicles 3-5 or more in the axils of terminal leaves or solitary supra-axillary on stems. Flowers 1-1.2 cm in diam.; male flowers much more than the females in an inflorescence. Staminal column up to 2 mm long, curved. Ovaries strigose; gynophores 2 mm long; styles 2 mm long. Follicles 5, sessile, reddish brown tomentose, 3.5-5 cm long, oblong, rusty villous.

Fl.: Jan. - March; *Fr.*: May - June. Jalpaiguri, Purulia.

Yield fibres.

14. WALTHERIA L.

Herbs or undershrubs with stellate hairs mixed with simple hairs. Leaves simple, serrate. Flowers small, in axillary and terminal clusters. Calyx 5-toothed. Petals 5, free, oblong-spathulate. Stamens 5, united into a subconical cup. Staminodes absent. Ovaries 1-celled; styles club-shaped; stigmas fimbriate. Capsules 2-valved, 1-seeded. Seeds ascending.

About 50 species in tropical America, West Indies, S. Africa, Malagasi, Malaya Peninsula and Formosa; 1 species in West Bengal.

Waltheria indica L., *Sp. Pl.* 673. 1753; Mast. in Hook.f., *Lc.* 374; Prain, *Lc.* 190. *W. americana* L., *Lc.* 673; Malick in Sharma *et al.*, *Lc.* 473.

Perennial herbs or undershrubs, 0.5-1.2 m high, hoary tomentose. Leaves ovate-elliptic, subplicate, 3-7 × 1.5-4.5 cm, velvety on both the surfaces, with a 5-nerved rounded or subcordate base. Flowers in sessile or shortly stalked dense

capitate cymes, pink or yellow, heads axillary or on leafless branches. Petals 4-6 mm long, clawed. Staminal tube with 5 oblong anthers; staminodes absent. Capsules ovoid, ca 2 mm long; seed one, black.

Fl. & Fr. : Sept. - March. Common in the wastelands, throughout the plains of West Bengal.

TILIACEAE
(R. N. Banerjee)

A family of about 45 genera and 400 species, mostly tropical, a few extending into temperate regions; 4 genera and 21 species in West Bengal.

1. Trees or shrubs:
 2. Inflorescence paniculate; fruits globose, not lobed 1. BROWNLOWIA
 2. Inflorescence not paniculate; fruits 2-4-lobed 3. GRIWIA
1. Herbs or undershrubs:
 3. Herbs, petals glandular at base; fruits echinate or bristly 4. TRIMECTIA
 3. Undershrubs; petals not glandular at base; fruits neither echinate nor bristly 2. COMPTONIA

1. BROWNLOWIA Roxb. *nom. cons.*

Trees, covered with stellate or scaly hairs. Leaves alternate, 3-5 nerved, sometimes peltate; stipules sometimes large and foliaceous. Flowers numerous, small in large terminal panicles or smaller in axils of upper leaves, sepals united campanulate, 3-5 fid. petals 5, stamens numerous; anthers subglobose; staminodes 5, staminodes within stamens, opposite to petals, linear and subpetaloid. Ovary 5-loculed; locules 2-ovuled. Carpels ultimately separating, mature one subglobose, thick, 2-valved, 1 seeded. Seeds nonendospermous, cotyledons thick, fleshy.

A genus of ca 3 species; 1 species in West Bengal.

Brownlowia tersa (L.) Kosterm. in Penerbitan Majd. Pengetahuan Indonesia 1:73, 1995; Daniel & Chandrase in Sharma *et al.*, Fl. India, 3: 480, 1993. *Glabraria tersa* L., Mant. Alt. 276, 1771. *Brownlowia lanceolata* Benth. in J. Linn. Soc. Bot. 5, Suppl. 2: 57, 1861; Mast. in Hook. C., Fl. Brit. India 1: 381, 1874; Prain, Bengal Pl. 1: 193, 1963 (repr.ed.). "Kedar-Sundri", "Bhola-Sundri" (Beng.).

Trees, 4-10 m tall, or littoral shrubs branchlets slender, scaly, greyish. Leaves 13-21 × 3-6 cm, lanceolate, acuminate at apex, obtuse at base, dark-green glabrous above, silvery grey beneath, entire; petioles 10-14 mm long, thickened at apex. Inflorescence 12-18 cm long. Flowers whitish, in terminal and axillary panicles; buds ovoid. Sepals campanulate, 5 mm long, lanceolate. Petals 5, oblong, 6-7 mm long. Stamens many, epipetalous; staminodes petaloid; anthers

didymous, connective thick. Style 3-4 mm long, stigma 4 lobed. Fruits 12 mm in diam., brownish, pyriform, truncate.

24-Parganas (in Sunderbans), along salt water creeks, high up stream beyond, high up stream beyond the mangrove forming dense thickets along the banks and almost submerged during high tides.

Fl.: May - June; *Fr.*: Aug.-Oct.

A good fuel-wood.

2. CORCHORUS L.

Herbs or undershrubs. Leaves simple, serrate, the lower pair of teeth usually much prolonged into filiform appendages. Flowers small, yellow, bracteate. Sepals 4-5. Petals 4-5, not glandular at the base. Stamens generally numerous on short torus. Ovary 2-5 loculed; ovules many in each locule; styles short. Capsules elongated or subglobose, echinate or muriculate, usually beaked, 2-5-valved, sometimes transversely septate between the seeds. Seeds numerous.

A genus with about 90 species, mostly in warmer parts of the globe; 5 species in West Bengal.

1. Capsule globose, beak absent ...2. *C. capsularis*
1. Capsule elongated beak present:
 2. Beak 3-fid, radially spreading ...1. *C. aestuans*
 2. Beak entire, erect:
 3. Capsule solitary axillary or fascicled, valves with internal transverse partitions :
 4. Capsules glabrous, 10-ribbed, 5-valved ...4. *C. olitorius*
 4. Capsules scabrous or aculeate 3-angled, 3-valved ...5. *C. trilocularis*
 3. Capsules fascicled, valves almost without internal partitions ...3. *C. fascicularis*

1. **Corchorus aestuans** L., Syst. ed. 10. 2: 1059. 1759; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 485. *C. acutangulus* Lamk. *Encycl.* 2: 104. 1786; Mast. in Hook.f., *l.c.* 397. "Tita Pat" (Beng.)

Annual or rarely biennial suffruticose herbs, 0.7-1.2 m tall; branches glabrous or with a band of hairs. Leaves ovate-acute or oblong-acuminate, 5-9 × 2.2-3.5 cm, sparsely hairy, base obtuse, with or without appendage, erenate, serrate, 3-5-nerved; petioles 12-18 mm long, slender, hairy; stipules acicular. Flowers in leaf-opposed cymes, 5 mm in diam.; bracts filiform. Peduncles 2-3-flowered, 1-2 mm long; pedicels 1-2 mm long. Sepals linear-oblong, 4 mm long. Petals yellow, obovate-spathulate, 5 mm. Stamens 15, 2-3 mm long. Capsules 2-5 cm long, erect, stout, cylindric, straight, 6- or 8- or 10-angled, or winged, apex with 3 apically bifid beaks recurved or spreading. Seeds globose-trigonous with flat faces, dark brown.

Fl. : July - Aug.; *Fr.* : Sept. - Oct. Burdwan, Birbhum, Howrah, Hooghly, Murshidabad, 24-Parganas.

In wastelands, dry fields, river beds, forest edges and road sides.

2. **Corchorus capsularis** L., Sp. Pl. 529, 1753; Mast. in Hook.f., *l.c.* 397; Prain, *l.c.* 197; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 485. *C. cordifolius* Salisb. Prodr. 366, 1796. "Pat" (Beng.).

Erect annual 40-75 cm tall herbs, grows quite taller under cultivation. Leaves ovate to ovate-lanceolate 4-12 × 2.3-6 cm, glabrous, acute or shortly acuminate at apex, base rounded, bearded, margins serrate, basal serratures prolonged into appendages; petioles 5.5 cm long, pubescent; stipules 5-8 mm long filiform. Flowers yellow in cymes, bud obovoid. Sepals 3 mm long. Petals 3-5 × 2.5-3 mm broad. Capsules 6-10 cm in diam., globose, ridged, muricate, 5-valved. Seeds few in each locule, smooth, brown, 2 × 1-1.5 mm.

Fl. : July - Sept.; *Fr.* : Sept. - Oct. Commonly cultivated for its well known fibre (Jute).

3. **Corchorus fascicularis** Lamk. Encycl. 2: 104, 1783; Mast. in Hook.f., *l.c.* 398; Prain, *l.c.* 197; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 486. "Jangli-pat" "Bilnalita" (Beng.).

Annual much branched glabrous herbs. Leaves linear lanceolate or oblong-lanceolate, 2-5.5 × 1-1.5 cm, glabrous, serrate, obtuse; stipules *ca* 5 mm, subulate-filiform. Flowers in leaf-opposed cymes. Sepals 1.2-1.4 × 1 mm, obovate, apiculate. Petals yellowish brown, 2-3 mm long, glabrous, oblong-obovate. Stamens 5-10, *ca* 1 mm long. Ovary oblong-ovate to linear. Capsules fascieled, 1-1.5 cm long, not partitioned.

4. **Corchorus olitorius** L., Sp. Pl. 529, 1753; Mast. in Hook.f., *l.c.* 397; Prain, *l.c.* 197; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 487.

Annual erect much branched herbs, 90-120 cm tall, base woody. Leaves elliptic-oblong, 5-7.5 × 2.5-3.5 cm; acute or acuminate at apex, base obtuse or rounded, bearded, margin serrate 5-nerved; petioles up to 4 cm long, pubescent; stipules 6-9 mm long, subulate. Flowers usually solitary, rarely in pairs or in threes; buds beaked; bracts lanceolate. Sepals 5-6 × 2-3 mm, oblong, apiculate. Petals 5-8 mm, pale yellow, oblong-spathulate. Stamens 4 mm long; anthers globose. Style 2 mm long; stigma 5-lobed, papillose. Capsules 3-5 × 0.3 - 0.5 cm, glabrous, cylindric, angled, beaked, 10-ribbed. Seeds black, trigonous or prismatic, 2 × 1.2 mm.

Fl. : July - Sept.; *Fr.* : Oct. A common cultivated crop in the plains; also found as self-sown in the surroundings of the fields and along water channels. The commercial jute fibres are obtained from the sclerenchymatus lignified secondary phloem elements of this plant as well as from that of *C. capsularis*.

5. **Corchorus trilocularis** L., Mant. 77, 1767; Mast. in Hook.f., *l.c.* 397; Prain, *l.c.* 197; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 488.

Tall herbs. Stems sparsely hairy. Leaves elliptic to oblong or lanceolate, 5-10 × 2-3 cm, serrate, acute or obtuse at apex, hirsute on veins, base rounded, petals 3 mm long, hairy; stipules subulate to filiform, 10 mm long. Flowers yellow in leaf-opposed cymes; pedicels 4 mm long. Sepals 5 mm long. Petals oblong 15 × 7 mm. Stamens 6-7 mm long. Stigma capitate. Capsules up to 7 cm long, beak simple, scabrous. Seeds many.

Fl.: June - Sept.; *Fr.*: Oct. -Jan. 24 - Parganas.

3. GREWIA L.

Trees, shrubs or undershrubs, with stellate pubescence. Leaves alternate, usually distichous, serrate, simple or lobed. Flowers regular, bisexual or unisexual, yellow or white, in axillary, extra axillary or terminal cymes. Sepals 5, free. Petals 5. Stamens many, on a raised torus, sometimes 5-adelphous. Ovary 2-4-locular with 2-many ovules in each, styles subulate or divided into as many branches as locules in ovary. Drupes often lobed; pyrenes 1-4.

About 160 species confined to tropical and subtropical regions of the old world; 9 species in West Bengal.

1. Drupes when dry with a distinct crustaceous rind; peduncles short as long as petioles:
 2. Leaves oblong, rough with short stellate tomentum; drupes ca 1 cm across ...3. *G. flavescens*
 2. Leaves ovate or obovate, very harshy scabrid, drupes ca 2 cm across ...7. *G. sclerophylla*
1. Drupes fleshy, without a crustaceous rind; peduncles always nearly as long as or usually longer than petioles:
 3. Leaves strongly 5 or sometimes more-nerved at base, ovate, ovate-oblong or oblong:
 4. Stipules auricled at base ...9. *G. tiliaefolia*
 4. Stipules not auricled at base :
 5. Peduncles at least twice as long as petioles, often much longer:
 6. Stipules lanceolate; flower buds clavate; drupes subturbinate; small tree ...1. *G. asiatica*
 6. Stipules linear; flower buds ovoid; drupes subglobose, faintly 4-lobed; dwarf shrubs with woody stock annually emitting her haccous pubescent shoots ...6. *G. sapida*
 5. Peduncles slightly if at all exceeding the petioles ...2. *G. eriocarpa*
 3. Leaves 3-nerved at base, lanceolate or ovate-lanceolate:
 7. Petals lobed; lamina stellate beneath :

8. Leaves obovate-lanceolate; flowers white.
ca 25 mm across; drupes black or purplish ... 8. *G. serrulata*
8. Leaves ovate-lanceolate; flowers yellow.
ca 15 mm across; drupes reddish brown ... 4. *G. hirsuta*
7. Petals entire, lamina pubescent ... 5. *G. optiva*

1. ***Grewia asiatica*** L., Mant. Pl. 122, 1767; Mast. in Hook. f., *l.c.* 386, excl. var. *vestita*; Prain, *l.c.* 194; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 494. *G. subinaequalis* DC., Prodr. 1:511, 1824. "Phalsa, Phushra, Sryal Phusra" (Beng.).

Small trees, 7-12 m tall, or large struggling shrubs. Ferruginous pubescent. Leaves orbicular or broadly ovate, acute or acuminate at apex, obliquely cordate at base, up to 17 × 12 cm, scabrous above, tomentose beneath, irregularly dentate; petioles 1-3 cm long; stipules 3 cm long, subulate. Flower buds clavate; peduncles 2 or more. Flowers yellow, 10 mm in diam., 1-4 in axillary umbelliform cymes. Sepals oblong lanceolate, 3-6 mm long. Petals 3-5 × 2-2.5 mm, linear oblong with a ring of hairs around the gland. Ovary villous. Drupes 6-8 mm in diam., red or purple, subturbinate, globose, 1-2-lobed, pilose.

Fl. : May-June. Common throughout the plains. Birbhum, Burdwan, Darjeeling, Hooghly, Howrah, Jalpaiguri, Malda, Midnapore, Purulia, 24 Parganas.

2. ***Grewia eriocarpa*** A.L. Juss. in Ann. Mus. Natl. Hist. Nat. 4:93, 1804; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 497. *G. elastica* Royle, Ill. Bot. Himal. 1: 104, t. 22, 1834. *G. asiatica* L. var. *vestita* Mast. in Hook. f., l. 17, Brit. India 1:387, 1874. *G. vestita* Wall. in Prain, Bengal Pl. 1:195, 1963 (repr. ed.).

Deciduous tree up to 1.8 m tall; bark greenish white. Leaves obliquely ovate, oblong-ovate or elliptic, obscurely 3-lobed, 7-12 × 5-6.3 cm, acuminate, crenate-serrate, dark-green and hispid with stellate hairs above, pale softly tomentose beneath; nerves 5; petiole 5-10 mm long; stipules ca 3 mm long, subulate. Flowers yellow, in fascicles or in solitary axillary cymes. Peduncles downy. Sepals linear-oblong, 3-5 mm long; yellow inside. Petals oblong 5-7 mm long yellow. Stamens numerous 5-8 mm long; filaments yellow slender, glabrous. Ovary villous. Drupes globose, blackish when ripe, edible.

Fl. : April-May; *Fr.* : Sept.-Nov.

Grey white wood used for bows, spear-handles, poles etc. Bark yields a strong fibre suitable for ropes.

3. ***Grewia flavescens*** Juss. in Ann. Mus. Par. 4:91, 1804; Mallick in Bull. Bot. Surv. India 8:48, 1966; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 498. *G. pilosa* Lamk. Encycl. Suppl. 3:43, 1813 (excl. syn.); Mast. in Hook. f., *l.c.* 388.

Small trees or shrubs. Leaves sub-sessile, scabrous, cuneate, obovate or lanceolate, ca 7 × 5 cm, acute at apex, cuneate or cordate at base below, serrate, glaucous, beneath, stellate hairy on both surface, 3-nerved; stipule subulate, acuminate. Flowers 6 mm in diam., peduncles 5 mm long, axillary; pedicels 4-5 mm long. Sepals linear-lanceolate, densely stellate hairy outside. Petals yellow.

spathulate, linear-oblong, 2-fid. Torus glabrous. Anthers stellate-hairy. Stigma 4-partite. Drupes entire or slightly lobed, reddish brown, 10 mm in diam., edible.

Fl. & Fr.: Aug.-Dec. Purulia.

4. *Grewia hirsuta* Vahl, *Symb. Bot.* 1: 34, 1790; Roxb., *Fl. Ind.* 2:587, 1832; Mast. in Hook. f., *l.c.* 391, *Prain, l.c.* 195; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 501. *G. pilosa* Roxb., *Fl. Ind.* 2:588, 1832; *non* Lamk.

Shrubs up to 3 m tall with stellate hairy branches. Leaves obliquely lanceolate or ovate-lanceolate, 5-7 × 3-5 cm, densely clothed with stellate hairs beneath, acute or acuminate, irregularly serrate, 3-nerved at base; petioles 15-20 mm long; stipules subulate, 2 cm. Peduncles 1-3, axillary, 2-4 flowered. Flowers yellow, 4 mm in diam, polygamous or dioecious. Sepals lanceolate or linear-oblong. Petals obovate-oblong, 10-15 × 2-3 mm. Stamens 45 or more. Ovary villous. Fruits 2-4-lobed, bright reddish brown.

Fl.: July - Sept.; *Fr.*: Oct.-Dec. Bankura, Hooghly, Midnapore, Purulia.

Fruits are eaten by the villagers. The decoction of leaves is used to cure dysentery.

5. *Grewia optiva* Drumm. ex Burret *Notizbl. Bot. Gart. Berl.* 9:692, 1926; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 504. *G. oppositifolia* Hamilt. ex Roxb. *Fl. Ind.* ed. 2, 1: 583, 1832. *G. abutilifolia* Vent. ex Juss. in *Ann. Mus. Par.* 4: 92, 1804; Mast. in Hook. f., *l.c.* 390; Sarkar *et al.*, *Bull. Bot. Surv. India* 15: 148, 1973.

Small trees, bark ash-coloured. Stems stellately hairy. Leaves ovate-lanceolate, ca 7.5 × 5 cm, acuminate, distichous, scabrous dorsally pubescent beneath, crenate-serrate, lower serratures glandular, base rounded, 3-nerved, secondary nerves scarcely areolate, tertiary parallel; petioles 7.5 cm, pilose; stipules caducous, linear-lanceolate. Peduncles ca 8 cm long, leaf-opposed, rarely terminal, axillary; pedicels ca 6 cm long, clavate, bracteolate; bracteoles 3-4 mm long. Cymes umbellate. Flowers yellow, 3-4 mm in diam. Sepals linear, 3-nerved, 4-6 × 3-4 mm. Petals oblong, entire. Torus hairy, scarcely longer than the glands. Drupes glabrescent, 1-4-lobed, blackish.

Common in lower and upper hill-forests in Terai and Duars, ascending up to 3000 m (Biswas *l.c.*).

6. *Grewia sapida* Roxb. ex DC., *Prodr.* 1:512, 1824; Mast. in Hook. f., *l.c.* 387; Prain, *l.c.* 195; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 508. *G. pumila* Buch.-Ham. ex D. Don, *Prodr.* 227, 1825. "Taglar-Kung" (Lepcha), "Phalsa-Tenga" (Beng.).

Small decumbent shrubs, branches sprouting yearly from a woody rootstock; young leaves coppery. Leaves ovate, obovate-oblong or orbicular, doubly serrate, 5-10 × 1.2-7.5 cm, pilose or scabrid above, softly pubescent beneath; base cuneate, apex rounded, petioles 5-7 mm long; stipules 7 mm long, linear to subulate, persistent. Flowers yellow, buds ovoid. Peduncles hairy, 2-5- flowered. Sepals reddish brown inside, oblong or oblanceolate, 7 × 3 mm. Petals yellow,

6-8 mm long. Stamens many on a raised torus. Drupes obscurely lobed, subglobose hirsute.

Fl.: May - June; *Fr.*: Feb. - April, Jalpaiguri, Darjeeling, Midnapore, Purulia,
Favourite fodder plant. Ripe fruits are edible.

7. *Grewia sclerophylla* Roxb. ex G. Don, Gen. Hist. 1:550. 1831; Prain, *l.c.* 194; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 509. *G. scabrophylla* Roxb., Mast. in Hook. f., *l.c.* 387. "Taglar" (Lepcha), "Phalsa" (Beng.).

Shrubs or undershrubs, about 2 m tall, young parts, petioles and inflorescence densely brown rough stellate tomentose. Leaves elliptic-ovate or obovate to suborbicular, grey, scabrid, 11-20 × 6-12 cm, irregularly serrate, larger teeth often glandular; petioles 7-15 mm long; stipules subulate, 1 mm long. Cymes umbellate, bracteoles linear-subulate, 3-5 mm long. Flowers 10 cm in diam. Sepals 1.2 cm long, oblong or linear-lanceolate, pubescent, yellow inside. Petals obovate, white, 6 mm long, notched at apex. Ovary villous, style exceeding the stamens; stigma with 4, lamelliform lobes. Drupes globose, 2 cm in diam., purple, hairy.

Fruits are edible and stem yields a good fibre.

8. *Grewia serrulata* DC., Prodr. 1: 510. 1824; Narayans. & Rao in Journ. Ind. Bot.Soc. 29: 187. 1950; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 509. *G. glabra* Bl. Bijdr. 115. June to Dec. 1825. *G. disperma* Rottl. ex Spreng., Syst. 2: 579. 1825. *G. laevigata* auct (*non* Vahl): 1: 34. 1790; Prain, *l.c.* 195. *G. multiflora* auct (*non* Juss) Mast. in Hook.f., *l.c.* 388. "Panisara" (Beng). Fig. 55

Small trees or large shrubs; branches slender, dark grey, sparingly hairy. Leaves distichous, obovate-lanceolate, 3-18 × 1.2-3.5 cm, apex acuminate at apex, serrate-dentate, chartaceous, glabrescent, base 3-nerved, rounded or subacute, glandular (cup like); petioles 3-4 mm, pilose, slender; stipules linear subulate, 2-5 cm long. Flowers in axillary umbellate cymes. Peduncles 1.2-2 cm long, 3-flowered. Flowers white; buds ovoid, clavate, ribbed. Sepals linear oblong, 15-18 mm long, petals 3.5 × 1.5 mm, lobed. Filament short. Gynophore glabrous with a ring of hairs at top. Drupes 1-4-lobed, globose, black or purplish.

Fl. : June - Aug.; *Fr.* : Sept. - Nov. In dry mixed forests and waste lands. Coochbehar, Darjeeling, Hooghly, Jalpaiguri, Midnapore, Murshidabd, Purulia.

Sometimes used as a hedge-plant.

9. *Grewia tiliaefolia* Vahl, Symb. Bot. 1: 35. 1790; Mast. in Hook.f., *l.c.* 386; Prain, *l.c.* 194; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 511. "Dhamin, Olat" (Beng.).

Trees up to 8 m tall with purplish branches. Leaves orbicular-ovate, or ovate-oblong, 5-15 × 3-10 cm, hoary beneath, 5-veined, serrate, obliquely cordate at base, acute at apex; stipules falcate, acuminate; petioles 25 mm long, auricled. Cymes axillary, very rarely extra-axillary 3-flowered. Flowers 4 mm across, pink or red. Sepals oblong-lanceolate, acute, 8-12 mm long, hairy outside. Petals



Fig. 55. *Grewia serrulata* DC.

oblong, emarginate, 6 × 3 mm yellow. Drupes 1-4-lobed, subglobose, fleshy, didymous, black, 8 mm in diam.

Fl. : April - June; *Fr.* : Sept. - Oct. Burdwan, Malda, Midnapore, Purulia.

4. TRIUMFETTA L.

Herbs or undershrubs with stellate pubescence. Leaves usually serrate or dentate, sometimes lobed. Flowers yellow, in dense cymes, or axillary or leaf-opposed terminal spike. Sepals 5. Petals 5, glandular ciliate at base. Stamens 5 to many. Ovary 2- 5-loculed, locule 2-ovuled; style filiform. Capsules subglobose, having hooked spines or bristles.

A genus of about 40 species, mostly tropical weeds; 4 species in West Bengal.

1. Capsules ovoid to globose; leaves ovate-rhomboid or cordate; petals ciliate at base:
 2. Capsules covered with hairs and hooked spines, stems tomentose to villose:
 3. Flowers 10 mm long; capsule prickles 5-6 mm long, villous or hispid; sepals linear ...3. *T. pilosa*
 3. Flowers 3 mm long; capsule prickles up to 2 mm long, glabrous, sepals oblong ...4. *T. rhomboidea*
 2. Capsules covered with only hooked spines; stems glabrous ...1. *T. annua*
1. Capsules oblong, leaves rounded, petals glabrous at base ...2. *T. pentandra*

1. **Triumfetta annua** L., Mant. Pl. 1: 73, 1767; Mast. in Hook.f., *lc.* 396; Prain, *lc.* 196; Daniel & Chandrabose in Sharma *et al.*, *lc.* 318.

Annual herbs. Stem 30-60 cm with a line of hairs on one side. Leaves 10-12 × 5-10 cm, ovate, acuminate, toothed; stipules subulate. Peduncles 1-3 cm, extra axillary, 3-flowered. Petals orange, nearly as long as the apiculate sepals. Stamens 10. Fruits globose, glaucous, 4-loculed, covered with long glabrous spines.

Fl. : July - Sept.; *Fr.* : Oct. - Dec. Darjeeling

2. **Triumfetta pentandra** A. Rich. in Guill. & Perr., Fl. Seneg. Tent. 1: 93, t. 19, 1831; Daniel & Chandrabose in Sharma *et al.*, *lc.* 519. *T. neglecta* Wt. & Arn., Prodr. 1: 15, 1834; Mast. in Hook.f., *lc.* 396; Prain, *lc.* 196.

Annual herbs. Stems pubescent. Leaves upper ones lanceolate, lower subcordate at base, acuminate at apex, 3-lobed, serrate, hairy on both surfaces. Flowers in lateral extra-axillary cymes. Sepals linear. Petals oblong, obtuse, glabrous at base. Stamens 5-10, filaments hairy. Fruits oblong indehiscent, covered with hooked spines, ciliate on the upper edge, spines ciliate in the upper part.

Fl.: Sept. - Oct.; *Fr.*: Oct. - Nov. In dry plain meadow with weeds of cultivated fields.

3. **Triumfetta pilosa** Roth., Nov. Sp. 223. 1821; Mast. in Hook.f., *l.c.* 394; Prain, *l.c.* 196. Daniel & Chandrabose in Sharma *et al.*, *l.c.* 519.

Suffruticose 2.5 m tall. Stems densely stellate hairy with red bulbous bases, ribbed. Lower leaves lobed, upper simple, lanceolate or ovate-lanceolate, acuminate at apex, obliquely cordate at base, stellate hairy on both surfaces, serrate, 6-16 × 3-6 cm; petioles up to 5 cm long, stellate hairy; stipules 5 mm long, linear, pilose. Flowers in dense cymes, 3 mm in diam, subsessile. Sepals 5, 3-5 mm long, linear, stellate hairy, apiculate. Petals 5, linear, oblong or oblanceolate, 5-6 mm long, spreading. Stamens 10. Style filiform, 5 mm long; stigmas 5, toothed. Capsules 8-seeded, globular, densely tomentose, separating when ripe into 3-4 densely bristly cocci, locules usually 2-seeded; bristles 4 mm long, patent at apex.

Fl.: Aug. - Oct.; *Fr.*: Jan. - Nov. Darjeeling.

4. **Triumfetta rhomboidea** Jacq., Enum. Syst. Pl. 22. 1760; Mast. in Hook.f., *l.c.* 395; Prain, *l.c.* 196; Daniel & Chandrabose in Sharma *et al.*, *l.c.* 520. *T. bartramia* L., Syst. Nat. ed. 10,2: 1044. 1759 *nom. illegit.* "Bon okhra, Chikti" (Beng.).

Herbs or suffruticose undershrubs, up to 1.5 m tall; branches glabrous or scabrous. Lower leaves usually 3-lobed, ovate-rhomboid, or cordate, irregularly sharply crenate, rounded or cuneate at base; upper leaves smaller and narrower, not lobed, palm-nerved, stellate tomentose; petioles 2.5 to 3.8 cm long, hairy, swollen at tip. Flowers yellow, in dense leaf-opposed and terminal cymes, 5-7 mm in diam. Sepals hooked at apex, 5 mm long. Petals yellow, 4-4.5 mm, oblong, ciliate at base. Stamens 10-15. Capsules villous or hispid between the spines, globose, bristles glabrous.

Fl.: Aug.-Oct.; *Fr.*: Sept. - Oct. Bankura, Birbhum, Burdwan, Darjeeling, Hooghly, Howrah, Jalpaiguri, Malda, Midnapore, Purulia, West Dinajpur.

CULTIVATED PLANTS

Berrya ammonilla Roxb. Large trees; planted in the gardens.

ELAEOCARPACEAE

(Aloke Bhattacharyya)

A family of about 12 genera and 350 species mainly tropical; 2 genera and 5 species in West Bengal.

1. Petals fimbriate; fruit a drupe, about 0.8-1.2 cm in diam.

...1. ELAEOCARPUS

1. Petals not fimbriate; fruit a capsule, about 1.5-2.5 cm in diam.

...2. SLOANEA

1. ELAEOCARPUS L.

Trees. Leaves simple, entire or serrate. Flowers in racemes, rarely polygamous. Sepals 4-5, valvate. Petals as many as the sepals, laciniate, lobed or rarely entire, inserted round the base of a thickened glandular torus. Stamens numerous (rarely 8-12), inserted on the torus between the glands; anthers linear, dehiscing by a transverse valve at the apex. Ovary 2-5-celled, ovules 2 in each cell; style subulate, entire. Drupe with a single honey tuberculate stone, 3-5- or 1-celled, cells one-seeded. Seeds pendulous, testa crustaceous or honey, albumen fleshy; cotyledons broad, flat or undulate.

A genus of about 200 species in eastern Asia, Indo-Malaya, Australia and the Pacific; 4 species in West Bengal.

1. Petals laciniate :
 2. Stamens about 40, bearded; drupes globose ...2. *E. sphaericus*
 2. Stamens 20-35, anther valves sparingly bearded; drupe oblong ...1. *E. serratus*
1. Petals limbriate:
 3. Leaves ovate-oblong, serrate; sepals glabrous; stamens 50; anthers bearded ...3. *E. tectorius*
 3. Leaves elliptic, serrulate; sepals silky; stamens less than 50, anthers puberulous ...4. *E. varunua*

1. ***Elaeocarpus serratus*** L., Sp. Pl. 515, 1753; Mast. in Hook.f., Fl. Brit. India 1: 401, 1874; S.K. Murti in Sharma *et al.*, Fl. India 3: 553, 1995. "Jalpai" (Beng.).

A small tree; young parts pubescent. Leaves oblong or obovate, 4 - 5.5 × 2-2.5 cm, obtuse, acute or shortly acuminate, glabrous, often with glandular thickenings; petioles 8-13 mm long. Racemes drooping, 2-3.5 cm long. Sepals lanceolate, acute. Petals white, cuneate-obovate, laciniate to halfway down. Stamens about 30; filaments short; anthers linear, one valve tipped at the apex. Ovary pilose, 3-celled, style slender, longer than the stamens, the basal part hairy. Drupes 2-2.5 cm long, oblong, narrowed at base, bluntly pointed at apex, much tubercled, 1-celled, 1-seeded.

Fl. & Fr.: Jan. - June, Jalpaiguri, 24-Parganas.

Fleshy portion is edible. Wood is used for small packing cases, match-boxes and splints. Leaves are used in rheumatism and as an antidote for poison. The fruits are used in dysentery and diarrhoea.

2. ***Elaeocarpus sphaericus*** (Gaertn.) K. Schum. in E. & P. Pfl. fam., III-6: 5, 1890; Murti in Sharma *et al.*, *l.c.* 3: 555, 1993. *Ganitrus sphaericus* Gaertn., Fruct. 2: 271, t. 139, 1791; Wight *l.c.* Pl. Ind. Or., 1: 66, 1838. *Elaeocarpus ganitrus* Roxb. ex G. Don, Gen. Syst. 1: 559, 1831; Roxb. Fl. Ind. 2: 592, 1832; Mast. in Hook.f., *l.c.* 400; Prain, Bengal Pl. 1: 197, 1963 (repr.ed.). "Rudrakshya" (Beng., H.).

Fig. 56



Fig. 56. *Elaeocarpus sphaericus* (Gaertn.) K. Schum. : a. fruiting twig; b. nut; c. part of inflorescence.

Trees. Leaves oblong-lanceolate, 8-10 × 2.5-3.5 cm, acute or acuminate, obscurely and irregularly crenate serrate or subentire, glabrous; petioles 6-7 mm long. Racemes 4-5 cm long, buds ovoid, conical, pointed. Sepals oblong, 4-5 mm long, acuminate, pubescent outside. Petals oblong, lacinate to about halfway down, ciliolate. Stamens about 40, in groups opposite to each petal; filaments very short, anthers linear, one valve tipped at the apex. Ovary pilose, 5-celled; style longer than stamens. Drupes 1.5-2.5 cm in diam., globose, tubercled outside, 5-celled, 5-seeded.

Fl. & Fr. : April - Oct. Jalpaiguri.

The stone are cleaned, polished, sometimes stained, and used as beads for rosaries, bracelets and other ornamental objects. They are frequently set in gold, freaky stones with fewer or more than 5 cells fetch high prices. The flesh is sour and is considered useful in epileptic fits.

3. *Elaeocarpus tectorius* (Lour.) Poir. in Lamk. Encycl. Suppl. 2: 704. 1812; Murti in Sharma *et al.*, *l.c.* 3:559. 1993. *Elaeocarpus robustus* Roxb., Fl. Ind. 2: 597. 1832.; Mast. in Hook.f., *l.c.* 402; Prain, *l.c.* 198. "Nard Champa" (Beng.).

Fig. 57

Trees; young shoots much pubescent. Leaves ovate-oblong, acuminate, 10-12 × 5-5.5 cm, serrate, glabrous; petioles 2-3.5 cm long. Racemes shorter than the leaves. Flower buds oblong- obovate. Stamens 50; anthers bearded, rarely beardless, puberulous. Ovary downy, 3-celled, 1-seeded. Drupes 2-2.5 cm long, rind hard, crustaceous, yellow, stone furrowed, deeply pitted.

Fl. & Fr. : April - June. Jalpaiguri.

Wood is used for making boards, boxes and dugouts.

4. *Elaeocarpus varunua* Buch. - Ham. ex Mast. in Hook.f., *l.c.* 407; Murti in Sharma *et al.*, *l.c.* 3:561. 1993; Prain, *l.c.* 198.

Trees. Leaves elliptic, acuminate, 6-8 × 3-3.5 cm, glabrous, serrulate, long petioled, base rounded. Racemes axillary, half the length of the leaves. Sepals ovate-lanceolate, white, silky. Petals oblong, fimbriate. Stamens with basifixed anthers; anthers puberulous. Ovary villous. Fruits not seen.

Fl. & Fr. : March - June. Jalpaiguri.

2. SLOANEA L.

Trees. Leaves simple, arch-veined. Flower peduncles axillary, 1- flowered, solitary or tufted. Sepals 4, imbricate. Petals 4, gashed. Stamens numerous, free, springing from a thick disc; anthers linear, opening by a terminal pore. Ovary 3-4-celled; cells many-ovuled; style subulate. Capsules coriaceous or woody, prickly or setose, 3-4-celled, or by abortion, 1-celled. Seeds solitary, few or many, pendulous, ovoid, testa bony, shining; albumen fleshy; cotyledons broad and flat.

A genus of about 120 species in tropical Asia and America, 1 species in West Bengal.

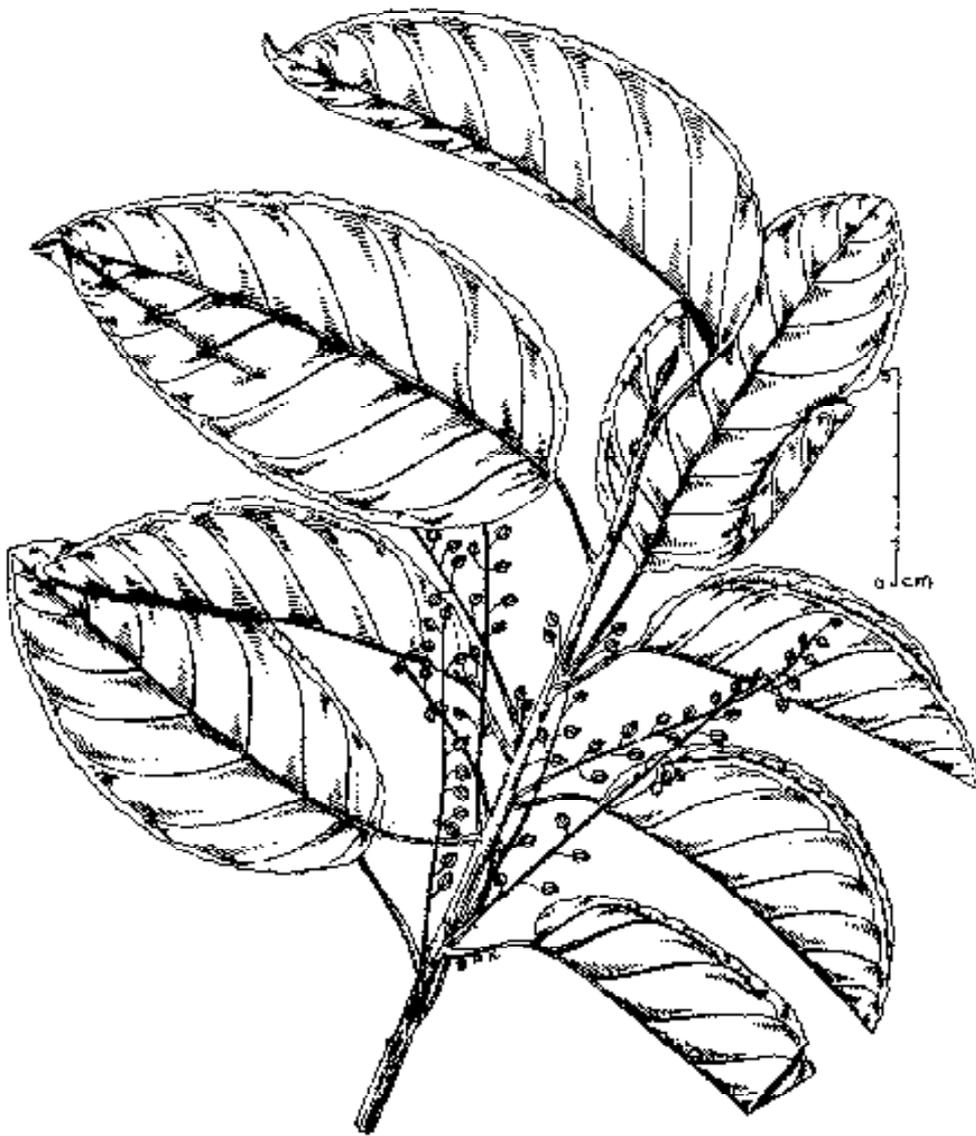


Fig. 57. *Elaeocarpus tectorius* (Lour.) Poir.

Sloanea sterculiacea (Benth.) Rehder & Wilson in Sarg., Pl. Wilson 2: 362. 1915; Murti in Sharma *et al.*, *l.c.* 3:566. 1993. *Echinocarpus sterculiaceus* Benth. in Proc. Linn. Soc. 5. Suppl. 2: 72. 1861; Mast. in Hook.f., *l.c.* 400.

Trees, bark smooth. Leaves 10-15 × 4-8 cm, base rounded or subcordate, minutely serrulate; petiole 4-5 cm long. Peduncles tomentose. Capsules globose, densely covered with very long subulate spines.

Fl. & Fr.: June - Dec. Jalpaiguri.

CULTIVATED SPECIES

Muntingia calabura L. "Japanese berry"

LINACEAE

(T.K. Paul & S.K. Das Das)

The family comprises of ca 12 genera and 290 species, cosmopolitan in distribution; 2 genera and 3 species in West Bengal.

1. Herbs up to 30 cm high; flowers in racemes or narrow panicles; petals white, pink or blue, 0.3-1.5 cm long 1 LINUM
1. Undershrubs up to 1 m high; flowers in axillary cymes or clusters, rarely solitary; petals yellow, 1.5-5 cm long ...2 RINWAROTIA

1. LINUM L.

Herbs or rarely shrubs. Leaves alternate, simple; stipules absent or replaced by glands. Inflorescence usually cymose. Flower pedicellate, regular, bisexual. Sepals 5, free or slightly connate at base, imbricate. Petals 5, contorted, fugacious. Stamens 5, connate at base; often alternating with minute staminodes; anthers versatile. Ovary superior, 5-loculed, sometimes 3- or 4-lobed, each locule again 2-locellate; styles free stigmas clavate or capitate; ovule 1 in each locellus. Fruit a capsule, globose. Seeds compressed.

About 230 species; 1 species cultivated in West Bengal.

Linum usitatissimum L., Sp. Pl. 277. 1753; Hook.f., Fl. Brit. India 1: 410. 1874; Prain, Bengal Pl. 1: 199. 1963 (repr.ed.); Hujra in Sharma *et al.*, Fl. India 3: 580. 1993. "Tisi" (Beng.); "Atasi" (Sans.); "Alsi" (H.); "Linseed, Flax" (Eng.).

Annual erect herbs, 60-120 cm tall; stems cylindric. Leaves sessile, linear to lanceolate, 2-2.5 × 0.2 cm, acute. Flowers ca 2.5 cm across; pedicels 2-3 cm long. Sepals 5, acuminate, 9 × 3 mm, 2 outer elliptic and 3 inner boat shaped, persistent. Petals 5, ovate to lanceolate, 1 × 0.3 cm, blue. Ovary globose; styles ca 3 mm, slender. Capsules 7-8 mm across. Seeds elliptic-obovate, ca 4 mm long, dark brown.

Fl. & Fr.: Jan. - Aug. Cultivated almost throughout the plains of West Bengal.

Fibres obtained from stems are used for making linen cloth, twines and wrapping papers. Oil obtained from seeds is used as drying oil in the preparation of paints, varnishes, printing ink, water proof fabrics and oil cloths.

2. REINWARDTIA Dumort.

Undershrubs or shrubs. Leaves simple, alternate, entire or crenate-serrate; stipules subulate, caducous. Flowers axillary, solitary or in terminal cymose fascicles, pedicelled, bracteate. Sepals 5, lanceolate, acuminate. Petals 5, contorted, fugacious. Stamens 5, connate at base. Ovary 3-5 loculed, each locule 2-locellate, ovule 1 in each; styles 3-4, filiform, free or connate below; stigmas subcapitate. Capsules globose, splitting into 6-8 cocci. Seeds reniform.

2 species in India, China and Malaysia; both in West Bengal.

1. Leaves elliptic-lanceolate, apex acuminate,
margins serrate, styles usually 4 ...1. *R. cicanoba*

1. Leaves elliptic-obovate, apex rounded or subacute,
margins entire or minutely serrulate, styles 3 ...2. *R. indica*

1. **Reinwardtia cicanoba** (Buch. -Ham. ex D. Don) Hara in J. Jap. Bot. 40: 328. 1965 et in Fl. East Himal. 168. 1966; Hajra in Sharma *et al.*, *l.c.* 581. *Linum cicanobum* Buch. -Ham. ex D. Don. Prodr. Fl. Nep. 217. 1825. *Reinwardtia tetragyna* Planch. in Hook., Lond. J. Bot. 7: 523. 1848; Hook. *f.*, *l.c.* 412. **Fig. 58**

Similar to the following *R. indica* Dumort., but differs in its larger (5-13 × 1.5-4 cm) elliptic-lanceolate leaves, apex acuminate, margins serrate; flowers more numerous in terminal cymes; larger petals 3-5.5 cm and styles 3-4 (5).

Fl. & Fr. : Oct. - Dec. Darjeeling, 400 - 2000 m.

2. **Reinwardtia indica** Dumort., *Comm. Bot.* 19. 1822; Hara in Fl. East Himal. 169. 1966; Hajra in Sharma *et al.*, *l.c.* 581. *Linum trigynum* Roxb. in *Asiat. Res.* 6: 357. 1799 *non* L. 1753. *Reinwardtia trigyna* (Roxb.) Planch. in Hook., Lond. J. Bot. 7: 522. 1848; Hook. *f.*, *l.c.* 412.

Undershrub, 60-90 cm high with both erect and prostrate rooting stout branches. Leaves 2-7 × 1-3 cm, elliptic-ovate, glabrous, apex acute or obtuse, mucronate, base attenuate, margins entire or minutely serrulate, glabrous; petioles 3-10 mm long; stipules *ca* 1 mm. Flowers solitary or few in axillary or terminal clusters or cymes, pedicels 2-7 mm long, pubescent; bracts 1.5-3 mm, glandular toothed. Sepals lanceolate, 7-10 mm. Petals obovate, 1.5-3 cm, yellow, styles 3, connate at base, 1.4-2.2 cm. Capsules 6-7 mm, subglobose.

Fl. & Fr. : Sept. - March. Darjeeling, 1000-2000 m.

The plant is commonly grown in gardens for its showy bright yellow flowers. leaves and stems are medicinal for cattles.

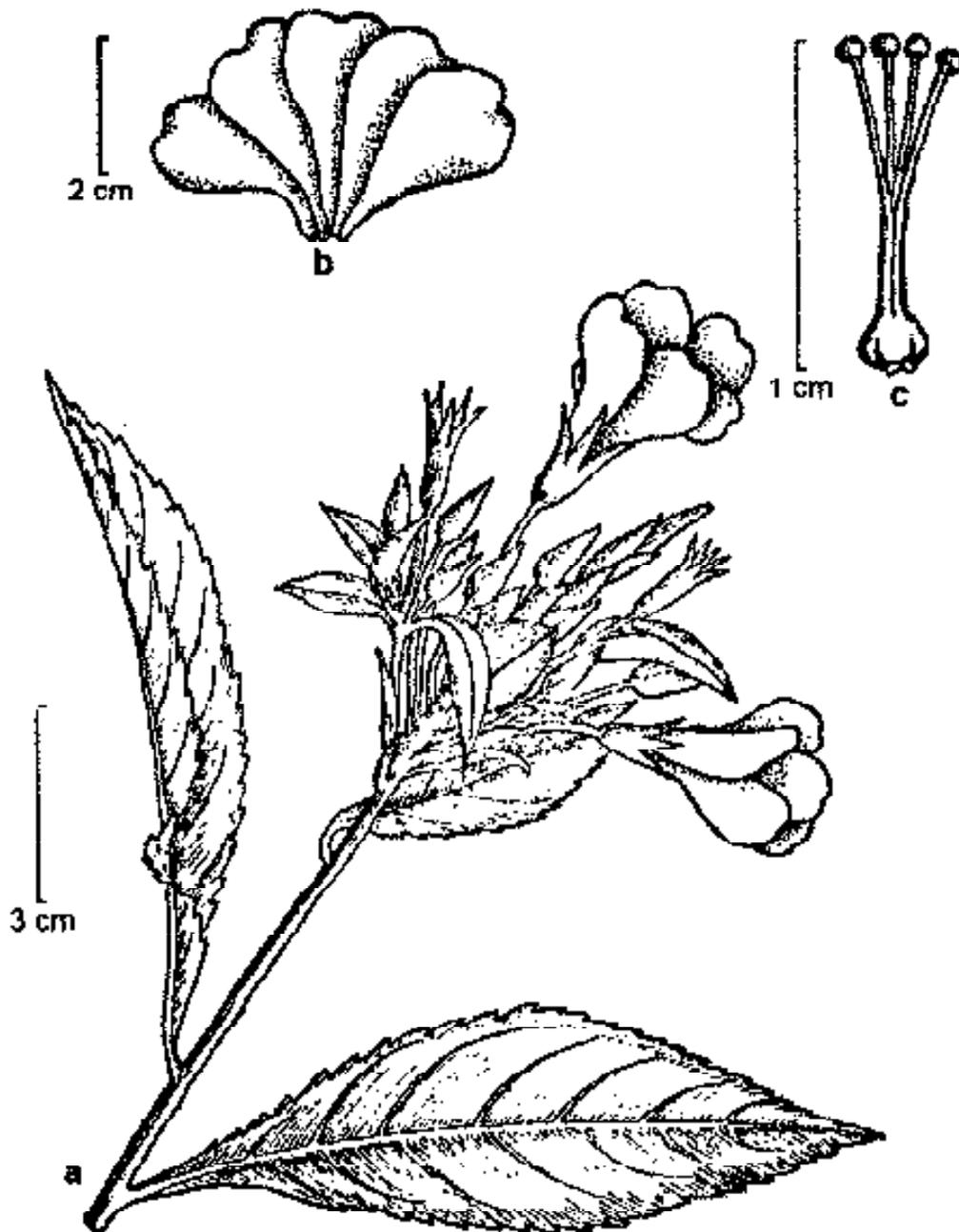


Fig. 58. *Reinwardtia cicanoba* (Buch.-Ham. ex D. Don) Hara. : a. flowering branch; b. petals; c. pistil.

MALPIGHIACEAE

(B. Safui)

A family of ca 60 genera and 800 species, chiefly in tropics; 2 genera and 3 species in West Bengal.

1. Leaf base mostly acute; glandular at the junction of calyx and pedicel; flowers zygomorphic; style 1; samara with one long, median wing and 2 shorter lateral wings ...2. HIRTAGE
1. Leaf base rounded, truncate or cordate; eglandular at the junction of calyx and pedicel; flowers actinomorphic; styles 3; samara surrounded by a disc or shield-like lateral wing ...1. ASPIDOPTERYS

1. ASPIDOPTERYS Juss.

Lianas. Leaves opposite, simple, entire; stipules minute, caducous, or absent. Inflorescence mostly axillary, sometimes a terminal panicle. Flowers bracteate and bracteolate, bisexual, actinomorphic, white or yellow; pedicels articulate. Sepals 5, small. Petals 5, spreading or reflexed after anthesis, entire. Stamens 10, sometimes connate at base. Ovary 3-lobed, lobes flattened with winged sides; styles 3, free; stigmas capitate. Samaras 1-3, often attached to a carpophore; lateral wing of each mericarp developed into a orbicular or oblong wing, dorsal wing little developed. Seeds linear.

A genus of about 20 species, distributed mostly in tropical South-east Asia; 2 species reported from West Bengal.

1. Flowers small, 1.5-3 × 1-2 mm; samara wings auricled at base ...1. *A. balakrishnanii*
1. Flowers large, 3-4.5 × 1.5-2.5 mm; samara wings not auricled at base ... 2. *A. nutans*

1. *Aspidopterys balakrishnanii* Srivastava in J. Econ. Tax. Bot. 4: 1003, 1983.

Woody climbers, young parts tomentose. Leaves 9-15 × 7-10.5 cm, ovate, acuminate, sparsely villous beneath, base almost round; petioles 1.5-2 cm, rusty brown tomentose. Panicles axillary or terminal, rachis 12-16 cm long, elongating to 25 cm in fruits, tomentose; pedicels 1.5-5.5 mm long, articulated at the middle or below; bracts 2-3 mm, linear, densely tomentose; bracteoles 0.75- 1.25 mm, tomentose. Sepals oblong or ovate-oblong. Petals 5, oblong. Stamens 10. Ovary 3-celled; styles 3, united. Samara 3; wings ovate or ovate-oblong, auriculate at base, basal lobes ovate, 10-12 × 5-7 mm.

Fl. & Fr. : Aug. - Dec. Jalpaiguri.

2. *Aspidopterys nutans* (Roxb. ex DC.) Juss. in Ann. Sc. Nat. 2. Ser Bot. 13: 267, 1840 et in Arch. Mus. 3: 513, 1843; Hook.f., Fl. Brit. India 1: 421, 1874, *excl. variety*; Hutch. in Kew Bull. 98, 1917 p.p. *Hiraea nutans* Roxb. ex DC., Prodr. 1: 585, 1824.

Woody climbers, young parts tomentose to villous. Leaves 5.5-19 × 4.5-14 cm, mostly ovate or ovate-oblong; rounded or slightly cordate at base, mostly

acuminate at apex, sparsely to densely hairy beneath; petioles 1-3 cm. tomentose. Panicles axillary or terminal; rachis 8-35 cm. villous; pedicels articulate, glabrous. Bracts 2.5-5 mm, villous; bracteoles ca 0.75 mm, hairy. Sepals united at base, obtuse. Petals oblong. Stamens with short filaments, connective dorsally broad and shield-like; anthers oblong. Ovary sparsely villous, 3-celled. Samara 3, wings broadly elliptic, ovate-oblong or suborbicular.

Fl. : May - Sept.; *Fr.* : June - Nov. Darjeeling.

HIPTAGE Gaertn.

Stout, scandent or suberect shrubs. Leaves opposite, entire, shortly petioled; mostly glabrescent, generally with two basal glands beneath or eglandular; margin often with scattered glands beneath; stipules minute or absent. Inflorescence a raceme, axillary or terminal. Peduncles bracteate; pedicels articulate with 2 bracteoles. Flowers bisexual, zygomorphic. Sepals 5, with a dark coloured gland adnate to pedicel. Petals 5, clawed, unequal. Stamens 10, one anterior 2-3 times longer than the rest. Ovary 3-lobed; style 1 circinate, other 2 abortive; stigma acute. Samara 3-winged, wing at the middle is largest and at right angle to the two laterals. Seed subglobose.

A genus of about 20-30 species, chiefly in Ceylon to N.W. India, S. China, East and South-east Asia; 1 species in West Bengal.

Hiptage benghalensis (L.) Kurz, in J. Asiat. Soc. Bengal 43, II: 136, 1874. *Banisteria benghalensis* L., Sp. Pl. 1: 437, 1753. *H. madablora* Gaertn., Fuct. 2: 169, t. 116, 1791; Hook.f., Fl. Brit. India 1: 418, 1874; Prain, Bengal Pl. 1: 200, 1963 (repr. ed.). *H. parviflora* Wt. & Arn. Prodr. 107, 1834; Hook.f., Fl. Brit. India. 1: 419, 1874.

Fig. 59

Extensive climbers, young parts tomentose. Leaves subcoriaceous, 8-15 × 3-6 cm, ovate, ovate-oblong or elliptic; base with two glands; petioles 5-10 mm long. Inflorescence a raceme, 5-25 cm long; bracts acute, 2-5 mm, tomentose; bracteoles 2. Pedicels articulate, thickened upwards, tomentose. Glands inbetween calyx and pedicel 2-5 mm long. Flowers 1-2.5 cm in diam., fragrant. Sepals 2-5 × 1.5-3 mm, ovate-oblong, silky pubescent. Petals 6-12 × 5-10 mm, margin irregularly cleft, clawed, inner petal with two outgrowths at base. Samaras 3-winged, variable in size and shape, middle wing mostly obovate or slenderly elliptic and larger than two lateral wings, dorsal crest sometimes present.

Fl. & Fr. : March - May, Burdwan, Darjeeling and Jalpaiguri.

Leaves used externally in skin diseases; bark is powdered and applied on fresh wounds.

CULTIVATED TAXA

Aspidopterys hirsuta (Wall.) Juss.

Hiptage benghalensis var. *longifolia* (Nied) Srivastava

Malpighia coccigera L.



Fig. 59. *Hiptage benghalensis* (L.) Kurz

ZYGOPHYLLACEAE

(K.C. Malick)

About 25 genera with over 240 species in tropics and subtropics; 2 genera and 2 species in West Bengal.

1. Terminal pair of leaflets the smallest and narrowly oblong; cocci of fruits with 2 pairs of hard spines and falling without leaving any central axis 2 TRIBULUS
1. Terminal pair of leaflets the largest and falcately obovate; cocci of fruits without any hard spine and falling leaving a central axis 1 KALLSTROEMIA

1. KALLSTROEMIA Scop.

Procumbent herbs, sometimes rather woody. Leaves opposite, pinnate, one of each pair alternately smaller than the other or absent; leaflets oblique; stipules present. Flowers solitary, axillary; pedicels swollen below the calyx. Sepals 5-6, persistent. Petals 5-6. Stamens 8-12, antipetalous, one slightly longer and adnate to the base of the petals, antisepalous one subtended by a small exterior gland or often sterile. Ovary 8-12-celled; ovule one in each cell; stigma grooved. Cocci dorsally tuberculate, falling away from persistent styliferous axis.

About 17 species in North, Central and South America, N. Australia, tropical Africa; 1 species in West Bengal.

Kallstroemia pubescens (G. Don) Dandy in Kew Bull. 138, 1965; Bennett in Indian For. 91(5) : 282, 1965. *Tribulus pubescens* G. Don, Gen. Syst. 1, 769, 1831.

Diffusely branched procumbent herbs, 20-55 cm long; stems ridged; young shoots covered with whitish pubescence. Leaves 2-5 cm long; petioles 5-10 mm long; leaflets in usually 3, rarely 2 or 4 unequal pairs, terminal pair the largest, 1.2-2.3 × 0.7-1.3 cm, elliptic, elliptic-oblong, obovate-oblong, terminal pairs falcately obovate, entire, apiculate at apex, obliquely round at base; petioles very short, pilose; stipules 3-5 mm long, linear-lanceolate. Peduncles 1.2-2.5 cm long. Sepals 5, narrowly lanceolate, 4-6 mm long, acuminate, densely pubescent. Petals 5, yellow, obovate, 6-7 mm long, prominently veined. Stamens 10. Ovary 10-lobed; style stout; ovule one in each lobe. Fruit ca 5 mm long and broad, usually ventrally 10-angled in mature carpels, separating from the central axis. Seed one in each coccus, small.

Fl. & Fr. : June - Aug. Hooghly, Howrah, 24-Parganas.

2. TRIBULUS L.

Prostrate diffusely branched herbs, usually silky hairy. Leaves opposite, usually unequal, abruptly pinnate. Flowers solitary on pseudo-axillary peduncles. Sepals 5, imbricate, usually deciduous. Petals 5, patent, caducous. Stamens 10, inserted at the base of the disc, alternately long and short; filaments filiform. Disc

annular, 10-lobed. Ovary sessile, hirsute, 5-12-lobed, 5-10-celled, each cell divided into 3-5 compartments by transverse partitions; ovule one in each compartment. Fruits splitting into 5-12 tubercled cocci falling without leaving any central axis. Seed solitary in each compartment of the cocci.

About 25 species in tropical and sub-tropical regions; 1 species in West Bengal.

Tribulus terrestris L., Sp. Pl. 387. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 423. 1874; Prain, Bengal Pl. 1: 201. 1963 (repr. ed.).

Prostrate annual or biennial silky villous herbs. Leaves 3-6 cm long, in unequal pairs, larger one 4-6 pairs, smaller one 3-5 pairs or often absent; petioles 4-6 mm long; leaflets opposite, narrowly oblong, 5-17 × 2-8 mm, mucronate; stipules lanceolate. Flowers yellow, axillary or leaf-opposed, solitary. Peduncles 4 mm long. Sepals ca 5 mm long, lanceolate, acute, hairy. Petals ca 6 mm long, oblong-obovate. Stamens 8-10, inserted at the base of the disc. Ovary bristly; style short. Fruits ca 5 mm in diam., globose, of 4-5 tubercled cocci, each coccus with a pair of sharp spines. Seeds several in each coccus, with one in each transversely septate compartment.

Fl. : Feb. - April; *Fr.* : July - Nov. Bankura, Burdwan, Purulia.

Fruits are used in painful micturation and urinary troubles.

GERANIACEAE (sensu str.)

(B. Safui)

A family of about 5 genera having 750 species with cosmopolitan distribution; 1 genera and 3 species in West Bengal.

GERANIUM L.

Herbs or undershrubs. Leaves opposite or alternate, palmately lobed, rarely entire, stipulate. Flowers regular, bracteate, in axillary 1-2-flowered cymes, or umbelled. Sepals 5, imbricate. Petals 5, hypogynous, imbricate, alternating with 5 glands. Stamens 10, usually all fertile, sometimes alternately 5 fertile and 5 imperfect, free or shortly connate below. Ovary 5-lobed, beaked; styles 5, stigmas longitudinal; ovules superposed. Capsules 5-lobed, 5-celled, cells 1-seeded. Carpels usually split ventrally, often separating septifragally from the axis, their beaks coiling elastically upwards from the base to the apex. Seeds without or with scanty albumen.

About 40 species, cosmopolitan; 3 species in West Bengal.

1. Flowers large, 2.5-3.5 cm in diam. ; stigmatic branches
4.5-5 mm long ... 3 *G. procurrens*
1. Flowers small, 1-2.5 cm in diam. ; stigmatic branches
1-1.5 mm long :
2. Leaves 3-5-lobed, ultimate lobes acutish; inflorescence
1-2-flowered; carpels smooth ... 1 *G. nepulense*

2. Leaves 5-9-lobed, ultimate lobules obtuse;
inflorescence 3-10-flowered; carpels reticulate ... 2. *G. polyanthes*

1. **Geranium nepalense** Sw., Geran. 1: t. 12. 1820; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 430. 1874; Hara, Fl. East Himal. 1: 167. 1966.

Slender much branched hairy or villous creeping perennial herbs with rhizomatous rootstock. Leaves 2.5-6 cm in diam., opposite, 5-gonal, deeply 3-5 palmatilobed or partite, segments incised, acute, sparsely hairy; petioles, 0.5-1.5 cm long of which radical ones are longer; stipules subulate-lanceolate, free. Peduncles axillary, slender, tomentose, 1-2-flowered. Flowers white to pale purple or pink, ca 1 cm in diam. Sepals ca 5 mm long, lanceolate, almost equal or slightly smaller than petals, hairy. Carpels smooth, minutely hairy, beaked. Capsules subglobose. Seeds black.

Fl. : March - Oct. ; Fr. : Aug. - Dec. Darjeeling.

2. **Geranium polyanthes** Edgew. & Hook. f. in Hook.f., l.c. 431. 1874; Hara, Fl. East Himal. 1: 167 & 3: 73. 1975.

Fig. 60

Slender decumbent sparingly hairy perennial herbs with stout tufted rootstock. Leaves orbicular-reniform to orbicular, 2.5-6 cm in diam., 5-9 partite or lobed; segments cuneate, obtuse, 3-7-lobed, more or less pilose; petioles of radical leaves very long, sparsely hairy; uppermost ones crowded along the pedicels, 2 almost sessile; stipules subulate-lanceolate or ovate-acute, connate below. Inflorescence subumbellate to umbellate, 3-10-flowered; pedicels filiform, 0.5-1.5 cm, glandular hairy. Flowers 1-2.5 cm in diam., red purple. Sepals shortly awned, clothed with spreading glandular hairs. Filaments broad and ciliate towards base. Carpels with slender beak, reticulate and glabrous; style very short; stigmatic branches 1-1.5 mm. Capsules erect, ca 2 cm long.

Fl. : June-Oct.; Fr. : Aug. - Oct. Darjeeling.

3. **Geranium procurrens** Yucc. in, Bot. Mag. 179. t. 644. 1973; Hara, Fl. East Himal. 3: 73. 1975. *G. grevilleanum* auct. non Edgew. & Hook.f. in Hook.f., l.c. 430. 1874, p.p.

Prostrate branched slender or robust glandular hairy perennial herbs. Leaves opposite, 3-gonal, 5(-7)-lobed, segments below the middle, acute or acuminate, incised; petioles long, slender, hairy; stipules bifid or in pairs, ovate, acuminate. Peduncles long, slender, sparsely hairy, 1-2-flowered; pedicels filiform, tomentose. Flowers 2.5-3.5 cm in diam., rose colour or purplish; bracts linear. Sepals 6-8 mm, hairy, mucronate or long awned. Petals obovate, with rounded or retuse tip, hairy at base. Filaments villous with long bristle-like hairs. Style short, stigmatic branches 4.5-5 mm long. Carpels pilose. Seeds smooth.

Fl. : Aug.-Oct. Fr. : Oct.- Nov. Darjeeling.



Fig. 60. *Geranium polyanthes* Edgew. & Hook. f.

BALSAMINACEAE

(L.K. Ghara)

A family of 4 genera and over 900 species, mostly in tropical and temperate Eurasia, Africa and North America, with the major centre in India, Ceylon and Madagascar; 1 genus and 32 species (one cultivated) are reported from West Bengal.

IMPATIENS L.

Annual or perennial herbs. Stems translucent. Leaves opposite or alternate, sometimes whorled, simple, exstipulate. Flowers axillary or terminal, one-many together, bisexual, irregular. Sepals imbricate, 2 lateral sepals (sometimes 4), small, flat, usually green; lower sepal large, with a spur. Petals 3 (or 5); dorsal petal large; lateral petals united, usually 2-lobed. Stamens 5, filaments short; anthers cohering. Ovary 5-celled; stigma sessile, 5-toothed. Capsules 5-valved, elastically exploding. Seeds smooth, tubercled or minutely granulate, glabrous or hairy, usually many, very occasionally as few as 3 (*I. glandulifera*).

1. Capsules fusiform, turgid in the middle :
 2. Inflorescence terminal; bract with long appendage ... 5. *I. bracteata*
 2. Inflorescence axillary; bract without appendage :
 3. Capsules densely hairy ... 3. *I. balsamina*
 3. Capsules glabrous :
 4. Leaves sessile or subsessile, linear ... 7. *I. chinensis*
 4. Leaves petioled, lanceolate, ovate or ovate-lanceolate :
 5. Lower sepal navicular, spur straight, slender ... 10. *I. exilis*
 5. Lower sepal bucciniform, spur curved :
 6. Appendage or beak present on the mouth of lower sepal :
 7. Peduncles 2-4.5 cm long; appendage present on the mouth of lower sepal ... 27. *I. trilobata*
 7. Peduncles 0.2 - 0.5 cm long; appendage absent but beak on the mouth of lower sepal ... 28. *I. tripetala*
 6. Appendage or beak absent on the mouth of lower sepal :
 8. Spur 4-5 mm long ... 12. *I. florigera*
 8. Spur 13-25 mm long ... 19. *I. pulchra*
 1. Capsules clavate or linear .
 9. Flowers large or medium size

10. Peduncle absent :
11. Sepals 4 ...2. *I. arguta*
11. Sepals 2 :
12. Pubescent, appendage absent on the sepal ...18. *I. puberula*
12. Glabrous, appendage present on the sepal :
13. Tip of spur spirally coiled ... 24. *I. spirifer*
13. Tip of spur incurved ...9. *I. decipiens*
10. Peduncles present :
14. Lateral united petals with appendage :
15. Lower petal of lateral united petals broader than long ... 11. *I. falcifer*
15. Lower petal of lateral united petals longer than broad :
16. Lower sepal bucciniform ... 26. *I. sulcata*
16. Lower sepal navicular :
17. A hooked appendage inserted towards the sinus of upper and lower petal of lateral united petals ... 30. *I. uncipetala*
17. Appendage inserted opposite sinus of upper and lower petal of lateral united petals ... 16. *I. jurpia*
14. Lateral united petals without appendage :
18. Pedicels whorled (verticillate) ... 4. *I. bicornuta*
18. Pedicels not whorled :
19. Lower sepal navicular :
20. Lower sepal spurless ... 8. *I. cymbifera*
20. Lower sepal spurred :
21. Sepal small, 7 mm long, ovate ... 22. *I. scabruda*
21. Sepal large, 16 mm long, orbicular ... 6. *I. cathcartii*
19. Lower sepal bucciniform :
22. Lateral sepals 4 ... 23. *I. scitula*
22. Lateral sepals 2 :
23. Leaves mostly sessile ... 31. *I. urticifolia*
23. Leaves all petiolate :
24. Leaves membranous; lateral sepals with glands on one side ... 32. *I. wallichii*
24. Leaves not membranous; lateral sepals without glands ... 13. *I. gamblei*
9. Flowers small, sometimes minute :

25. Lateral sepals 2 :
26. Pedicels whorled :
27. Spur of lower sepal 6-12 mm long ... 21. *I. radiata*
27. Spur of lower sepal 25-38 mm long ... 15. *I. graciliflora*
26. Pedicels seriate:
28. Spur of lower sepal very small or absent:
29. Lower sepal with an appendage ... 29. *I. tuberculata*
29. Lower sepal without an appendage ... 14. *I. gammiei*
28. Spur of lower sepal large :
30. Lateral sepal with an appendage ... 20. *I. racemosa*
30. Lateral sepal without appendage, ovate-acuminate ... 17. *I. longipes*
25. Lateral sepals 4 :
31. Lateral sepals obliquely ovate ... 1. *I. angustiflora*
31. Lateral sepals narrowly ovate, base incurved ... 25. *I. stenantha*

1. *Impatiens angustiflora* Hook. f., Fl. Brit. India 1 : 480, 1875.

Erect annual herbs. Stem glabrous or finely pubescent, stout, simple or branched. Leaves alternate, whitish beneath, narrowly elliptic-lanceolate, 3-7.5 × 1.2-3 cm, long acuminate; lateral veins 4-9 pairs; margin shallowly crenate; petiole 5-17 mm. Flowers yellow or violet, 1.5-4 cm with spur, horizontal to axis; bracts persistent, obliquely ovate, pedicels many, glabrous. Lateral sepals 4; 2 large, 2 minute, 2-4 mm, obliquely ovate; lower sepal obliquely navicular with long slender spur, 3 cm, greenish-yellow. Dorsal petal orbicular or oblong; lateral united petals 0.5-2.3 cm long; upper petals of each pair yellowish, triangular; lower petals of each pair narrow-ovate, pink. Capsules 0.5-2 cm, elongate, glabrous. Seeds compressed, granulate, black.

Fl. & Fr. : March - Nov. Darjeeling.

2. *Impatiens arguta* Hook. f. & Thoms. in J. Linn. Soc. 4: 137, 1860; Hook. f., *l.c.* 470; Hara in Fl. East. Himal. 3 : 78, 1975. *I. gagei* Hook. f. in Hook., Icon. Pl. 30: t. 2951, 1911. "Dumdhakuwa" (Assam.).

Herbs, sometimes much branched, erect, more or less glabrous. Leaves alternate, ovate or lanceolate, often ciliate at base, 6-12 × 3-5 cm margin serrate; petiole usually glandular, 3 cm. Flowers axillary, 1-2, pedicellate, 2-4 cm. Lateral sepals 4, outer dimidiate-ovate, 5-9 × 2-5 mm; lower sepal bucciniform, constricted into a narrow incurved yellowish spur. Dorsal petals obovate with red spot; lateral united petals bilobed, 2.5 cm long. Stamens petaloid, glabrous. Capsules narrow, stout, linear, 1-4 × 0.2-0.5 cm. Seeds glabrous.

Fl. & Fr. : July - Oct. Coochbehar, Darjeeling.

3. **Impatiens balsamina** L., Sp. Pl. 938. 1753; Hook. f., *l.c.* 452; Prain, Bengal Pl. 1 : 205. 1963 (repr. ed.). "Dupati" (Beng.), "Gul-mehndi" (H.), "Harogaura" (U.).

Annual herbs. Stem translucent. Leaves alternate, linear lanceolate, 2-11 × 0.5-2.5 cm, acuminate; margin serrate. Flowers pedicellate, axillary, solitary or fasciated, rose coloured, 1.2-4 cm with short or long and slender spur. Lateral sepals 2, ca 6 mm long, broadly ovate; lateral united petals much rounded, 1-3.5 cm long. Stamens 5; filaments short; anther cohering. Ovary 5-celled, stigma sessile. Capsules short, turgid in the middle, 0.5-2.5 × 0.2-1 cm, densely hairy. Seeds globose, minutely granulate.

Fl. & Fr. : March - Oct. Darjeeling, Hooghly, Howrah, Malda, Midnapore & Purulia.

The plant is cultivated throughout India for seasonal ornamental flowers, single ones largely running wild.

4. **Impatiens bicornuta** Wall. in Roxb., Fl. Ind. 2 : 460. 1824; Hook. f., *l.c.* 475; Hara, *l.c.* 78.

Herbs. Leaves sometimes purple below, petiolate, elliptic to lanceolate or oblong, 4.5-23 × 1.8-8 cm, long acuminate, pubescent; lateral veins 5-14 pairs; margin crenate, filiform appendage present on crenations, 1 mm. Flowers 2.5-3 cm long, dull yellow-brown spots on the tails, brown lines inside the bucket; bracts lanceolate, 3 mm, tip appendiculate. Peduncles slender, 4.5-17 cm with whorled pedicels. Lateral sepals ovate, 2.5 × 1.5-2 mm with an appendage, curved, 1-2 mm long, 7-8 veins prominent; lower sepal bucciniform, 1.5-2.5 cm, suddenly constricted into 2-5 mm spur. Dorsal petal cucullate, 6-8 mm; lateral united petals emarginate on the sinus of the upper and lower lateral petals; upper petal of each pair ovate, lower petal of each pair more or less ovoid with long appendage. Capsules linear, 0.3-2.5 cm, acute.

Fl. & Fr. : July - Oct. Darjeeling.

5. **Impatiens bracteata** Colebr. in Roxb., Fl. Ind. 2 : 458. 1824. *I. fimbriata* Hook. f., Exot. Fl. 2. t. 146. 1825 et in Fl. Brit. India 1 : 461. 1874.

Herbs. Leaves opposite or alternate, petiolate, young with red cilia, lamina elliptic to ovate-lanceolate, 3.4-14.5 × 1.5-5 cm, base abruptly cuneate, apex acuminate; margin sub-serrulate, lower teeth filiform, upper teeth apiculate; petiole 4-7.5 cm. Inflorescence truly terminal. Flowers violet or pink; bracts linear, 10-12 mm, with appendage, pale green persistent. Peduncles terminal, 0.5-9 cm long and clothed with ciliate bracts. Lateral sepals lanceolate; lower sepal bucciniform, mouth 6-7 mm with appendage, yellow with red streaks, gradually constricted into a 12-16 mm incurved filiform spur, gradually tapering to the tip. Dorsal petal ovate, 4 × 5 mm, dark pink; lateral united petals 15-16 mm long, 7.5 mm broad, with a small rounded lobe, upper petal of each pair triangular, 3 mm, reddish streaks present; lower petal of each pair broadly elliptic to kidney-shaped, 10-12 × 7-8 mm, inner margin slightly emarginate, entire. Capsules, turgid narrowed at both ends, 1 cm.

Fl. & Fr. : May - Nov. Darjeeling.

6. *Impatiens cathartii* Hook. f., *Fl. Brit. India* 1 : 473. 1875.

Branched undershrubs. Leaves alternate and opposite, deep green above, pale green beneath, ovate to ovate-lanceolate or elliptic-ovate, 8-19 × 2.5-10 cm, acuminate; lateral veins 5-10 pairs; petiole 0.3-7.5 cm, margin shallowly crenate, crenations 3-6 mm apart. Flowers in cluster, pedunculate; bracts small, 4 mm, herbaceous. Peduncles 1.5-10 cm long, glabrous. Lateral sepals orbicular thin, 16 mm; lower sepal broad-navicular, with slightly inflated spur. Lateral united petals 2.5 cm, the upper and lower petals of each pair about equal in size; upper petal broadly elliptic to kidney-shaped; lower petal broadly oval, distally emarginate on the outer margin. Capsules linear, 2.2 cm, submarginate.

Fl. & Fr. : June - Dec. Darjeeling.

7. *Impatiens chinensis* L., *Sp. Pl.* 937. 1753; Hook. f., *l.c.* 444.

Succulent. Leaves sessile, or subsessile, opposite, linear to linear-elliptic, 3-7 × 0.3-0.5 cm, base rounded or cordate, apex acute to acuminate; margin finely serrate, teeth prominent; stipulary glands present. Flowers white or reddish-white, large; pedicels very variable, up to 4 cm, axillary. Lateral sepals linear acute, 8 mm long; lower sepal bucciniform, spotted on one side, abruptly constricted into a curved spur, 1.5-2 cm long, violate-red. Dorsal petal suborbicular, 5-7 mm long, 4-8 mm broad, abruptly pointed, white. Lateral united petals 14-20 mm long; upper petal of each pair ovate-triangular to ovate-elliptic 3-6 × 2-4 mm; lower petal of each pair broadly oval 10-16 × 6-12 mm, distally subemarginate, oval portion white with reddish tinge deep violet. Capsules 0.7-1.5 × 0.2-0.7 cm, elliptic, turgid. Seeds many, black shining.

Fl. & Fr. : June - Nov. Darjeeling.

8. *Impatiens cymbifera* Hook. f., *Fl. Brit. India* 1 : 475. 1875.

Glabrous herbs. Stem 60-90 cm tall, green with pale red-purple blotches. Leaves membranous elliptic-ovate or lanceolate, 10-20 × 3-7 cm, base attenuate, apex acuminate; lateral veins 8-12 pairs, margin finely serrate, serratures with filiform bristles; petioles 1-2.8 cm long, winged. Flowers 1.8-3 cm long; pale lilac spotted with red; bracts boat-shaped with long points. Peduncles much shorter than the leaves, terminal and subterminal, 3.4-6.2 cm long. Lateral sepals ovate or broadly oblong, acuminate, green; lower sepal navicular, 1.6 cm long, ovoid, without spur. Dorsal petal cucullate (when flattened), broad with a shallow crest; lateral united petals rounded at base, upper petal of each pair ovoid, lower petals slightly elongate with round apex. Capsules linear, 5-9 mm long, glabrous.

Fl. & Fr. : Nov. Darjeeling.

9. *Impatiens decipiens* Hook. f. in *Rec. Bot. Surv. India* 4 : 17. 1905.

Glabrous herbs. Leaves alternate, elliptic-oblancoate, 4.5-11 × 2.5-5 cm, acuminate, long-attenuate or cuneate at base; lateral veins 7-9 mm apart. Flowers solitary; lateral sepals 3-7 × 2-4 mm, ovate, appendage 1-2 mm long; lower sepal shallowly navicular, 6-9 mm long, abruptly constricted into a curved filiform spur

2-2.7 cm long. Dorsal petal caudate, 1×1.2 cm, emarginate lateral united petals 15 mm long, upper petal of each pair ovate; lower petal of each pair ovate-elliptic. Capsules 0.5-1.5 cm long, linear.

Fl. & Fr. : June - Oct. Darjeeling.

10. *Impatiens exilis* Hook. f. in Rec. *l.c.* 13. 1905; Hara, *l.c.* 195.

Herbs. Leaves petiolate, pale beneath, ovate-elliptic to elliptic or oblong, $4.5 \times 11.5 \times 2.3 - 4.4$ cm, attenuate at base, acuminate, at apex, finely pubescent above; lateral veins 7-10 pairs; margin shallowly serrate, serrations with short filiform appendage stipulary glands present. Flowers 3.5-4 cm long with straight filiform spur, pedunculate. Lateral sepals lanceolate, 2-4 mm, acuminate; lower sepal shallowly navicular 4-8 mm long, 3-4 mm deep, constricted into a 2.5 - 3 cm long filiform spur. Dorsal petal broadly obovate, 3×2 mm, slightly emarginate with a small appendage; lateral united petals 10-15 mm long with a short hooked appendage inserted opposite the sinus of the upper and lower lateral petals; upper petal of each pair ovate-triangular, $6-7 \times 3-4$ mm, lower sepal of each pair elliptic obovate, $7-10 \times 5-7$ mm, distally drawn out into a short acute point. Capsules 2-6 mm long, glabrous, turgid, both ends tapering.

Fl. & Fr. : June-Oct. Darjeeling.

11. *Impatiens falcifer* Hook. f. in Bot. Mag. t. 7923. 1903 et in Rec. *l.c.* 18 ; Hara, *l.c.* 1 : 195, 1966 and 3 : 79, 1975. *I. serrata* Benth. *sensu* Hook. f., *l.c.* 473, *p.p.*

Herbs. Leaves sessile or subsessile, pale green beneath, elliptic to elliptic-oblanccolate, rarely lanceolate, $2.4-6.8 \times 0.9 - 2.3$ cm, base cuneate into the petiole or abruptly attenuate into the stem; apex long acuminate; lateral veins 4-7 pairs; margin serrate, teeth minutely apiculate. Flowers 2.8-3 cm with long spur, pedunculate; pedicels 1.5 - 2.5 cm long, appendage near the middle of the pedicel, 1-2 mm long. Lateral sepals lanceolate, $4-5 \times 1.5 - 2$ mm, acuminate; lower sepals 5-7 mm long, abruptly constricted into a 20-23 mm long filiform spur. Dorsal petal elliptic to elliptic-obovate, $1-1.3 \times 0.6 - 0.7$ cm, acute; lateral united petals 1×2 cm; upper petal of each pair broadly triangular, 3×4 mm, with an appendage; lower petal of each pair oblong-reniform, $1.7 - 2 \times 0.3 - 0.7$ cm. Capsules 1.2 - 3.5 cm long, acute.

Fl. & Fr. : Sept. - Nov. Darjeeling.

12. *Impatiens florigera* C.B. Clarke ex Hook. f. in Rec. Bot. Surv. India 4 : 13. 1905. Fig. 61

Erect herbs. Leaves alternate, ovate, lanceolate to narrowly elliptic, whitish beneath, $2.2 - 9.5 \times 1.4 - 3$ cm, base cuneate, apex long acuminate; lateral veins 4-11 pairs; margin shallowly serrate, filiform appendage scarcely developed. Flowers white, pedunculate; lower sepal pale lilac. Lateral sepals linear-lanceolate, 2-3 mm long; lower sepal bucciniform, 5-8 mm long, 9-12 mm deep, gradually constricted into an upcurved filiform spur, 4-5 mm long. Dorsal petal orbicular, 4×3 mm closely veined; lateral united petals 8 mm long, bilobed; upper petal of each pair more or less globose or triangular ovate; lower petal of



Fig. 61. *Impatiens florigera* C.B. Clarke ex Hook. f.

each pair narrow-ovate, abruptly narrowed above the middle. Capsules turgid, 0.5-1.2 cm long, glabrous.

Fl. & Fr. : May - Oct. Darjeeling.

13. *Impatiens gamblei* Hook. f. in Rec. Bot. Surv. India 4 : 15. 1905; Hara, *l.c.* 79.1975.

Branched herbs. Leaves alternate, dorsally velvety, petiolate, ovate-lanceolate, 4-9 × 1.5-3 cm, base slightly attenuate, apex acuminate; lateral veins 4-6 pairs; margin shallowly crenate, crenations 4-8 mm apart. Inflorescence an axillary pedunculate raceme. Flowers 3 cm with spur; peduncles few-flowered. Lateral sepals ovate-lanceolate, 4-5 × 2-3 mm, acuminate, small appendages on the margin, lower sepal bucciniform, 1-1.4 cm long and 0.8-1.7 cm deep, constricted into a 5-9 mm spur. Dorsal petal 0.8-1 cm long, cucullate; lateral united petals bilobed, upper petal of each pair ovate with one side extended; lower petal of each pair ligulate. Stamens 5; anthers united. Capsules linear, 0.4-2.2 cm, acute.

Fl. & Fr. : July - Sept. Darjeeling.

14. *Impatiens ganumiei* Hook. f. in Rec. Bot. Surv. India 4 : 16. 1905.

Herbs. leaves mostly on the upper half of stem, alternate, ovate to ovate-lanceolate or ovate-elliptic, with a strong midrib, 4.2-9 × 2.5-3.5 cm, base attenuate into the petiole, apex acuminate; lateral veins 4-10 pairs; margins deeply crenate, the crenations 4-6 mm apart. Flowers small, 4-6 mm, flesh-coloured. Peduncles 5-16 cm long with large number of pedicels; bracts lanceolate, 2-4 mm, with an appendage 1-2 mm long. Lateral sepals ovate, 2 mm long, long-acuminate; lower sepal navicular, spurred or spurless. Dorsal petal suborbicular, shallowly emarginate; lateral united petals 2-lobed, jointed by a narrow sinus, upper petal of each pair ovate; lower petal of each pair fusiform. Capsules linear, 0.3-2.3 cm long, acute.

Fl. & Fr. : July - Oct. Darjeeling.

15. *Impatiens graciliflora* Hook. f. in Rec., *l.c.* 15; Hara, *l.c.* 195. 1966

Herbs. Leaves with seriate glands on the lower margin of leaf base and downwards on stem; elliptic-lanceolate, 6-12 × 1.6-5 cm, pubescent on both surfaces, base attenuate into petiole, apex acuminate. Lateral veins 5-12 pairs; margin crenate, crenations 1-2 mm apart. Flowers reddish, small; pedicels whorled on the peduncle; bracts obovate, 3 mm long. Lateral sepals obliquely obovate, 3-4 mm long, with 1.5-2 mm long appendage; lower sepal shallowly navicular, 4-5 mm, abruptly constricted into a 2.5-3.8 cm long spur. Dorsal petal cucullate, 4-5 mm long, with appendage 1 mm long; lateral united petals 7-10 mm long; upper petal of each pair 3-4 mm; lower petal of each pair transversely semi-ovate, 4-6 mm long. Capsules 1.7-2 cm long, linear, acute.

Fl. & Fr. : Aug. Darjeeling.

16. *Impatiens jurpia* Buch.-Ham. ex Hook. f. & Thoms. in J. Linn. Soc. 4 : 140. 1860; Hook. f., *l.c.* 471 et in Rec., *l.c.* 14; Hara, *l.c.* 1 : 196. 1966 & 2 : 75. 1971.

Tall branched herbs. Stem stout, woody below, finely pubescent. Leaves alternate, ovate-elliptic to oblanceolate, pubescent on both surfaces, 5-25 × 2.5-8 cm, base attenuate, apex acuminate, lateral veins 6-12 pairs; margin shallowly crenate-serrate, with poorly developed filiform appendage; petioles red, 3-3.5 cm long. Inflorescence a large pedunculate axillary raceme. Flowers yellow, light-orange or white, lateral united petals with red line on the back, 3.5 cm long; bracts linear, 4 mm long, red. Lateral sepals 2, reddish, ovate-lanceolate, acuminate; lower sepal navicular, 2-3 cm long, suddenly constricted into a 1 cm long curved spur, with reddish spots. Dorsal petal sub-orbicular, 1.3-1.5 × 1.8-2 cm, dorsally spurred, 5 mm long, red; lateral united petals 3-3.5 cm long, yellowish; lower petal larger and upper with red streaks, appendaged between the lower and upper petal; upper petal ovate, 1.3 × 1.5 cm, entire; lower petal ovate-oblanceolate, 2 × 1.3 cm, entire. Capsules 1-3 cm long, linear, acute, glabrous.

Fl. & Fr. : June - Dec. Darjeeling.

17. *Impatiens longipes* Hook. f. & Thoms. in J. Linn. Soc. 4 : 151. 1860; Hook. f., *l.c.* 473. 1875, in *Rec. l.c.* 16.

Herbs. Leaves black on drying, broadly lanceolate to obovate, 3.3-13 × 1.2-3.5 cm, base attenuate into the petiole, apex acuminate; lateral veins 5-10 pairs; margin crenate. Flowers yellow, twisted in various ways, sometimes spur curled upwards; pedicels seriate on the peduncle; bracts caducous. Lateral sepals ovate, 3 mm long, long-acuminate; lower sepal bucciniform and gradually tapering into an incurved spur, 1.8 cm long. Dorsal petal orbicular; lateral united petals; upper petal of each pair ovate-triangular; lower petal of each pair long-narrow with twisted lobe. Capsules 0.7-2.5 cm long, linear.

Fl. & Fr. : July - Oct. Darjeeling.

18. *Impatiens puberula* DC. Prodr. 1 : 687. 1824; Hook. f., *l.c.* 470. & in *Rec. l.c.* 17; Hara, *l.c.* 1 : 196. 1966 & 2 : 75. 1971.

Herbs, stems finely pubescent or glabrous. Leaves oblong to elliptical or lanceolate, 6-13 × 2.3-4.7 cm, pubescent above, glaucous beneath, base shortly attenuate, petiole 0.5-4.5 cm long, apex acuminate; lateral veins 6-10 pairs; margin shallowly crenate to crenate-dentate. Flowers reddish-violet, 2.5-3.5 cm long. Bracts linear, 2 mm long. Pedicels axillary, 1-flowered. Lateral sepals ovate to lanceolate, 6-10 × 2.5-3 mm, acuminate; lower sepal 6-10 × 10-15 mm, pink-white, abruptly constricted into a 1.5-2.2 cm long, incurved filiform spur. Dorsal petal sub-orbicular to obovate, 1-1.8 × 1.2-2 cm; lateral united petals dark-purple, 1.5-2.5 cm long, upper petal of each pair elliptic-reniform; lower petal transversely semi-elliptic or obovate. Capsules linear, 4-5 mm long.

Fl. & Fr. : June - Oct. Darjeeling.

19. *Impatiens pulchra* Hook. f. & Thoms. in J. Linn. Soc. 4 : 139. 1860; Hook. f., *l.c.* 459. & in *Rec. l.c.* 12.

Branched herbs. Leaves dark green above, paler beneath, alternate, oblong to elliptic-lanceolate, 6.5-15 × 1.7-4 cm, base shortly attenuate, apex acuminate; margin shallowly crenate to crenate-dentate; petioles 1-3 cm long. Flowers 3-4

cm long, rose or straw-coloured, bracts lanceolate, 2-5 mm long. Lateral sepals 2, ovate, 6-10 × 4-7 mm, acuminate. Lower sepal bucciniform, 1-1.5 × 0.8-1.2 cm abruptly constricted into a filiform curved spur, 1.3-2.5 cm long. Dorsal petal suborbicular, 1.6 × 1 cm; lateral united petals 2-2.8 cm long, upper petal of each pair elliptic-oblong, 1.3 × 1 cm, lower petal of each pair narrowly oval, ca 19 × 11 mm. Capsules 1-1.3 cm, glabrous, turgid in the middle, narrowed at both ends.

Fl. & Fr. : Sept. - Nov. Darjeeling.

20. ***Impatiens racemosa*** DC. in Prodr. 1 : 688. 1824; Hook. f. & Thoms. in J. Linn. Soc. 4 : 147. 1860; Hook. f., *l.c.* 479 et in Rec. *l.c.* 6; Hara, *l.c.* 196.

Glabrous herbs. Leaves pale beneath, ovate-elliptic to elliptic-oblong or oblanceolate, 3.5-12 × 0.8-3 cm, sometimes smaller, base attenuate, apex acuminate; petiole 0.8-3.5 cm long; margin shallowly crenate or crenate-serrate, crenations with poorly developed filiform appendages. Flowers reddish, 16-25 mm long; bracts ovate, 3 mm long, with filiform appendage 2 mm long; pedicels alternate on the peduncle. Lateral sepals lanceolate, 3 × 1 mm, usually with 3 mm long, appendage, yellow; lower sepal shallowly navicular, with a short point, 2 × 5 mm, constricted into a curved spur, 11-16 mm long. Dorsal petal cucullate, 4-5 mm long, with an appendage, lateral united petals 7-10 mm long; upper petal of each pair ovate-triangular, 3-4 × 4-5 mm; lower petal of each pair, transversely semi-ovate to elliptic-ovate, 5-7 × 2-3 mm with a short apiculum. Capsules 0.5-1.8 cm, linear or clavate.

Fl. & Fr. : June - Oct. Darjeeling.

21. ***Impatiens radiata*** Hook. f., *l.c.* 476 & in Rec. *l.c.* 4; Hara, *l.c.* 1 : 196. 1966 et 2 : 75. 1971.

Glabrous herbs, 36-54 cm high, leaf-base deep red with stalked glands 1.5 mm long. Leaves with petiole 13-14 × 3-4 cm long; lamina ovate to elliptic-oblong, base attenuate, apex long acuminate; lateral veins 9-12 pairs; margin crenate, crenations with filiform red appendages. Flowers pale rosy, 1.3-1.7 cm long; peduncles 8.5-11 cm long, pedicels 2-5 in whorls; bracts 0.5-0.8 cm long, ovate with glandular tip. Lateral sepals ovate, 3 × 1 mm long, appendage 1 mm long, tip swollen, lateral sepal shallowly navicular, 3-5 mm long, abruptly constricted into a straight filiform spur, 6-12 mm long, rosy. Dorsal petal ovate, 4 × 3 mm; lateral united petals 9-12 mm long; upper petal of each pair ovate-triangular, 2-3 × 1.5-2 mm; lower petal of each pair narrow-ovate and slender above the middle, 6-9 × 3-4 mm, with an apiculum. Capsules 1.5 cm, glabrous.

Fl. & Fr. : Sept. - Nov. Darjeeling.

22. ***Impatiens scabrida*** DC. Prodr. 1 : 687. 1824; Hook. f., *l.c.* 472 et in Rec. *l.c.* 4; Hara, *l.c.* 1 : 196. 1866 et 2 : 75. 1971. *I. praetermissa* Hook. f. in J. Linn. Soc. 37 : 29. 1904 et in Rec. *l.c.* 18.

Branched herbs. Leaves pale green beneath, ovate-lanceolate to ovate-oblong, 5-17 × 2-8.5 cm, pubescent on both surfaces, base attenuate into petiole, apex subacute to acuminate; margin serrate to dentate, with filiform appendage.

Flowers pedunculate; peduncle pubescent, 3-4-flowered; bracts lanceolate, acuminate. Lateral sepal ovate, 7×4 mm, acuminate, pubescent; lower sepal navicular, 0.8-1 cm long, 0.8-1.4 cm deep, abruptly constricted into 1.3-3.3 cm long spur. Dorsal petal suborbicular, dorsally with a shallow crest ending in a short acute point; lateral united petals 2.2 cm long; upper broadly obovate, 1.2×0.8 cm; lower narrow-oblong, 1-1.2 cm long. Capsules linear, 1-1.6 cm (3.6 cm) long, acute.

Fl. & Fr. : Sept. - Oct. Darjeeling.

23. *Impatiens scitula* Hook. f. in Rec. Bot. Surv. India 4 : 14, 1905; L.K. Ghara, G.G. Maity & J.K. Sikdar in Bull. Bot. Surv. India 22 (1-4) : 191, 1980.

Succulent herbs, nodes swollen, glabrous. Leaves glaucous beneath, elliptic to ovate-lanceolate, $2-3 \times 1-1.5$ cm; margin crenate with bristles in the notches, apex acute; lateral veins 3-4 pairs with faint reticulations, petioles 2-9 mm long. Inflorescence a raceme. Flowers 3-3.5 cm long; bracts 1 or 2, ca 2×1.5 mm; peduncles both axillary and subterminal, 1-1.7 cm long, simple or 2-pedicelled; pedicels filiform, 0.8-1.5 cm long, bracteate. Lateral sepals outer ovate to ovate lanceolate, $4-5 \times 2-3$ mm, lower bucciniform, constricted into an incurved spur. Dorsal petal ovate, $5-8 \times 0.5$ mm, acute, base caudate; lateral united petals 2.5-3 cm long, upper pair elliptic ovate; lower pair unevenly bilobed, ligulate below. Filaments dilated, 4-5 mm long. Capsules linear, 1-1.7 cm long.

Fl. & Fr. : July-Sept. Darjeeling.

24. *Impatiens spirifer* Hook. f. & Thoms. in J. Linn. Soc. 4 : 135, 1860; Hook. f., *Lc.* 471 et in Rec. *Lc.* 17; Biswas, *Lc.* 208.

Glabrous herbs. Leaves alternate, ovate to elliptic-lanceolate, $3.2-15 \times 1.7-5.5$ cm, base rounded or attenuate into petiole, apex acuminate to long acuminate; lateral veins 4-8 pairs, network of secondary veins prominent; margin shallowly crenate, crenations 4-9 mm apart. Flowers yellow, solitary; pedicels 2-3.2 cm long, very slender. Lateral sepals ovate, $7-8 \times 6-7$ mm, usually with 3 mm appendage, slightly pubescent; lower sepal bucciniform, 2 cm long and 2.5 cm deep, abruptly constricted into a spirally coiled spur, 5 mm long, purple spotted. Dorsal petal cucullate, deeply emarginate to almost bifid 1.5×1.4 cm; lateral united petals 2.3-2.5 cm long, upper petal of each pair slightly smaller than the lower; upper petal ovate to narrowly obovate, $1.5-1.7 \times 0.8-0.9$ cm; lower petal of each pair widely oblong, $1.5-1.9 \times 1-1.2$ cm. Capsules 0.5-2 cm, elongate.

Fl. & Fr. : Sept. - Dec. Darjeeling.

25. *Impatiens stenantha* Hook. f., *Lc.* 478 et in Rec. *Lc.* 17; Hara, *Lc.* 1 : 197, 1966 et 2 : 75, 1971.

Glabrous herbs. Leaves drying black or reddish, glaucous beneath, lanceolate to elliptic-oblong, $2.5-15 \times 1.5-4.7$ cm, pubescent, base shortly attenuate, apex acuminate; lateral veins 6-12 pairs, margin crenate, crenations with filiform appendage. Flowers 1.5-2.5 cm; lateral sepals 4, narrowly ovate, acuminate, base incurved, $4-5 \times 2-2.5$ mm, other pair 3 mm long with appendage, lower

sepal shallowly and rather obliquely navicular, 0.7 - 1 cm long, abruptly constricted into a spur, 1.5 - 1.8 cm long, gradually tapering. Dorsal petal elliptic-oblongate, 6-8 × 4-5 mm, shallowly emarginate; lateral united petals 1.5 - 1.8 cm long; upper triangular 1.5 - 1.7 × 0.4 - 0.5 cm lower linear, 0.8-1 cm; acute. Capsules 1.2 - 2 cm linear.

Fl. & Fr. : Sept. - Nov. Darjeeling.

26. ***Impatiens sulcata*** Wall. in Roxb. Fl. Ind. (ed. Carey & Wall.) 2 : 458. 1824; Hook. f., *l.c.* 469 et in Rec. 4 : 5. 1904; Hara, *l.c.* 3 : 179. 1975. *I. gigantea* Edgew. in Trans. Linn. Soc. 20 : 38. 1846.

Annual herbs. Leaves pale beneath; stipules pulvinate; lamina elliptic-ovate to oblong or oblanceolate, 7-18 × 2-5.5 cm, finely pubescent on both sides, base attenuate into the petiole, apex acuminate; lateral veins 6-11 pairs; margin with shallow crenations 3-6 mm apart. Flowers axillary, 2.5 - 3.7 cm long, pink, purple or dark crimson; bracts broad, 6 × 3 mm, with an appendage 1 mm long; peduncles 4-15 cm long; pedicels slender, umbelled. Lateral sepals obliquely ovate, 6-8 × 3-4 mm, with an appendage 2 mm long; lower sepal bucciniform, 1.2 - 1.6 cm long, 1-1.5 cm deep, abruptly constricted into a short 5-8 mm long spur, spotted. Dorsal petal bilobed; lateral united petals 2.5 cm long with orange-streaks; upper broad, 1 × 0.8 cm, with an appendage; lower linear-oblong. Capsules up to 2.8 cm long, elongate, narrowly clavate.

Fl. & Fr. : June - Sept. Darjeeling.

27. ***Impatiens trilobata*** Colebr. in Hook. f., Exot. Fl. 2 : 141. 1825; Hook. f., *l.c.* 451 et in Rec. 4 : 13. 1905. *I. flavida* Hook. f. & Thoms. in J. Linn. Soc. 4 : 127. 1860; Hook. f., *l.c.* 452.

Tall herbs; nodes swollen. Leaves opposite or whorled with filiform stipules, petiolate, lanceolate-elliptical, 2.5 - 7.5 × 1.3 - 1.8 cm, pubescent, base attenuate, apex acuminate; lateral veins 4-8 pairs; margin shallowly serrate, with 2 mm filiform appendages at base. Flowers pink; peduncles 2-4.5 cm long; 3-5-flowered; bracts lanceolate, 3 mm long. Lateral sepals 5-6 × 2-3 mm, ovate-lanceolate; lower sepal 1.3 - 1.6 cm long, 1.7-1.9 cm deep, bucciniform with two appendages on the mouth, with network markings, abruptly constricted into 0.8 - 1 cm long spur, curved. Dorsal petal 1-1.2 × 0.6-0.8 cm, deep violet, emarginate, spurred, cucullate, lateral united petal 1.5-2 cm long; appendiculate, yellow; upper petal of each pair ovate-triangular, 7-8 × 4-6 mm, pale violet entire; lower petal broadly elliptic to kidney-shaped, 8-11 × 6-10 mm, violet. Capsules 1.2 - 1.7 cm, turgid in the middle, glabrous.

Fl. & Fr. : July - Oct. Darjeeling.

28. ***Impatiens tripetala*** Roxb. ex DC. Prodr. 1 : 687. 1824; Hook. f., *l.c.* 470 et in Rec. *l.c.* 4 : 13. 1905; Hara, *l.c.* 1 : 197. 1966 et 2 : 76. 1971.

Herbs with swollen nodes. Leaves opposite or whorled, petiolate, with filiform stipules, pale beneath or whitish, ovate-elliptic, 3.5 - 20 × 2-7.5 cm long, finely pubescent above; base shortly attenuate, apex acuminate; lateral veins 6-19 pairs; margin shallowly serrate, serrations 3-5 mm apart. Flowers often solitary, 2-2.5

cm long; peduncles short, 2-5 mm long; pedicels 1.3-2.3 cm long, slender. Lateral sepals linear-lanceolate, acuminate, 3 × 1 mm; lower sepal 12-15 mm long, with a beak, 10-12 mm deep, with 8 mm long, curved spur. Dorsal petal semicucullate; lateral united petals 16 mm long, with a short globular appendage inserted opposite the sinus of the upper and lower petal, almost equal in size; upper petal broadly oval, 8-10 × 5-6 mm; lower petal 11-13 × 7-8 mm with a slight notch in the inner margin. Capsules 1.5-2 cm long, turgid in the middle, acute.

Fl. & Fr. : Nov. - Dec. Darjeeling.

29. *Impatiens tuberculata* Hook. f. & Thoms. in J. Linn. Soc. 4 : 155. 1860; Hook. f., *l.c.* 478 et in Rec. Bot. Surv. India 4 : 16. 1905.

Herbs; stem succulent 60-90 cm. Leaves whorled at the ends of branches, elliptic-lanceolate or occasionally oblanceolate, 3.3-8.2 × 1-2.6 cm, the base gradually attenuate into 5-15 mm long petiole, apex acuminate; lateral veins 7-12 pairs; margin crenate to serrate, crenations 3 mm apart. Flowers purplish, 1 cm long. Lateral sepals ovate, 6 mm, curved, acuminate; lower sepal navicular, with a short spur and apendiculate. Dorsal petal orbicular with a shallow crest on the back. Lateral united petals with short projection opposite the sinus of the upper and lower petal; upper petal ovate; lower narrow-ovate, but narrowed just above the middle. Capsules dumb-bell-shaped, 0.4-1 cm long, obtuse.

Fl. & Fr. : Aug. - Sept. Darjeeling.

30. *Impatiens uncipetala* C. B. Clarke ex Hook. f. in Rec. Bot. Surv. India 4 : 18. 1905.

Herbs; stem thickened at nodes. Leaves petiolate, lamina ovate-lanceolate, whitish beneath, base slightly attenuate into 4 cm long petiole, apex acute to acuminate; margin crenate, with filiform appendage. Flowers 3-3.3 cm, with spur; peduncles subterminal, 2 or 3, each bifurcated. Lateral sepals ovate, 1 × 0.5 cm, acuminate; lower sepal navicular, green, 1-1.2 cm long, 1-1.3 cm deep, abruptly constricted into 2-2.8 cm long almost annular spur. Dorsal petal green, 1.5 × 0.9 cm, acuminate; lateral united petals pinkish with a short hooked appendage; upper petal of each pair triangular-ovate, lower ligulate. Capsules linear, acute, 1.7-5.4 cm long.

Fl. & Fr. : Aug. Darjeeling.

31. *Impatiens urticifolia* Wall. in Roxb. Fl. India (ed. Carey) 2 : 457. 1832; Hook. f., *l.c.* 474 et in Rec. *l.c.* 15; Hara, *l.c.* 3 : 79. 1975.

Herbs. Leaves mostly sessile, alternate, ovate-elliptic to elliptic-lanceolate, 8-23 × 3.2-4.8 cm, base attenuate, apex acute to long-acuminate; lateral veins 6-12 pairs; margin crenate to deeply crenate, crenations 3-7 mm apart. Flowers pink, pedunculate. Bracts lanceolate, 2 mm, persistent. Lateral sepals ovate, 4 mm, acuminate; lower sepal bucciniform, 1.3-1.5 cm long. Dorsal petal cucullate, 0.8-1 cm, with acute point; lateral united petals bilobed; upper petal of each pair ovate with a base extended on both sides; the lower lobe long ligulate. Capsules 0.6-3 cm long, linear, acute.

Fl. & Fr. : July - Nov. Darjeeling.

32. *Impatiens wallichii* Hook. f. in Rec. Bot. Surv. India 4 : 15. 1905; Hara, *L.c.* 3 : 1975.

Glabrous herbs. Leaves alternate, membranous, ovate-lanceolate, 3.2 - 8.7 × 1.8 - 2.8 cm, base slightly attenuate, apex long acuminate, finely pubescent along midrib and lateral veins; petioles 0.5 - 1.5 cm long; lateral veins 4-8 pairs; margin shallowly crenate, with filiform appendage. Flowers 3-4 cm with small spur; bracts ovate-lanceolate, 3-4.5 mm long; peduncles glabrous, 2-4 cm; pedicels glabrous, 1-1.3 cm. Lateral sepals ovate-lanceolate, 3-5 × 2.5-3 mm, glandular on one margin; lower sepal bucciniform with pointed end, 1.5 - 1.7 cm long, 2.3-2.5 cm deep, abruptly constricted into 4-5 mm long filiform spur. Dorsal petal caudate, closely nerved, acuminate; lateral united petals bilobed; lower petal ovate-oblong. Capsules linear, 0.5-1.5 cm long, acuminate.

Fl. & Fr. : Aug. - Oct. Darjeeling.

TROPAEOLACEAE (M.K. Manna)

A family of 2 genera and about 92 species distributed from Mexico to Temp. S. America; 1 genus and 1 species in West Bengal.

TROPAEOLUM L.

Succulent tuberous herbs with watery juice, climbing by sensitive petioles. Leaves alternate (rarely opposite) peltate. Flowers zygomorphic, solitary. Calyx 5-lobed, produced into a short or long spur below, lobes imbricate. Petals 5, the upper 2 often different from lower 3, clawed, inserted on calyx. Stamens 8; filament filiform; anthers basifixed. Ovary 3-lobed; style simple, 3-lobed.

Tropeolum majus L., Sp. Pl. 345. 1753; Bailey, Cyclop. Hort. 3369. 1917.

Branches climbing with sensitive leaf-stalks. Leaves peltate, orbicular, ca 6.5 cm across, with petiole up to 20 cm long, or more. Flowers with pedicels 20 cm long showing different shades of orange and yellow. Sepals connate at base, usually petaloid, posterior sepals produced below into a long pointed spur. Petals ca 3 cm long, oblanceolate to orbicular, entire or undulate, the anterior 3 smaller and usually clawed, ciliate at base, the posterior 2 perigynous and larger, attached to the base of spur. Stamens 8 in two rows of four, anthers 2-celled, 3 mm long, oblong, basifixed. Ovary 3-lobed, 3-loculed, each locule containing 1 pendulous ovule; style simple with 3 unequal linear stigmas.

Fl. : Dec. - Jan. Commonly cultivated as an ornamental.

OXALIDACEAE (L.K. Ghara)

A family of 3 genera and nearly 875 species, mostly in the tropics and subtropics throughout World; 2 genera and 7 species are reported from West Bengal.

1. Leaves with 4-20 pairs of sensitive leaflets, valves separating from axis of the capsule ...1. BIOPHYTUM
1. Leaves with only 3 non-sensitive leaflets; valves cohering with axis of the capsule ...2. OXALIS

1. BIOPHYTUM DC.

Herbs or undershrubs, stem simple or branched, sometimes red. Leaves paripinnate, terminal or whorled at the top of the stem, leaflets opposite, sensitive, 4-20 pairs; petioles swollen at the base. Flowers small, cymose, yellow or rarely purple; peduncle terminal; pedicels umbelled, bracteate. Sepals 5, persistent, lanceolate, acuminate. Petals 5. Stamens 10, in two rows, filaments free. Carpels 5, ovary superior; styles 5. Capsules small, valves dehiscing from axis.

A genus with about 70 species in Malaya Peninsula, China, Philippines; 2 species in West Bengal.

1. Pedicels long; sepals not exceeding the capsule; seeds spirally furrowed ...1. *B. reinwardtii*
1. Pedicels very small; sepals exceeding the capsule; seeds transversely ridged ...2. *B. sensitivum*

1. ***Biophytum reinwardtii*** (Zucc.) Walp., Rep. 1: 476, 1842; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 437, 1874; Prain, Bengal Pl. 1: 204, 1963 (repr. ed.). *Oxalis reinwardtii* Zucc. in Abh. Akad. Muench. 1: 274, 1829-30.

Herbs. Stem 4-20 cm, erect, glabrous. Leaves terminal, pinnate; petioles 1-4 cm long; leaflets 10-20 pairs, glabrous, 5-13 mm long, tip-rounded, midrib straight and prominent, lower side whitish. Flowers umbelled, yellow; peduncle slender, glabrous, 1-10 cm; pedicels long, more than one, bracteate, pubescent; bracts persistent, pubescent. Sepals persistent, lanceolate, 3 mm long. Capsules dehiscing into 5 valves, globose, shining. Seeds spirally furrowed.

Fl. : Dec. - July; *Fr.* : Aug. - Oct. Jalpaiguri.

Plants reported to be medicinal.

2. ***Biophytum sensitivum*** (L.) DC., Prodr. 1: 690, 1824; Edgew. and Hook. f. in Hook. f., l.c. 436, p.p. excl. syn. *Oxalis sensitiva* L., Sp. Pl. 1: 434, 1753; Prain, l.c. 204. "Lak-Chana" (H).

A small herb with a spreading crown of sensitive leaves. Stem 1-15 cm long, pubescent. Leaves 1.2-8 cm long in a terminal crown; petioles small, pubescent, 0.5-2 cm long; leaflets 4-15 pairs, vary variable, orbicular to obovate, 0.5-1.5 cm long, entire, upper leaflets unequal, nerves few. Flowers small; peduncles 2-10.5 cm; bracts persistent, pedicels very small. Sepals persistent, lanceolate, grooved, glandular, exceeding the capsule. Petals yellow. Capsules globose, shining, with few cells. Seeds with transverse ridges.

Fl. & Fr. : Aug. - Dec., Birbhum, Nadia, Purulia, 24-Parganas.

It is reported to be used for chest complains and also for stomach-ache.

2. OXALIS L.

Herbs. Root adventitious. Stem bulbous or sometime creeping. Leaves petioled, 3-foliolate, glabrous, non-sensitive. Flowers terminal, umbelled, bluish, violet, purple, pinkish-white or yellow. Sepals 5, persistent, imbricate. Petals 5, membranous. Stamens 10, in two rows; filaments free or united at the base. Ovary 5-celled; styles 5. Capsules elongate, valves cohering with axis. Seeds in rows.

A genus with about 800 species in Malaya Peninsula, Africa, Western Asia, Europe, America; 5 species in West Bengal.

1. Peduncles 1-flowered:
 2. Leaflets obovate ...1. *O. acetosella*
 2. Leaflets triangular ... 3. *O. griffithii*
1. Peduncles two-many flowered:
 3. Petals yellow ...2. *O. corniculata*
 3. Petals pinkish-white, whitish or violet:
 4. Leaflets distinctly triangular ...4. *O. latifolium*
 4. Leaflets obovate ...5. *O. martiana*

1. *Oxalis acetosella* L., Sp. Pl. 433. 1753; DC., Prodr. 1: 700. 1824; Edgew. & Hook. f. in Hook. f., *l.c.* 436; Calder in Rec. Bot. Surv. India 6: 326. 1919.

A small delicate stemless perennial herb, 5-15 cm high; rootstock creeping, scaly. Leaves radical, numerous, with 5-15 cm long petioles; leaflets broadly obovate; stipules large, broad and membranous. Flowers solitary, 1-1.8 cm in diam., on elongated slender peduncles; peduncles longer than petioles, axillary with two scaly opposite bracteoles above the middle. Sepals oblong or ovate, 4 × 2 mm. Petals short, clawed, cohering above, obovate, blunt, white on pale-rose veined with purple. Stamens 10, in two whorls, five longer, 7 mm long, others shorter, 4 mm long. Ovary cells 2-3; styles little longer than the stamens; stigma blunt.

Fl. : May - July. Darjeeling.

2. *Oxalis corniculata* L., Sp. Pl. 435. 1753; Edgew. & Hook. f. in Hook. f., *l.c.* 436, *p.p.* excl. syn. *O. repens* Thunb.; Prain, *l.c.* 203. "Amrulshak", "Chuka-tripati" (Beng.); "Amboti" (H.); "Indian Sorrel" (E).

Herbs. Stems creeping, rooting at nodes. Leaves long petioled; leaflets with white hairs on the margins and lower portion of the middle vein; petioles pubescent, 2-4 cm long. Flowers yellow, umbelled, long peduncled; peduncles pubescent, grey, 3-10 cm long; pedicels pubescent with linear bracts, 1.5 mm. Sepals persistent, imbricate, green, lanceolate, pubescent, 3-5 mm long. Petals yellow, 6 mm long. Stamens 10, one row 4 mm long other 3 mm long. Styles free, pubescent; ovary superior. Capsules oblong with 5 rows of seeds, 1-1.8 cm long. Seeds ovoid.

Fl. : May - June; *Fr.* : Dec. - May. Hooghly, Howrah, Malda, Midnapore, Purulia, 24-Parganas.

The leaves of plant are eaten both raw as a "Salad" and cooked as pot-herb. They are also used for making sandwiches, chutney and pickles. They are injurious if eaten in excess. The leaves of the plant are considered as "Cooling Refrigerant."

3. *Oxalis griffithii* Edgew. & Hook. f. in Hook. f., *l.c.* 436.

A small stemless perennial herb, 5-15 cm high with a creeping thickened rootstock bearing numerous fibrous roots and densely clothed with the persistent bases of the leaf stalks, densely hairy. Leaves radical with somewhat thickened hairy 5-12 cm long petioles; leaflets broadly triangular, hairy; stipules small. Flowers white, solitary, axillary on elongated hairy pedicels; peduncle 1-flowered; pedicels when fully developed as long as or longer than the petioles with hairy bracteoles above the middle. Sepals narrowly ovate to oblong, pubescent especially on the margins, 4 mm long. Petals 5, white, narrowly obovate, 1 cm long. Stamens 10, two rows, the longer 5 mm long, shorter two-thirds the length of the longer. Ovary obtusely five angled, glabrous; styles diverging, as long as the longer stamens.

Fl. : April - Aug. Darjeeling.

4. *Oxalis latifolia* Kunth in H.B.K. Nov. Gen. et Sp. 5: 237. t. 467, 1821; Hara, Fl. East Himal. 168. 1966. "Khatmitthi, Khatmanduri" (H.).

Herbs. Leaves from a bulbous stem; leaflets broadly and distinctly triangular, glabrous, membranous. Petioles glabrous, 9-21 cm long. Flowers terminal, umbelled. Peduncles glabrous, 11-24 cm long; pedicels bracteate, glabrous, 0.5 - 2 cm. Sepals persistent, gland dotted, hairy, imbricate. Petals 5, whitish-violet, obliquely obovate-cuneate, apex roundish. Stamens 10, alternately longer and shorter, filaments pubescent; anthers oblong. Style distinct, glabrous; stigmas 5, obtuse, ovules 4 in each cell.

Fl. : June - Nov. Jalpaiguri, Murshidabad.

The leaves and bulbs can be used as green manure as they contain sufficient quantity of nitrogen.

5. *Oxalis martiana* Zucc. in Denksch. Akad. Muench 9: 144. 1823 - 24. *O. corymbosa* DC., Prodr. 1. 696. 1824; Hara, Fl. East Himal. 168. 1966. "Tenga Se Tenga" (Assm.).

A perennial herb; bulbs globose. Leaves radical with long petioles, obovate, pubescent; petioles glabrous or pubescent, 8-22 cm long. Flowers umbelled, 1.5 cm in diam; peduncles pubescent, 10-22 (-30) cm long; pedicels small, bracteate. Sepals persistent, with gland at the tip, lower united, elliptic, pubescent. Petals pinkish-white, oblanceolate. Stamens 10, filaments pubescent.

Fl. : May - Feb. Calcutta, Coochbehar, Jalpaiguri.

The tubers are eaten and have a pleasant flavour.

AVERRHOACEAE

(M.K. Manna)

A small tropical family of 3 genera and 16 species found mainly in tropics of W. Malaysia, Madagascar, Burma and South America; only 1 genus with 2 species in West Bengal.

AVERRHOA L.

Trees. Leaves alternate, imparipinnate; leaflets sub-opposite. Flowers in panicles, axillary or directly on stem and branches. Flowers 5-merous, bisexual. Sepals 5, free. Petals 5, imbricate. Stamens 10, outer 5 short, inner 5 long; filaments shortly connate at base. Ovary 5-locular, with numerous ovules in each locale. Berries oblong with acute or obtuse ridges. Seeds arillate or ex-arillate.

1. Leaflets 5-17 pairs, pubescent beneath; panicles cauliferous; berries with obtuse-angled ridges; seeds ex-arillate ...1, *A. bilimbi*
1. Leaflets 4-5 pairs, glabrous and glaucous beneath; panicles axillary; berries with acute-angled ridges; seeds arillate ...2, *A. carambola*

1. ***Averrhoa bilimbi*** L., Sp. Pl. 428, 1753; Hook.f., Fl. Brit. India 1: 439, 1874; Prain, Bengal Pl. 1: 204, 1963 (repr. ed.).

Small trees, up to 6 m tall; younger branches and shoots hispid. Leaves with petioles up to 8 cm long; leaflets 11-17 pairs, subopposite, acuminate, entire, pubescent beneath. Panicles 6-10 cm, directly on branchlets. Sepals oblong, 5 mm long, subequal. Petals 15 mm long, united at base, purplish red. Stamens 10, 5 longer up to 1.5 cm long, 5 shorter 1 cm long. Ovary densely strigose; style slender, 2 mm long. Berries oblong, 3-5 cm long, obtuse, faintly 5-angled, light yellow at maturity.

Fl. : March - May. Widely cultivated.

The very sour fruits are used for pickles.

2. ***Averrhoa carambola*** L., Sp. Pl. 428, 1753; Hook.f., *l.c.* 439; Prain, *l.c.* 204. "Karmal" (H.) "Kamarak" (Beng.). Fig. 62

Trees, 4-5 m tall; branchlets hispid. Leaves 12-17 cm long; leaflets 4-5 pairs, subopposite, ovate or lanceolate, the terminal one largest, upper surface glabrous, lower sparsely pubescent, base oblique, acute, apex acuminate, margins entire; petioles 1.5-2 cm long. Flowers in axillary panicles. Sepals 5 mm long, oblong or ovate. Petals 8 mm long, dark purple. Stamens 10, alternating with 5 staminodes. Berries 5 × 2 cm, with 5 acute ridges, yellow when ripe.

Fl. : May - Aug. Cultivated in some of the districts.

Fruit eaten, fresh or pickled.

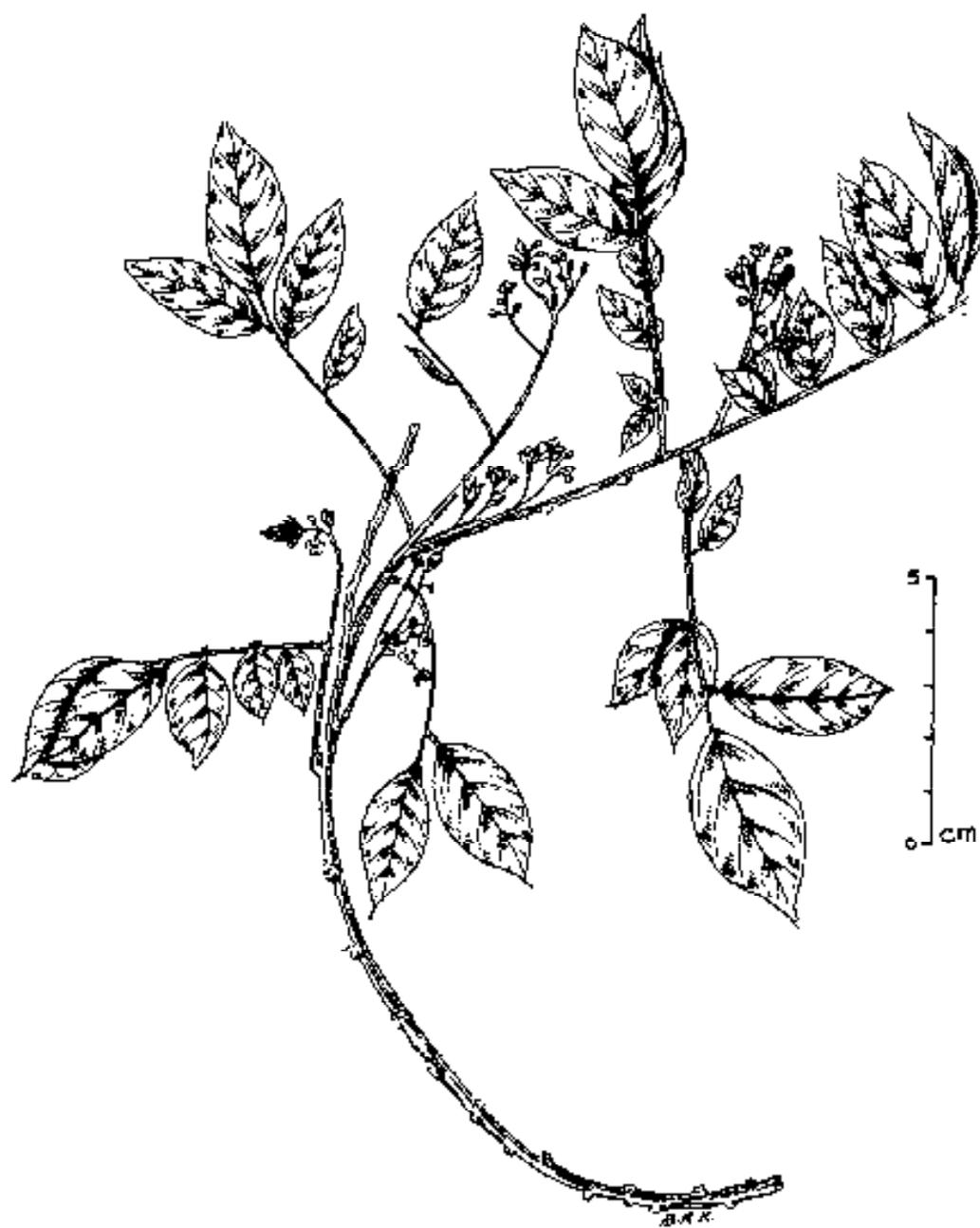


Fig. 62. *Averrhoa carambola* L.

RUTACEAE

(R.B. Ghosh)

A family of ca 150 genera and 900 species in tropical and temperate regions, abundant in S. Africa and Australia; 16 genera and 26 species are reported from West Bengal.

1. Flowers usually polygamous; ovary entire or lobed, sessile; ovules not more than 1-2 in each cell; styles simple or 4-5; fruits dehiscent or indehiscent; seeds albuminous:
 2. Ovary deeply lobed in male and female flowers; styles free; fruit capsular, dehiscent:
 3. Unarmed trees; leaves opposite ...6. ELYDIA
 3. Armed erect or scandent trees or shrubs; leaves alternate ...15. ZANTHOXYLUM
 2. Ovary entire in male and female flowers; styles united; fruit baccate or drupaceous, indehiscent:
 4. Prickly, & scandent shrubs; leaves alternate, 3-foliolate ... 14. TODDALIA
 4. Unarmed erect shrubs or small trees; leaves 1-foliolate or simple:
 5. Disc thick, 8-angled, tomentose; petals 4, stamens 8 ...1. AURONYCHIA
 5. Disc obovate; petals and stamens 4-5 each ...13. SKIMMIA
1. Flowers usually bisexual; ovary entire; ovules 1-2 or more in each cell; style simple; fruit baccate, indehiscent, rarely capsular and then ovary stipitate; seeds exalbuminous:
 6. Ovules 1-2 in each cell; fruit indehiscent:
 7. Plants unarmed:
 8. Leaves 1-foliolate to imparipinnate; leaflets not oblique; styles persistent ...7. GLYCOSMIS
 8. Leaves imparipinnate; leaflets oblique; style deciduous:
 9. Petals imbricate; cotyledons plano-convex:
 10. Filaments dilated below; anthers large; stamens 8-10 ...5. CLAUSENA
 10. Filaments not dilated below; anthers small; stamens 10 ...11. MURRAYA
 9. Petals valvate; cotyledons crumpled; stamens 10 ...10. MICROMELUM
 7. Plants mostly armed:
 11. Leaves 3-foliolate ...9. LIVINGIA

11. Leaves 1-foliolate:
12. Bushy trees; calyx broadly 1-5 lobed; filaments 8-10 .12. PARAMIGNYA
12. Climbing shrubs; calyx irregularly split with crose scarious margins; filaments 8, rarely 5-7 .13. ATALANTIA
6. Ovules 4-8 or many in each cell; fruit indchiscent or dehiscent:
13. Unarmed herbs; ovary pedicelled; leaves 2-3 pinnate; stamens 6-8 .. 4. BOENNINGHAUSENIA
13. Usually armed shrubs or trees; ovary sessile; leaves imparipinnate or 1-3 foliolate; stamens 10:
14. Leaves 1-3-foliolate; stamens 20-60; ovary many-celled; placentation axile:
15. Leaves 1-foliolate; disc large, cupular or annular; fruit pericarp leathery . CITRUS
15. Leaves 3-foliolate; disc inconspicuous; fruit pericarp woody ?. ANGLE
14. Leaves imparipinnate; stamens 10-12; ovary 5-6-ultimately 1-celled; placentation parietal ..8. LIMONIA

1. ACRONYCHIA J.R. & G. Forst.

Trees or large shrubs with opposite or alternate 1-foliolate entire leaves. Flowers in peduncled corymbs. polygamous. Calyx 4-lobed, lobes imbricate. Petals 4, spreading and revolute, valvate. Stamens 8, inserted under a thick 8-angled tomentose disc; filaments subulate, alternate ones longer. Ovary tomentose, 3-5-celled; style terminal, stigma 4-grooved; ovules 2, superposed. Fruit a 5-celled drupe. Seeds often extended from the carpels, testa black, albumen copious, embryo straight.

A genus of ca 17 species in tropical Asia, China, Japan, Australia and Polynesia; 1 species in West Bengal.

Acronychia pedunculata (L.) Miq., Fl. Ind. Bot. Suppl. 532. 1861. *Jambolifera pedunculata* L., Sp. Pl. 349. 1753. *Acronychia laurifolia* Blume, Cat. Grew. Buiten. 63. 1823; Hook.f., Fl. Brit. India 1: 498. 1875; Prain, Bengal Pl. 1: 207. 1963 (Repr.ed.).

Small trees. Leaflets elliptic-oblong, obtuse or mostly acuminate, glabrous. Flowers white, fragrant, in axillary corymbs. Petals linear, bearded at base. Fruit a 4-celled drupe, subglobose apiculate.

Fl. & Fr. : April - Nov. Jalpaiguri, 24-Parganas (Sunderbans).

Leaves yield an aromatic essential oil. Bark and roots are used in external application for sores and ulcers. Roots also used as fish poison.

2. AEGLE Corr.

Trees with 1 or more axillary thorns. Leaves alternate, 3-foliolate; leaflets subcrenulate, crenate or nearly entire. Flowers rather large, white or greenish white, in axillary panicles. Petals 4-5, spreading, imbricate. Stamens numerous, inserted round a inconspicuous disc; anthers long; filaments subulate. Ovary ovoid with broad axis, cells 8-20, style short; stigma deciduous; ovules many, 2-seriate in each cells. Fruit a large globose or ovoid berry, several celled, many-seeded, rind woody.

A genus of 2 species in E. & S.E. Asia and W. Africa; 1 species in West Bengal, wild and cultivated.

Aegle marmelos (L.) Corr. in Trans. Linn. Soc. Lond. 5: 223. 1800; Hook.f., *l.c.* 516; Prain, *l.c.* 212. *Crataeva marmelos* L., Sp. Pl. 444. 1753. "Bel" (H. & Beng.).

Deciduous medium-sized tree; spines 2-3 cm long. Leaflets ovate, rounded at base, glabrous or grey-pubescent. Flowers 5-merous; sweet-scented. Petals greenish-white. Ovary glabrous. Berry yellowish-brown, pulp thick, sweet, orange-coloured.

Fl. & Fr. : April-July. Common everywhere in the plains, wild and also planted.

Fruits are used in diarrhoea and dysentery. The fresh Juice is used in feverish condition. Leaves are sacred to Lord Shiva and used in rituals. Pulp is used to prepare a fresh drink.

3. ATALANTIA Corr.

Thorny or unarmed shrubs or trees with alternate 1-foliolate entire or crenulate leaves. Flowers fascicled or in short axillary racemes or panicles. Calyx 3-5-lobed or -partite. Petals 3-5, free or adnate to the stamens. Stamens 6-8, rarely more, sometimes united into a tube inserted around an annular or cupular disc; anthers short, ovate-oblong or base cordate. Ovary 2- or 4-, rarely 3- or 5-celled; style deciduous; ovules 1 or 2. Fruit a berry, subglobose, seeds oblong.

A genus of ca 13 species in Indo-Malayan region; 1 species in West Bengal.

Atalantia missionis (Wt.) Oliver in Journ. Linn. Soc. 5 (Suppl. 2): 25. 1861; Hook.f., *l.c.* 513. *Limonia missionis* Wt. *l.c.* 175. 1840.

A small thorny glabrous tree. Leaflets oblong-obovate or elliptic, nerves obscure, dull greyish-brown when dry. Flowers 3-5-merous, in racemes. Stamens 8 or 10; filaments quite distinct, dilated below only; anthers linear-oblong. Ovary 4-5-celled, narrowed below; ovules 2 in each cell. Fruit globose; seeds oblong.

Fl. & Fr. : Dec. - May. Burdwan.

Sometimes planted as hedge.

4. BOENNINGHAUSENIA Reichb. ex Meissn.

Perennial branched herbs. Leaves alternate, 2-3-pinnate. Flowers in compound terminal leafy paniced cymes, white. Calyx 4-5-lobed, persistent. Petals 4-5, obovate-oblong. Stamens 6-8, inserted at the base of an urceolate disc. Filaments filiform; the alternate shorter; anthers oblong. Ovary long stipitate, 3-5-lobed; each lobe 1-celled; styles 3-5, connate; stigma simple; ovules 6-8 in each cell. Fruit of 6-8 free membranous ventrally dehiscent few-seeded carpels.

Monotypic genus distributed in E. India to Japan.

Boenninghausenia albiflora (Hook.) Reichb. ex Meissner, Pl. Vasc. Gen. 2: 44. 1836; Hook.f., *l.c.* 486, p.p. *Ruta albiflora* Hook., Exot. Fl. t. t. 79. 1823.

An erect slender perennial herb. Leaflets obovate or orbiculate, glaucous below, terminal one largest, petioled. Flowers white numerous in a terminal leafy paniced cymes. Sepals very small. Petals much longer than calyx, oblong, obtuse. Pedicel variable in length. Fruits up to 1 cm in diam.

Fl. & Fr. : May - Nov. Darjeeling, 3500 - 4000 m.

5. CLAUSENA Burm. f.

Unarmed shrubs or trees. Leaves imparipinnate; leaflets alternate, usually crenate. Flowers small, in terminal or axillary cymes, panicles or racemes. Calyx 4-5-lobed. Petals 4-5, free, membranous, imbricate. Stamens 8-10, inserted around an elongated disc; filaments dilated below the tip, alternate ones shorter. Ovary 4-5-celled; style thick, articulate, deciduous; stigma entire or lobed. Fruit an oblong or globose 2-5 celled berry; pericarp glandular.

A genus with ca 30 species distributed in Tropical Asia, few in Africa and Australia; 3 species in West Bengal.

1. Inflorescence lateral; leaves 5-13-foliolate; leaflets 2-5 cm long ...1. *C. dentata*
1. Inflorescence terminal; leaves often more foliolate; leaflets usually larger:
 2. Leaves 3-7-foliolate; leaflets 13-23 cm long ...3. *C. pentaphylla*
 2. Leaves 15-30-foliolate; leaflets 5-9 cm long ...2. *C. excavata*

1. **Clausena dentata** (Willd.) Roem., Syn. Hesper. 1: 44. 1846. *Anyris dentata* Willd., Sp. Pl. 2: 337. 1799. *Clausena willdenovii* Wt. & Arn. Prodr. 96.1834; Hook.f., *l.c.* 506, 1834.

Large shrubs. Leaflets membranous, obliquely ovate-oblong or ovate-lanceolate, acute, crenulate. Flowers fragrant, in slender compound racemes. Sepals ovate, acute, ciliate. Petals white, ovate, concave. Ovary stipitate, 4-angled or grooved, 4-celled, ovules 2 in each cell, superposed; style stout; stigma 4-lobed. Berry ovoid, smooth, greenish white.

Fl. & Fr. : March - July. Darjeeling, Jalpaiguri.

Fruits are edible.

2. *Clausena excavata* Burm. f., Fl. Ind. 87. t. 29. f. 2. 1768; Hook. f., *l.c.* 504; Prain, *l.c.* 208; Kanai in Fl. East. Himal. 3 : 75. 1975. "Agnijal" (H. & Or.).

Undershrubs or small trees, young parts grey tomentose, strongly scented. Leaflets ovate to oblong or lanceolate, oblique at base, crenulate, acuminate, with large marginal glands; rachis very hairy. Flowers 4-merous, in panicles, with alternate branching. Sepals hairy. Petals 4, glabrous. Ovary villous, stipitate. Berry oblong or obovoid, 2 cm long.

Fl. & Fr. : April - Aug. Darjeeling, Jalpaiguri.

Used for indigestion and as a diuretic. Fruits are edible.

3. *Clausena pentaphylla* DC., Prodr. 1 : 538. 1824; Hook. f., *l.c.* 503. "Ratanjot" (H.).

A deciduous shrub, young parts silky-tomentose. Leaflets ovate or lanceolate, acuminate, aromatic, base obliquely cuneate. Flowers 4-merous, 6 mm across, yellowish, in erect terminal panicles. Sepals triangular, acute. Petals oblong, concave, obtuse. Berry ca 1 cm diam., pale orange, papillose.

Fl. & Fr. : May - Sept. Lower hills of Darjeeling, Jalpaiguri.

A much-valued Indian veterinary medicine. Bark is powdered and applied with sweet oil to flesh wounds.

6. EUODIA J.R. & G. Forst. (*Evodia*, sphalm.)

Unarmed trees or shrubs. Leaves opposite, simple, 1-3-foliolate or imparipinnate; leaflets entire. Flowers small, 1-sexual, in axillary paniced cymes. Sepals 4-5, imbricate. Petals 4-5, valvate. Stamens 4-5, inserted at the base of the 4-5-lobed disc, in female represented by staminodes. Ovary 4-celled, deeply 4-lobed; ovules 2 in each cell; style basilar; stigma 4-lobed. Fruit of 4 coriaceous 3-valved, 1-seeded cocci; endocarp horny, separable, 2-lobed. Seeds oblong.

A genus with 45 species distributed in Tropical Africa, Asia, the Pacific Australia; 3 species in West Bengal.

1. Leaflets 3 ...2. *E. lunuankenda*

1. Leaflets 6-10:

2. Leaf-rachis puberulous; leaflets 8-13 × 2-5 cm; flowers 4-6 mm across; seeds globose ...1. *E. glaberifolia*

2. Leaf-rachis glabrous; leaflets 9-23 × 3-8 cm; flowers 10-15 mm across; seeds somewhat compressed ...3. *E. trichotoma*

1. *Euodia glaberifolia* (Champ.) Balakr., Fl. Jowai 1 : 115. 1981. *Boymia glaberifolia* Champ. in Hook., J. B. t. Kew Miscell. 3. 330. 1851. *E. meliaefolia* Benth., Fl. Hongk. 58. 1861; Hook. f., *l.c.* 490. "Ankijhora" (Or).

Tall trees up to 25 m high. Leaflets 9-15, opposite, lanceolate, ovate or oblong-lanceolate, acuminate, unequal-sided quite entire, thinly chartaceous, glabrous, glaucous beneath. Flowers very small, greenish-white, generally

5-merous, in umbellate pubescent cymes arranged in terminal and axillary 3-chotomous panicles. Sepals minute, obtuse. Petals hairy within. Capsules globose, 7-8 mm, of 5, 2-valved, 1-seeded cocci seeds black, globose, shining.

Fl. & Fr. : April - Sept. Darjeeling, Jalpaiguri.

2. ***Euodia lunuankenda*** (Gaertn.) Merr. in Philippine J. Sci. 7: 378. 1912. *Fagara lunuankenda* Gaertn., Fruct. 1: 334, t. 68, f. 9. 1788. *E. roxburghiana* (Champ.) Benth. Fl. Hongk. 59. 1861; Hook. f., *l.c.* 487. *Zanthoxylum roxburghianum* Champ. in Linnæa 5: 58. 1830.

Trees up to 15 m, bark corky, greyish. Leaflets elliptic ovate to oblong-lanceolate, base cuneate to acute, membranous, glabrous; petioles 5-15 cm; petiolules 2-3 mm. Flowers generally 4-merous, white, bracteate. Cymes dense, pubescent, in axillary or terminal 3-chotomous panicles. Calyx small, lobes rounded with ciliate margins. Corolla whitish, lobes ovate-oblong. Male flowers with 4 stamens; filaments glabrous. Female flowers with 4 staminodes and pubescent ovary; style short, stigma obsolete 4-lobed. Capsule of 4, 2-valved cells, globose. Seeds black, shining.

Fl. & Fr. : Aug. - April. Darjeeling, Jalpaiguri.

The juice of leaves is used in fever. Leaves used as condiment.

3. ***Euodia trichotoma*** (Lour.) Planch. in Pierre, Fl. Cochinch. t. 287. 1893. *Tetradium trichotomum* Lour. Fl. Cochinch. 91. 1790. *E. fraxinifolia* (D. Don) Hook. f., *l.c.* 490. *Rhus fraxinifolius* D. Don *l.c.* 24.

Small to moderate sized tree; bark brown or light grey to ashy grey. Leaves 20-26 cm long, rachis slightly ridged; leaflets usually 9-11, lanceolate or oblong-lanceolate, finely acuminate, base usually oblique, usually crenulate, glabrous or puberulous; petiolules 2-4 mm branched, axillary. Cymes or terminal panicles shorter than leaves puberulous. Bracts minute pedicels short. Flowers greenish white; shortly pedicelled. Sepals small, petals pubescent within, much longer. Male flowers with rudimentary carpels, female with glabrous ovary. Capsules red, with 4-cocci. Seeds rather compressed, dark-brown.

Fl. & Fr. : May - Sept. Darjeeling, Jalpaiguri.

Fruit is edible. Cultivated for fodder. Wood is used for making posts and tea-boxes.

7. GLYCOSMIS Corr.

Shrubs or rarely trees. Leaves 1-foliolate or imparipinnate; leaflets alternate. Inflorescence a panicle, usually axillary, rarely terminal. Flowers small 4-5-merous. Sepals 4-5, imbricate. Petals 4-5, imbricate. Stamens 8-10 free, inserted round the disc, anthers with a dorsal or apical gland. Ovary 2-5-celled; style short; stigma capitate; ovules solitary and pendulous in each locules. Fruit a dry or fleshy berry, globular or ellipsoid, 1-3-seeded.

A genus of ca 60 species in Indo-Malayan region; 1 species in West Bengal.

Glycosmis pentaphylla (Retz.) DC., Prodr. 1 : 538. 1824; Hook. f., l.c. 499. p.p.; Prain, l.c. 208. *Limonia pentaphylla* Retz., Obs. Bot. 5 : 24. 1789. "Ashhoura (Beng.)"; "Ban-Nimbu" (H.).

A shrub with variable 1-5-foliolate leaves and usually elliptic-oblong, obovate or lanceolate, entire or obscurely-toothed leaflets. Flowers small, white in axillary or terminal panicles. Berry depressed, globose, 1-seeded.

Fl. & Fr. : March - Sept. Throughout the plains of West Bengal.

Plant is used in cough, rheumatism, anaemia and jaundice; leaf-juice is used in fever, liver-complaints and as vermifuge.

8. LIMONIA L.

Shrubs or small trees, often armed with spines. Leaves alternate, 3-foliolate or imparipinnate; leaflets usually opposite. Flowers in fascicles, racemes or panicles. Sepals 4-5-lobed or partite. Petals 4-5, imbricate. Stamens 8-10, free, subequal; filaments subulate; anthers cordate or linear-oblong. Ovary oblong 4-5-celled; style short, thick, articulate; stigma capitate; ovule 1-2 in each cell. Fruit a globose 1-4-celled berry. Seeds 1-4, ovoid or flattened, embedded in mucilage.

A genus of ca 4 species in Tropical Asia; 1 species in West Bengal.

Limonia acidissima L., Sp. Pl. ed. 2. 554. 1762; *non* Prain. *Feronia elephantum* Correa, Trans. Linn. Soc. 5: 224. 1800; Hook. f., l.c. 516; Prain, l.c. 212. "Kath-Bel" (Beng.). Fig. 63

A small to medium sized deciduous tree with straight stout sharp spines; bark brown-grey. Leaves 3-7-foliolate, sweet smelling; petioles and rachis often winged. Flowers pale-greenish red male and female often in same panicles. Fruit large, globose, 5 cm across; rind woody, greyish.

Fl. & Fr. : March - June. Cultivated throughout the plains of West Bengal.

Pulp is edible; an ornamental and a medicinal plant.

9. LUVUNGA Buch.-Ham.

Armed climbing shrubs. Leaves digitately trifoliolate; leaflets petiolate, entire, coriaceous. Inflorescence of axillary fascicled racemes or panicles. Calyx cupular, entire or obscurely lobed. Stamens 8-10; filament free or connate below. Ovary 2-4 locular; style stout, deciduous; stigma capitate. Berry with thick rind, large, ellipsoid, 2-3 seeded. Seeds large, ovoid.

A genus of ca 12 species in Trop. Asia; 1 species in West Bengal plains.

Luvunga scandens (Roxb.) Buch. -Ham. ex Wight in Wt. & Arn. Prodr. 90. 1834; Hook. f., l.c. 509; Prain, l.c. 210 *Limonia scandens* Roxb. Fl. Ind. 2 : 380. 1832. "Lavangalata" (Beng.).

A large scandent evergreen shrub. Leaves alternate, leaflets 10- 25 × 2.5-6 cm, oblong-lanceolate, entire. Flowers white, fragrant, in axillary branched racemes. Petals 4-5, fleshy, recurved. Staminal filaments glabrous. Disc fleshy, annular.

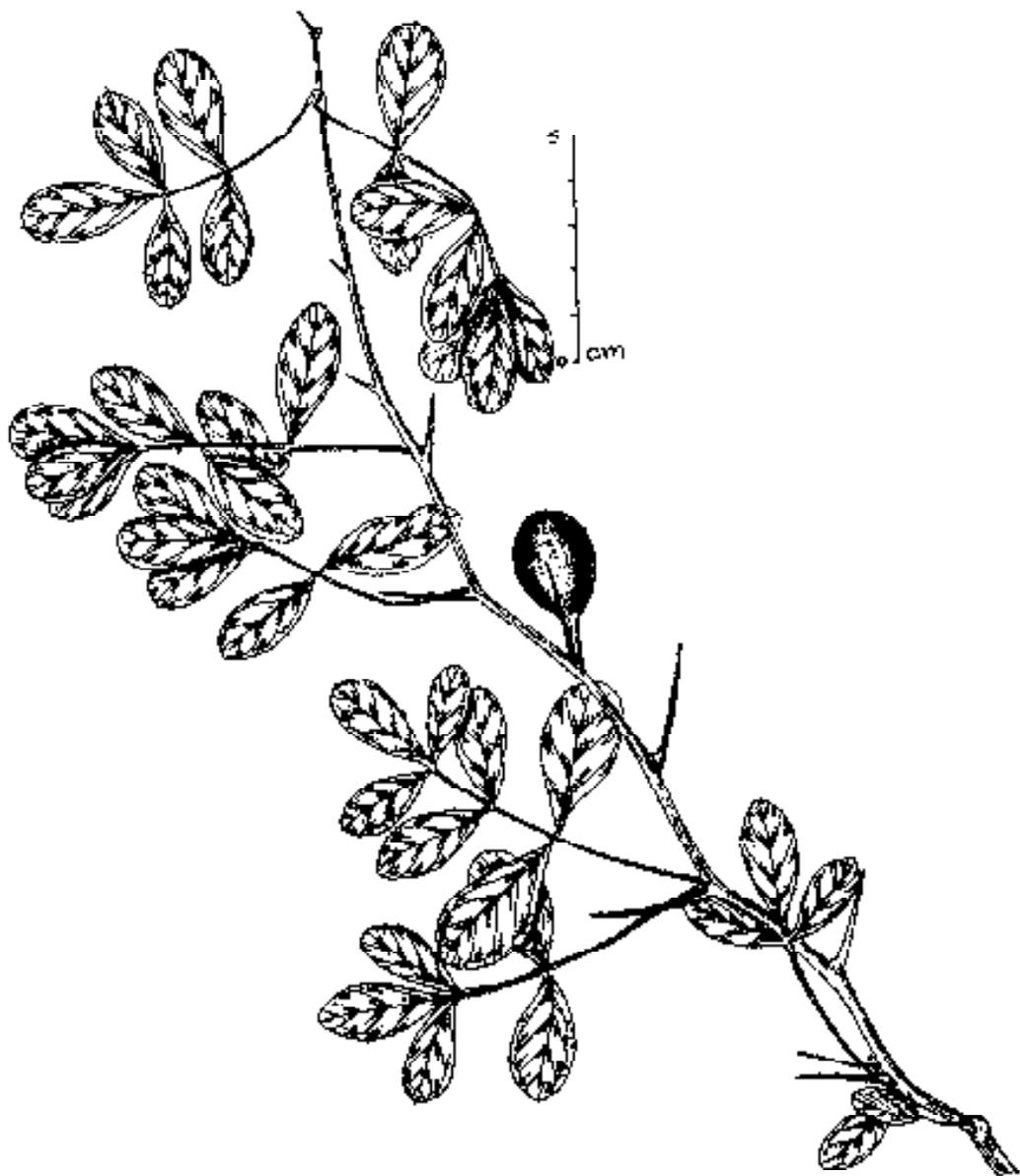


Fig. 63. *Limonia accidissima* L.

Ovary 3-celled, with 2 superposed axile ovules in each cell. Berry oblong, ca 2 cm long, obscurely 3-lobed, pulp odoriferous.

Fl. : March; *Fr.* : June. 24-Parganas (Sunderbans).

Planted as an ornamental for its flowers. Fruit under the name Kakala or Sungandhkokila is used in perfumery and pharmaceutical preparations.

10. MICROMELUM Blume

Small unarmed trees. Leaves imparipinnate, with alternate oblique leaflets. Flowers in large terminal panicles. Calyx cupular, 3-5-toothed on lobed. Petals 4-5, free. Stamens 10, inserted round a short or long disc. Style constricted at base, deciduous. Ovary 5-, rarely 2-6-celled; ovules 2, superposed in each cell. Fruit a small dry berry.

A genus of ca 10 species in Indo-Malayan and Pacific; 1 species in West Bengal.

Micromelum integerrimum (Roxb.) Roem. in Fam. Nat. Reg. Veg. 1: 47. 1846. *Bergera integerrima* Roxb., Fl. Ind. 2: 376. 1832. *M. pubescence* Hook. f., l.c. 501 p.p. non Blume, (1825); Prain, l.c. 209. "Ban-Kunch" (Beng.).

Small evergreen trees. Leaflets 7-15, ovate-lanceolate, obscurely crenulate. Flowers dull white, strongly scented in terminal corymbose-cymes. Petals 5, pubescent. Ovary shortly stipitate, hairy; style articulate stigma capitate. Fruit an ellipsoid berry, 8-12 mm, orange-yellow.

Fl. & Fr. : Jan. Sept. Coochbehar, Darjeeling, Purulia, 24-Parganas (Sunderbans).

Used medicinally for T.B. and chest troubles.

11 MURRAYA Koen, ex L.

Unarmed shrubs or small trees. Leaves pinnate; leaflets alternate. Flowers solitary, axillary or in terminal corymbs or axillary cymes. Calyx 5-lobed. Petals 5, free, imbricate. Stamens 10, inserted outside the elongated disc, alternate shorter; filaments linear-subulate; anthers small. Ovary seated on the disc, 2-5-celled; style elongate, deciduous; stigma capitate; ovule solitary or 2-superposed in each cell. Fruit a 1-2-celled berry, oblong or ovoid, rugose. Seeds with woolly testa.

A genus of ca 12 species in East Asia, Indo-Malaya, Pacific; 2 species recorded from West Bengal.

1. Leaflets 9-25, dull green; flowers small to 1 cm in diameter; berries black ... 1. *M. koenigii*
1. Leaflets 3-9, glossy green; flowers 2 cm or more in diameter; berries red ... 2. *M. paniculata*

1. **Murraya koenigii** (L.) Spreng., Syst. Veg. 2: 315. 1826; Hook.f., *L.c.* 503; Prain, *L.c.* 209. *Bergera koenigii* L., Mant. Pl. 68. 1767. "Barsanga" "Karipata" (Beng.); "Mithaneem". "Gandhela", "Kadhi-neem" (H.).

A large, deciduous strong-scented shrub or a small tree; bark grey. Leaflets pale green, usually ovate-lanceolate, oblique, entire or obscurely crenulate. Flowers white, numerous in terminal corymbose panicles. Petals oblong, much longer than calyx. Ovary 2-celled, usually 1 ovule in each cell. Berry 8 mm long, ovoid, black.

Fl. & Fr. : April - Sept. Plains of all the districts, wild and cultivated.

Leaves extensively used as flavouring agent in curries and chutneys.

2. **Murraya paniculata** (L.) Jack in Malayan Misc. 1(5): 31. 1820. *Chalcas paniculata* L., Mant. Pl. 1 : 68. 1767. *M. exotica* L. Mant. Pl. Alt. 563. 1771 ("Murræa"); Hook.f., *L.c.* 502; Prain, *L.c.* 209 "Kamini" (Beng.).

A handsome evergreen small tree or shrub. Leaflets obovate to rhomboid, shining, dark green. Flowers white, fragrant, in few flowered corymbs. Berries 10-20 mm long, red or deep orange. Seeds 1-2.

Fl. & Fr. : April - July. Planted as an ornamental and a hedge plant almost throughout the State, often self-sown.

12. PARAMIGNYA Wight

Erect or climbing shrubs, often with axillary thorns. Leaves 1- foliolate, entire. Flowers rather large, axillary, solitary or fascicled. Calyx cupular or small, 4-5-lobed. Petals 4-5, free. Stamens 8-10, inserted round a columnar disc; filaments free; anthers linear-oblong. Ovary 3-5-celled; style elongate, deciduous; ovules 1 or 2 in each cell, obliquely superposed. Berry ovoid or subglobose, 1-5-seeded.

A genus with 20 species distributed in Indo-Malayan region: 1 species in West Bengal.

Paramignya monophylla Wt., *Illus.* 1: 109, t. 42. 1840; Hook. f., *L.c.* 510.

A large climbing thorny shrub, spines recurved. Leaflets 5-9 cm long, coriaceous, elliptic or elliptic-lanceolate, acuminate. Sepals pubescent, 5-lobed. Petals white, oblong, imbricate. Stamens 10, free; filaments hairy inside. Berry ovoid, yellow, 2.5 cm long.

Fl. & Fr. : April - Aug. Darjeeling.

13. SKIMMIA Thunb.

Strong scented unarmed gregarious evergreen shrubs. Leaves alternate, simple, quite entire. Flowers polygamous, crowded in terminal panicles, white or greenish-yellow. Disc obsolete. Stamens 4-5, alternating with petals, imperfect in female flowers. Ovary 2-5-celled; style stout; stigma capitate, 2-5-lobed. Fruit a fleshy drupe; ovoid or ellipsoid, red, with 2-5- cartilaginous 1-seeded stones.

About 8 species in Himalays, E. Asia, Philippines Islands; 2 species in West Bengal.

1. Sub-scandent shrubs; flowers light yellow ... 1. *S. arborescens*

1. Erect shrubs; flowers bright yellow ... 2. *S. laureola*

1. *Skimmia arborescens* T. Anders. ex Gamble in J. Linn. Soc. Bot. 43: 491, 1916; Gamble in Kew Bull. 1917: 302, 1917; Hara in J. Jap. Bot. 40: 98, 1965. *S. wallichii* Hook. f. & Shorns ex Gamble, l.c. 492, 1916. "Timburnyck" (Lepcha).

A strongly aromatic sub-scandent shrub, 0.9-2.4 m in height. Leaves aromatic, 7.5-15 × 2-3.8 cm, acute, elliptic-lanceolate or obovate, thick, coriaceous. Flowers ca 3.8 cm in diam., yellowish white, in terminal panicles. Sepals 5, ovate, ciliate. Petals 5, subequal, oblanceolate, 6 mm long. Stamens 5, equal in length. Drupe ovoid, 1-1.5 cm long, fleshy, bright scarlet or deep red, 1-3-seeded.

Fl. & Fr. : April - July. Darjeeling.

Leaves are often eaten in insane cases and also eaten in curries by hill-tribes. Also used as ornamental plant. Wood is used for preparing shoes and axe handles.

2. *Skimmia laureola* (DC.) Sieb. & Zucc. ex Walp. Repert. 5: 405, 1842; Hook. f. in Fl. Brit. India 1: 499, 1875. *Limonia laureola* DC. Prodr. 1: 536, 1824. "Jainberiphal" (Nep.).

An aromatic evergreen shrub. Leaves crowded, oblanceolate, lanceolate or oblong-lanceolate, acuminate, softly coriaceous. Flowers white or greenish-yellow, polygamous. Bracts persistent, sub-orbicular or ovate or obovate, obtuse. Sepals 5, persistent, ovate or sub-orbicular, obtuse. Petals 5, oblong, much longer than calyx. Disc obsolete. Stamens 5, filaments subulate. Ovary ovoid, 2-celled, ovule 1 in each cell. Drupe sub-globose, red, fleshy.

Fl. & Fr. : May - Sept. Darjeeling; 3500 m.

14. TODDALIA Juss.

Erect or climbing shrubs, usually armed with recurved prickles. Leaves digitately trifoliolate, coriaceous, leaflets sessile. Inflorescence a cyme or a panicle. Flowers pedicelled, abortively unisexual, 2-5-merous. Sepals small. Petals imbricate or valvate. Stamens 4-5; pistilloide present in male flowers. Staminodes in pistillate flowers 4-5; ovary usually shortly stalked oblong or globose, 2-7 locular; style short or 0; stigma capitate. Fruit fleshy or coriaceous. Seeds reniform or angular.

A genus of ca 8 species in Tropical Asia, Africa and Australia; 1 species in West Bengal.

Toddalia asiatica (L.) Lamk., Illus. 2: 116, 1793. *Paullinia asiatica* L., Sp. Pl. 365, 1753. *Toddalia aculeata* Pers., Syn. Pl. 1: 249, 1805, Hook. f., l.c. 497; Prain, l.c. 207. "Kadatodali" (Beng.).

A prickly rambling tomentose shrub. Leaves digitately trifoliolate; leaflets sessile, elliptic, obovate, crenulate, acute. Cymes axillary. Flowers small, cream-coloured. Ovary 5-celled with 2 ovules in each. Berry 5-grooved.

Fl. & Fr. : April - Oct. Midnapore.

The whole plant is pungently smelling. The root yields a yellow dye, and the ripe pungent berries are pickled.

15. ZANTHOXYLUM L.
(*Xanthoxylum* J.F. Gmel.)

Shrubs or trees, often stragglers or climbers. Leaves trifoliolate or pinnate; leaflets usually crenulate, gland-dotted. Cymes axillary or terminal, paniced. Flowers bisexual or often unisexual. Sepals and petals 3-5. Stamens reduced in female flowers. Ovary 1-5-celled, pistillode present in male flowers. Fruit a follicle or a capsule.

Pantropical, about 30 species in E. Asia; 6 species in West Bengal.

1. Leaflets 3 ... 4. *Z. ovalifolium*
1. Leaflets 4 or more :
 2. Leaves paripinnate :
 3. Rachis winged; petals absent :
 4. Leaflets glabrous; cymes in lax panicles ... 2. *Z. armatum*
 4. Leaflets puberulous; cymes dense, almost in clusters ... 1. *Z. acanthopodium*
 3. Rachis not winged; petals present :
 5. Trees; leaflets more than 6 cm long; seeds about 7 mm long, spines upcurved or straight ... 6. *Z. rhetza*
 5. Climbers or stragglers; leaflets less than 5 cm long; seeds less than 5 mm long, spines recurved ... 5. *Z. oxyphyllum*
 2. Leaves imparipinnate ... 3. *Z. nitidum*

1. *Zanthoxylum acanthopodium* DC., Prodr. 1 : 727. 1824; Hook. f., *l.c.* 493; Brandis, Ind. Trees 117. 1906. "Tambul" (Beng.).

Straggling shrubs or small trees; bark dark brown or reddish brown; spines straight. Leaves up to 10 cm long; leaflets usually 5-9 cm, elliptic-lanceolate to ovate, 3-9 × 1.2-2.5 cm, acute or acuminate, cuncate, serrulate. Inflorescence in dense axillary cymes. Flowers purplish. Calyx lobes linear. Fruit capsule. Seeds black.

Fl. & Fr. : April - Oct. Darjeeling, Jalpaiguri, 1500-2000 m.

Aromatic seeds used as sudorific and febrifuge.

2. **Zanthoxylum armatum** DC., Prodr. 1 : 727. 1824; Hara, Fl. East. Himal. 171. 1966. *Z. alatum* Roxb., Fl. Ind. 3 : 768. 1832; Hook. f., l.c. 493. "Gaira" (Beng.); "Darman" (H.).

Small trees up to 8 m high. Stems corky; bark greyish brown; spines straight. Leaves up to 20 cm long; leaflets 3-9 × 1-2 cm, oblong-lanceolate, ovate to elliptic-lanceolate, acuminate, obscurely serrulate. Inflorescence in pyramidal panicles, pubescent, axillary. Flowers greenish-yellow. Sepals 6-8, linear. Carpels 1-2, rarely 3, reddish. Seeds black.

Fl. & Fr. : April - May. Darjeeling, Jalpaiguri, 1500-2000 m.

Seeds are anthelmintic, astringent, carminative. Bark is applied in fever, dyspepsia and cholera. It is also used as remedy for tooth-ache.

3. **Zanthoxylum nitidum** (Roxb.) DC., Prodr. 1 : 727. 1824. *Fagara nitida* Roxb., Fl. Ind. 1 : 439. 1820. *Z. hamiltonianum* Wall. ex Hook. f. in Hook. f., Fl. Brit. India 1 : 494. 1875. "Tezamal" (Assm.).

A large evergreen scandent shrub with recurved prickles. Leaves imparipinnate; leaflets 5-7, opposite, ovate, oblong or elliptic, abruptly or gradually narrowed into a broad emarginate apex, rounded or sub-acute at base, scarcely oblique, chartaceous. Flowers dull-white, shortly stalked in slender puberulous axillary fasciated cyme-bearing panicles. Calyx lobes minute, triangular-ovate. Petals 4-5, ovate. Filaments slender. Carpels 2-4, obliquely set, globose. Seeds pitted, very glossy.

Fl. & Fr. : May-Oct. Darjeeling, Jalpaiguri, 1500-2000 m.

The fruit is used for its aromatic and stimulant properties. It is also used for poisoning fish.

4. **Zanthoxylum ovalifolium** Wt., Ill. Ind. Bot. 1 : 169. 1839; Hook. f., l.c. 492.

Small trees or shrubs; bark grey or brownish-grey, prickly. Leaflets 3-18 × 1.5-7 cm, lanceolate, elliptic, oblanceolate or obovate, acuminate, obtuse, emarginate, obscurely crenate. Flowers yellowish-white. Carpels red, solitary. Seeds black.

Fl. & Fr. : May-Nov. Darjeeling, Jalpaiguri, 1500-2000 m.

Wood is used as light timber.

5. **Zanthoxylum oxyphyllum** Edgew. in Trans. Linn. Soc. 20 : 42. 1846; Hook. f., l.c. 494; Hara, l.c. 170. "Timmi" (N.).

Scrambling shrubs; bark grey, prickles hooked. Leaves up to 35 cm long; leaflets 29-33, 2-4 × 1-2 cm, ovate-lanceolate, ovate-oblong, oblong-elliptic, acuminate, cuneate, minutely crenulate. Flowers in axillary panicles, yellowish white. Carpels 2-4, tubercled. Seeds globose.

Fl. & Fr. : April - Oct. Darjeeling, Jalpaiguri, 1500-2300 m.

Bark is considered as stimulant, stomachic and digestive.

6. *Zanthoxylum rhetza* (Roxb.) DC., Prodr. 1 : 728, 1824; *Fagara rhetza* Roxb., Fl. Ind. 1 : 438, 1820. *Zanthoxylum budrunga* (Roxb.) DC., Prodr. 1 : 728, 1824; Hook. f., Lc. 495; Prain, Lc. 207. "Bazinali" (Beng.); "Badrang" (H.).

Evergreen trees up to 15 m in height, studded with prickles on bark. Leaves imparipinnate; leaflets 15-20, opposite, oblong-lanceolate, very oblique, caudate-acuminate, distantly crenulate. Flowers minute, greenish-white, in 3-ctotomous cymes, arranged in crowded panicles. Calyx lobes minute, triangular. Petals 4. Fruits globose, 2-valved. Seeds solitary, globose, bluish-black.

Fl. & Fr. : May - Sept. Foothills of Darjeeling, 500 m.

The fruits cure asthma and bronchities. It is astringent, stimulant and digestive. Rootstock is reputed as purgative.

CULTIVATED SPECIES

Citrus aurantifolia (Christm) Swingle - "Kaghzi-nimbu" "Nimbu"

C. limettoides Tanaka - "Meetha-nimbu".

C. limon (L.) Burm. f. - "Jameri-nimbu", "Lemon".

C. maxima (Burm.) Merr. - "Batavi-nimbu"

C. medica L. - "Nimbu", "Khatta-nimbu", "Citron".

Clausena lansium (Lour.) Skeels - "Ampitch", "Wangpi"

Ravenia spectabilis Engl.

Triphasia trifoliata (L.) DC. "Chini-narangi".

SIMAROUBACEAE

(K.C. Malick)

About 30 genera and 200 species in tropics and subtropics of the world; 3 genera with 3 species in West Bengal.

1. Lofty trees; sepals and petals 5; Fruits winged, 2-6 cm long ... 1. AILANTHUS
1. Shrubs or small trees; sepals and petals 4 or 5; fruits not winged, up to 1.2 cm long :
 2. Margins of leaves finely wavy or entire; flowers in panicles; styles connate at base; sepals and petals persistent in fruits ... 3. PICRASMA
 2. Margins of leaves coarsely serrate or entire; flowers in compound cymes; styles free; sepals and petals not persistent in fruits ... 2. BRUCEA

1. AILANTHUS Desf.

Lofty trees. Leaves alternate, long-petioled, crowded at the ends of the branches, pari- or impari-pinnate; leaflets alternate or sub-opposite. Flowers

usually unisexual or functionally unisexual, in dense axillary and terminal panicles. Male flowers foetid during anthesis. Sepals 5, connate. Petals 5, induplicate. Disc flat, thick, 10-lobed. In male flowers stamens 10, obdiplostemonous, inserted at the base of the disc; filaments subulate. In female, staminodes or stamens absent. Carpels 2-5, free; styles free or connate; stigma peltate; in male rudimentary or absent; ovule 1. Fruits laterally compressed samaras, linear-oblong. Seed one in the middle.

About 5 species in the tropics or subtropics; 1 species in West Bengal.

Ailanthus excelsa Roxb., Pl. Coron. 1 : 24, t. 23, 1795; Bennett in Hook. f. Fl. Brit. India 1, 518, 1875; Prain, Bengal Pl. 1 : 214, 1963 (reprinted); Basak, Fl. India Fasc. 4 : 4, 1980.

Lofty trees with large leaf scars. Leaves 20-30 cm long; petioles long, tomentose; leaflets 8-14 pairs, 8-16 × 4-7 cm, alternate or sub-opposite, variable in shape, tomentose when young, coarsely toothed at margins, unequal at base, acute or acuminate at apex; petiolules *ca* 1 cm long with two hairy glands near base. Flowers in much-branched lax panicles. Pedicels 0.4-1 cm long. Sepals *ca* 2 × 1 mm, triangular. Petals 3-4 × 2 mm, ovate-lanceolate, glabrous, reflexed. Filaments short. Ovary sparsely hairy; stigma curling. Samaras 4-6 × 1-1.5 cm, linear-oblong to lanceolate, reticulate above the seed, twisted at base.

Fl.: Sept. - May; *Fr.* : July. Usually planted. Burdwan, Hooghly and Purulia.

The timber is used for packing cases, boats, toys and other articles. An inferior type of gum called 'Hog-gum' is available from the tree. Bark is used as a febrifuge and tonic.

2. BRUCEA J. F. Miller

Shrubs or small trees, containing bitter substances. Leaves large, imparipinnate; leaflets 2 to 17 pairs and the terminal one, slightly oblique at base, entire or coarsely toothed, acuminate. Flowers very small, uni- or bi-sexual, very numerous in long axillary cymose panicles. Calyx minute, 4 partite. Petals 4, free, disc cupular. Stamens 4, inserted beneath the disc, rudimentary or absent in female one; filaments short, anthers cordate-ovate. Ovary deeply 4-lobed or consisting of entirely free 4 carpels; styles free or coherent at base, recurved outwards over the ovary; stigma thickened or club-shaped. Fruits of 1-4 dried nuts, free, ovoid, somewhat fleshy. Seed solitary.

About 6 species in the tropics of the old world; 1 species in West Bengal.

Brucea mollis Wall. ex Kurz in J. Asiat. Soc. Bengal 42 : 64, 1873; Bennett, in Hook. f., *l.c.* 521; Basak, *l.c.* 9.

Small shrubs; branches with close set of lenticels; younger parts tomentose. Leaves alternate, 15-40 cm long, rachis pubescent; leaflets opposite, 6-10 × 2-6 cm, ovate-oblong, oblong-lanceolate or oblong, pubescent on both surfaces, rarely glabrous, margins undulate or entire, apex acute or acuminate, base unequal, rounded or cuneate; petiolules 2-10 mm long, pubescent. Flowers in axillary pubescent paniculate cymes, 10-28 cm long. Sepal *ca* 1 mm long. Petals

1-2 mm long, linear. Stamens about 1 mm long; anthers very small. Carpels 4, glabrous; styles linear. Drupes 1-2, sometimes 3-4, ovoid, 8-10 × 4-8 mm, acute.

Fl. : Nov. - May; *Fr.* : Jan. - June. Darjeeling, 300 m.

3. PICRASMA Bl.

Trees or shrubs with bitter substances; branches glabrous. Leaves large, imparipinnate; leaflets opposite or sub-opposite. Flowers small, unisexual or both unisexual and bisexual, in axillary pedunculate corymbose compound cymes. Sepals 4-5. Petals 4-5, accrescent in fruits. Stamens 4-5, inserted at the narrow base of the disc; anthers emarginate. Disc entire or lobed, pubescent, sometimes accrescent in fruits. Carpels 3-4; styles connate at the midrib; stigma simple. Fruits sub-globose, drupaceous.

About 8 species in the tropics; 1 species in West Bengal.

Picrasma javanica Bl. Bijdr. 5 : 248. 1825; Bennett in Hook.f., *l.c.* 520. Basak, *l.c.* 3. *P. nepalensis* J.J. Bennett, Pl. Jav. Rar. 201. 1844; Bennett in Hook.f. *l.c.* 520. *P. andamanica* Kurz ex Bennett, in Hook.f., *l.c.* 520. *P. javanica* var. *nishnitiensis* Bennett in Hook.f., *l.c.* 520.

Trees. Leaves 8-25 cm long, imparipinnate; leaflets 2-3 pairs and one terminal one, 5-12 × 2.5-3.8 cm, oblong, glabrous, finely wavy or entire, abruptly acuminate, cuneate at base; petiolules 1-5 mm long. Flowers in axillary paniculate cymes, pedicels 1 cm long, villous, elongating in fruits. Sepals 4, ca 1.5 mm long ovate. Petals 4, in male 2-3 × 1-1.5 mm; in female 3-6 × 2-3 mm, ovate-oblong or oblong. Disc 4-lobed, hairy. Stamens 4, 2-5 mm long. Ovary ca 2 mm long; styles ca 2 mm long. Drupes 1-4, oval to subglobose, 1-2.2 × 0.7-1 cm, on cushion like disc.

Fl. : Jan. - May; *Fr.* : March - Oct. Jalpaiguri.

BALANITACEAE

(S.K. Das Das)

A family of only one genus and nearly 25 species in Africa and Asia; 1 species in West Bengal.

BALANITES Delile

Spiny shrubs or trees. Leaves alternate, exstipulate, bifoliolate; leaflets coriaceous, entire. Inflorescence cymose, axillary. Flowers small, green, bisexual. Sepals 5, free, imbricate, deciduous. Petals 5, oblong, imbricate. Disc thick, conical, 10-grooved below, hollowed at apex. Stamens 10, inserted in the grooves at base of the disc; filaments filiform; anthers dorsifixed. Ovary entire, globose, semi-immersed in the disc, 5-celled or 1-celled by suppression; ovule 1 in each cell; style short; stigma minute. Fruit a fleshy oily 5-angled 1-celled, 1-seeded drupe. Seed pendulous, exalbuminous.

Balanites aegyptiaca (L.) Delile, Fl. Egypte 77 & 221. t. 28, f.1. 1813; Nair in Rec. Bot. Surv. Ind. 21(1) : 54. 1978. *Kimonia aegyptiaca* L., Sp. Pl. 1194. 1753. *B. roxburghii* Planch. in Ann. Sc. Nat. (Ser. 4) 2 : 258. 1854; Bennett in Hook. f., Fl. Brit. India 1 : 522-23. 1875; Prain, Bengal Pl. 1 : 214. 1963 (repr. ed.). *B. aegyptiaca* var. *roxburghii* (Planch.) Duthie, Fl. Upper Gang. Plain (repr.ed.) 1 : 136. 1960. "Hingan" (Beng.); "Hingue" (H.).

Shrubs or small trees, up to 6 m high; spines axillary, straight, strong, very sharp, 1-3.5 cm long. Leaflets elliptic or obovate, 2-4 × 1-2 cm, base usually cuneate, apex acute or obtuse, or sometimes slightly mucronate; petioles 3-4 mm long; petiolules up to 4 mm long. Flowers 4-12, in cymes; pedicels 0.5-1.5 cm long. Sepals ovate, pubescent outside, silky villous within, 3 mm long. Petals oblong-obovate, glabrous outside, silky villous within, 4-5 mm long. Stamens 2.5-3 mm long; filaments 1.5-2 mm long, glabrous. Ovaries about 2 mm across; styles about 1 mm long. Fruits woody, ovoid, 3-5 cm long.

Fl. : March - April. Fr. : Oct. - Dec. Howrah.

The plant is prescribed in the treatment of snake bite. Pulp of the fruit is edible and is used for cleaning silk and cotton. The leaves, bark, fruits and seeds are used as anthelmintic and purgative. Wood is used for walking sticks and as fuel.

OCHNACEAE

(B. Safui)

A family of about 40 genera and 600 species, mainly distributed in the tropics; only 1 genus with 2 species in West Bengal.

OCHNA L.

Trees, shrubs or under shrubs. Leaves alternate, simple, serrate or crenate, shining, chartaceous or sub-coriaceous, acute or obtuse, stipulate, nerves curved upwards. Flowers in thyrses, cymes, panicles or umbels, or compound, hermaphrodite, pedunculate; bracts caducous; pedicels jointed. Sepals 5, imbricate, persistent, pale green, reddish in fruit. Petals 5-10, yellow in 1-2 whorls, deciduous. Disc hemispherical turning red in fruits. Stamens many in 2 or more whorls; filaments subterete; anthers opening with two apical pores, deciduous. Ovaries 3-10-lobed, ovules solitary in each lobe; styles connate or sometimes free at apex. Fruits of 3-10 drupes. Seeds albuminous.

A genus of about 85 species in the tropics of S. Africa, C. America, S. and S.E. Asia; 2 species in West Bengal.

1. Shrubs or small tree; inflorescence many-flowered; peduncles 0.5-4 cm long ... 1. *O. obtusata*
1. Undershrubs; inflorescence 2-3-flowered; peduncles 3-10 cm long ... 2. *O. pumila*

1. *Ochna obtusata* DC., Ann. Mus. Paris 17 : 411. pt. II. 1811; Kanis in Blumea 16 : 32. 1968. *O. squarrosa* (non L.) Rottb.; Bennett in Hook. f., Fl. Brit. India 1 : 523. 1875, excl. syn. *O. lucida* Griff.; Prain, Bengal Pl. 1 : 215. 1963 (repr. ed.); Benth., Trees of, Calcutta 97. 1933.

Leaves 5-16 × 3-7 cm. very variable in shape, elliptic, ovate, oblong, lanceolate or mixed; base mostly acute, sometimes rounded or obtuse; petioles up to 5 mm long, stipules 3-7 mm long. Inflorescence a many-flowered cyme, umbellate or in thyrses. Sepals 10-20 × 5-10 mm, ovate or ovate-oblong. Petals 15-25 × 7-15 mm, obovate, margins thin or papery. Stamens 30-75 in 3-4 rows. Ovaries 5-10; style twisted, 8-12 mm, elongating to 18 mm in fruits. Drupes 3-5.

Fl. : March - June; Fr. : April - Aug.

Bankura, Howrah, N. Bengal.

Root used as antidote in snake-bite; the decoction of root is given in periodical disorders and also for asthma.

2. *Ochna pumila* Buch. Ham. ex DC. Prodr. 1 : 736. 1824; Bennett, in Hook. f., l.c. 524; Prain, l.c. 215. *O. obtusata* var. *pumila* (Buch. Ham. ex DC.) Kanis, l.c. 34. "Makha" (Beng.).

Undershrubs, branching from the base. Leaves oblong, obovate or obovate-oblong, subcoriaceous, acute at base, margins denticulate or serrate; stipules 6-15 mm. Flowers in cymes; bracts linear-lanceolate, ca 12 mm; pedicels 1-4 cm. Sepals 1.2-2 × 0.5-1.2 cm. Petals 2-3 × 1-1.5 cm. Stamens 75-110; anthers 3-4 mm. Ovaries lobed; style ca 9 mm, twisted; stigma lobed or branched. Fruits turning red to black on ripening.

Fl. : March - June; Fr. : April - Aug.

Darjeeling, Midnapur, N. Bengal, Purulia.

Roots pounded and infusion used as medicine by tribals.

BURSERACEAE

(Ratna Dutta)

A family of 18 genera and nearly 600 species mainly in the tropics of the world; 4 genera and 5 species are reported from West Bengal.

1. Drupes trigonous, dehiscent; pyrenes separating ... 1. BOSWELLIA
1. Drupes globose or ovoid, indehiscent; pyrenes not separating :
 2. Calyx 3-lobed; drupes ellipsoid with 3 pyrenes, each 1-2 seeded ... 3. CANAQUIM
 2. Calyx 4-5-lobed; drupes globose with 1-5 pyrenes, each 1-seeded:
 3. Leaves up to 7-foliolate; calyx small, cupular; disc annular ... 2. BURSERIA
 3. Leaves up to 11-foliolate, calyx campanulate, 10-ribbed; disc lining the calyx-tube ... 4. GARUGA

1. BOSWELLIA Roxb.

Trees with balsaminous juice and papery bark. Leaves alternate, exstipulate, deciduous; leaflets opposite. Flowers 5-merous, hermaphrodite, in axillary racemes or false terminal panicles. Sepals 5, persistent, saucer-shaped. Petals 5, persistent, narrowed below. Stamens 10, alternately longer and shorter, inserted at the base of the disc. Ovary 3-locular with short style; stigma 3-lobed, ovules 2 in each locule. Fruit a trigonous drupe containing 3 separating 1-seeded pyrenes, falling from persistent trigonous axis. Seeds flattened, pendulous.

A genus with about 24 species in tropical Africa, Madagascar, tropical Asia; 1 species in West Bengal.

Boswellia serrata Roxb. ex Colebr. in *Asiat. Res.* 9 : 379. t. 5. 1807; Bennett in Hook. f., *Fl. Brit. India* 1 : 528. 1875; Prain, *Bengal Pl.* 1 : 216. 1963 (repr. ed.). "Salcyā", "Salhc" (Beng.).

Deciduous trees, 3-4 m tall. Rachis 30 cm long, terete and pubescent; leaflets 8-10 (12) pairs, sessile, 3-6 × 1-2 cm, ovate or obliquely oblong, obtuse. Flowers shortly pedicelled, 6-8 mm long, pubescent throughout. Sepals 1-2 mm long, petals 4-5 mm long. Stamens 2-3 mm long, anthers oblong, minutely pubescent along the margin. Ovary globose, nearly 1 mm long; style 2.5 mm long, stout. Fruit oblong, obtuse, 2.5 × 1.5 cm. Seeds flattened.

Fl. : March - May; *Fr.* : April - Aug. Burdwan, Purulia.

A branch hung up in the cattle-shed is said to keep away flies etc. The resin or gum is used in incense and in medicine.

2. BURSERA Jacq. ex L.

Large evergreen trees. Leaves alternate, exstipulate, deciduous. Flowers 5-merous, hermaphrodite, numerous in much-branched axillary panicles shorter than leaves. Sepals 5, lobes rounded. Petals 5, valvate in bud. Stamens 10, in two rows, inserted at the base of the annular disc. Ovary subglobose, 3-locular, ovules 2 in each cell; style short, stigma 3-lobed. Fruit a drupe, on thick peduncles, indehiscent.

A genus with about 80 species in tropical America; 1 species in West Bengal.

Bursera serrata Wall. ex Colebr. in *Trans. Linn. Soc.* 15 : 361. t. 4. 1827; Bennett in Hook. f., *l.c.* 530; Prain, *l.c.* 217. "Chitrika" (Beng.).

Trees up to 13 m tall; bark grey or greyish-brown, exfoliating. Rachis 10-25 cm long, terete, pubescent; leaflets 3-4 pairs or more, opposite, petiolate, 10-17 × 5-7 cm, oblong-elliptic, bluntly acuminate. Flowers white, 2-3 mm long, pubescent throughout. Sepals free, 1 × 1-2 mm. Petals recurved, 2 × 1 mm. Stamens 10, with short and long filaments, anthers globose. Ovary ca 1 mm long, densely pubescent, 3-5 locular, ovules 1-2 in each locule; styles short; stigma 3-5-lobed. Drupes ovoid or subglobose, 1-2 cm across, 2-3-furrowed, bright pink, 1-3-seeded. Seeds globose.

Fl. : March - April; *Fr.* : May - Sept. Midnapore, Purulia.

It is a valuable timber tree. Fruits edible.

3. CANARIUM L.

Resiniferous trees. Leaflets opposite or subopposite, sessile or subsessile. Flowers in terminal or axillary panicles. Sepals 3, persistent. Petals 3-5. Disk annular. Stamens twice as many as petals, filaments united at base. Ovary 2-3-celled, ovules 2 in each cell. Drupes ellipsoid, with 3 pyrenes, each 1-2-seeded.

A genus with about 100 species, chiefly in Indo-Malayan region; 1 species recorded from West Bengal.

Canarium strictum Roxb., Fl. Ind. 3 : 138. 1832; Bennett, in Hook. f., *l.c.* 534; Leenhout in Blumea 4 : 414. 1959. *C. resiniferum* Brace ex Jing in Asiat. Soc. Beng. 62(2) : 157. t. 13. 1893. *C. sikkimense* King in J. Asiat. Soc. Bengal 62(2) : 187. 1894. "Goguldhup" (Beng.).

Trees about 40 in height, buttressed at base; bark greyish or blackish-brown, exfoliating. Rachis 30-60 cm long; leaflets 5-13 pairs, 10-16 × 4-7 cm, oblong-lanceolate or oblanceolate, glabrous and shining above, pubescent beneath. Flowers 1-1.5 cm long, brownish yellow. Calyx cup-shaped, 2-3 mm long, lobes rounded. Petals oblong, 2-3 times as long as the calyx. Drupes 3-4 cm long.

Fl. & Fr. : July - March. Darjeeling, lower hills.

The gum is used for incense and 'Dhuna' of commerce. Though the wood is not so good but it is extensively used for tea-chests.

4. GARUGA Roxb.

Deciduous trees. Leaves crowded at the end of branches. Flowers in much-branched panicles, 5-merous, polygamous. Calyx 5-lobed, campanulate. Petals 5, inserted on the mouth of the calyx tube. Stamens 10, nearly equal, lower half of the filament adnate to the disc and upper half free, pubescent at base. Ovary 5-locular; style as long as the petals, pubescent; stigma 5-lobed. Drupes globose.

A genus with about 4 species from Himalayas to S. China, S. E. Asia and N.E. Australia; 2 species in West Bengal.

1. Panicles crowded, short-peduncled; calyx tube long, deciduous; drupes large, more than 1 cm in diam. ... 2. *G. pinnata*
1. Panicles slender, few, long-peduncled; calyx tube short, persistent, drupes small, less than 1 cm in diam. ... 1. *G. gamblei*

1. *Garuga gamblei* King ex Smith in Rec. Bot. Surv. India 4 : 262. 1911. *G. floribunda* Decn. (Nouv. Ann. Mus. Paris 3 : 477. 1834) var. *gamblei* (King ex Smith) Kalkman in Blumea 7 : 466. 1953.

Trees up to 18 m high. Flowers on long slender panicles, pedicelled, pale yellow with dark brown anthers and blue stigma, fragrant, drupes small, green.

Fl. : April - May; *Fr.* : Aug. - Nov. Lower hill forests of Darjeeling, N. Bengal.

Wood is used for more expensive furnitures.

2. *Garuga pinnata* Roxb. Pl. Corom. 3 : 5, t. 208. 1819. et Fl. Ind. 2 : 400. 1832; Bennett. in Hook. f., l.c. 528; Prain, l.c. 216. "Jum" (Beng.); "Ghoghar" (H).

Trees up to 12 m high. Rachis 20-30 cm long, terete and pubescent or subpubescent; leaflets 4-5 pairs, sessile, 2-18 × 1-4.5 cm, elliptic oblong, subacute, crenulate. Flowers pedicelled, 5-6 mm long, pubescent. Sepals 1-2 mm long, triangular. Petals 2-3 mm long, narrowed below, free. Filaments pubescent. Ovary globose, densely pubescent; styles 2-2.5 mm long, pubescent; stigma 5-lobed. Drupes globose, 1 cm in diameter, black, with 1-5 pyrenes, each 1-seeded. Seeds with membranaceous testa.

Fl. : April - May; *Fr.* : July. Burdwan, Howrah, Jalpaiguri, Midnapore, Purulia.

Juice of the stem is used in conjunctivites. Juice of the leaves mixed with honey given in asthma.

CULTIVATED SPECIES

Following species are growing in the Indian Botanic Garden, Shibpur, Howrah:

1. *Canarium commune* L.
2. *Commiphora caudata* (Wt. & Arn.) Eng.
3. *Commiphora wightii* (Arn.) Bhandari

MELIACEAE

(M. K. Manna)

A family of about 50 genera and 1400 species mainly in the tropics of the world; 12 genera and 14 species in West Bengal.

1. Seeds not winged:
 2. Seeds albuminous :
 3. Flowers elongate ; fruits drupaceous ... 8. MELIA
 3. Flowers globose; fruits baccate ... 6. CIPADESSA
 2. Seeds exalbuminous :
 4. Flowers and staminal tube linear :
 5. Disc absent; petals 5 ... 3. AZADIRACHTA
 5. Disc large; petals 4 ... 7. DYSSOXYLUM
 4. Flowers and staminal tube globose to oblong :
 6. Tube longer than petals :
 7. Seeds arillate ... 1. AMORBA

- | | |
|---|--------------------|
| 7. Seeds exarillate | ... 12. XYLOCARPUS |
| 6. Tube as long as petals : | |
| 8. Disc obsolete; petals 3 | ... 2. APHANAMIXIS |
| 8. Disc short; petals 4-5 | ... 4. CLUSONETON |
| 1. Seeds winged : | |
| 9. Filaments united into a tube : | |
| 10. Staminal tube cupular; disc conspicuous | ... 9. SOYMIDA |
| 10. Staminal tube cylindrical; disc absent | ... 5. CHUKRASIA |
| 9. Filaments distinct : | |
| 11. Stamens 4-6 | ... 11. TOONA |
| 11. Stamens 10 | ... 10. SWIETENIA |

1. AMOORA Roxb.

Trees. Leaves usually imparipinnate; leaflets oblique, entire. Flowers polygamo-dioecious, small, male flowers in axillary panicles, females usually in spikes or racemes. Calyx 3-5 partite. Petals 3-5, thick, concave, free or rarely slightly united at base, imbricate or rarely valvate. Staminal tube a little shorter than petals, subglobose or campanulate, 6-10 crenate; anthers 6-10, included, sessile or subsessile. Disc obsolete. Ovary sessile, depressed, 3-5-celled; ovules 1-2 in each cell; style absent or short, or elongate; stigma entire or toothed. Capsules subglobose, coriaceous or woody, loculicidally 3-5-valved, cells 1-seeded. Seeds in a fleshy aril.

A genus of ca 25 Indo-Malayan species; 1 species in West Bengal.

Amoora cucullata Roxb. Cor. Pl. 3 : 54, 1819; Hiern in Hook. f., Fl. Brit. India 1 : 560, 1875; Prain, Bengal Pl. 1 : 221, 1963 (repr.ed.) "Latmi" (Beng.).

Trees, 10-15 m high. Leaves imparipinnate, 30-40 cm long; leaflets 2-4 pairs and an odd one, 8-10 × 3-6 cm, oblong-elliptic, subacute, glabrous, base rounded, very unequalateral except that of the terminal leaflet; petiolules 5-10 mm. Male flowers in axillary lax branched sparingly lepidote panicles about equalling the leaves; peduncles long; pedicels short. Calyx lepidote outside, 3-lobed, lobes rounded, ciliolate. Petals 3, longer than the calyx, broadly elliptic, concave. Staminal tube equalling the petals, obovoid, irregularly and obtusely 5-7-toothed; anthers 6-10, attached half way up on tube. Female flowers in few-flowered supra-axillary racemes about 5 cm long. Sepals, petals and staminal tube as in male. Ovary lepidote, ovoid, 3-angled, 3-celled; stigma sessile, large, 3-lobed. Fruits depressed globular, 5-10 cm in diam., dehiscent by 3 valves. Seeds 3, rounded.

Fl. : March - April. Occasional in 24-Parganas.

2. APHANAMIXIS Bl.
(‘Aphanomyxis’ Sphalm.)

Trees, dioecious. Leaves imparipinnate; leaflets oblique, entire. Male flowers in axillary panicles, females, in spikes or racemes. Calyx 3-5-fid. Petals usually 3, rarely up to 5. Staminal tube subglobose or campanulate, minutely 6-10 toothed; anthers 6-10, included. Disc obsolete. Ovary 3- or rarely up to 5-celled, depressed; style absent or distinct; stigma entire or toothed. Capsules woody or coriaceous, 3-5-celled, 3-5-seeded, loculicidally 3-5-valved. Seeds with fleshy aril, exalbuminous.

A genus with 4 species in Indo-Malayan region to New Guinea and Solomon Islands; 1 species in West Bengal.

Aphanamixis polystachya (Wall.) Parker in Ind. For. 57 : 486. 1931. *Aglaia polystachya* Wall. in Roxb. Fl. Ind. 2 : 429. 1824. *Amoora rohituka* Wight & Arn. Prodr. 1 : 119. 1834; Hiern, l.c. 559.

Trees, 6-10 m high. Leaves 30-60 cm long; leaflets opposite, 4-8 pairs, uniformly increasing in size from basal pairs to terminal pairs, 7-20 × 2.5-6 cm, glabrous, apex acuminate, base oblique; petiolules 5-8 mm. Male flowers numerous, bracteate, globular, ca 4 mm long. Calyx lobes orbicular. Petals 3, larger than the calyx-lobes, orbicular, concave. Staminal tube nearly equalling the petals, subglabrous with 6 subsessile anthers attached near the base of the tube. Female flowers larger than males, in axillary or supra-axillary solitary spikes. Calyx and petals as in male. Ovary hairy, stigma 3-lobed. Capsules 2.5-3.5 cm diam., globular, yellow when ripe, 3-celled, 3-valved.

Fl. : Aug. - Sept. In almost all the districts of West Bengal.

3. AZADIRACHTA A. Juss.

Trees. Leaves alternate, imparipinnate; leaflets serrate, oblique at base. Flowers bisexual, in axillary panicles. Calyx 5-partite. Petals 5, much exceeding the calyx, free, imbricate. Disc absent. Staminal tube a little shorter than the petals, lacinate at the apex. Ovary 3-celled; style elongate, slender; ovules 2 in each cell, collateral; stigma shortly cylindrical, 3-lobed. Fruit a 1-seeded drupe, endocarp woody. Seed ellipsoid.

A genus with 2 species in Indo-Malaysia region ; 1 species in West Bengal.

Azadirachta indica A. Juss. Mem. Mel. 68, t. 2, n. 5. 1830; DC. Monogr. Phan. 1 : 459, t. 6.f. 10. *Melia azadirachta* L., Sp. Pl. 385. 1753; Hiern, in Hook. f., l.c. 544; Prain, l.c. 218. "Neem" (Beng. & H.). Fig. 64

Large trees, about 15 m high. Leaves pinnate, 20-37 cm long, crowded near the end of the branchlets. Leaflets 9-13, subsessile, subopposite, 2.5 - 7.5 × 1-3.5 cm, obliquely lanceolate, sometimes falcate, acuminate, serrate, glabrous. Flowers white, fragrant, in branched glabrous panicles shorter than the leaves; bracts minute. Petals 5 mm, obovate-oblong, puberulous, outside ciliolate. Staminal tube a little shorter than the petals; anthers 10. Ovary 3-celled with 2



Fig. 64. *Azadirachta indica* A. Juss.

ovules in each cell; stigma 3-toothed, included in the tube. Drupes 1.2-2 cm long, 1-seeded.

Fl. : March - May. Throughout the plains of West Bengal, often planted.

The bark, leaves, flowers, seeds and oil are all in use for food, medicinal and other purposes. Tender fresh branches are extensively cut and chewed for cleaning teeth.

4. CHISOCHETON Blume

Trees or shrubs. Leaves pinnate, opposite or subopposite; leaflets more or less oblique. Panicles supra-axillary, divaricately branched, many flowered. Flowers polygamo-dioecious. Calyx cupular, 4-5-toothed. Petals 4-5. Staminal tube slender, 4-8-lobed at apex, lobes entire, or toothed; anthers linear, equal in number to and alternate with the lobes. Disc short. Ovary 2-4-celled; style filiform, stigma capitate; ovule one in each cell. Capsules subglobose, 2-4-celled. Seeds arillate.

A genus of 12 species confined to Eastern India and the Indian Archipelago; 1 species in West Bengal.

Chisocheton paniculatus (Roxb.) Hiern, in Hook. f., *Fl. Brit. India* 1 : 552. 1875; Prain, *l.c.* 219. *Guarea paniculata* Roxb., *Fl. Ind.* 2 : 242. 1832. **Fig. 65**

Middle-sized or small evergreen trees, with a narrow crown; young shoots and inflorescence brown hirsute. Leaves large, imparipinnate; leaflets subopposite, ovate-oblong or lanceolate, acuminate, entire, chartaceous, pubescent beneath; lateral nerves 8-12 on each side, obliquely arcuate; petiolules short. Panicles large, axillary, drooping, with elongate lax branches. Flowers pale yellow, fragrant; pedicels short. Calyx subtruncate. Petals 4, imbricate. Staminal tube white, as long as petals with 6-8-bifid lobes, pubescent; anthers 8, included, linear. Disc fleshy. Ovary 4-celled with one ovule in each cell. Capsules obpyramidal.

Fl. : June - July. Jalpaiguri.

5. CHUKRASIA A. Juss.

Trees. Leaves imparipinnate; leaflets usually alternate. Flowers bisexual, in terminal panicles. Calyx 5-lobed. Petals 5, free, comorted. Staminal tube cylindrical; anthers exserted. Disc absent. Ovary 3-5-locular; ovules numerous, biseriate in each locule; stigma capitate. Fruit a septicidal capsule. Seeds many, winged below.

A genus with 1 species in India eastwards to Malesia and Southern China.

Chukrasia tabularis A. Juss. in *Mem. Mus. Par.* 19 : 251, t. 22. 1830; Hiern, in Hook. f., *l.c.* 568; Prain, *l.c.* 223. "Chikrass", "Pabba", "Dalmara" (Beng.).

Large deciduous trees. Leaves bi- or tri-pinnate, 15-45 cm long; leaflets 10-24, ovate 4-13 cm long, acute or acuminate, entire, oblique, pubescent beneath. Panicles shorter than the leaves. Calyx puberulous, 2 mm long. Petals



Fig. 65. *Chisocheton paniculatus* (Roxb.) Hiern

linear-oblong to spatulate, 12×6 mm, creamish. Staminal tube 10-toothed. Ovary elongate, hairy, 3-5 locular. Capsules 2.5-4 cm long, usually 3-valved, ovoid, woody. Seeds ca 3 cm long, broadly winged.

Fl. : Feb. - April. Coochbehar, Jalpaiguri.

6. CIPADESSA Blume

Shrubs or small trees. Leaves alternate, imparipinnate; leaflets opposite, entire or coarsely serrate. Flowers small, hermaphrodite, in axillary peduncled panicles. Calyx 5-toothed. Petals 5, valvate, free. Disc cupular, adnate to the base of staminal tube. Stamens 5-10; filaments united below in a short tube, free above, 2-toothed at the apex; anther inserted between the teeth, apiculate. Ovary 5-celled; ovules 2 in each cell; style short; stigma capitate. Fruits baccate, subfleshy, 5-ribbed, 5-celled; cells 1-2-seeded. Seeds angled.

A genus of 3 species distributed in Madagascar and Indo-Malayan region; 1 species in West Bengal.

Cipadessa baccifera (Roth) Miq., Ann. Mus. Lugd. Bat. 4 : 6. 1868-69. *Melia baccifera* Roth, Nov. Pl. 215. 1821. *C. fruticosa* Bl., Bijdr. 162. 1825; Hiern, l.c. 545; Prain, l.c. 219.

Shrubs; young parts silky. Leaves 6-25 cm long; leaflets 3-6 pairs, elliptic-lanceolate, $3-7 \times 1-3$ cm, glabrous except the nerves which are more or less hairy. Flowers small, white, in axillary corymbose panicles mostly on long peduncles; pedicels short. Calyx pubescent outside, 5-toothed. Petals 3 mm long. Stamens a little shorter than the petals; filaments hairy. Ovary glabrous; style short; stigma capitate. Berries globose.

Fl. : Aug. - Sept. Sporadic in 24-parganas.

7. DYSOXYLUM Blume

Trees. Leaves pinnate; leaflets acuminate, oblique at base. Flowers bisexual, in lax axillary panicles of cymes. Calyx 4-5-fid. Petals 4-5, spreading. Staminal column cylindrical, toothed at mouth, anthers 6-10, inserted below the edge of staminal tube. Disc tubular around the ovary. Ovary pubescent, 3-4-celled, with 2 ovules in each cell. Capsules pear-shaped or globose, coriaceous, 1-4-celled.

About 200 species, Indo-Malayan and Polynesian; 1 species in West Bengal.

Dysoxylum binectariferum Hook. f. & Beddome in Trans. Linn. Soc. 25 : 212. 1866; Hiern, in Hook. f., l.c. 546; Prain, l.c. 220.

Evergreen, small or middle-sized trees; young shoots and inflorescences pubescent. Leaves large, paripinnate; leaflets 6-8 large; alternate, obliquely ovate-oblong, acuminate, entire, glabrous, dark green above, pale beneath; lateral nerves 8-10 on each side; petiolules short, channelled. Panicles large, spreading, branches short. Flowers dull white, tetramerous. Calyx cup-shaped, subentire, about half as long as corolla. Petals velvety outside. Staminal tube mealy. Disc glabrous within, puberulous outside. Ovary densely hairy. Capsules globose with

a narrowed base, about 5 cm across, at first pale-yellow, then deep orange, 4-celled, 4-seeded. Seeds purple.

Fl. : July - Dec. Sporadic in Jalpaiguri.

8. MELIA L.

Trees. Leaves alternate, simple or 2-3-pinnate with an odd one, the young ones often stellately tomentose; leaflets toothed, serrate or entire. Flowers hermaphrodite, in large many-flowered axillary much-branched panicles. Calyx 5-6-partite, lobes imbricate. Petals 5-6, free, much exceeding the calyx. Staminal tube a little shorter than the petals; anthers 10, within the staminal tube at its apex. Disc annular. Ovary 5-8-celled with 2 ovules in each cell; style cylindrical, much exceeding the ovary; stigma capitate. Drupes subfleshy.

A genus with 5 species in old World tropics; 1 species introduced in West Bengal.

Melia azedarach L., Sp. Pl. 384, 1753; Hiern, in Hook.f., *l.c.* 543. *M. sempervirens* Sw. Brandis, Indian trees 140, 1906; Prain, *l.c.* 218. "Gora Nim", "Mahanim" (Beng.); Bakain (H.).

Trees, up to 13 m high. Leaves bipinnate, sometimes tripinnate, 20-40 cm long; leaflets 2-8 cm × 5-13 cm. Flowers lilac, fragrant, 5-8 mm long. Calyx pubescent outside, lobes ovate-oblong, acute, ciliate. Petals 15 mm long, oblong-lanceolate. Staminal tube purple, 20-toothed; anthers sessile, 1 between each pair of teeth. Ovary 5-celled. Drupes subglobose, 1-2 cm, 4 seeded.

Fl. : April - May. Planted almost throughout the plains of West Bengal.

Wood useful for furniture and plants also medicinal.

9. SOYMIDA A. Juss.

Trees, with bitter bark and hard wood. Leaves paripinnate. Flowers 5-merous, unisexual but with well developed vestiges of the opposite sex present. Sepals 5, imbricate. Petals 5, spreading, clawed, contorted. Staminal tube cupular, 10-lobed, lobes bidentate; anthers inserted between the teeth. Disc conspicuous. Ovary 5-celled; ovules many in each cell; biserial, pendulous; style short; stigma thick, discoid, 5-angled. Capsules woody, 5-celled, septifragally 5-valved, the valves consisting of 2 plates separating from the 5-winged axis. Seeds pendulous from the top of the axis, imbricate in two series, compressed, winged at both ends.

Only 1 species in India and Sri Lanka.

Soymida febrifuga A. Juss, Mem. Mus. Hist. Nat. Paris 19 : 251, t. 22, 1830; Hiern in Hook.f., *l.c.* 567; Prain, *l.c.* 223.

Tall trees. Leaves crowded towards the end of the branches, 18-36 cm long; leaflets 3-6 pairs, opposite, 5-10 × 2-5 cm, elliptic or oblong, obtuse, penninerved; nerves numerous and conspicuous beneath, base rounded inequilateral; petiolules 3-6 mm. Flowers in large terminal or axillary branched

panicles often equalling the leaves; pedicels very short; bracts minute, triangular, acute. Sepals round, margins membranous, slightly lacerate. Petals obovate, 6 mm long, clawed, often notched at the apex. Staminal tube about half as long as petals, slightly urceolate; anthers attached at the middle on the back. Stigma discoid, 5-lobed. Capsules erect, woody, obovoid, 5-valved, opening from the apex. Seeds up to 12 per locule, oblong or slightly curved, unequally winged at both ends.

Fl. : March. Midnapore, Purulia.

The bark of the tree has been recommended as a substitute for Peruvian bark. The hard wood is heavy and close grained and well adapted for ornamental furniture.

10. SWIETENIA Jacq.

Trees. Leave compound, pinnate; leaflets opposite, oblique. Flowers in axillary or subterminal panicles. Calyx 4-6 partite. Petals 4-6 free. Stamens 10; filaments united into a tube. Disc annular. Ovary ovoid, 3-5 locular; ovules many in each locule. Capsules 3-5 locular. Seeds winged.

A genus of 7-8 species, mostly in tropical America and W. Indies; 2 species planted in West Bengal.

- | | |
|---------------------------|------------------------------|
| 1. Leaflets 4-8 cm long | ... 2. <i>S. mahagoni</i> |
| 1. Leaflets 10-14 cm long | ... 1. <i>S. macrophylla</i> |

1. **Swietenia macrophylla** King in Hook. Icon. 11. 1550. 1886; Butterworth, *l.c.* 128; Prain, *l.c.* 223.

The tree differs from *S. mahagoni* in the larger size of the leaflets which are up to 14 cm long. Flowers 6-7 mm long. Capsules 13 cm long. Seed 8 cm long.

Planted at some places.

2. **Swietenia mahagoni** Jacq. Enum. Pl. Carib. 20. 1760; Butterworth, Madras Trees 127. 1911; Parker, For. Fl. Punjab ed. 3. 72. 1956; Prain, *l.c.* 222.

Evergreen trees up to 22 m tall. Leaves alternate, imparipinnate; leaflets ovate-lanceolate, 4.5-8 cm long, opposite to sub-opposite, entire, glabrous to sparsely pubescent, often ciliate, base oblique; petioles 3-6 mm long, pubescent. Flowers small, in lax spreading panicles. Calyx truncate. Petals greenish white, obovate, 3-6 mm long. Staminal tube sub-cylindrical; anthers 10. Disc annular. Capsules 5-locular, ovoid, 11.5 cm long, brown. Seeds many, 5 cm long, winged at one end.

Planted at some places.

Wood used mainly for household furniture.

11. TOONA Roem.

Tall trees. Leaves pinnate; leaflets entire. Flowers in terminal or subterminal panicles, bisexual. Calyx short, 5-fid. Petals 5, free. Stamens usually 5, rarely 4 or

6, inserted on the top of the slightly 4-6-lobed fleshy disc, sometimes with alternating staminodes; anthers versatile. Ovary seated on the disc, 5-celled with 8-12 biseriate pendulous ovules in each cell; style filiform; stigma discoid. Fruit a 5-celled septifragally 5-valved capsule. Seeds compressed, winged either at the upper end or at both ends.

A genus with approximately 6 poorly defined species in Old World, eastwards from India to Australia; 1 species in West Bengal.

Toona ciliata Roem. Syn. Hesp. 139. 1846; Santapau in Bull. Bot. Surv. India 3 : 13. 1962. *Cedrela toona* Roxb. ex Rottl & Willd. in Ges. Naturf. Fr. Neue. Schr. 2 : 198. 1803; Hiern, in Hook. f., l.c. 568; Prain, l.c. 224. "Tun" (Beng. & H.); "Mahalimbu" (Oriya).

Trees. Leaves 25-45 cm long; leaflets usually 5-10 pairs, opposite or alternate, 4-13 × 2-4 cm, glabrous, lanceolate, ovate-lanceolate or ovate, apex acuminate, base slightly oblique, petiolules 5-15 mm long. Panicle drooping, shorter than leaves. Flowers 4-5 mm long, fragrant, minutely bracteate. Calyx pubescent, deeply lobed; lobes ovate. Petals white, pubescent outside, ovate, acute, base sagittate, clawed. Anthers dark; staminodes absent. Disc orange, pubescent. Ovary slightly 3-lobed, pubescent. Capsules 12-13 mm long, ovoid, pale green with minute white dots.

Fl. : Jan. - March. Commonly planted as an avenue tree.

12. XYLOCARPUS Koen.

Trees. Leaves alternate, compound, paripinnate; petioles swollen at base, leaf scars distinct; leaflets opposite, usually 2 pairs, dark shining green with almost invisible venation above, pale green with prominent midrib and veins beneath; petiolules 2 mm, slightly swollen. Inflorescence axillary, rarely on older branches, paniculate. Flowers small, yellowish or pinkish. Calyx 4-lobed. Petals 4. Staminal tube urceolate, 8 dentate; stamens 8, included, inserted on a fleshy cup-shaped disc, alternating with teeth of tube. Ovary superior, 4-celled; ovules 2-8 in each cell; style short; stigma discoid. Fruits large, globose, 4-celled with leather pericarp dehiscing by valves. Seeds large, not embedded in pulp, numerous, irregularly pyramidal with rounded base, testa soft, spongy.

An old-world genus with 2 species in mangrove swamps; both found in West Bengal.

1. Leaflets obovate or obovate-oblong; fruits 18-26 cm in diam.; stem with smooth pale bark ... 2. *X. granatum*
1. Leaflets elliptic-oblong; fruits 7.5 - 12.5 cm in diam.; stem rough and fissured, dark coloured ... 1. *X. gangeticus*

1. **Xylocarpus gangeticus** C.E. Parkinson in Ind. For. 60 : 140. 1934. *Carapa maluccensis* var. *gangetica* Prain in Rec. Bot. Surv. India 2 : 292. 1903. *Carapa maluccensis* Watson in Malayan Forest Records No. 6 : 70 and 75, tt. 34 and 35. 1928; non Lamk. 1784; Prain, l.c. 222.

Trees with a straight stem, attaining a height of 2.5 m or more; bark dark coloured, rough, and with long longitudinal fissures, detaching in oblong flakes, buttresses small. Roots sending up erect pointed pneumatophores through the soft tidal mud. Leaves elliptic-oblong. Fruits 7.5-10 cm in diam., obscurely 4-lobed, reddish brown when ripe.

Littoral parts of 24-Parganas.

2. *Xylocarpus granatum* Koen., Naturforscher (Halle) 20 : 2. 1784. *X. obovatus* (Bl.) A. Juss. in Mem. Mus. Natl. Hist. Nat. 19 : 224. 1830. *Carapa obovata* Bl., Bijdr. 179. 1825; Prain, *l.c.* 222. *C. moluccensis* auct. (*non* Lam. 1784); Hiern, in Hook. f., *l.c.* 567.

Trees up to 25 m high and 2 m in girth; stem buttressed, usually contorted, often hollow; bark thin, smooth, pale reddish brown. Leaflets coriaceous, elliptic or obovate. Inflorescence cymose, much branched, spreading, under 5 cm long; peduncles stout. Calyx trumpet-shaped, cut into broadly acute teeth. Corolla lobes 4, white, spreading, broadly oblong, apex rounded. Staminal tube unceolate. Ovary bright orange yellow. Fruits globose, brownish when ripe.

Fl. : Feb. - March. In southern parts of 24-Parganas.

OLACACEAE

(K. L. Maity)

A family of ca 25 genera and 250 species in tropical and subtropical regions; 2 genera and 3 species in West Bengal.

- | | |
|---|---------------------|
| 1. Flowers in dichotomously branched cymes; stamens 5;
staminodes absent | ... 1. ERYTHROPALUM |
| 1. Flowers solitary or in racemes or panicles; stamens 3;
staminodes 5-6 | ... 2. OLAX |

1. ERYTHROPALUM Bl.

Climbing shrubs or lianes with axillary tendrils shortly bifid at apex. Leaves alternate, palminerved at the base; petioles long. Cymes axillary, dichotomously branched. Flowers very small. Calyx 4-5-lobed, accrescent and finally split into 3-5 reflexed valves. Corolla rotate, campanulate, deeply 5-lobed, caducous. Stamens 5, opposite to petals; filaments very short; anthers introrse, 2-celled, connective thick. Staminodes 5, inserted with the stamens as 2 lateral bearded scales at the base. Disc shortly cupular, pentagonal. Ovary obconic, one-celled, with 1-3 ovules pendulous from the apex of the cavity; style short, thick, conical; stigma 3-lobed. Drupes fleshy, indehiscent, ovoid-oblong or clavate, surmounted by the remains of the calyx. Seed 1, pendulous.

About 2-3 species in Eastern Himalaya to Celebes & Java; 1 species in West Bengal. The genus is sometimes also placed under the family Erythropalaceae.

Erythropalum vagum (Griff.) Mast. in Fl. Brit. India 1 : 578. 1875.
Modecepis vaga Griff. Not. 4 : 638. 1854.

A rambling climber with whitish stem. Leaves ovate-oblong, 10-17 × 5-10 cm, subcoriaceous, subpetate and cordate at base, glaucous beneath, usually 5-nerved at the base with 3 or 4 lateral nerves on either side of the midrib; petioles 3-6 cm long. Cymes lax, 12-18 cm long. Corolla lobes reflexed. Ovary 1-celled through disappearance of thin septum with large 5-lobed disc; ovules 3, pendulous. Fruit ovoid oblong, surmounted by the remains of the disc, arrowed at base. Seed solitary, ovoid, large, pendulous.

Fl. & Fr. : June - Sept. Darjeeling.

2. OLAX L.

Trees or shrubs, often scandent or climbing, sometimes armed. Leaves alternate, petioled, stipule absent. Flowers in axillary racemes or panicles, sometimes solitary; bract minute. Calyx campanulate, truncate or obscurely toothed, much enlarged and accrescent in fruits. Petals 3(-6), free or slightly connate, valvate, two bifid, one entire. Stamens usually 3 fertile; staminodes 5-6, bifid; anthers oblong, 2-celled, dehiscing longitudinally. Ovary superior, more or less 3-celled, partly sunk in shallow and hypogynous disc at base, ovules 3, one in each chamber hanging down from the apex of a central placenta; style simple; stigma 3-lobed. Drupes more or less enclosed by the accrescent calyx, 1-celled, 1-seeded; stone crustaceous, seed invarse.

About 55 species distributed in tropical Africa, Malagasi, Madagascar, Indo-malaysia and Australia; 2 species in West Bengal.

1. Armed climbing shrubs; flowers in axillary racemes ... 2. *O. scandens*

1. Unarmed erect undershrubs; flowers solitary, axillary ... 1. *O. nana*

1. *Olax nana* Wall. ex Benth. in Trans. Linn. Soc. 18 : 674, 1841; Mast. in Hook.f., Fl. Brit. India 1 : 576, 1875; Prain, Bengal Pl. 1 : 227, 1963 (repr. ed.).

Low undershrubs, branching from a woody rootstock. Leaves sessile, oblong-lanceolate or linear-oblong, 2.5-7 × 1-1.5 cm, cuneate at base. Flowers solitary, axillary, small, white; pedicels 0.6-1 cm long. Calyx small, cupular, truncate or obscurely lobed. Petals 3, oblong-lanceolate, rather obtuse, cohering for about half way up, tip inflexed. Anthers yellow; staminodes 6, one at each edge of each petal and a little shorter than it. Ovary ovoid-oblong, 1-celled. Fruits pea-like, 1-seeded, deep yellow when ripe, nearly covered by the accrescent calyx.

Fl. & Fr. : April - Nov. Darjeeling, Hooghly, Jalpaiguri, 24- Parganas.

Fruits are edible.

2. *Olax scandens* Roxb., Fl. Ind. ed. Carey and Wall. 1 : 163, 1820; Mast. in Hook.f., l.c. 575; Prain, l.c. 226. "Kokoaru" (Beng.), "Dheniani" (H.).

A rambling or climbing much branched shrubs armed with slightly curved stout prickles on the old wood. Leaves ovate-oblong, 5-9 × 3-4.5 cm, rounded or subacute at base, pale green; petioles 5-8 mm long. Flower peduncles 2-3 cm long, puberulous; bracts minute. Flowers small, white, buds oblong; pedicels

short, pubescent. Calyx cupular, truncate, ciliate, puberulous or glabrous. Petals 3.5(-6), linear. Stamens 3, about half as long as the petals; staminodes 2-fid. Ovary ovoid-oblong, 1-celled, 1- or rarely 3- ovuled. Drupes ovoid or globose with its three-fourth part covered by accrescent calyx.

Fl. & Fr. : Feb. - Nov, Bankura, Birbhum, Malda, Midnapore, Purulia.

Leaves and young shoots are cooked as green vegetable. Fruits are edible. Bark medicinal.

OPILIACEAE

(K. L. Maitty)

A family of ca 8 genera and 60 species, mainly in Asia; 2 genera and 2 species in West Bengal.

- | | |
|-------------------------|-------------------|
| 1. Flowers tetra-merous | ... 1. LEPIONURUS |
| 1. Flowers penta-merous | ... 2. OPPIA |

1. LEPIONURUS Blume

Small trees. Leaves shortly petioled; stipule absent. Cymes axillary, dense, trichotomously branched, umbellate, each subtended by an ovate bract. Flowers monochlamydous. Perianth 4-lobed. Stamens 4 and opposite to perianth lobes. Disc fleshy, yellow. Ovary conical, 1-celled; ovule solitary, pendulous; style short. Fruit a drupe with crustaceous stone. Seed pendulous.

About 5 species in Eastern Himalaya to Indo-China, Java & New Guinea; 1 species in West Bengal.

Lepionurus sylvestris Bl., Bijdr. 1148. 1826; Prain, Bengal Pl. 1 : 227. 1963 (repr. ed.). *L. oblongifolium* Griff. in Calcutta J. Nat. Hist. 4 : 236. 1844. *L. oblongifolius* (Griff.) Mast. in Hook. f., Fl. Brit. India 1 : 583. 1875.

A large shrub or a small tree with grey bark. Leaves oblong-lanceolate to elliptic or obovate, 10-17 × 2-4 cm, acute or acuminate, membranous, covered on both surfaces with numerous raised pustules; lateral nerves 6-9 pairs, slender, arched; petioles about 7 mm long. Flowers in umbel-like groups of 3-9, on small bracteate protuberance on the rachis of fascicled, axillary or slightly supra-axillary slender 2.5 - 6 cm long racemes; bracts acute, membranous, ciliate. Perianth urceolate, 4-lobed, greenish; lobes ovate, velvety outside. Stamens 4, opposite perianth lobes; anthers sessile. Disc fleshy, linear at base of the perianth tube. Drupes ca 5 × 3 mm. Seed solitary, pendulous.

Fl. & Fr. : Jan. - March, Jalpaiguri.

The plant and its roots are reported to be used as a poultice for headache in children.

2. *OPILIA* Roxb.

Low trees or climbing shrubs. Leaves distichous, shortly petioled; stipule absent. Inflorescences with numerous flowers in axillary racemose umbellate cymes; bracts deciduous. Calyx obscurely 4-5-toothed or minutely annular or obsolete, not accrescent. Petals 5, free, valvate. Stamens 5, alternating with 5 thick fleshy disc-glands or staminodes; anthers 2-celled, dehiscing longitudinally. Ovary 1-celled; ovule solitary, pendulous; style short; stigma minute. Fruit an indehiscent drupe; pericarp thin, fleshy, stone crustaceous. Seed inverted.

A genus of about 22 species, paratropical; 1 species in West Bengal.

Opilia amentacea Roxb., Pl. Corom. 2 : 31. t. 158. 1802; Mast. l.c. 583; Prain, l.c. 127.

A low scrambling shrub or a small weak tree; young parts fairly pubescent. Leaves ovate or ovate-lanceolate, 5-8 × 1.5-4 cm, coriaceous, with 5-8 pairs of lateral nerves; petioles 2-5 mm long. Racemes 3-4 cm long, erect, young resembling cones. Flowers bisexual, pedicellate, minute, greenish-yellow at first concealed by the peltate roundish deciduous bracts. Calyx almost obsolete. Staminodes fleshy, oblong, half the length of the stamens. Drupes ovoid or globose.

Fl. & Fr. : April - July, West Bengal (vide Prain, l.c.).

ICACINACEAE

(K. L. Maity)

A family of ca 58 genera and 400 species in tropics and subtropics of the world; 3 genera and 3 species in West Bengal.

- | | |
|---|---------------------|
| 1. Flowers congested in heads | ... 1. MIQUELIA |
| 1. Flowers in elongated spikes, racemes or panicles : | |
| 2. Flowers unisexual, in spikes or racemes | ... 2. NATSIATUM |
| 2. Flowers bisexual, in panicles | ... 3. NOTIAPODYTUS |

1. *MIQUELIA* Meissn.

Climbing dioecious shrubs. Leaves alternate, membranous, petiolate, usually palm-nerved. Inflorescence racemose in case of male and solitary in female plants. Flowers capitate. Male flowers: calyx minute, 4-5-fid; corolla 4-5-lobed, tube pedicel like, lobes inflexed. Stamens 4-5, alternate with petals; filaments short; anthers introrse. Pistillode absent. Female flowers : calyx 4-5-fid, minute; petals 4-5, free or only faintly connate below; staminodes 4-5, alternate with petals, or absent; ovary 1-locular; style short; stigma dilated, cupular; ovules 2, pendulous from the apex of the locules. Fruit an oblong somewhat compressed drupe, its base surrounded by the persistent calyx; stone crustaceous, rugose, 1-seeded. Seed pendulous.

About 5 species in Indo-China and Malayan region; 1 species reported from West Bengal.

Miquelia gibba Baill. in *Adansonia* 10 : 278. 1872; Mast. in Hook.f., *l.c.* 594; Prain, *l.c.* 228.

Climbing shrubs; branches terete, glabrous. Leaves ovate, acuminate, entire, membranous, ca 20 × 10 cm, glabrous, base rounded, 5-nerved, nerves prominent beneath. Drupes 3-4 cm long, ellipsoid, glabrescent, brownish, convex on one side, furrowed on the other, gibbous towards the base; stone hard, granular; cotyledons thin.

Western Bengal. *Griffith* (vide Mast. in Hook.f., *l.c.* & Prain, *l.c.*). An imperfectly known species of which no specimens are available in Calcutta Herbarium.

2. NATSIATUM Buch. Ham.

A climbing dioecious shrub with thin wiry branches. Leaves alternate, repand, palmately 7-9-nerved, petiolate; stipule absent. Flowers in extra-axillary racemes. Male flowers : calyx deeply 5-lobed, persistent; petals 5, free or connate at base; stamens 5, fertile alternating with petals; staminodes external to the antheriferous filaments, opposite to petals; pistillode rudimentary. Female flowers : sepals and petals as in male flowers; staminodes 4-6, alternating with an equal number of compressed glands; ovary 1-locular; ovules collateral, pendulous; style short, apex 2-3-lobed; stigma capitate. Drupes obliquely ovoid. Seed solitary; albumen fleshy.

1 to 2 species in E. Himalayas and S.E. Asia; 1 species in West Bengal.

Natsiatum herpeticum Buch. - Ham. ex Arn. in *Edinb. New Phil. J.* 16 : 314. 1834; Mast. *l.c.* 595; Prain, *l.c.* 229.

Dioecious densely strigose climbing shrubs with tuberous roots. Leaves 8-15 × 4-14 cm, broadly ovate, acute or acuminate, repand at margin, palmately 7-9-nerved; petioles 5-8 cm long. Inflorescence a supra-axillary spiciform raceme 10-12 cm long. Flowers greenish-yellow; pedicels 5 mm long; bracts linear. Sepals linear-lanceolate, saggy outside with coarse hairs. Petals lanceolate, slightly longer, hairy. Stamens 5, anthers sagittate, bright-yellow, staminodes (in female flowers) subulate. Drupes compressed, somewhat oblique and tapering, 1.5 × 1 cm rugose.

Fl. & Fr. : Dec. - Feb. Coochbehar, Darjeeling, Jalpaiguri.

Leaves and tender shoots are eaten by the Miris, cooked as a pot herb especially with fish.

3. NOTHAPODYTES Bl.

Trees. Leaves alternate, simple. Flowers in terminal corymbose cymes, small, pentamerous, polygamous, usually pubescent outside. Sepals small, 5-toothed. Petals valvate. Stamens 5; anthers dorsifixed. Disc hypogynous, cupular,

surrounding the ovary, sometimes inconspicuous. Ovary 1-celled, ovules 2, pendulous; style short; stigma thickened. Drupe with a slender crustaceous or subwoody putamen. Seed pendulous.

A genus of ca 7 species mainly in the central and tropical South America; 1 species in West Bengal.

Nothapodytes nimmoniana (Graham) Mabblerly in Botany and History of Hortus Malabaricus 88. 1980. *Premna nimmoniana* Graham Cat. Pl. Bombay, 155, 1839. *Mappia foetida* Miers in Ann. Mag. Nat. Hist. 2, 9 : 395. 1852; Mast. l.c. 589.

Small trees with wrinkled bark. Leaves crowded towards ends of the branches, 10-22 × 6-9 cm, ovate-oblong, acuminate subcoriaceous, young thinly pubescent beneath; petioles 2-5 cm long. Inflorescence a terminal panicle, 5-12 cm long. Pedicels densely pubescent. Sepals small, pubescent. Petals linear-oblong, densely sericeo-villous on both surfaces, tip inflexed, yellow. Stamens a little shorter than the petals; filaments flattened and dilated below, attached to the edges of the petals at the base; anthers elliptic-oblong. Disc shallow, villous within. Ovary densely silky hairy; style slightly conical. Drupes ellipsoid or somewhat obovoid, purple, pubescent when young.

Fl. & Fr. : May - Nov. Darjeeling.

CARDIOPTERYGACEAE

(K. L. Maity)

A family of 1 genus and 3 species, mainly tropical; 1 species in West Bengal.

CARDIOPTERIS Wall. ex Blume

Climbing herbs with milky juice. Leaves alternate, cordate, membranaceous, exstipulate; palminerved. Inflorescence of axillary racemes or paniced cymes or scorpioid, ebracteate. Flowers very small, bisexual, dichlamydeous. Calyx 4-5-lobed, persistent. Corolla rotate to funnel-shaped, 4-5-lobed. Stamens 4-5, epipetalous, inserted at the base of corolla tube, alternate to petals; filaments short; anther 2-celled, introrse, dehiscent longitudinally. Ovary surrounded at the base by a thick fleshy annular disc, compressed, 1-celled; ovule 1 (rarely 2), pendulous, apiculate; styles 2, dissimilar, one longer, thicker, cylindric, persistent on the fruit, other shorter, thinner with capitate stigma. Fruits ovoid or orbicular, emarginate or obovate, compressed, very broadly 2-winged, 1-celled, indehiscent. Seed solitary, linear furrowed.

About 3 species in S.E. Asia and Australia; 1 species in West Bengal.

Cardiopteris quinqueloba (Hassk.) Hassk., Nat. Tijd. N. I. 10 : 64. 1855; Sleumer in Steenis, Fl. Males. 7(1) : 95. 1971. *Peripterygium quinquelobum* Hassk., Tijd. Nat. Gesch. Phys. 10 : 142. 1843. *Cardiopteris lobata* R. Br. in Benn. & Br., Pl. Jav. Rar. 246. t. 49. 1852, *nom. illeg.*; Mast. in Hook. f., Fl. Brit. India 1 : 597. 1875.

Glabrous climbing herbs. Leaves broadly cordate, lobed, 12-13 × 10-12 cm; petioles 5-7 cm long. Flowers in axillary cymes. Calyx 5-lobed. Corolla 5 lobed, lobes spreading, imbricate. Stamens 5, inserted on the base of the corolla tube. Ovary 1-locular, ovules 2, pendulous from the apex of the locule. Fruits obovoid-oblong, emarginate, dry, indehiscent, 2-winged, wings broad, transversely striolate. Seeds pendulous, linear, grooved.

Fl. & Fr. : Sept. - Dec. Darjeeling, Jalpaiguri.

In Java, the leaves are reported to be eaten as a vegetable.

AQUIFOLIACEAE

(B. Safui)

A family of 2 genera and about 400 species, distributed both in tropical and temperate zones; 1 genus with 7 species in West Bengal.

ILEX L.

Shrubs or trees. Leaves alternate, usually coriaceous and evergreen, rarely deciduous; stipules minute or absent. Flowers in axillary cymes, fascicles or umbellules, usually dioecious, male with imperfect ovary and female with imperfect stamens. Calyx 4-5 (-6-8)-lobed, persistent. Petals 4-5 (-6-8), free or connate at base. Stamens 4-5, adnate to the base of corolla in male flowers, staminodes free and hypogynous in female flowers; anthers dorsifixed. Ovary 2-12-celled; style absent or very short; stigma capitate or discoid, free or confluent. Fruit globose, rarely ovoid, with 2-16 stones.

About 400 species, cosmopolitan in distribution; 7 species in West Bengal.

1. Plants deciduous, leaves membranaceous ... 2. *I. fragilis*
1. Plants evergreen, leaves coriaceous (except *umbellulata*) :
 2. Low bushes with prostrate branches; stem with warty ridges ... 4. *I. intricata*
 2. Trees or shrubs with erect branches; stem not with warty ridges :
 3. Leaf-margin entire; fruits sulcate ... 6. *I. umbellulata*
 3. Leaf-margin serrate or serrulate (at least in younger stage); fruits globose :
 4. Leaves less than 5 cm (generally between 1-3.5 cm) long, dotted with dark glands beneath ... *I. crenata* var. *thomsoni*
 4. Leaves 7 cm or more long, not dotted with glands beneath :
 5. Terminal buds covered with large bracts; flowers stalked; fruits up to 5 mm in diam. ... 5. *I. sikkimensis*

5. Terminal buds not covered with large bracts; flowers sessile or subsessile; fruits 6 mm or more in diam. ;
6. Branches whitish and grooved; leaves more than 12 cm long; petioles above 1.5 cm long; fruits 6-7 mm in diam. ... 3. *I. insignis*
6. Branches neither whitish nor grooved; leaves less than 12 cm long; petioles less than 1 cm long; fruits 8-10 mm in diam. ... 1. *I. dipyrrena*

Ilex crenata var. *thomsoni* (Hook. f.) Loes., Monogr. Aquifol. 1 : 202, t. 4, f. 2C. 1901; Hara, Fl. East. Himal. 187. 1966. *I. thomsoni* Hook. f., Fl. Brit. India 1:602. 1875.

Evergreen shrubs or small trees with dense crown; young shoots pubescent. Leaves shortly petioled, 1-3.5 × 0.5-1.5 cm, obovate-oblanccolate or elliptic-lanceolate, coriaceous, acute, subacute or apiculate, distantly serrate, dotted with dark raised glands beneath; nerves indistinct, only midrib prominent below. Flowers white, about 2 mm in diam., 4-merous; male in axillary 1-3-flowered, peduncled cyme, female usually solitary; peduncles 6-8 mm, pedicels 2-3 mm. Sepals suborbicular or broadly ovate. Petals suborbicular, obovate or oblong, connate at base. Stamens nearly as long as petals, inserted at base. Stigma sessile, 4-lobed. Drupe globose, up to 8 mm across, black when ripe, with persistent calyx. Stones 4.

Fl. : April - June; *Fr.* : Nov. - Dec. Darjeeling.

1. *Ilex dipyrrena* Wall. in Roxb. Fl. Ind. ed. Carey 1 : 473. 1820; Hara, *l.c.* 187. Fig. 66

Evergreen trees. Leaves coriaceous, elliptic or oblong-lanceolate, 7-12 cm long, margins prominently spinous, older ones with scattered spines; petioles 3-8 mm. Flowers subsessile, in axillary subglobose cluster, 4-merous, white; bracts 2, ovate, acute. Calyx broadly ovate, with ciliate teeth. Petals ovate, longer than sepals, connate below in male fls. but free in female fls. Stamens inserted on the corolla, longer than petals; anthers 2-celled. Ovary 2(-4) celled; stigma quadrate. Drupes globose, 8-10 mm in diam., wrinkled when dry, dark brown, stones 2, rarely 3-4, deeply grooved.

Fl. : April - July; *Fr.* : May - Aug. Darjeeling.

2. *Ilex fragilis* Hook. f., Fl. Brit. India 1 : 602. 1875; Hara, *l.c.* 187.

Small or medium sized deciduous trees with glabrous fragile branches. Leaves membranous, elliptic or ovate, 6-12 × 2.5-4.5 cm, with acuminate apex and cuneate base; nerves strongly reticulate and raised beneath with faint pubescence; margins serrate or serrulate, teeth generally apiculate; petioles 1-2 cm long. Flowers white, 3-5 mm in diam., fascicled in both sexes, often shortly peduncled; pedicels filiform, up to 5 mm long. Calyx 5-8-lobed, somewhat rounded, persistent. Petals 5-8, jointed at base, broadly oblong or ovate-acute. Stamens as many as and shorter than petals. Stigma tumid, persistent. Drupes globose, red, 4-5 mm across, with 5-8 stones.

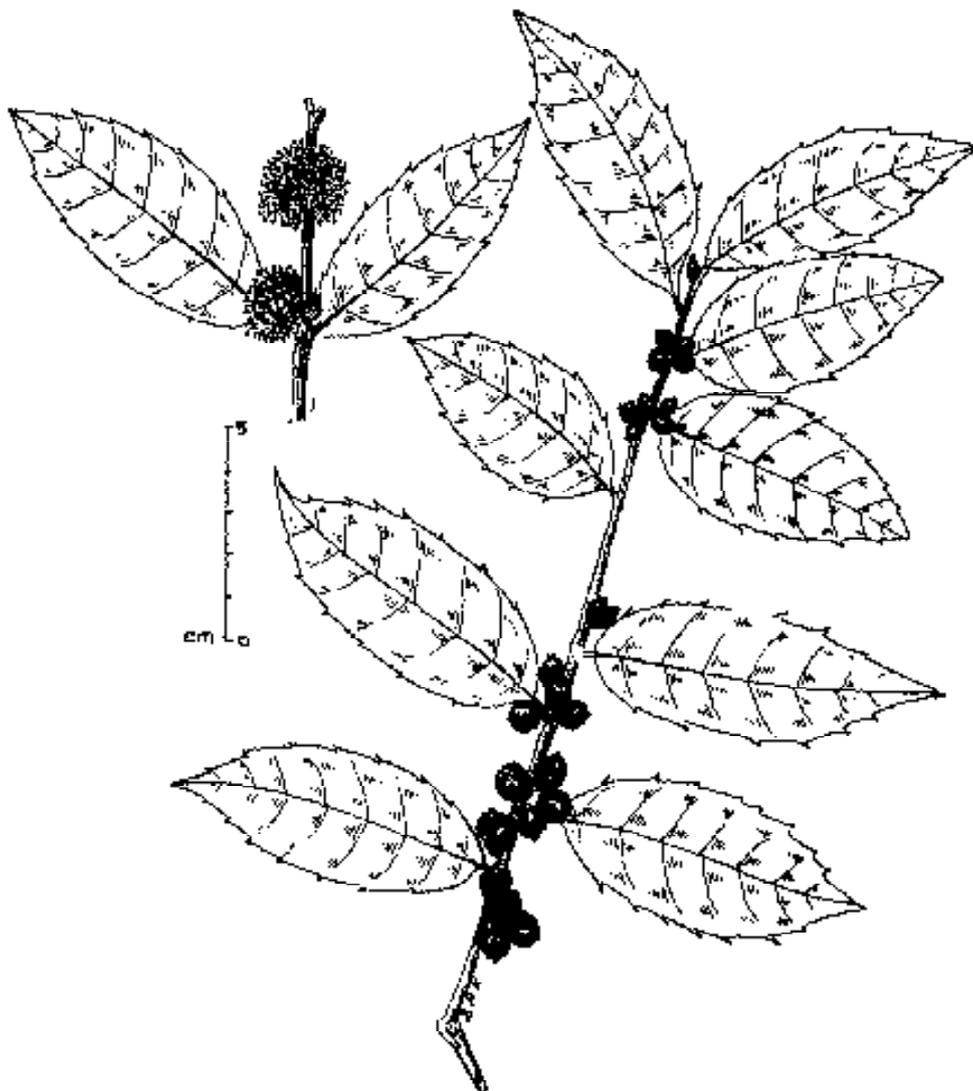


Fig. 66. *Ilex dipyrena* Wall.

Fl. : April - June; *Fr.* : July - Sept. Darjeeling.

3. *Ilex insignis* Hook. f., *Fl. Brit. India* 1 : 599. 1875; Loes., *l.c.* t. 8, f. 2; Hara, *l.c.* 188.

Small evergreen trees; branches stout, grooved, whitish. Leaves very coriaceous, oblong or elliptic-lanceolate, acute, 12-24 cm long, young spinous and older remotely serrate; nerves prominent and ridged below; petioles 1.5-2.5 cm, grooved. Flowers 4-merous, in axillary sub-globose clusters, green, almost sessile; bracts small. Calyx broadly ovate. Petals orbicular-ovate, connate below in male fls. Stamens inserted on the corolla, as long as petals. Ovary 4-celled; stigma sessile, 4-lobed; pistillode rudimentary with 4 minute papillae as stigmas in male fls. Drupes subsessile, globose, 6-7 mm across, wrinkled when dry with 1-3 grooved woody stones.

Fl. : March - May; *Fr.* : April - Aug. Darjeeling.

4. *Ilex intricata* Hook. f., *Fl. Brit. India* 1 : 602. 1875; Hara, *l.c.* 188.

Low evergreen bushes; branches stout, straggling with warted ridges, forming matted masses on rocky slopes. Leaves coriaceous, obovate or obovate-elliptic, glabrous, shortly petioled, 1-1.5 x 0.3-0.8 cm, apex obtuse with mucronate tip, base cuneate; nerves raised beneath, impressed above; margins serrate, mostly involute. Flowers small, in 1-3-flowered fascicles, 4-merous, shortly pedicelled. Sepals saucer-shaped, glabrous, about 2 mm in diam. Petals oblong, about 2 mm long, slightly connate at base in male flowers. Stamens nearly as long as petals; anthers ovoid; staminodes in female shorter. Ovary ovoid; stigma capitate, 4-lobed (rudimentary in male). Drupes globose, ca 5 mm across, fresh reddish, deep brown or blackish when dry, with flat persistent calyx and stigma; pyrens 4.

Fl. : April - June; *Fr.* : Sept. - Nov. Darjeeling.

5. *Ilex sikkimensis* Kurz in *J. As. Soc. Beng.* 44 : 202. 1875; Hara, *l.c.* 188. *I. odorata* Buch.-Ham. ex Hook. f., *l.c.* 599. *I. hookeri* King, *J. As. Soc. Beng.* 55 : 266, 1886.

Small glabrous evergreen trees, terminal buds covered by numerous large broadly ovate imbricate bracts. Leaves coriaceous, petiolate, elliptic-oblong or lanceolate, acute, 10-17 cm long, almost entire or minutely serrate, midrib prominent beneath. Flowers small, in shortly pedunculate glomeruli, 4-merous white. Sepals rounded. Petals of male fls. connate below, of female fls. free, oblong, obtuse. Stamens as long as or longer than petals. Ovary globose, 4-celled. Drupes globose, 3-4 mm across, crowned by the remains of quadrate stigma. Stones 4, trigonous.

Fl. : April - May; *Fr.* : June - July, Darjeeling.

6. *Ilex umbellulata* (Wall.) Loes., *Monogr. Aquifol.* 1 : 99. 1901; Balakrishnan, *Fl. Jowai* 1 : 128. 1981. *Ehretia umbellulata* Wall. in Roxb. *Fl. Ind.* 2 : 344. 1824. *I. godajam* Coleb. ex Hook. f., *l.c.* 604; Prain, *l.c.* 229.

Large spreading evergreen trees; young shoots glabrous or puberulous. Leaves ovate, elliptic or oblong, 7-12.5 x 4-6 cm, shortly acuminate, entire, glabrous;

petioles 1-2 cm, glabrescent; stipules minute. Flowers small, pale white, fragrant; umbels simple or paniced, pedunculate; pedicels slender up to 0.5 cm. pubescent. Sepals 4-5-lobed, orbicular, pubescent, persistent. Petals 4-5, ovate-oblong, connate at base. Filaments slender, longer than petals. Ovary 4-6-celled. Fruits ovoid, about 3 mm in diam., sulcate, with 4-6 stones.

Fl. : March - May; *Fr.* : April - June. Darjeeling, Jalpaiguri.

CELASTRACEAE

(Raina Dutta)

A family of ca 55 genera and ca 850 species mainly distributed in the tropics and temperate regions of the world; 6 genera and 17 species in West Bengal.

1. Leaves spiral or alternate; fruits dehiscent:
 2. Trees; unarmed; venation not reticulate; fruits narrowly oblong; splitting on one side ... 1. BHESA
 2. Shrubs, armed or not; venation reticulate; fruits globose or subglobose, 3-valved :
 3. Scandent shrubs, unarmed; ovary free from disc; seeds completely enveloped by aril ... 3. CELASTRUS
 3. Erect or scandent shrubs, usually armed; ovary partially sunk in the disc; seeds incompletely enveloped by aril ... 5. MAYTENUS
1. Leaves decussate or opposite; fruits dehiscent or indehiscent:
 4. Fruit drupaceous; indehiscent ... 2. CASSINE
 4. Fruit a dehiscent capsule :
 5. Capsule 4-5 celled, seeds 2 in each cell ... 4. EUONYMUS
 5. Capsule 1-celled, seed 1 in each cell ... 6. MICROTROPIS

1. BHESA Buch. Ham. ex Arn.

Trees. Leaves alternate, elliptic or elliptic-oblong, acute, entire, parallel-nerved, coriaceous; stipules deciduous. Flowers bisexual, in simple racemes. Sepals 5, imbricate. Petals 5, spreading or recurved. Disc fleshy entire or lobed. Stamens inserted on the disc. Ovary free, 2 celled; styles 2, free or united at base. Capsules entire or 2-lobed, dehiscing by 2 valves. Seeds partially or wholly covered by aril.

A genus of ca 5 species in Indo-Malaya and Pacific; 1 species in West Bengal.

Bhesa robusta (Roxb.), Ding Hou in Blumea Suppl. 4 : 152. 1958. *Celastrus robustus* Roxb. Fl. Ind. 2 : 395. 1824. *Kurrimia robusta* (Roxb.) Kurz in J. As. Soc. Beng. 39(11) : 73. 1870. *K. pulcherrima* Wall. ex Laws. in Hook. f., Fl. Brit. India 1 : 622. 1875; Prain, Bengal Pl. 1 : 232 (repr.ed.); Brandis, Ind. Trees 164. 1906. "Shilkoil" (Beng.).

Leaves petioled 6-16 × 2-8.5 cm, elliptic or oblong-elliptic, acute. Flowers subsessile. Sepals sub-rotundate, 1-2 mm long. Petals oblong, 2-3 × 1.5 - 1.7 mm. Stamens attached beneath the disc. Ovary subglobose, pubescent at apex; style free. Capsules oblong, 3-3.5 × 1-1.3 cm, 1-seeded. Seeds oblong.

Fl. & Fr. : Jan. - Dec. Darjeeling.

2. CASSINE L.

Trees. Leaves opposite or subopposite, elliptic, crenate; stipules deciduous. Flowers polygamous or hermaphrodite, in axillary peduncled cymes. Sepals imbricate. Petals imbricate, spreading. Stamens inserted on the disc. Ovary partly immersed in the disc, 2-celled; styles short. Fruits succulent or dry, 1-2-seeded. Seeds not arillate.

A genus of ca 40 species in S. Africa, Madagascar, Tropical Asia to Pacific; 1 species in West Bengal.

Cassine glauca (Roth.) Kuntze, Rev. Gen. Pl. 1: 114, 1891. *Mangifera glauca* Rothb. Nyeg. Saml. Koncl. Norske. Vidensk. Selsk. Skr. 2: 534, t. 4, f. 1, 1783. *Elaeodendron glaucum* (Roth.) Persoon, Syn. 1: 241, 1805; Laws, *Lc.* 623; Prain, Bengal Pl. 1: 230, 1963 (repr. ed.). "Raj jehul" (Beng.).

Deciduous trees. Leaves petioled, 6-7 × 3-5 cm, elliptic or obovate, acute, entire. Flowers greenish white, in axillary dichotomous cymes. Sepals broadly ovate, acute, 0.2 - 0.3 mm long. Petals orbicular, 4-4.5 × 3 mm. Disc flat, orbicular. Drupes obovoid or ellipsoid, 12-18 mm long, yellowish green when ripe. Seeds oblong, elliptic, 1 × 1.5 mm.

Fl. & Fr. : Aug. - Nov. Bankura, Howrah, Purulia.

The root is said to be an antidote for snake-bite. The bark and leaves are used medicinally.

3. CELASTRUS L.

Scandent shrubs, unarmed. Leaves alternate, orbicular or elliptic, serrate or remotely crenate; stipules small, deciduous. Flowers polygamous, in terminal or axillary cymes. Sepals ovate or orbicular, persistent. Petals inserted under the cupular disc. Ovary free from the disc or slightly confluent at base, 3-celled, ovules 2 in each cell; stigmas 2-3-lobed. Capsules 3-valved, loculicidally dehiscent, 1-3 seeded. Seeds arillate.

A genus of ca 50 species in tropical and subtropical Asia, China, Japan, Australia and North America; 4 species in West Bengal.

1. Flowers many in terminal spreading panicles ... 3. *C. paniculatus*
1. Flowers few or many in both terminal and axillary cymes :
 2. Flowers numerous in umbellate cymes; capsules cylindrical ... 2. *C. monospermus*

2. Flowers few in short cymes; capsules globose or subglobose ;

3. Petals oblong, papillose ... 4. *C. stylosus*

3. Petals obovate-oblong, glandular ... 1. *C. hookeri*

1. *Celastrus hookeri* Prain in J. Asiat. Soc. Bengal 73:197. 1904; Ding Hou in Ann. Miss. Bot. Gdn. 42:254. 1955. *C. stylosa auct. non* Wall.; Laws in Hook.f., *l.c.* 618.

Shrubs, ca 10 m high. Leaves petioled, 6-12 × 4-7 cm, elliptic to ovate, acute, serrate. Flowers 3-5, in short peduncled or sessile cyme. Sepals deltoid, 1.5 mm long, ciliate. Petals oblong to obovate, glandular 3.5 × 1.5 mm. Capsules subglobose, 10 × 7 mm, 3-6 seeded. Seeds ellipsoid, 4 × 2 mm, black, areolae distinct.

Fl. & Fr. : March - July. Jalpaiguri.

2. *Celastrus monospermus* Roxb., Fl. Ind. ed. Carey & Wall. 2 : 394. 1824 (*monosperma*); Laws, in Hook.f., *l.c.* 618.

Scandent shrubs, ca 10 m high. Leaves petioled, 7-17 × 3-9 cm, elliptic or broadly ovate, acute, glossy, serrulate. Flowers small, greenish yellow or white, in short peduncled cymes in long slender axis, terminal or axillary. Sepals orbicular, 0.5 - 1 mm long, glandular-ciliate. Petals oblong, 2.5 mm long. Disc fleshy, annular. Ovary slightly confluent with disc at base. Capsules cylindric, stipitate, 2 × 1 cm. Seed 1, 1.5 mm long, pinkish brown, smooth.

Fl. & Fr. : March - September. Darjeeling.

3. *Celastrus paniculatus* Willd., Sp. Pl. 1 : 1125. 1798; Laws., *l.c.* 617; Prain, Bengal Pl. 1 : 231. 1963. "Malkagni" (Beng.). **Fig. 67**

Large climbing shrubs. Leaves petioled, 5-10 × 5-6 cm, broadly ovate or elliptic, acute, crenulate. Flowers small, white. Sepals semiorbicular, ciliate, 0.7 × 1.5 mm. Petals oblong, 3 × 1.5 mm, minutely pubescent. Stamens 3 mm long, filaments subulate. Ovary globose; stigma 3-lobed. Capsules subglobose, white, with persistent style at the tip, 5-10 × 5-8 mm. Seeds brownish, smooth, with obscure areolae.

Fl. & Fr. : April - Jan. Bankura, Burdwan, Malda, Purulia.

An oil for burning in lamp is obtained from the seeds.

4. *Celastrus stylosus* Wall. in Roxb. Fl. Ind. 2 : 401. 1824; Laws., *l.c.* 610, *p.p.*; Prain in J. Asiat. Soc. Bengal 73 : 196. 1904. *Gymnosporia neglecta* Wall. ex Laws, in Hook.f., *l.c.* 619.

Shrubs, 3-4 m tall, glabrous or puberulous. Leaves petioled, 5-8 × 3-5 cm, elliptic, acute. Flowers 3-7 in peduncled cymes. Sepals ovate, acute, 1-1.5 mm long. Petals obovate, 2-4 × 1-1.5 mm, papillose. Stamens inserted between disc lobes, 2-2.5 mm long, filaments filiform, papillose. Ovary subglobose; stigma 3-lobed, each lobe bifid, reflexed. Capsules subglobose, yellow, 3-6- seeded. Seeds more or less plano-convex, reddish to blackish brown, 4-6 mm long, areolate.

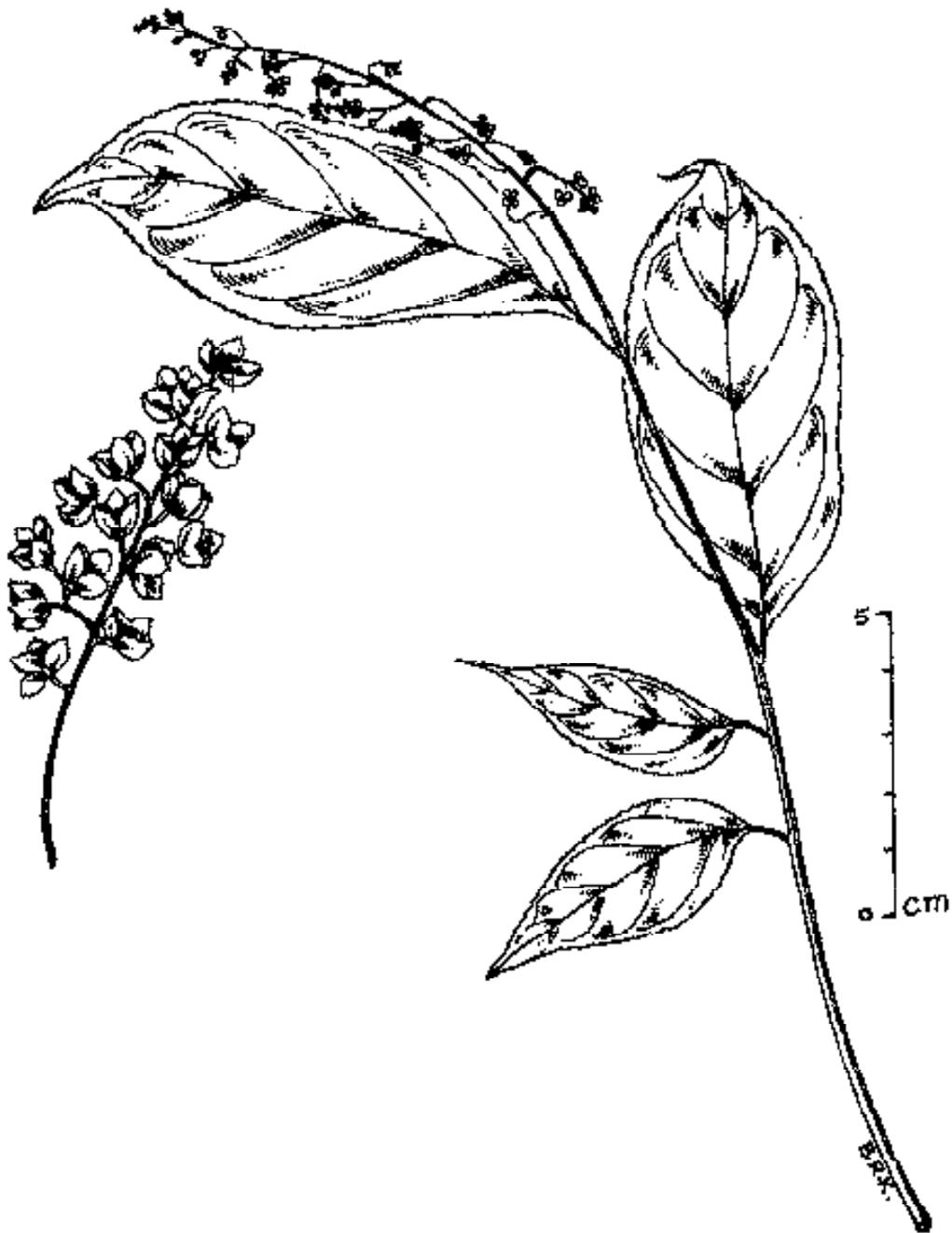


Fig. 67. *Celastrus paniculatus* Willd.

Fl. & Fr. : April - Dec. Darjeeling.

4. EUONYMUS L.

Trees or shrubs, sometimes climbing by rootlets. Leaves opposite, sessile or petioled; stipules small, deciduous. Flowers hermaphrodite, in axillary cymes. Sepals spreading or recurved. Petals spreading, entire, ciliate or fimbriate. Disc large, fleshy. Stamens inserted on the disc. Ovary sunk in the disc, 3-5 celled, with 2 ovules in each cell. Capsules 3-5 winged, 1-6-seeded. Seeds black, with aril at the base.

A genus of ca 175 species in tropical and subtropical Asia; 8 species in West Bengal.

1. Branches acutely angled; flowers usually 4-merous :
 2. Style obscure:
 3. Trees. Leaves biserrate ... 3. *E. fimbriatus*
 3. Straggling shrubs; leave sharply once serrate ... 4. *E. frigidus*
 2. Style distinct:
 4. Shrubs climbing with adventitious roots; fruits armed ... 2. *E. echinatus*
 4. Straggling or climbing shrubs without adventitious root; fruits unarmed :
 5. Fruits globose, ca 5 mm across, minutely tubercled ... 8. *E. vagans*
 5. Fruits obscurely 4 angled, slightly larger, smooth ... 6. *E. thaefolius*
1. Branches cylindric flowers 5-merous:
 6. Petals lanceolate, cordate ... 5. *E. hamiltonianus*
 6. Petals orbicular, shortly clawed:
 7. Capsules obovoid, 4 angled ... 1. *E. attenuatus*
 7. Capsule globose ... 7. *E. tingens*

1. **Euonymus attenuatus** Wall. ex Laws. in Hook. f., Fl. Brit. India 1 : 610. 1875.

Trees. Leaves 5-15 × 2-4 cm, lanceolate, acuminate, entire, coriaceous. Flowers red, in peduncled cymes; cymes much shorter than leaves. Capsules obovoid, 4-angled. Seed 1 in each cell, black, yellow arillate.

Fl. & Fr. : March - Sept. Darjeeling, Jalpaiguri.

2. **Euonymus echinatus** Wall. in Roxb. Fl. Ind. 2 : 410. 1824; Laws. in Hook.f., 611, p.p.; Brandis, Indian. Trees. 158. 1906.

Climbing over trees and rocks by adventitious rootlets. Leaves 2- 5 × 1-3 cm elliptic to ovate-lanceolate, dark green above, pale beneath. Flowers greenish

white, in peduncled cymes. Capsules globose, with scattered spines. Seeds with red aril.

Fl. & Fr. : March - Aug. Darjeeling.

3. ***Euonymus fimbriatus*** Wall. in Roxb. Fl. Ind. 2 : 408. 1824; Laws. in Hook. f., *l.c.* 611.

Trees. Leaves elliptic or ovate, acuminate, membranous. Flowers white, in sub-umbellate cymes. Petals broadly ovate, entire. Capsules with 4-wings.

Fl. & Fr. : Feb. - July. Darjeeling.

4. ***Euonymus frigidus*** Wall. in Roxb. Fl. Ind. 2 : 467. 1824; Laws. in Hook. f., *l.c.* 611.

Straggling shrubs, young branches succulent. Leaves lanceolate. Flowers small, on filiform peduncles and pedicels. Petals orbicular, entire. Capsules with 4-wings, coriaceous.

Fl. & Fr. : April - Nov. Darjeeling, Jalpaiguri.

5. ***Euonymus hamiltonianus*** Wall. in Roxb. Fl. Ind. 2 : 403. 1824; Laws., *l.c.* 612.

Small trees. Leaves 5-10 × 1.5 - 3 cm, ovate-lanceolate, membranous, finely serrate. Flowers small, greenish white. Petals 7-15 mm, lanceolate, cordate. Capsules turbinate, 4-lobed.

Fl. & Fr. : May - Dec. Darjeeling.

Wood used for carving.

6. ***Euonymus thaeifolius*** Wall. ex Laws. in Hook. f., Fl. Brit. India 1 : 612. 1875; Hara in Fl. East. Himal. 2 : 71. 1971.

Subscandent shrubs. Leaves 4-12 × 1-5 cm, ovate to elliptic-lanceolate. Flowers greenish white, in axillary or supra-axillary cymes. Petals orbicular, reddish, 5-10 mm long. Capsules globose, much enlarged, 1-2 seeded. Seeds plano-convex, 5-7 mm long, with yellow orange aril.

Fl. & Fr. : May - Dec. Darjeeling.

7. ***Euonymus tingens*** Wall. in Roxb. Fl. Ind. ed. Carey 2 : 406. 1824; Laws. in Hook. f., *l.c.* 610; Hara in Fl. East. Himal. 190. 1966.

Trees. Leaves 3-7 × 1-2.5 cm, ovate-lanceolate, sharply serrate, rough. Flowers mostly 5-merous, rarely 4-merous. Petals yellowish with purplish veins. Capsules round, 4-5-angled, not winged, smooth.

Fl. & Fr. : April - Sept. Darjeeling.

Bark used for eye-ailments and constipation.

8. ***Euonymus vagans*** Wall. in Roxb., *l.c.* 412; Laws. in Hook. f., *l.c.* 611.

Climbing shrubs. Leaves 1.5 - 5 × 1-2 cm, ovate-lanceolate, serrate. Flowers small, in axillary cymes. Fruits small, globose, the size of a pen, black, minutely tubercled.

Fl. & Fr. : May - Dec. Darjeeling.

5. MAYTENUS Molina

Shrubs, branches often modified into thorns. Leaves alternate, ovate-oblong, acuminate. Flowers hermaphrodite, in axillary cymes. Sepals connate at base. Petals reflexed after anthesis. Disc fleshy, flattened. Ovary partly immersed in the disc, 3-celled; stigma sessile. Capsules 3-valved, 2-6-seeded. Seeds arillate.

A genus of *ca* 100 species in tropical and sub-tropical regions especially in Africa; 2 species in West Bengal.

1. Leaves obovate, obtuse; capsules globose; aril of the seed membranous ... 1. *M. emarginata*

1. Leaves lanceolate, acuminate, capsules obovate, aril of the seed fleshy. ... 2. *M. hookeri*

1. **Maytenus emarginata** (Willd.) Ding Hou in van Steenis, Fl. Mal. Ser. 1, 6: 241, 1962. *Celastrus emarginatus* Willd., Sp. Pl. 1 : 1128, 1798. *Celastrus montanus* Roth in Roem. & Schult. Syst. Veg. 5 : 427, 1819; Roxb. Fl. Ind. ed. Wall. 2 : 387, 1824, et (*montana*), ed. Carey 1 : 610, 1832. *Gymnosporia montana* Laws, in Hook. f., l.c. 621; Prain, l.c. 231; Brandis, Indian Trees 163, 1906.

Shrubs, branches armed. Leaves 2-6.5 cm long, linear, obovate or orbicular, crenate. Flowers in rigid cymes, slenderly pedicelled. Capsules globose, black, 1-3 celled, 1-seeded.

Fl. & Fr. : May - July, Purulia.

2. **Maytenus hookeri** Loes. in E. & P. Pflanzenfam. 206, 140, 1942. *Gymnosporia acuminata* Laws, in Hook. f., l.c. 619; non Szysz. 1888; nec. Loes. 1942.

Shrubs unarmed. Leaves 2-8 cm long, ovate-oblong, acuminate, serrate, membranous. Flowers in delicate cymes. Petals 0.5 - 0.8 mm, oblong or elliptic, reddish. Capsules 0.5 - 1 cm, obovate, compressed, 2-seeded. Seeds black.

Fl. & Fr. : March - Sept, Darjeeling.

6. MICROTROPIS Wall. ex Meissn.

Trees or shrubs. Leaves opposite exstipulate, entire. Flowers in axillary peduncled cymes. Sepals imbricate. Petals connate at base. Disc absent or annular. Stamens inserted on the disc. Ovary free from disc globose, 2-3-celled ovules 2 in each cell; stigma obscurely 2-lobed. Capsules oblong, coriaceous, 2-valved, 1-seeded. Seeds arillate.

A genus of *ca* 70 species in N. America, S.E. Asia, Ceylon and Malaya Peninsula; 1 species in West Bengal.

Microtropis discolor (Wall.) Arn. in Ann. Nat. Hist. 3, 152, 1839; Laws, in Hook. f., l.c. 614; Brandis, Indian Trees, 160, 1906. *Cassine discolor* Wall. in Roxb. Fl. Ind. 2 : 378, 1824.

Small trees. Leaves petioled, 7-12 × 4-5 cm, elliptic, acuminate, entire. Flowers greenish white, in axillary or supra axillary compact cymes. Sepals

small, orbicular. Petals free, 2 mm long, concave. Stamens alternate with petals. Capsules ellipsoid, 12-16 × 8-12 mm, 1-celled, 2-valved, greenish orange. Seed 1, stipitate ellipsoid, 10-13 × 7-8 mm, scarlet red, finely veined.

Fl. & Fr. : Jan. - Dec. Darjeeling, Jalpaiguri.

CULTIVATED SPECIES

Following species are planted in the Indian Botanic Garden, Howrah:

***Euonymus bullatus* Wall.**

***E. glaber* Roxb.**

***E. grandifloras* Wall.**

***E. javanicus* Bl.**

***E. nitidus* Benth.**

RHAMNACEAE

(G. Sengupta & B. Safui)

A family of ca 58 genera and 900 species almost cosmopolitan in distribution; 7 genera and 17 species in West Bengal.

1. Shrubs with tendrils; disc prominently lobed between the stamens; fruits inferior, 3-winged at maturity ...2. *COLUANIA*
1. Trees or shrubs, without tendrils; disc not prominently lobed between the stamens; fruits superior, 1-winged or not winged:
 2. Leaves strongly 3(-5)-nerved at base:
 3. Plants unarmed; peduncles swollen and fleshy in fruit; fruits with 3 pyrens ...3. *HOVENIA*
 3. Plants armed; peduncles neither swollen nor fleshy in fruit; fruits with 1 pyrens ...7. *ZIZIPHUS*
 2. Leaves penninerved:
 4. Erect trees or shrubs; leaves alternate; disc not lobed; flowers peduncled in fascicles or racemes; fruit a berry ...4. *RHAMNUS*
 4. Shrubs with scandent branches; other characters not as above:
 5. Fruit prolonged into a linear-oblong wing ...16. *VENTILAGO*
 5. Fruit not winged:
 6. Fruit 2-celled, 2-seeded ...1. *BERCHEMIA*
 6. Fruit 3-celled, 3-seeded ...5. *SAGERETIA*

1. *BERCHEMIA* Neck.ex DC.

Shrubs, unarmed, branches often scandent. Leaves alternate, penninerved; nerves straight, almost parallel. Flowers in axillary or terminal panicles, or in fascicles, usually 5-merous. Disc lining the calyx-tube, margin free. Ovary sunk in the disc, free, 2-celled. Fruit a hard or fleshy drupe, mostly cylindrical, girt at the base with calyx-tube, 2-seeded. Seeds linear-oblong.

About 22 species in tropics of Asia, Africa and America; 2 species in West Bengal.

1. Leaves ovate-oblong, 4-6.5 cm long; inflorescence below 8 cm long ...1. *B. flavescens*

1. Leaves ovate, 4-12 cm long; inflorescence 10-25 cm long ...2. *B. floribunda*

1. *Berchemia flavescens* (Wall.) Brongn., Ann. Sci. Nat. 10: 357. 1826; Lawson in Hook. f., Fl. Brit. Ind. 1: 637. 1875; Hara in Fl. East Himal. 197. 1966. *Ziziphus flavescens* Wall. in Roxb. Fl. Ind. ed. Carey & Wall. 2: 367. 1824.

Unarmed smooth climbing shrubs. Leaves oblong or ovate-oblong, 4.5-6.5 × 2-3.5 cm, apex acute or obtuse, base acute or rounded, entire; veins parallel, oblique to midrib. Flowers small, in axillary racemes or panicles; bracteate; pedicels short with subulate bracteoles. Calyx lobes 5, triangular. Petals oblong. Drupes about 1 cm long, with persistent style base at tip.

Fl. : May - Oct.; *Fr.* : June - Dec. Darjeeling.

2. *Berchemia floribunda* (Wall.) Brongn., Ann. Sci. Nat. 10:357, t. 13.1. 1826; Lawson, in Hook f., *l.c.* 637; Hara, *l.c.* 197. *Ziziphus floribunda* Wall. in Roxb. *l.c.* 368.

Climbing shrubs or small trees with smooth branches. Leaves ovate, 4-12 × 2-6.5 cm, entire, apex mostly acuminate, base rounded; veins parallel, forming a narrow angle to the mid. petioles 1-2.5 cm, terete. Flowers small, fascicled on large a axillary or terminal panicles, pedicellate. Calyx lobes 5, triangular. Petals 5, spatulate. Stamens shorter than calyx. Drupes 1-1, long, with persistent style base at the tip and seated on persistent calyx base and disc.

Fl. & Fr. : May - Sept. Darjeeling.

Leaves are supposed to be poisonous to cattle.

2. *GOUANIA* Jacq.

Unarmed shrubs, climbing by means of tendrils from ends of branchlets or from base of inflorescences. Leaves alternate, petiolate, penninerved. Flowers polygamous, in axillary or terminal spikes or racemes. Sepals 5, lobes triangular, connate below, persistent. Petals 5, hooded or spatulate. Disc flat or concave, glabrous or pilose sunk in the calyx-tube, 5-angled or stellate. Stamens 5, antepetalous; anthers dehiscing longitudinally. Ovary inferior, sunk in the disc, 3-celled and angled. Seeds plano-convex, obovate.

About 20 species, mostly in the tropics and subtropics; 2 species in West Bengal.

1. Flowers glabrous; disc lobes faintly emarginate ...2. *G. tiliaefolia*
 1. Flowers pubescent or villous; disc lobes linear
 acuminate ...1. *G. napalensis*

1. *Gouania napalensis* Wall. in Roxb. Fl. Ind. ed. Carey & Wall. 2: 417. 1824; Lawson in Hook.f., l.c. 644.

Leaves ovate, 7-12 × 4-8 cm, chartaceous, crenate or crenulate, sharply acuminate at apex, subcordate at base; nerves impressed on upper surface, prominent and tomentose on lower; petioles slightly furrowed, pubescent. Inflorescence a terminal or axillary raceme or spike, 12-30 cm long, villous, shortly peduncled; bracteoles subulate, caducous. Flowers small, solitary or fascicled, shortly pedicelled. Sepals densely villous outside. Petals spatulate. Stamens opposite and enclosed within the petals. Disc 5-lobed or stellate. Fruit a schizocarp.

Fl. : June - Oct. Darjeeling.

The fruit is said to be medicinal.

2. *Gouania tiliaefolia* Lamk., Encycl. 3: 5. 1789. *G. leptostachya* DC. Prodr. 2: 40. 1825; Lawson in Hook. f., l.c. 643. Prain, Bengal Pl. 235; 1963 (repr.ed.). Hara l.c. 197.

Leaves ovate, 5-10 × 3-6 cm, subcoriaceous, crenate, abruptly acuminate at apex, subcordate at base, lateral veins arched. Inflorescence a long raceme; bracteoles conspicuous. Flowers pedicelled, solitary or fascicled. Sepals glabrous or with few scattered hairs outside. Petals hooded. Disc concave. Fruit a schizocarp, glabrous.

Fl. : July - Sept.; Fr. : Sept. - Dec. Bankura, Howrah, Jalpaiguri.

The plant contains an alkaloid. Leaves used in sores; young leaves eaten as vegetable. Bark and root used for washing hairs.

3. HOVENIA Thunb.

Unarmed tree; young branches puberulous. Leaves alternate, petiolate, chartaceous, penninerved; stipules small, deciduous. Flowers in pedunculate dichotomously branched axillary and terminal cymes. Sepals 5, tube funnel-shaped. Petals 5, clawed, cucullate. Disc lining the calyx tube, margin free and hairy. Stamens 5, slightly longer than petals. Ovary sunk in the disc, 3-celled; style 3-cleft. Fruit roundish with thickened peduncles, faintly 3-lobed, 3-seeded.

About 5 species distributed mostly in E. Asia (Himalaya, China, Japan); 1 species in West Bengal.

Hovenia dulcis var. *acerba* (Lindl.) Sengupta & Safui, Bull. Bot. Surv. India 26 : 53. 1984. *H. acerba* Lindl. Bot. Reg. 6 : 6. 501. 1820. *H. dulcis sensu* Lindl. non Thunb; Lawson in Hook.f., l.c. 640.

Unarmed trees. Leaves ovate, sometimes suborbicular-ovate, 10-18 × 6-12 cm, nearly rounded or acute at base, acuminate at apex, serrate, sometimes almost entire, 3-nerved at base. Flowers 5-merous, white, about 6 mm across. Drupes 7-8 mm in diam. Seeds orbicular, black, shiny.

Fl. : May - Aug.; *Fr.* : July - Dec. Darjeeling.

Hovenia acerba is treated as a variety of *H. dulcis* and not as a separate species in view of its close affinity with it.

4. RHAMNUS L.

Shrubs or small trees. Leaves alternate, sometimes fascicled, rarely opposite, petiolate, chartaceous, penni-nerved; stipules small, deciduous. Flower in axillary fascicles or in simple or compound racemes. Sepals 4-5, connate up to one-third its length. Petals 4-5, cucullate or flat. Disc lining the calyx tube, margin thin. Stamens 4-5; filaments short; anthers versatile, oblong, 2-celled. Ovary free, globose or ovoid; style 3-4 cleft. Fruit a berry-like drupe, on persistent calyx tube, 2-3-celled. Seeds obovoid, albumen fleshy.

About 110 species distributed over both the hemispheres with greater concentration in E. Asia and N. America; 3 species in West Bengal.

- 1. Plants armed; flowers 4-merous ...3. *R. virgatus*
- 1. Plants unarmed; flowers 5-merous :
 - 2. Medium-sized trees; leaves ovate; petals absent ...2. *R. purpureus*
 - 2. Rambling shrubs; leaves oblong or elliptic-oblong; petals 5 ...1. *R. napalensis*

1. ***Rhamnus napalensis*** (Wall.) Lawson in Hook.f., Fl. Brit. India 1:640 1875. *Ceanothus napalensis* Wall. in Roxb. l.c. 375.

Suberect or scrambling shrubs with long slender glabrous branches; young parts pubescent. Leaves oblong or elliptic-oblong, 7.5-12.5 × 3.5-6 cm, serrulate, shortly acuminate, more or less rounded at base, dark-green or shining above. Flowers pedicellate, small, green. Sepals 5, lanceolate, acute, ridged at the inner middle. Petals 5, cucullate and caducous. Stamens 5. Style 3-cleft, connate up to middle. Fruits blackish-red, 3-lobed at maturity. Seeds brown, shiny.

Fl. : July - Oct. ; *Fr.* : Oct. - Feb. Darjeeling, Jalpaiguri.

Pounded fruits with vinegar are prescribed for the treatment of herpes.

2. ***Rhamnus purpureus*** Edgew. in Trans. Linn. Soc. 20: 44. 1846; Lawson in Hook. f., l.c. 639; Hara, l.c. 198.

Trees of moderate size, unarmed; branches purplish. Leaves petiolate, ovate or ovate-elliptic, 6-13 × 2.5-6 cm, acute at both ends, glabrous, serrate; stipules linear. Flowers in axillary fascicles; pedicels stout, 1 cm long. Calyx cup-shaped, lobes 5, triangular. Petals absent. Style 3-cleft. Fruits sub-globose, 5-10 mm across.

Fl. : May - June; *Fr.* : June - Oct. Darjeeling.

Fruit bitter in taste, used as purgative.

3. **Rhamnus virgatus** Roxb., Fl. Ind. ed. Carey & Wall, 2: 351. 1824; Hara, *l.c.* 198. *R. dahuricus* Pall. Fl. Ross. 2.t. 61; Lawson, in Hook.f., *l.c.* 639.

Shrubs or small trees; with straight branches; branchlets spinescent; bark smooth, shining. Leaves fasciated on arrested branchlets, ovate, ovate-lanceolate or elliptic-lanceolate, 1.5-6 × 0.5-3 cm, ovate, acuminate, mostly tapering at both ends, serrulate, petiolate, glabrous. Flowers many, small, clustered in the axils; pedicels filiform. Calyx tube campanulate. Petals spatulate. Style 2-3-cleft. Berry globose, 2-3-celled.

Fl. : March - June; *Fr.* : May - Aug. Darjeeling.

5. SAGERETIA Brongn.

Shrubs, unarmed or armed, with slender subsucculent branches. Leaves subopposite or opposite, penninerved, serrate or crenate. Inflorescence an axillary or terminal spike or spike-like panicle. Flowers minute, sessile, numerous. Calyx 5-lobed, tube hemispherical, lobes acute, keeled. Petals 5, clawed or hooded. Stamens 5, as long as petals. Disc cup-shaped, lining the calyx-tube, margin free, 5-lobed. Ovary superior, sunk in the disc, free, 3-celled; style short, 3-grooved; stigma 3, capitate. Drupes globose, 3-seeded, indehiscent.

About 35 species in Central and Eastern Asia, Java and warmer parts of N. and S. America; 1 species in West Bengal.

Sageretia hamosa (Wall.) Brongn., Ann. Sc. Nat. Ser. 1, 10: 360. 1826; Lawson, *l.c.* 641. *Ziziphus hamosa* Wall. in Roxb., *l.c.* 369.

Large shrubs. Leaves oblong or ovate-oblong, 5.5-10 × 2.5-5 cm, serrate or serrulate, acuminate, glabrous, mostly rounded at base; petioles canaliculate; nerves impressed above, prominent below. Flowers small, puberulous, fasciated. Drupes dark green, glaucous, with 2-3 pyrenes.

Fl. & Fr. : Aug. -Feb. Darjeeling.

6. VENTILAGO Gaertn.

Climbing shrubs; branches puberulous, striate. Leaves alternate, stiff, penninerved, usually crenate; stipules very small, caducous. Flowers small; bracteoles many, small. Sepals 5, keeled internally. Petals 5, deltoid or obovate, cucullate. Stamens 5, adnate to base of petals; anthers dorsifixed. Ovary sunk in the disc, 2-celled; style short, stigmas 2. Fruits subglobose 1(-2)-seeded nut, base more or less enclosed in the adherent calyx-cup and prolonged above into a coriaceous wing. Seeds subglobose.

About 40 species, distributed mostly in E. and S.E. Asia, Australia, Africa, Madagascar and America; 1 species in West Bengal.

Ventilago denticulata Willd., Ges. Natur. f. Neue. Schr. 3: 417. 1801; Banerjee & Mukherjee in Indian For. 96(3): 209. 1970. *V. calyculata* Tulasne in Ann. Sci. Nat. Ser. 4.8:124; Lawson in Hook.f., *l.c.* 631; Prain, *l.c.* 235. "Ruknupita" (Beng.); 'Bonga-Sarjom' (Sant). Fig. 68



Fig. 68. *Ventilago denticulata* Willd.

Climbers. Leaves ovate-oblong to elliptic-oblong, 5-15 × 2.5-7 cm, crenate or crenate-serrate, pubescent, oblique at base and subacute at apex; petioles short, channelled. Flowers in clusters, in axillary or terminal panicles, pubescent, pedicellate. Sepals puberulous outside. Petals alternate with sepals. Stamens equal and opposite the petals. Disc villous. Ovary hairy, style diverging. Fruit samaroid, wing flat, oblong, coriaceous, pubescent, the persistent calyx-cup covering half or more than half of the nut.

Fl. : Sept. - April; *Fr.* : Nov. - May. Burdwan.

Bark is powdered and applied to sprains. The sap is used for treatment of deafness. Oil obtained from the seed is used in cooking.

7. ZIZIPHUS Mill.

Trees or shrubs, frequently armed with stipular spines. Leaves alternate, petiolate, entire or serrate, mostly 3-nerved. Flowers bisexual, in axillary fascicled sessile or peduncled cymes. Sepals 5, triangular, ovate, innerside ridged in the middle, keeled. Petals 5, clawed or nearly absent. Disc 5-10-lobed, flat or pitted, fleshy, margin free. Stamens 5, opposite and enclosed in petals, enlarging during anthesis. Ovary partly or fully immersed in the disc, 2-4-celled. Style 2-3, free or partly connate; stigma small, papillose. Drupes globose or oblong with 1-4-celled and seeded stone. Seeds plano-convex.

More than 100 species, found more or less all over the World, concentrated mostly around S.E. Asia and tropical Africa; 7 species in West Bengal.

1. Petals 5:

2. Flower in fascicles, or in sessile or short peduncled cymes; peduncles shorter than pedicels:
 3. Trees, shrubs or undershrubs; young branches with grey pubescence; stipular prickles 1 or 2; style connate up to two-third its length :
 4. Small trees; leaves up to 6.5 × 4 cm, tomentose only on the undersurface ; moderately prickly ; disc not pitted ...3. *Z. mauritiana*
 4. Bushy shrubs with profuse branching; leaves up to 2.5 × 2 cm, tomentose on both sides; highly prickly; disc pitted ...4. *Z. nummularia*
 3. Scramblers or climbers; young branches rusty tomentose; stipular prickle 1; style connate almost up to apex ...5. *Z. oenoplia*
2. Flowers in peduncled cymes; peduncles longer than pedicels:
 5. Small trees or straggling shrubs; leaves shortly pubescent beneath; style 3; disc grooved at centre ...7. *Z. xylopyrus*

5. Scrambling shrub; leaves glabrous; style 2; disc not grooved at centre ...2. *Z. funiculosa*
1. Petals absent:
6. Leaves ovate, apex acuminate; disc 10-lobed; style bifurcated from above the middle ...1. *Z. apetala*
6. Leaves suborbicular, apex almost rounded or slightly acute; disc 5-lobed; style bifurcated from below the middle ...6. *Z. rugosa*

1. ***Ziziphus apetala*** Hook.f. ex Lawson in Hook.f., Fl. Brit. India 1: 635. 1875.

Shrubs; young branches covered with rusty pubescence. Leaves ovate or ovate-lanceolate, acuminate, 6-10 × 2-4.5 cm, oblique at base, serrate, membranous, with 3 prominent nerves from base, glabrous except for hairs on veins below; stipular prickles solitary, recurved, base broad, with rusty pubescence. Flowers axillary or in terminal cymes, rusty tomentose, pedicellate. Petals absent. Disc 10-lobed, fleshy, hairy. Stamens as long as sepals. Ovary 2-celled, hairy; style bifurcated from a little above the middle. Fruits 1-celled, compressed, glabrous.

Fl. : March- Aug.; *Fr.* : April - Oct. Darjeeling, Jalpaiguri.

Fruits are said to be edible.

2. ***Ziziphus funiculosa*** Ham. ex Lawson in Hook. f., *l.c.* 636. 1878.

A scrambling shrub; young shoots pubescent. Leaves ovate or elliptic-oblong with acuminate apex, 6-10.5 × 3-5 cm, base oblique or almost rounded, crenate, coriaceous, glabrous, with 3 prominent convergent nerves; stipular prickles solitary, recurved. Flowers shortly pedicelled, in axillary or terminal paniced cymes. Sepals with rusty pubescence outside. Petals cucullate or hooded. Disc thin, glabrous, faintly 10-lobed. Ovary 2-celled; style 2, divided almost from the middle. Drupes obovoid or roundish, about 2 cm across, tomentose when young, glabrous on maturity, fleshy.

Fl. : Feb. - April; *Fr.* : April - June. North Bengal.

Fruits edible.

3. ***Ziziphus mauritiana*** Lamk., Encycl. 3 : 319. 1789; Hara, *l.c.* 198. *Z. jujuba* Lamk. (*non* Mill. 1768); Lawson in Hook. f., *l.c.* 632; Prain, *l.c.* 234. "Kool", "Ber" "Boroi" (Beng.); "Baer", "Ber" (Hindi). Fig. 69

Small trees; young branches pubescent; stipular spines 2, one straight, erect, the other recurved, cernuous. Leaves ovate- elliptic, sometimes ovate or suborbicular, 2.5-6.5 × 2-4 cm, tomentose beneath, finely crenate-serrate, obtuse or slightly rounded at both ends or weakly oblique at base; petioles grey tomentose. Flowers shortly pedicelled. Sepals pubescent outside, keeled. Petals white, cucullate. Disc 10-ridged grooved at the centre. Ovary ovoid, almost immersed in the disc; style connate up to two-third way up. Drupes globose, fleshy, 1-2 cm across.

Fl. : July - Oct. ; *Fr.* : Oct. - Feb. Throughout West Bengal.

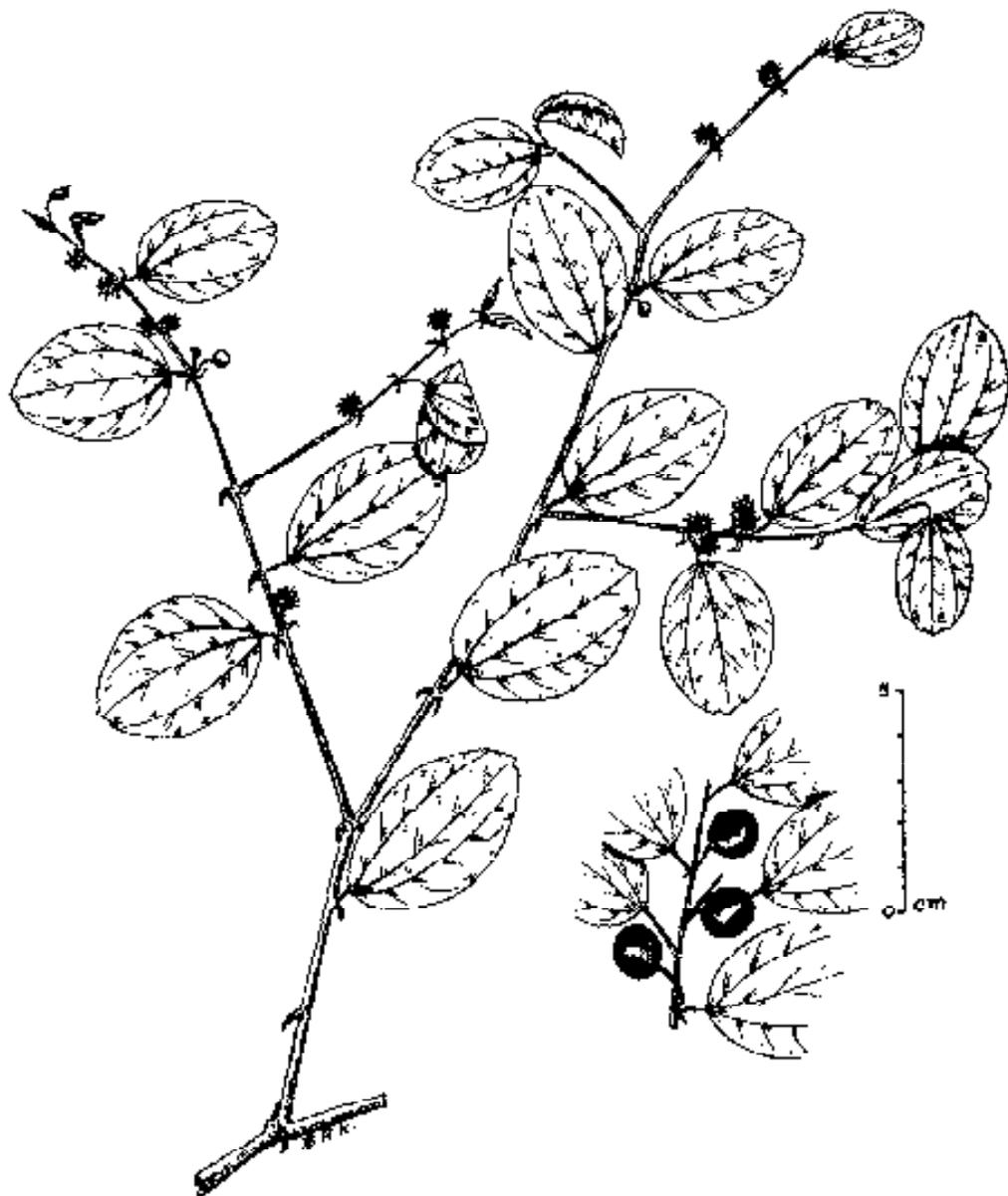


Fig. 69. *Ziziphus mauritiana* Lamk.

The trees are good host for Lac-insects. Fruits are edible and a good source of vitamin C, sugar and many mineral constituents. Bark is used for tanning and wood as fuel and for charcoal.

4. *Ziziphus nummularia* (Burm.f.) Wt. & Arn., Prodr. 162. 1834; Lawson in Hook.f., *l.c.* 633. *Rhamnus nummularia* Burm.f., Fl. Ind. 61. 1768.

A bushy shrub with profuse zig-zag branches; young shoots puberulous; bark at times covered with white pellicle; stipular prickles 2, one straight, long, the other short, recurved. Leaves variable, ovate, elliptic, orbicular or sometimes oblong, 1.5-2.5 × 1.2-2 cm, weakly serrate, tomentose on both sides, lower grey and velvety. Flowers greenish-white to yellow, in axillary, sometimes in terminal, fascicled cymes. Sepals tomentose outside, keeled. Petals 5, cucullate with convolute margins. Disc 10-lobed, pitted. Ovary 2-celled; style bifurcated above the middle. Drupes globose, about 1.2 cm across, green or brown, sometimes red.

Fl. : May - Sept. ; *Fr.* : Aug. -Dec. Purulia.

Fruits edible.

5. *Ziziphus oenoplia* (L.) Mill., Gard. Dict. ed. 8. n. 3. 1768; Lawson in Hook.f., *l.c.* 634; Prain, *l.c.* 234. *Rhamnus oenoplia* L., Sp. Pl. 194. 1753. "Siakul" "Makua" "Jhauska", Gangal ku (Beng.); "Makai" (H.).

A thorny straggling or climbing shrub; young branches rusty tomentose. Leaves ovate or ovate-lanceolate, or oblong ovate, acute or subacute, with very oblique base, 2.5-6.5 × 2-2.5 cm, glabrous or pubescent above, silky hairy beneath, with usually 3-4 main nerves at base; stipular prickles usually 1, short, stout, straight or hooked, pubescent at base. Flowers in subsessile pubescent paniculate cymes. Sepals hairy outside. Petals shorter than sepals but longer than stamens. Disc glabrous with 10 deeply pitted lobes. Style united almost up to apex. Drupes globose or obovoid, black and shiny.

Fl. : Aug. - Oct. ; *Fr.* : Sept. - Dec. Bankura, Burdwan, Hooghly, Howrah, Malda, Murshidabad, Purulia, 24-Parganas.

Fruits edible; fruits, bark and roots used medicinally; bark used in tanning. Plant is a good host for sandalwood tree.

6. *Ziziphus rugosa* Lamk., Encycl. 3: 319. 1789; Lawson in Hook.f., *l.c.* 636; Prain, *l.c.* 234; Hara in Fl. East Himal. 77. 1971.

A large shrub or a small tree, often climbing; young branches densely tomentose. Leaves suborbicular, 6-15 cm long, apex almost rounded or slightly acute, base oblique, sometimes cordate; margins denticulate; petioles puberulous; stipular prickles short, stout and curved with broad base, sometimes in pairs. Flowers densely pubescent, in long pedunculate cymes. Sepals tomentose outside. Petals absent. Disc 5-lobed, hairy. Ovary 2-celled, hairy; styles 2, connate below the middle, hairy. Drupes globose or pyriform, 0.5-1 cm across, 1-celled and 1-seeded.

Fl. : Dec. - Feb. ; *Fr.* : Jan. - April. Bankura, Darjeeling, Purulia.

Fruits edible; bark and flowers medicinal; wood used as fuel.

7. *Ziziphus xylopyrus* (Retz.) Willd., Sp. Pl. 1: 1104. 1798; Lawson in Hook. f., *Lc.* 634; Prain, *Lc.* 234; Hara, *Lc.* 198. 1966. *Rhamnus xylopyrus* Retz., Obs. Bot. 2: 11. 1781. "Kat-ber", "Kakor", "Ghoni" (H).

Small trees; young branches grey tomentose. Leaves 2-7.5 × 1-5 cm, suborbicular, or sometimes obovate or elliptic-oblong, 2-7.5 × 1-5 cm, serrulate, pubescent beneath, glabrous or minutely pubescent above, oblique or subcordate at base; stipular prickles either in pairs or absent. Flowers green, pedicels up to 5 mm. Sepals pubescent outside, lobes ovate, acute. Petals spatulate and reflexed. Disc 5-angled. Ovary 3(-7)-celled; styles 3(-2). Fruits globose, hard and woody, 1.5-2.5 cm across, rarely glabrous, 3-celled and 3-seeded.

Fl. : April - June; *Fr.* : May - Aug. Burdwan, Darjeeling, Purulia.

Trees are good host for lac-insects. Fruits and bark used for tanning. Wood used as charcoal and for making handles of agricultural implements.

VITACEAE

(J. Bhattacharya & T. K. Paul)

A family of about 12 genera and 700 species in tropics and subtropics of the world; 6 genera and 27 species in West Bengal.

1. Petals free; leaves simple or compound :
 2. Inflorescence tendril bearing; flowers 5-merous ... 1. AMPELOCISSUS
 2. Inflorescence not tendril bearing; flowers tetramerous :
 3. Flowers unisexual; stigma 4-lobed ... 5 TETRASTIGMA
 3. Flowers bisexual; stigma simple or 2-lobed:
 4. Petals 5, spreading or sometimes calyptrate ... 4. PARTIENOCISSUS
 4. Petals 4, at first connivent, then separating :
 5. Berry 2-4 seeded; inflorescence axillary; leaves compound, pedate or digitate ... 2. CAKRATA
 5. Berry usually 1-seeded, rarely 2-seeded; inflorescence leaf apposed; leaves usually simple, sometimes 3-foliolate or digitate ... 3. CISSUS
 1. Petals united at the tip; leaves always simple ... 6. VITIS

1. AMPELOCISSUS Planch.

Climbing shrubs. Leaves simple, entire or lobed, sometimes digitate, pedate or biternate. Flowers in leaf-opposed pedunculate cymes or thyrse, polygamous, 4- or 5-merous; peduncle tendril bearing. Calyx cupular, toothed. Petals free or cohering at apex. Stamens free; filaments slender, inserted below the margins of disc; disc annular, 5-10-furrowed. Ovary 2-loculed with 2 ovules in each locule; style short, conical; stigma discoid. Berry succulent, 2-3-seeded. Seeds obovoid, dorsally compressed.

A genus with ca 95 species in the tropical regions of Asia, Africa, America and Australia; 5 species in West Bengal.

1. Inflorescence a paniculate cyme :
 2. Subwoody climbers; branchlets, peduncles and petioles with stiff black hairs; leaves with long glandular hairs ... 1. *A. barbata*
 2. Herbaceous climbers; branchlets, peduncles and petioles glabrous; leaves glabrous when mature ... 2. *A. latifolia*
1. Inflorescence an umbellate cyme :
 3. Leaves entire ... 4. *A. sikkimensis*
 3. Leaves lobed:
 4. Stem deeply grooved; leaves shallowly 5-7-lobed; minutely hairy, lobes with rounded tips ... 3. *A. nervosa*
 4. Stem not grooved; leaves prominently 3-5-lobed, densely woolly tomentose, lobes with acute tips ... 5. *A. tomentosa*

1. **Ampelocissus barbata** (Walt.) Planch. in DC. Monogr. Phan. 5: 375. 1887. *Vitis barbata* Walt. in Roxb. Fl. Ind. ed. Carey, 2: 478. 1824; Lawson in Hook. f., Fl. Brit. India 1: 651. 1875; Prain, Bengal Pl. 1: 237. 1963 (repr.ed.) "Jarila-lahara" (Beng.).

Large woody climbers, with leaf opposed tendrils. Stem and branches terete with stiff black glandular hairs, young shoots woolly; petioles and peduncles glabrescent at maturity. Leaves ovate-cordate, acute or acuminate, 12-30 × 11-22 cm, long glandular hairy to glabrescent above, brownish pubescent beneath; margins sparingly dentate; petioles 5-16 cm long, bristly tomentose. Cymes laxly panicled; peduncles 7-14 cm long, pubescent, with long forked tendril at base. Flowers pentamerous, sessile or subsessile. Calyx toothed. Petals ovate-oblong. Stigma capitate. Berries elliptic, black, 0.5-1 cm long, shortly stalked, 1-2-seeded. Seeds wedge-shaped.

Fl. : June - Aug.; *Fr.* : Aug. - Oct. Darjeeling, Jalpaiguri.

Fruits are edible.

2. **Ampelocissus latifolia** (Roxb.) Planch. in J. Vigne Amer. 8: 374. 1884. *Vitis latifolia* Roxb., l.c. 474; Lawson in Hook.f., l.c. 652. Prain, l.c. 237. "Gowalia-lata" (Beng.).

Large twining herbaceous climbers with perennial rootstock. Stems hollow, striated and glabrous. Leaves broadly orbicular-cordate, 3-5-7-angled or shallowly lobed, 5-16 × 7-18 cm, dentate, glabrous; petioles 6-12 cm long, glabrous. Flowers in pyramidal paniculate compact cymes, reddish-brown; peduncles 5-8 cm long with 2-branched slender tendril. Calyx truncate. Petals 2 mm long, oblong. Berries ellipsoid, 5-6 × 6-9 mm, black, 2-or rarely 3-4-seeded. Seeds ellipsoid, stony, face plain or ridged, black rugose, margins crenulate.

Fl. : May - Aug.; *Fr.* : Oct. - Nov. Throughout West Bengal.

Roots are medicinal. Fruits are eaten.

3. *Ampelocissus nervosa* (Lawson) Planch. in DC. Monogr. Phan. 5 : 372. 1887. *Vitis nervosa* Lawson in Hook.f., l.c. 650.

Climbers with deeply grooved hollow stems. Leaves broadly ovate-cordate, often up to 60 cm wide, subpalmately shallowly 5-7-lobed, tips rounded, pubescent above, lower surface minutely hairy, veins prominent, margins irregularly dentate. Flowers sessile, pentamerous, in umbellate cymes; peduncles stout with forked tendril. Stigmas capitate. Berries ovoid, black, fleshy, 2-seeded. Seeds oblong, with incurved margins, pointed at apex.

Fl. & Fr. : April - Oct. Darjeeling, 1100 - 1600 m.

4. *Ampelocissus sikkimensis* (Lawson) Planch. in J. Vigne Amer. 8. 376. 1884 & in DC. Monogr. Phan. 5 : 371. 1887. *Vitis sikkimensis* Lawson in Hook. f., l.c. 650. Fig. 70

Slender climbers, often trailing, younger parts glaucous. Stem cylindrical, hollow, reddish. Leaves orbicular-ovate, unlobed, deeply cordate, 8-30 × 6-24 cm, abruptly acuminate, sparsely covered with peltate hairs, margin denticulate; petioles 4-9 cm. Cymes umbellate, subfleshy, leaf-opposed; peduncles 2-10 cm long, bearing a forked tendril. Flowers pentamerous, 1-2 mm. Calyx short, distinct; stigma simple. Berries obovoid, 3-6 mm, black, 2-seeded. Seeds with a spatulate tubercle on the back.

Fl. : July - Aug.; *Fr.* : Aug. - Dec. Darjeeling.

5. *Ampelocissus tomentosa* (Roth) Planch. J. Vigne Amer. Vitic. Eur. 8 : 375. 1884. *Vitis tomentosa* Heyne ex Roth, Nov. Pl. Sp. 157. 1821; Lawson in Hook.f., l.c. 650; Prain, l.c. 237. "Ghora lidi" (Sant.).

Large woody climbers, covered with a dense reddish loose woolly tomentum. Leaves palmately 3-5-lobed, 7-12 × 8.5-14 cm, cordate at base; lobes obovate or oblong, acute, floccose with woolly tomentum; margins denticulate; petioles 2-10 cm long, woolly; stipules short, truncate. Cymes dense, umbellate; peduncles leaf-opposed, stout, with or tendril below the cyme. Flowers sessile, scarlet red, araneously woolly. Calyx membranaceous, woolly. Petals 5, spreading, ovate-oblong. Ovary conical, stigma capitate. Berries ovoid, 5 × 4 mm, black, 1-seeded. Seeds obcordate, furrowed and keeled on ventral surface, pitted on the outer, with rayed fissure from the pit.

Fl. : July - Oct.; *Fr.* : Oct. - Dec. Bankura, Burdwan, Jalpaiguri.

Root is applied to cure body swelling.

2. CAYRATIA Juss.

Climbing shrubs or herbs with tendrils opposite the leaves. Leaves alternate, trifoliolate or pedately compound, stipulate. Flowers axillary or in pseudo-terminal corymbs or umbels, hermaphrodite, tetramerous. Calyx cupular, entire or rarely toothed. Petals free, patent or reflexed, more or less cucullate within, adnate to the base of the ovary. Stamens inserted around disc, anthers introrse. Ovary 2-loculed with 2 ovules in each locule; style subulate; stigma

indistinct. Berries globose, 2-4-seeded, thickly discoid or transversely ellipsoid. Seeds hemispheric pyriform or oblong, convex on the back, smooth or angular.

A genus with *ca* 50 species in the tropical regions of the world; 4 species in West Bengal.



Fig. 70. *Ampelacissus sikkimensis* (Lawson) Planch.

1. Leaves digitately 3-foliolate:
 2. Leaflets ovate or elliptic ovate, 2.5-8 × 2-5 cm, lower surface hairy or glabrescent; berry depressed-globose or discoid, shining black ... 4. *C. trifolia*
 2. Leaflets ovate-oblong, 9-18 × 5-8.5 cm, lower surface densely hairy; berry transversely oval, pale red ... 1. *C. geniculata*
1. Leaves pedately 5-11-foliolate:
 3. Leaves pedately 5-foliolate, leaflets 3-7.5 × 1.2 - 3.5 cm, margin sharply serrate; peduncles articulate; seeds pyriform ... 2. *C. japonica*
 3. Leaves pedately 5-11-foliolate, leaflets 3.5-20 × 2-6 cm, margin crenate or shallowly serrate; peduncles not articulate; seeds hemispheric ... 3. *C. pedata*

1. ***Cayratia geniculata*** (Bl.) Gagnep., Not. Syst. 1 : 347, 1911. *Cissus geniculata* Bl., Bijdr. 184, 1825.

Climbers. Stem angular, pubescent. Leaves digitately 3-foliolate; leaflets 5-18 × 2-8 cm, ovate-oblong, acute, serrate, pubescent beneath; petioles 5-8 cm; petiolules 1-2 cm; tendril simple. Inflorescence pendulous; peduncles 6-8 cm, upcurved at apex, usually geniculate. Flowers 5 mm across. Petals 2.5-3 mm, ovate with prominent vein, margin entire. Disc bright yellow. Stamens 4, short. Stigma capitate. Berries transversely ovoid, tri- or quadri-lobed, 5-15 mm across, 2-4-seeded. Seeds orbicular, 8-10 mm, ventral aperture large, ca 1.5 mm.

Fl. & Fr. : April - Oct. Darjeeling.

Commercially used as brush-wood.

2. ***Cayratia japonica*** (Thunb.) Gagnep. in Not. Syst. 1 : 349, 1911. *Vitis japonica* Thunb., Fl. Jap. 104, 1784; Prain, l.c. 238. *Vitis nullis* Wall. ex Lawson in Hook. f., l.c. 660.

Slender woody climbers. Stem solid, terete, pubescent. Leaves pedately 5-foliolate; leaflets 3-7.5 × 1.2-3.5 cm, ovate, ovate-lanceolate to obovate, shortly acuminate, base acute or cuneate, margins sharply serrate, lower surface pubescent; petioles 5-10 cm long; tendril leaf-opposed, simple or forked. Inflorescence an umbellate cymose panicle. Flowers 2-3 mm across, pedicel 2.5-6.5 cm long. Sepals and petals pubescent outside. Petals greenish white, sub-orbicular. Fruits 5-8 mm across, white, turning purple, 1-4-seeded. Seeds pyriform with ridged faces, back convex, rugose, acute at base.

Fl. & Fr. : April - Aug. Darjeeling, Jalpaiguri.

Common on hedges and shrubs, and also in some evergreen forests - known as wild grapes.

3. ***Cayratia pedata*** (Lam.) Juss. ex Gagnep. in Not. Syst. 1 : 346, 1911. *Cissus pedata* Lamk., Encycl. 1 : 31, 1783. *Vitis pedata* Wall. ex Wt. & Arn., Prodr. Fl. Pen. Ind. Or. 128, 1834; Lawson in Hook. f., l.c. 661; Prain, l.c. 238. "Goali-lata" (Beng.).

A large climber. Stem pubescent or puberulous, leaf-opposed tendril branched at the end. Leaves pedately 5-11-foliolate; leaflets $3.5-20 \times 2-6$ cm, crenate or shallowly serrate, shortly acuminate, base rounded, midnerve and secondary nerves prominent beneath, central one larger ovate-elliptic, lateral usually obliquely elliptic; petioles 10-15 cm long; petiolules 2-3 cm. Flowers white, in pedunculate spreading subcorymbose cymes; peduncles 5-7 cm, rusty pubescent. Calyx shallowly 4-lobed, lobes triangular. Petals 4, triangular, 2 mm, cohering at apex. Disc large, cup-shaped, 4-lobed. Berries 0.5-1 cm across, depressed globose, cream coloured when ripe. Seeds usually 4, smooth, hemispheric, flat face with deep circular single pit.

Fl. & Fr. : April - Oct. Throughout West Bengal.

4. *Cayratia trifolia* (L.) Domin., *Biblioth. Bot.* 89 : 371, 1927. *Vitis trifolia* L., *Sp. Pl.* 203, 1753. *Cissus carnososa* Lamk., *Encycl.*, 1 : 31, 1783. *Vitis carnososa* Wt. & Arn., *l.c.* 127. Lawson in Hook. *f., l.c.* 654; Prain, *l.c.* 238. "Amal-lata" (Beng.).

Fig. 71

Slender herbaceous climbers. Stem and branches sulcate, hairy. Leaves trifoliolate, on 6-8 cm long petiole, leaflets ovate or elliptic ovate, 8×4 cm, short acuminate, subcordate or cuneate at base, dentate, sparsely hairy or glabrescent below, petiolule 0.5-2 cm long. Tendril wiry, 2-3 times forked; apices often discoid. Inflorescence a corymbiform divaricate cyme, on 10-15 cm long peduncles. Flowers greenish white, 3 mm long, shortly stalked. Calyx obscurely 4-lobed, 0.5 mm long, funnel-shaped, truncate, pubescent. Petals 4, oblong obtuse, hooded, hairy outside. Disc white, cupular 4-lobed. Stamens 4, 0.5 mm. Style 1 mm long, conical, pinkish. Berries globose or discoid, fleshy, shining black, 6-7 mm across, 3-4-seeded. Seeds trigonous, rounded and rugose on the back.

Fl. & Fr. : June - Nov. Throughout West Bengal.

Mostly climbing on shrubs and hedges, sometimes prostrate in open waste land.

The leaves are often used in the form of poultice in the treatment of boils.

3. CISSUS L.

Herbaceous or subwoody climbers with leaf opposed tendril. Leaves membranous simple, lobed or sometimes trifoliolate. Flowers bisexual, tetramerous, in umbellate cymes, opposite to the leaves. Calyx cup-shaped, 4-lobed. Petals 4. Stamens 4. Disc cup-shaped, 4-lobed, adnate to the base of the ovary. Ovary 2-celled with 2 ovules in each cell; style subulate, stigma small. Fruit and subglobose berries dark-purple to black, one-seeded, rarely 2-seeded. Seeds ellipsoid or pyriform with an encircling raphe, smooth or pitted on either sides; albumen with 3 vertical lobes, radicle large.

A pantropical genus of ca 350 species, very few in the warmer parts of the temperate zone; 9 species in West Bengal.

1. Stem branches jointed, fleshy, 4-angled

... 5. *C. quadrangularis*

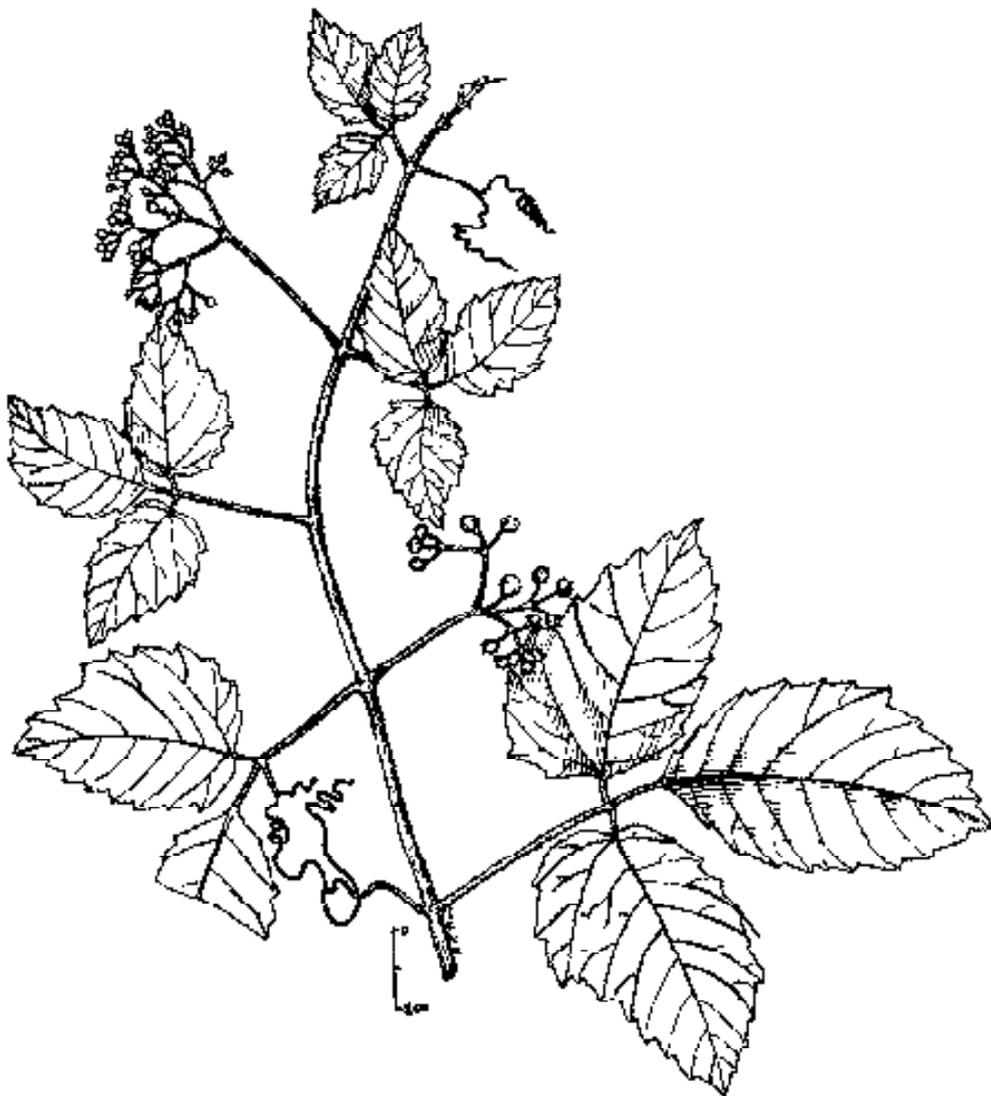


Fig. 71. *Cayratia trifolia* (L.) Domin.

1. Stem branches not jointed terete:
 2. Leaves glabrous beneath :
 3. Young shoots glaucous or nearly white; leaves narrowly ovate, sinus deep at the leaf base ... 7. *C. repens*
 3. Young shoots green, leaves orbicular or broadly ovate, sinus shallow at the leaf base :
 4. Leaves variegated; slender climbers ... 4. *C. javana*
 4. Leaves not variegated, woody or fleshy climbers:
 5. Woody climbers; leaf membranous, apex abruptly acuminate ... 2. *C. assamica*
 5. Fleshy climbers, leaf thick leathery, apex acute or shortly acuminate ... 3. *C. heyneana*
 2. Leaves pubescent or tomentose beneath :
 6. Leaves sessile ... 8. *C. spectabilis*
 6. Leaves with distinct petioles:
 7. Leaves ferruginous, longer than broad, seeds pitted with angled facets throughout ... 1. *C. adnata*
 7. Leaves with grey tomentum, nearly as long as broad, seeds not faceted throughout:
 8. Stem and leaves minutely pubescent, leaves 5-angled or lobed; berry oblong; seeds tessellated on sides of raphe ... 9. *C. vitiginea*
 8. Stem and leaves with appressed woolly tomentum, leaves unlobed or sublobed; berries pyriform with persistent style; seeds nearly smooth ... 6. *C. repanda*

1. *Cissus adnata* Roxb., Fl. Ind. ed. Carey 1 : 405. 1820, *Vitis adnata* (Roxb.) Wall ex Wt. & Arn., Prodr. Fl. Pen. Ind. Or. 126. 1834; Lawson in Hook. f., l.c. 649; Prain, l.c. 238. "Bod lamari" (Sant.).

Large woody climbers with sulcate branches. Inflorescence and leaves beneath covered with orange red tomentum. Tendril forked, woolly. Leaves simple, 6-12 × 5-10 cm, ovate to orbicular, cordate, bristly serrate, rusty tomentose below, upper surface glabrescent with age, connecting veins parallel; petioles 2-8 cm; stipules orbicular, caducous. Cymes umbellate on leaf opposed 3-4 cm long brownish tomentose peduncle. Pedicel 0.8-1.5 cm, hairy; bracteoles small, caducous. Flowers greenish yellow, 3-4 mm across. Calyx truncate. Petals 4, broadly oval, ovate, 2-3 mm long, calyprately deciduous. Berries obovoid, apiculate, 1-1.5 cm long, bluish-black, 1-seeded rarely 2-seeded. Seeds obovoid, 5-6 mm, brown pitted.

Fl. & Fr. : March - Sept. Throughout the West Bengal.

Root used medicinally.

2. *Cissus assamica* (Lawson) Craib in Kew Bull. 1911 : 30. 1911. *Vitis assamica* Lawson in Hook. f., *l.c.* 648; Prain, *l.c.* 238.

Large woody, climbers. Stem somewhat angled, glabrous except younger parts. Leaves simple, membranous, ovate-orbicular, cordate, abruptly acuminate, bristly serrate, 10-17 × 6-10 cm, nerves prominent above; petiole 2.5-9.5 cm; stipule oblong, rounded, 2-3 mm. Tendril simple. Inflorescence axillary leaf-opposed, umbellate cymes; peduncles 1.5-7 cm. Flowers tetramerous, greenish, yellow, 2-5 mm across. Petals 2 mm. Stigma subcapitate. Berries obovoid-turbinate, 1-seeded. Seeds pyriform, 0.4-0.5 mm long, ridged.

Fl. & Fr. : May - Oct. Darjeeling.

3. *Cissus heyneana* (Wt. & Arn.) Planch. in DC. Monogr. Phan. 5. 476. 1887. *Vitis heyneana* Wt. & Arn., *l.c.* 125. 1834; Lawson in Hook. f., *l.c.* 647; non R. & S. 1814.

Large thickly fleshy glabrous climbers; branches smooth, glaucous. Leaves leathery, ovate-orbulate to triangular ovate, cordate, and acute to acuminate, 5-12 × 4-10 cm, faintly crenate-serrate and angled at margins, basal nerves 5; petioles 1.5-3.5 cm; stipules broadly ovate-triangular, faintly serrate, 1.5 cm. Inflorescence leaf-opposed cymes in corymbose panicle. Peduncle 2.5 cm long, bearing simple or forked tendrils. Flowers yellow, ca 4 mm across, pedicelled; pedicel 3-4 mm. Calyx membranous, 1 mm, corniculate. Petal obovate, 2 mm, pubescent. Berries globose, 5-7 mm, purplish black, 1-seeded. Seeds obconic, flat, ca 3 mm, smooth.

Fl. & Fr. : March - Sept. Howrah. A new record for West Bengal.

Roots and ripe fruits are eaten by local people.

4. *Cissus javana* DC., Prodr. 1 : 628. 1824. *Vitis discolor* (Bl.) Dalz. in Hook. Kew J. Bot. 2 : 39. 1830; Lawson in Hook. f., *l.c.* 647; *C. discolor* Bl., Bijdr. 181. 1825.

Climbers with subwoody base, branches slender, subangular, deep red, leaves ovate-lanceolate, 4.5-16 × 2-7.5 cm, acuminate, cordate or subtruncate base, crenate-serrate, membranous, deep green above, often blotched with greyish green and deep red beneath; petioles red, 0.8-4 mm; stipule ovate-oblong, rounded at apex, 2-2.5 mm, persistent. Cymes umbellate; peduncle 0.5-1.3 cm, leaf-opposed; pedicel 0.5-1 cm, deep red. Flowers 1-6 mm across, greenish yellow. Calyx glandular, truncate, red. Petals 0.15-0.2 mm long, thickened at apex. Stigma capitate. Berries obovoid, 5-7 mm long, reddish purple to black. Seed solitary.

Fl. : May - Aug.; *Fr.* : Sept. - Dec. Darjeeling.

Often used as ornamental for its beautiful foliage.

5. *Cissus quadrangularis* L. Mant. 39. 1767. *Vitis quadrangularis* Wall. ex Wt. & Arn., *l.c.* 125; Lawson in Hook. f., *l.c.* 645; Prain, *l.c.* 237. "Harjora" (Beng. & H.).



Fig. 72. *Cissus quadrangularis* L.

Profusely branching fleshy climbers. Stem sharply quadrangular, winged when young, constricted at the nodes subwoody at base, pruinose, excepting apical part. Tendril leaf-opposed, slender, simple. Leaves simple succulent, reniform, 3-7 × 2-7.5 cm, denticulate, 3-5 lobed, obtuse; with truncate base; petiole 1-1.5 cm, stipules paired, 3-4 × 4-5 mm, fleshy green, broadly ovate, obtuse, deciduous. Cymes umbellate, spreading, long, 1.5-2.5 cm peduncled. Flowers 5 mm across, reddish. Calyx 1 mm, cupular, truncate, faintly lobed. Petals 2 mm long, ovate, cucullate at apices. Disc erect, white, 4-lobed. Style simple, accrescent after anthesis, finally 2-2.5 mm long. Berries 5-8 mm across, globose, apiculate, red when ripe, 1-seeded. Seed ellipsoid.

Fl. & Fr. : Feb. - Oct. Planted throughout West Bengal, occasionally running wild.

The tender shoots are eaten in curries. Juice of the stem is medicinal.

6. *Cissus repanda* Vahl. *Symb.* 3 : 18. 1794. *Vitis repanda* Wt. & Arn., *l.c.* 125; Lawson in Hook. f., 648; Prain, *l.c.* 238.

Large subwoody climbers with wrinkled soft stem and terete subglaucous branchlets covered with appressed tomentum when young. Leaves simple, ovate-orbiculate or repand, acuminate, cordate, 8-18 × 6.5-14 cm, crenate-dentate, often 5-sublobed, densely tomentose beneath when young, pubescent when mature; petioles 6-10 cm long; stipules oblong, obtuse. Tendril twisted, forked, with flattened disc. Inflorescence leaf-opposed, sub-corymbose, peduncle 2.5-7 cm long, pink, slender and ribbed. Bracts and bracteoles reddish, densely woolly. Flowers tetramerous, pedicel 1-2 mm. Calyx truncate hairy. Petals pink, triangular or ovate. Berries pyriform, tipped by mucronate style, 1-seeded. Seed nearly smooth.

Fl. & Fr. : April - July. Darjeeling, Jalpaiguri, West Dinajpur.

The stem on cutting yields a good quantity of drinkable water. The powdered root after heating is applied to cuts and fractures. The bark and stalk yield a good cordate fibre.

7. *Cissus repens* Lamk., *Encycl. Math. Bot.* 1 : 31. 1783. *Vitis repens* (Lamk.) Wt. & Arn., *l.c.* 125; Lawson in Hook. f., 646; Prain, *l.c.* 237.

Glabrous climbers. Stem quadrangular, shoots glaucous or milky white. Leaves simple, ovate to triangular, acute, 3.5-12 × 1.5-9 cm, deeply cordate, undulated and toothed at margins, pale-green, membranous, nerves; 4 pairs; petioles 5-12.5 cm long; stipules 0.4 mm, rounded. Tendril weak, forked. Flowers greenish red, in compound umbellate cyme; peduncle 1.5-4 cm long; pedicel slender 3-5 mm, hairy. Flower-bud conical. Calyx membranous, truncate, green. Petals ovate-triangular, 2-3 mm. Disc violet. Style almost absent, stigma short. Berries ellipsoid, 1.5-2 cm diam, black when ripe, one-seeded. Seed globose, pale brown.

Fl. : June - Sept.; *Fr.* : Oct. - Dec. Darjeeling, Jalpaiguri.

Tender leaves are eaten by the local people.

8. *Cissus spectabilis* (Kurz) Planch. in A. & C. DC. Monogr. Phan. 5 : 501. 1987. *Vitis spectabilis* Kurz in J. Bot. 12 : 196. 1874; Lawson in Hook. f., l.c. 649.

Scandent ferruginously hirsute shrubs without tendril. Leaves 12-16 × 10-15 cm, almost sessile, broadly cordate, 3-5-lobed, denticulate, membranous, pubescent beneath, obtuse, base sinuate-cordate; stipule triangular-ovate with a gland at base. Inflorescence a pedunculate leaf-opposed corymbose cyme, 3-4 cm. Flowers very small, with 2-3 mm. long, pedicel. Calyx 0.5 mm, truncate, semicircular. Petals 1-1.5 mm, green, reflexed, hairy. Ovary discoid with elongated truncate style. Berries ovoid.

Fl. : June - Oct.; Fr. : Dec. North Bengal, 1600 - 1800 m, C.B. Clarke 26524 A, Oct. 1897 (CAL.).

This species is represented in CAL by the only collection mentioned above. It could be extinct or endangered as mentioned by Shetty and Singh (Red Data Book of Indian Plants 3 : 261. 1990).

9. *Cissus vitiginea* L. Sp. Pl. 117. 1753. *Vitis himaii* Wall. ex Wt. & Arn. Prodr. Fl. Pen. Ind. Or. 126. 1834; Lawson in Hook. f., l.c. 649.

Scandent climber covered with short grey curly pubescent hairs, older stem fissured, tendril stout, simple, woody, pubescent near base, glabrous above, leaf 5-angled or lobed; petiole 2-4 cm. Stipules 0.4 × 0.2 cm broadly ovate slightly auricled basally, deciduous. Flowers whitish green, 0.3-0.4 cm, across in a leaf-opposed 3-7 cm pedunculate umbellate cyme. Pedicels 3 to many, 0.3 - 0.5 cm, bracteate calyx 0.1 cm long, cupular, puberulous. Corolla 0.1 - 0.15 cm, cucullate tip. Style subulate; stigma minute. Berry on deflexed pedicels, oblong, purple prunose, 0.8 × 0.5 cm, ovoid, 1-seeded.

Fl. : Jul. - Sept.; Fr. : Oct. - Dec. Darjeeling.

4. PARTHENOCISSUS Planch.

Climbing undershrubs. Leaves palmately 3-5-foliolate. Tendrils leaf-opposed, ending in discs. Flowers hermaphrodite, in terminal or leaf-opposed branched dichotomous cymes, ending in umbellules. Calyx cupular, irregularly 5-dentate. Petals 5, each hooded at the tip, usually with a bifid acumen. Stamens 5, inserted under the disc. Disc thin, almost obscure, adnate to the base of the ovary. Ovary ovoid, 2-loculed; style short; stigma capitate. Fruit a berry, 1-, rarely 2-4-seeded. Seeds globose, smooth.

A genus of ca 15 species in subtropical to temperate Asia and America; 1 species in West Bengal.

Parthenocissus semicordata (Wall.) Planch. in DC. Monogr. Phan. 5: 451. 1887. *Vitis semicordata* Wall. in Roxb., Fl. Ind. ed. Carey 2: 481. 1824.

Large climbers. Stem subwoody, young parts glabrous or slightly pubescent. Leaves 3-foliolate, leaflets 6-10 × 5-7.5 cm, ovate, obovate or rhomboid, glabrous, subcoriaceous; base cuneate, apex acute or abruptly somewhat

acuminate, margins sharply serrate; petioles *ca* 3.5 cm. Tendril branched. Flowers yellowish-green in 4-6-flowered umbels on tri- or di-chotomously branched terminal or leaf-opposed panicles. Calyx salver-shaped, obscurely 5-toothed. Petals 3-5 mm long, style short, truncate. Berries globose, 4-seeded. Seeds smooth, black.

Fl. & Fr.: May - Jan. Darjeeling.

5. TETRASTIGMA (Miq.) Planch.

Subwoody climbers with simple or forked tendrils. Leaves simple or 3-5-l foliolate. Flowers in axillary or leaf-opposed cymes, polygame-dioecious, tetramerous. Calyx cupular, scarcely lobed. Petals 4, apex usually cuspidate. Disc hypogynous, more or less persistent in fruit. Stamens or staminodes 4. Ovary 2-loculed with 2 ovules in each locule; style short; stigma 4, lobed, peltate. Fruit a 1-4 seeded berry, usually succulent, sometimes nearly dry. Seeds globose, oblong or pyriform.

A genus with *ca* 100 species in the tropics; 8 species in West Bengal.

1. Leaves 3-foliolate:
 2. Flowers in lax cymes, long peduncled; stigma 4-lobed ...2. *T. bracteolatum*
 2. Flowers in dense cymes, almost sessile; stigma peltate ...1. *T. angustifolium*
1. Leaves 5-7-foliolate:
 3. Leaflets digitate 6. *T. planicaule*
 3. Leaflets pedate:
 4. Slender climbers with bifid tendrils; leaflets small, 2-10 × 1-3 cm ...8. *T. serrulatum*
 4. Robust climbers with simple or bifid tendrils, leaflets large, 6-20 × 2-8.5 cm:
 5. Leaflets obovate or broadly oblanceolate; leaflet serration reduced to subulate vein tips; cymes rounded, 4-10 cm diameter ...7. *T. rumicispermum*
 5. Leaflets lanceolate, elliptic or sometimes oblanceolate, distinctly serrate; cymes rounded, 2-7 cm or corymbose to paniculate, 8-15 cm diameter:
 6. Cymes lax, corymbose, glabrous 8-15 mm diameter ...3. *T. corymbosum*
 6. Cymes compact, rounded, 2-7 cm diameter:
 7. Leaflets lanceolate, 4.5-14 × 1.5-5.5 cm; petals with subulate point ...4. *T. dubium*

7. Leaflets elliptic or narrowly ovate, 7-20 ×
3-8.5 cm; petals with short blunt point

Syn. *T. themsonianum* Planch. in A. & C. DC., *Mimoz.* ^{*S. T. leucostaphyllum*} ~~Planch.~~ 5: 438-1887-
1. ***Tetrastigma angustifolium*** (Roxb.) Planch. in DC. Monogr. Phan. 5: 439.
1887. *Cissus angustifolia* Roxb., Fl. Ind. ed. Carey 1: 427. 1820. *Vitis*
angustifolia (Roxb.) Wt., Ic. Pl. Ind. Or. 1: 91. 176. 1839; Lawson in Hook. f.,
l.c. 654; Prain, l.c. 238.

A slender climber. Stem pubescent or puberulous, flattened. Leaves 3-foliolate, often pinkish; leaflets lanceolate, or elliptic-lanceolate, 6-15 × 2-4 cm, glabrous, acute, base cuneate; petioles 2-4 cm; stipules ovate or somewhat triangular 2-5 mm. Tendril leaf-opposed, slender, simple. Cymes axillary, dense, 1-3.5 cm, pubescent; peduncles 2-7.5 cm long. Flowers almost sessile, yellowish green, ca 3 mm across. Petals corniculated at the tip. Disc thick, round. Ovary papillose pubescent; stigma peltate, rarely lobed. Berries globose, bright red when ripe, 2-4-seeded. Seeds furrowed on either face, transversely rugose.

Fl. & Fr. : March - Oct. Coochbehar, Darjeeling.

Fruits are edible.

2. ***Tetrastigma bracteolatum*** (Wall.) Planch., l.c. 428. *Vitis bracteolata*
Wall., l.c. 483; Lawson in Hook. f., l.c. 654; Prain, l.c. 238.

Subwoody climbers, glabrous except inflorescence. Leaves trifoliolate; leaflets 5-18 × 2-8.3 cm, lanceolate or ovate-lanceolate, shortly stalked remotely serrate acute, membranous; petiole 3-10 cm long. Flowers very small, pale green, in axillary trichotomous puberulous lax cyme 2-5 cm long; peduncle 3-3.2 mm long. Calyx a saucer-shaped, 4-5 mm long, toothed. Petals with inflexed acute tip, along with a dorsal spur. Disc large, thin, covering half the ovary. Ovary 4-lobed; stigma sessile. Berries orange, ovoid, succulent, 0.5-0.7 mm across, ridged. Seeds 1-2, ovoid with prominent linear raphe, 1 or 2 furrows on the convex side and timely transversely rugose.

Fl. & Fr. : Aug. - March. Coochbehar, Darjeeling (Mongpoo), Jalpaiguri.

3. ***Tetrastigma corymbosum*** Lons., Pl. Brit. 2(1): 156, 1991.

Large climbing shrub, glabrous throughout main branches with scattered pale tendrils. Older stem strongly warty. Tendril leaf-opposed, stout bifid, leaves pedately 5-7-foliolate. Petioles 6-10 cm, stipule caducous. Leaflets thinly coriaceous elliptic-oblanccolate, 6.5-17 × 2-6 cm, acuminate, base cuneate, often oblique, margin sharply serrate. Flowers functionally unisexual in pseudo-axillary corymbose cyme 6-12 cm diam., 3-9 cm. Calyx minute, cup-shaped, shortly lobed. Petals 4, white, ovate 0-2 mm, free, caducous. Stamens reduced to staminode. Disc cup-shaped, short, thick style, with lobed spreading. Fruits obovoid, sub-globose, 2-3-seeded.

Fl. & Fr. : March - Oct. Darjeeling.

4. ***Tetrastigma dubium*** (Lawson) Planch., l.c. 437. 1887. *Vitis dubia* Lawson
in Hook. f., l.c. 661. *V. oxyphylla* Wall, ex Prain, l.c. 238.

Subwoody climbers. Stem glabrous, branches finely striate, smooth. Leaves 3-5 foliolate, membranous, ovate to lanceolate, 4.5-14 × 1.5-5.5 cm apex, acuminate, base cuneate, margin deeply serrated; petioles 4-6.5 cm, petiolule 0.4-0.8 cm. Tendril, simple, wiry, leaf opposed. Cymes axillary, compact, corymbose, peduncle shorter than petiole, 1-2.5 cm. Flower 4 mm across; pedicel 2 mm. Petals 2 mm, long, ovate, coriaceous. Disc 4-toothed, 1.5-2 mm across, encircling the ovary. Stigma peltate. Berries oblong, 6-8 mm long, 2 seeded. Seeds 3-5 mm long, black when ripe, transversely rugose, ventral raphe prominent.

Fl. & Fr.: Feb. - June. Darjeeling, Jalpaiguri.

5. ***Tetrastigma leucostaphyllum*** (Dennst.) Alston ex Mabb. in *Taxon*, 26:539, 1977. *Cissus leucostaphyla* Dennst. Schliiss, Hort. Malab. 17, 19, 33, 1818. *T. lanceolarium* Planch., l.c. 423. *Vitis lanceolaria* Roxb., Fl. Ind. Carey 1: 412, 1820; Lawson in Hook. f., l.c. 1:660; Prain, l.c. 238.

Large climbers, glabrous except the inflorescence. Stem cylindrical woody, often flat with corky warts or tubercles. Tendril leaf opposed, slender, simple. Leaves 5-7 foliolate, petioles 5-15 cm long petiolules 0.5-2 cm long; leaflets elliptic or narrowly ovate, 7-20 × 3-8.5 cm. Flowers 4 mm across yellow, in axillary cymes: male cyme paniculate but female ones corymbose, cymes shorter than petiole; peduncles 1.5-2.5 mm. Calyx 0.5-0.8 mm funnel-shaped, truncate at the apex. Petals 2.5-5 mm, ovate-oblong, hooded, pubescent. Stamens long, reduced to staminode in female. Disc, flat, grooved, style short, stigma peltate, 4-lobed. Berries 0.5-2 cm across, smooth, brown-red, globose. Seeds 2, subpyriform, transversely rugose, 0.6-1 cm long.

Fl. & Fr.: March - Oct. Darjeeling, Jalpaiguri (Barandahari); mainly in very wet and marshy places.

Fruits are edible.

6. ***Tetrastigma planicaule*** (Hook. f.) Gagnep. in *Notul. Syst. (Paris)* 1: 319, 1911. *Vitis planicaulis* Hook. f., in *Bot. Mag.* 1, 5685, 1868; Lawson in Hook. f., l.c. 658.

Large glabrous, climbers. Stem strongly flattened, striated. Leaves digitately 5-foliolate leathery; leaflets oblong or ovate, 9-20 × 4-11 cm, subacuminate, faintly serrate; petiole 12-18 cm, petiolule 1.5-4 cm long; stipule reniform; deciduous, 0.8-1.2 cm. Flowers tetramerous, green in axillary cymes with divericating branches; peduncles 1-2.5 cm, fruiting pedicel 0.8-2 cm. Style subulate, stigma 4-lobed. Berries 2-3 cm, ovoid, cherry-like, 1-2-seeded. Seeds elliptic, 1.5-2 cm, transversely rugose.

Fl. & Fr.: April - Dec. Darjeeling.

7. ***Tetrastigma runicispermum*** (Lawson) Planch., l.c. 429. *Vitis runicisperma* Lawson in Hook. f., l.c. 661.

Lianas. Stem terete, covered with or warts, glabrous. Leaves usually 5-foliolate; leaflets 4-12 × 2-6 cm, obovate or broadly oblanceolate, obliquely cuneate at base, shortly acuminate, bristly serrate, coriaceous; petioles 8-10 cm,

petiolules 2-10 mm, tendril bifid. Flowers in axillary cyme and terminally subcorymbose; peduncles 1.5-4 cm; pedicels 2-4 mm. Flowers pale green, 4 mm across. Sepals 1-1.5 mm. Petals 3 mm, oblong, acute with inflexed tip. Disc cupular, 4-lobed. Style short, with 4-fid stigma. Berries 0.8-1 cm across with a distinct ring often with minute tubercles before the middle, turbinate at apex, reddish black, 1-4-seeded. Seeds triangular-obcordate, with broad shallow grooves on back side, and a sharp ridge formed with raphe on the face.

Fl. & Fr.: March - Oct. Darjeeling (Kalimpong, 3344 m).

The fruit is sweet and pleasant to taste.

8. *Tetrastigma serrulatum* (Roxb.) Planch, *l.c.* 432. *Cissus serrulata* Roxb., Fl. Ind. ed. Carey 1: 432. 1820. *C. capriolata* (D. Don) Royle. Ill. Bot. Himal. 1: 149. t. 2b. f. 2. 1889. *Vitis capriolata* D. Don, Prodr., 188. 1825; Lawson in Hook.f., *l.c.* 659 (as *V. capriolata*). *T. indicum* Maulik, in Bull. Bot. Surv. Ind. 13: 352. 1971.

Scandent dioecious glabrous wiry creepers. Leaves pedately 5-foliolate, apical leaflets 3-9.5 × 1.8-3.8 cm and lateral 3.5 × 1.75 cm, obovate, cuspidate acuminate, sharply serrate, chartaceous; petioles 2-6 cm, petiolule 2-15 mm, stipule 3.5 mm, cordate, scarious. Tendril leaf-opposed, glabrous, forked near the apex. Inflorescence 2-5 cm long, cyme umbellate 2-3 cymotous, 5-8 flowered in each umbel. Flowers yellow-green, unisexual, tetramerous. Calyx 0.2 × 0.5 mm, cupular persistent. Petals 2-2.5 × 0.7-1.2 mm elliptic, hooded. Disc 0.8 × 0.3 mm, toothed. Stamens 1.7 mm, anther oblong; staminode 4 in pistillate flowers. Ovary 1.2 × 0.5 mm, urnshaped; style obscure; stigma 4-fid, slightly recurved. Berries 4-6 mm, globose, green to reddish brown when ripe, hard, smooth. Seeds 2-4, obovoid, 3 × 4.5 mm, greyish brown, shortly beaked, rough, raphe ventrally prominent.

Fl. & Fr.: June - Dec. Darjeeling.

Fruits edible.

6. VITIS L.

Climber; tendril bifid, borne opposite leaves and often also on peduncle. Leaves simple, usually lobed, stipule minute. Flowers in condensed leaf-opposed panicle, unisexual or bisexual, 5-merous. Calyx minute, cupular, minutely lobed. Petals united at apex, during anthesis shed as a cap. Disc 5-lobed, united to base of ovary. Ovary 2-celled; style very short or absent, stigma discoid; berries 2-4-seeded.

About 70 species in the Northern Hemisphere; 1 species cultivated in West Bengal.

Vitis vinifera L., Sp. Pl. 202. 1753; Laws. in Hook.f., *l.c.* 652; Kanjital *et al.*, Fl. Assam 2: 293. 1936. "Angur Phal"; "Drakhyalata" (Beng.).

A large woody climber with bifid tendril. Stems woolly whitish tomentose when young. Leaves roundish or suborbicular, deeply cordate, more or less

deeply 5-lobed, 6-14 × 5-13 cm, coarsely and irregularly dentate, glabrescent above, tomentose beneath. Flowers arranged in compact umbel-like paniculate cymes, 5-merous, small, 2-4 mm across, greenish white. Style very short, thick. Berries, oblong, 2.5 × 2 cm, green or blackish purple, succulent, 2-4-seeded.

Fl. & Fr. : Oct. March. Darjeeling (occasionally cultivated in Terai and foot-hills).

An important crop plant; berries used in fermentation of wine; eaten as fresh fruit and dried to produce raisine.

LEEACEAE (R. N. Banerjee)

The family consists of only one genus and ca 34 species distributed in S.E. Asia, tropical Africa, Madagascar, Taiwan and Micronesia; 7 species occur in West Bengal.

LEEA van Royen et L.

Small trees, shrubs or herbs. Stems striate or furrowed, articulated. Leaves alternate, 1-3-pinnate, usually imparipinnate, rarely simple; petioles dilated at base, sheathing; stipules persistent or caducous; leaflets opposite, pearl glands present ventrally, globular or stellate; margins crenate to serrate-dentate. Flowers in leaf-opposed peduncled corymbose cymes, bisexual, 5-merous. Calyx campanulate, glandular. Corolla adnate to androecium. Staminal tube adnate to corolla dividing upper and lower portion. Filaments 5, from basal portion of the upper part of staminoïdal tube; anthers exerted from or connate and included in the tube. Ovary on the disc, up to 6-locular; styles short, stigma swollen. Fruit a berry, discoid-globose, up to 6-loculed. Seeds triangular.

1. Petals and inflorescence red :
 2. Leaves 1-pinnate, lateral leaflets sessile; branches and bud rachis winged ... 2. *L. alata*
 2. Leaves 2-pinnate, lateral leaflets petioluled; branches and rachis not winged ... 5. *L. guineensis*
1. Petals green or white. Inflorescence not red :
 3. Herbaceous; lower leaves large, simple, cordate ... 7. *L. macrophylla*
 3. Suffruticose; leaves all pinnate :
 4. Young branches and leaves hirsute; inflorescence a sessile corymb ... 1. *L. aequata*
 4. Young branches and leaves pubescent; inflorescence a stalked panicle:
 5. Bracts linear-lanceolate ... 4. *L. crispa*
 5. Bracts ovate-deltoid:

6. Stems and leaflets glabrous, glandular; mature fruits orange yellow ... 6. *L. indica*
6. Stems and leaflets pubescent, eglandular; mature fruits purple black ... 3. *L. compactiflora*

1. *Leea aequata* L., Syst. Nat. ed. 12, 2: 627, 1767 et Mant. 1: 124, 1767; Prain, Bengal Pl. 239, 1903. *L. hirta* Roxb. ex Hornem., Hort. Hafn. 1: 231, 1813; Roxb., Fl. Ind. ed. 1, 2: 469, 1824, ed. 2, 1: 656, 1832.

Shrub or small trees up to 4 m; young branches hirtus. Leaves 2-pinnate; petioles 8-14 cm, hairy; stipules oblong, caducous, 2-4 × 3-6 cm, ferruginous, rachis 7-20 cm; leaflets 7, glandular, 10-22 × 4-8 cm, hirtus on both surfaces, chartaceous, pearl glands globular to discoidal, brown, margins serrated, apex acuminate, base cuneate, truncate or sometimes subcordate or unequal; petiolules 5-15 mm. Corymbs sessile, 5-14 cm, rusty hairy; bracts ovate, up to 8 × 5 mm; peduncles 1-4 cm. Flowers greenish white. Calyx 3-4 × 3-4 mm, glabrous to densely pubescent, with pearl glands. Corolla tube with staminodal lobes 2-4 mm. Petals subacute, 2-3 × 1-2 mm. Filaments 1-2 mm, anthers coherent, 1-2 mm. Ovary 4-7-loculed; style 1.5-2.5 mm. Fruits 10 mm diam., orange-red when ripe dark-blue or black. Seeds 5 or 6, 4-6 × 4-6 mm.

Fl. & Fr. : Throughout the year. Coochbehar, Darjeeling, Hooghly, Howrah, Jalpaiguri, Malda, 24-Parganas.

2. *Leea alata* Edgew., Trans. Linn. Soc. 20: 36, 1846; Laws, in Hook. f., Fl. Brit. India 1: 665, 1875; Prain, *l.c.* 239.

Woody shrubs, up to 3 m tall; branches winged. Leaves 1-pinnate, 3-7-foliolate, long petioled; stipules oblong, 3-4 × 1 cm; rachis 5-30 cm, winged; leaflets elliptic-oblong to elliptic-lanceolate, 15-20 × 4-8 cm, glabrous, subcoriaceous, pearl gland stellate, margins dentate serrate, apex acute, base rounded, lateral leaflets sessile. Inflorescences 10-30 cm long, rusty pubescent; bracts deltoid, up to 2 mm long; peduncles red. Flowers red. Calyx 2-2.5 × 1.5-2 mm, glabrous. Corolla tube with staminodal lobes 3 mm. Staminodal tube 2 mm, lobes retuse. Filaments 1 mm; anthers 1.2 mm. Ovary 6-locular; style 1 mm. Fruits 5-10 mm in diam. Seeds 3-6, 3 × 2 mm.

Fl. & Fr. : June - Dec. Darjeeling, in Terai region, Howrah (planted).

3. *Leea compactiflora* Kurz, in J. Asiat. Soc. Beng. 42: 65, 1873 & 44: 179, 1875; *L. trifoliata* Laws, in Hook. f., *l.c.* 666. *L. robusta auct. non* Roxb.; Laws, in Hook. f., *l.c.* 667, *p.p.* Prain, *l.c.* 239. *L. bracteata* Clarke in J. Bot. 19: 164, 1881. "Harmada" (Sant.).

Small shrubs, straggling. Leaves trifoliolate, having 2 vestigial leaflets below; petioles 12-20 cm long; stipules 5-8 cm; rachis 12-20 cm long; leaflets elliptic to elliptic-lanceolate to ovate-oblong, 10-25 × 5-11 cm, ferruginously hairy beneath, coriaceous, margin serrulate, acuminate to obtuse apex and at base; ventrally glandular; petiolules 2-20 mm, hairy. Cymes 15 cm long, pubescent; bracts ovate, 2 × 0.5 cm, peduncle 3-5 cm. Flowers greenish white. Sepals 2 × 2 mm. Corolla tube with staminodal lobes 3-3.5 mm. Filaments 1-1.5 mm, anthers

1.75-2 mm. Ovary 6-locular; style 2-3 mm. Fruits 7-10 mm in diam., orange-yellow.

Fl. : April - Sept.; *Fr.* : Nov. - Jan. Darjeeling, Howrah (planted?).

4. *Leea crispa* L., Syst. Nat. ed. 12, 2: 627. 1767 et Mant. 1: 124. 1767; Laws. in Hook. *f.*, *l.c.* 665; Prain, *l.c.* 239. *L. herbacea* Hamilton in Trans. Linn. Soc. 14: 228. 1823; Prain, *l.c.* 239. *L. aspera* Edgew. in Trans. Linn. Soc. 20: 36. 1846, *nom. illeg.* non Wall. ex G. Don. Laws. in Hook. *f.*, *l.c.* 665. *L. edgeworthii* Sant., Rec. Bot. Surv. Ind. 16: 54. 1953. *L. pumila* Kurz in J. Asiat. Soc. Beng. 41: 302. 1872; Laws. in Hook. *f.*, *l.c.* 666. "Ban-chalita" (Beng).

Shrubs, up to 4 m tall. Stems terete or ribbed. Petioles 1-4 cm long; stipule wing-like, 1-3 cm long; rachis 4-13 cm. Leaflets 5-7, ovate-oblong, elliptic to elliptic-oblong, acuminate, 10-17 × 4-12 cm, chartaceous to subcoriaceous, scabrous on nerves ventrally; pearl glands globular, sparse; margins crenate to serrate, base cuneate; petiolules up to 5 cm long. Inflorescences 2-13 cm long, glabrous or pubescent on younger parts; bracts linear-lanceolate, up to 6 mm long; peduncles up to 6 cm long, winged. Flowers greenish white. Calyx 2-3 mm, glabrous; corolla-tube with staminodal lobes 3-4 mm, lobes bifid. Filaments 1.2 mm; anthers 1 mm. Ovary 4-8-locular; style 1-2 mm. Fruits 12 mm in diam., purple to black on maturity, 4.5 × 3 mm.

Fl. : May - Aug.; *Fr.* : Aug. - Nov. Coochbehar, Darjeeling, Murshidabad, Purulia.

Fruits reportedly eaten.

5. *Leea guineensis* G. Don., Gen. Hist. 1: 712. 1831; Ridsd. in Steenis Fl. Males. Ser. 1.7(4): 777. 1976. *L. laetue* Wall.; *L. sanguinea* Wall., *L. acuminata* Wall., Haines. Bot. Bihar & Orissa 1: 207. 1925; Cowan & Cowan, Trees N. Bengal 40. 1929.

Shrubs or small trees, branches furrowed, glabrous or finely pubescent. Leaves 2- or 3-pinnate; petioles 10-20 cm; stipules obovate, 2-4 × 1.5-3 cm, caducous; rachis 25-75 cm; leaflets oblong or elliptic-oblong, 8-24 × 3-12 cm, glabrous, chartaceous, pearl glands globoid, caducous, margin denticulate, apex acuminate, base acuminate; petiolules 4 cm. Corymbs 10-25 cm, compact, rusty pubescent; bracts ovate-deltoid, 3 mm long; peduncles 3-10 cm. Flowers red. Calyx 1-3 × 2-4 mm. Corolla tube with staminal lobes 3-5 mm. Staminodal tube 2-3 mm. Filaments 0.5 mm, anthers 2 mm. Ovary 6-loculed; style 1-2.5 mm. Berry orange-red, 5-15 mm in diam., maturing blue-black. Seeds 5 × 4 mm.

Fl. & *Fr.*: Throughout the year. Darjeeling, Howrah, Jalpaiguri.

6. *Leea indica* (Burm. f.) Murr., Philip. J. Sci. 14: 245. 1919. *L. sambucina* Willd., Sp. Pl. 1: 1177. 1789; Roxb., Fl. Ind. ed. 1, 2: 470. 1824; Laws. in Hook. *f.*, *l.c.* 666; Prain, *l.c.* 239. *L. umbraculifera* Clarke, J. Bot. 19: 141. 1881. "Kukur-Jhiwa" (Beng.).

Scandent shrubs, glandular, 2-10 m tall. Leaves spinescent, 2-3 pinnate; petioles 10-25 cm long; stipules obovate, 6 × 4 cm, deciduous, scar broadly triangular; rachis 10-35 cm long; leaflets 5, ovate-oblong, ovate-lanceolate or

elliptic, 10-24 × 3-12 cm, chartaceous, pearl glands globose, margins crenate, serrate, apex acute to acuminate, petiolules up to 25 mm. Cymes terminal or leaf-opposed, 10-25 cm long; bracts deltoid, 4-8 mm long, peduncle 15 cm long. Flowers white. Calyx 2-3 × 3-4 mm. Corolla tube with staminodal lobes 2.5-3.5 mm; lobes 2.5-3.5 × 1.5-2.5 mm. Staminodal tube 2-2.5 mm. Anthers 1-1.5 mm. Ovary 4-loculed; style 1-2.5 mm. Berry spherical, orange, 5-10 mm in diam., purple-black.

Fl. : April - Aug.; *Fr.* : Sept. - Nov. Common in moist deciduous and evergreen forests in Darjeeling, Jalpaiguri.

7. *Leca macrophylla* Roxb. ex Hornem., Hort. Hafn. 1 : 231. 1813; Laws. in Hook.f., *l.c.* 664; Prain, *l.c.* 240. *L. integrifolia* Roxb., Fl. Ind. ed. 1, 2 : 472. 1824; Laws. in Hook. f., *l.c.* 667. *L. robusta* Roxb., *l.c.* 468; Laws., *l.c.* 667, *p.p.*, *L. aspera* Wall. ex G. Don, Hist. 1 : 713. "Dholsamudra" (Beng.); "Halkan" (Sant.).

Herbs, branches terete, villous. Leaves aggregated at apex of the stem; petiole ca 20 cm long; stipule obovate, 2-6 × 1-4 cm; rachis 10-15 cm long, densely hairy; leaflet one, ovate to ovate-lanceolate or elliptic to elliptic-lanceolate, 14-26 × 4-8 cm, dorsal surface glabrous glandular, ventral surface pilose on nerves, subcoriaceous margins serrate, apex cuspidate, base cordate; nerves 8-14 pairs, palmate at base. Inflorescence 12-45 cm long, pubescent; bracts deltoid to narrowly triangular, up to 6 mm long; peduncles ca 7 cm long. Flowers greenish white, Calyx 1.5-3 × 2.5-4 mm. Corolla lobes 2-4 × 1-2 mm, grey pubescent to papillose, thick. Staminodal tube 1.5-2 mm, lobes retuse or cleft. Filaments 1.2-1.7 mm; anthers 1.5-2 mm, orange brown, ovary 6-locular; style 1-1.5 mm. Berry 10 mm in diam., green.

Fl. : March - Sept.; *Fr.* : Oct. - Dec. Darjeeling, Howrah, Purulia, 24 Parganas.

SAPINDACEAE

(S. Chandra)

A family of ca 150 genera and 2000 species, tropical and subtropical in distribution, 9 genera and 13 species are reported from West Bengal.

1. Leaves compound; stamens inserted within the disc; fruit a berry (except *Cardiospermum*);
 2. Flowers irregular; disc unilateral:
 3. Trees or shrubs; fruit indehiscent :
 4. Leaves 1-3 foliolate, serrate; sepals 4; fruit divided into oblong lobes; seeds with a short aril ... 1. ALLOPHYLUS
 4. Leaves 8-12-foliolate, entire, sepals 5; fruit divided into globose lobes; seeds without aril ... 6. ERIODENNUM
 3. Climbers; fruit an inflated trilobed capsule ... 3. CARDIOSPERMUM
 2. Flowers regular; disc annular:
 5. Fruits entire ... 9. SCORBIJIBRA

5. Fruits lobed:
 6. Drupes smooth, seeds without aril; sepals imbricate:
 7. Drupes globose united at sides, fruit distinctly lobed separating into distinct subglobose cocci ...8. SAPINDUS
 7. Drupes oblong, united at base, fruit with indistinct lobes, not separating in distinct cocci ...2. APIFANIA
 6. Drupes tubercled or mucronate; seeds with a fleshy aril; calyx-lobes or sepals valvate:
 8. Petals absent ...7 LITCHI
 8. Petals 4-6, villous ...4. DIMOCARPUS
1. Leaves simple; stamens inserted outside the disc; fruit a membranous 3-winged capsule ...5. DOIDONAEA

1. ALLOPHYLUS L.

Small trees or shrubs. Leaves 1- or 3-foliolate; leaflets entire or serrate; stipules absent. Flowers polygamo-dioecious, in axillary simple or branched racemes, irregular. Sepals 4, in unequal opposite pairs, outer pair smaller. Petals 4, small or almost obsolete, often with a shaggy scale inside. Disc unilateral, usually with 4 glands opposite the petals. Stamens 8, inserted on the receptacle inside the disc in bisexual flower surrounding the ovary. Styles 2; ovary usually 2-lobed and 2-celled; with one ovule in each cell; male flowers with pistillode. Fruit indehiscent, 1-2-lobed, fleshy or dry, lobes subglobose. Seeds erect, with a short aril; embryo curved, cotyledons plicate.

A genus with ca 255 tropical and subtropical species; 3 species in West Bengal.

1. Leaves 1-foliolate ...1. *A. chartaceus*
1. Leaves 3-foliolate:
 2. Leaves entire, glabrous ...3. *A. triphyllus*
 2. Leaves serrate-dentate, pubescent ...2. *A. serratus*

1. *Allophylus chartaceus* (Kurz) Radlk. in E. & P. Naturl. Pflanzenfam. 3(5) : 313. 1805. *A. zeylanicus* L., Sp. Pl. 348. 1753; Hiern. in Hook. f., Fl. Brit. India 1 : 673. 1875. *Schmidelia chartacea* Kurz in Journ. Asiat. Soc. Bengal 43 : 183. 1874.

A large shrub or a small tree with terete branches; young shoots pubescent. Leaves 1-foliolate, oblong, ovate or obovate, acuminate, 30-35 × 10-12 cm; toothed, glabrous, subcoriaceous with 10-14 pairs of lateral nerves; petioles 5 cm long, often with a pair of short processes at the upper extremity. Racemes 18-22 cm long; peduncles 4-6 cm. Flowers small white; buds globose. Sepals 4, two outer smaller, ovate. Petals reduced to obsolete tuft of scales inside. Stamens 8,

pistillode present in male flowers. Female flowers with globose ovary and bifid style. Fruit 1 cm long, red when ripe.

Fl. : April - Sept.; *Fr.* : Oct. - Dec. Sub-himalayan and hilly districts of North Bengal.

1. *Allophylus serratus* DC., Prodr. 1 : 610. 1824; W. & A., Prodr. 1 : 110. 1834; Kurz in J. Asiat. Soc. Bengal 44(2) : 185, 1875; Hiern in Hook. f., *l.c.* 674.

Much branched evergreen small trees. Leaves 3-foliolate; leaflets subsessile, ovate to ovate-oblong, 11-15 × 5-6 cm, acuminate, irregularly and coarsely serrate, with a tuft of hairs in the nerve axils beneath, pubescent; petioles 3-7 cm long, pubescent. Racemes long, hairy, axillary. Flowers small, white, polygamodioecious. Sepals 4, outer 2, smaller. Petals 4, cuneate, notched with a basal scale bearing a tuft of wool, or villous all over. Stamens 8, filaments woolly at base. Ovary pubescent, 2-lobed. Berries usually paired, the size of a pepper kernel, smooth, bright red, 1-seeded.

Fl. : Aug. - Oct.; *Fr.* : Nov. - Feb. In Southern and Western districts of the State.

Roots medicinal.

3. *Allophylus triphyllus* (Burm. f.) Merrill in Phil. J. Sci. 19 : 363. 1921. *Usabis triphylla* Burm. f., Fl. Ind. 89, t. 22, f. 1768. *A. cobbe* (L.) Blume, Rumph. 3 : 131, 1847; Hiern in Hook. f., *l.c.* 673. *A. glaber* (Roxb.) Radlk. in Engl. & Prantl. Pflanzenfam. 3 : 313. 1895. "Arhik-bouaa" (Lushai).

Shrubs. Leaves 3-foliolate; leaflets subsessile, ovate or ovate-oblong, ca 20 cm long, cuneate and decurrent at base, acuminate at apex, crenate-toothed, glabrous except a tuft of hairs, in the nerve axils beneath. Flowers small, whitish, shortly pedicelled, in axillary racemes shorter or longer than leaves. Petals cuneate, notched, with a basal scale bearing a tuft of hairs above the claw or woolly all over. Filaments villous at the base. Ovary pubescent, 2-lobed. Berries solitary, globose, the size of a pepper-kernel, bright red, 1-seeded.

Fl. : July - Nov.; *Fr.* : Feb. Lower Bengal, in the Sunderbans in 24-Parganas.

Wood is used as fuel.

2. APHANIA Blume

Trees or shrubs. Leaves alternate, exstipulate, even-pinnate or 1-foliolate. Flowers regular, polygamous, terminal or in axillary panicles. Sepals 4-5, biseriolate. Petals 4-5, with or without scales on their inner face. Disc annular, complete. Stamens 6-8, inserted within the disc. Ovary 2-3-locular; style terminal, stigma 2-3-lobed; ovules solitary in each locule. Fruits fleshy, 1-2-lobed, indehiscent, the lobes ellipsoid, not separating as distinct cocci. Seeds with crustaceous or membranaceous testa, without aril; embryo with thick cotyledons.

A genus with 24 Indo-Malayan and 1 West African species; 2 species in West Bengal.

1. Leaves pinnately compound, scattered ...2. *A. rubra*

1. Leaves simple, crowded at bases and ends of shoots ...1. *A. danura*

1. **Aphania danura** (Voigt.) Radlk. in Sitzb. Math. Phys. Acad. Muench. 8 : 238. 1878; Prain, Bengal Pl. 1 : 243. 1963 (repr. ed.). *Supindus danura* Voigt., Hort. Sub. Calcutta, 94. 1845; Hiern in Hook. f., Fl. Brit. India 1 : 684. 1874. "Danura" (Beng.).

An evergreen shrub or a small tree, 3-4 m high. Leaves simple, alternate, crowded at bases and ends of shoots, 20-38 × 2.5-13 cm, elliptic, obovate or oblong; petioles 2-5 mm. Inflorescence puberulent. Sepals 5. Petals 5, pale yellow tinged terminal panicles with pink, short incurved woolly scale at base. Stamens 6-8; filament short; anthers oblong. Disc glabrous. Ovary 2-3-lobed. Fruits of 3-1-cocci, shortly stipitate, ellipsoid, 9-13 mm orange when ripe.

Fl. : Dec. - March; *Fr.* : April - June. Western Sunderbans in 24 Parganas.

2. **Aphania rubra** Radlk. in Sitzb. Math. Phys. Acad. Muench. 8 : 238. 1878; Prain, *l.c.* 243. *Supindus attenuatus* Wall. ex Hiern in Hook. f., *l.c.* 684. "Lal-koi-pura" (Beng.).

Shrubs or small trees. Leaves pinnate; leaflets 8-10, ovate-lanceolate, elliptic or oblong, acuminate, 5-20 × 2-4.5 cm glabrous, base rounded or cuneate. Flowers 2.5-5 mm long, red, in axillary or terminal panicles. Sepals 5, ovate. Petals 5, obovate, glabrous, imbricate, about equalling the sepals; scale present. Stamens 6-8, not exerted; anthers yellow, oblong, filament short or absent. Ovary bilobed. Fruits 1-2-lobed, ellipsoid, about the size of an olive, red or dark-purplish.

Fl. : Dec. - March.; *Fr.* : April - May. Sub-Himalayan tracts in North Bengal.

Fruits are eaten by Sylhet people.

3. CARDIOSPERMUM L.

Slender tendril climbers. Leaves exstipulate biternate; leaflets crenate or serrate. Flowers polygamo-dioecious; irregular, lowest pair of pedicels modified into cirrose or tendril. Sepals 4, imbricate, outer pair smaller. Petals 4, in unequal pair, each with a scale inside at base. Disc unilateral, almost reduced to glands opposite the lower petals. Stamens 8, excentric; filaments connate below or free, 4 shorter. Ovary 3-celled with a solitary ovule in each cell; style very short, 3-fid. Fruit an inflated loculicidally dehiscent 3-valved capsule; valves membranaceous, reticulate. Seeds arillate at base.

A genus with ca 12 tropical species; 1 species in the plain of West Bengal.

Cardiospermum halicacabum L., Sp. Pl. 366. 1753; Hiern. in Hook. f., *l.c.* 670; Prain, *l.c.* 241. "Sibghul; Lataphat-kori" (Beng.). Fig. 73

Annual climbing herbs, branches striate. Leaves alternate, compound, up to 12 cm long; leaflets 2.5-6 × 1.5 - 2.3 cm, dentate, glabrous. Flowers small, white, in axillary cymes; peduncles up to 10 cm long. Sepals 4, biseriata, outer 2 smaller, 1-1.5 mm long, acuminate. Petals 4, rounded at apex, 2 mm long; Stamens 8,

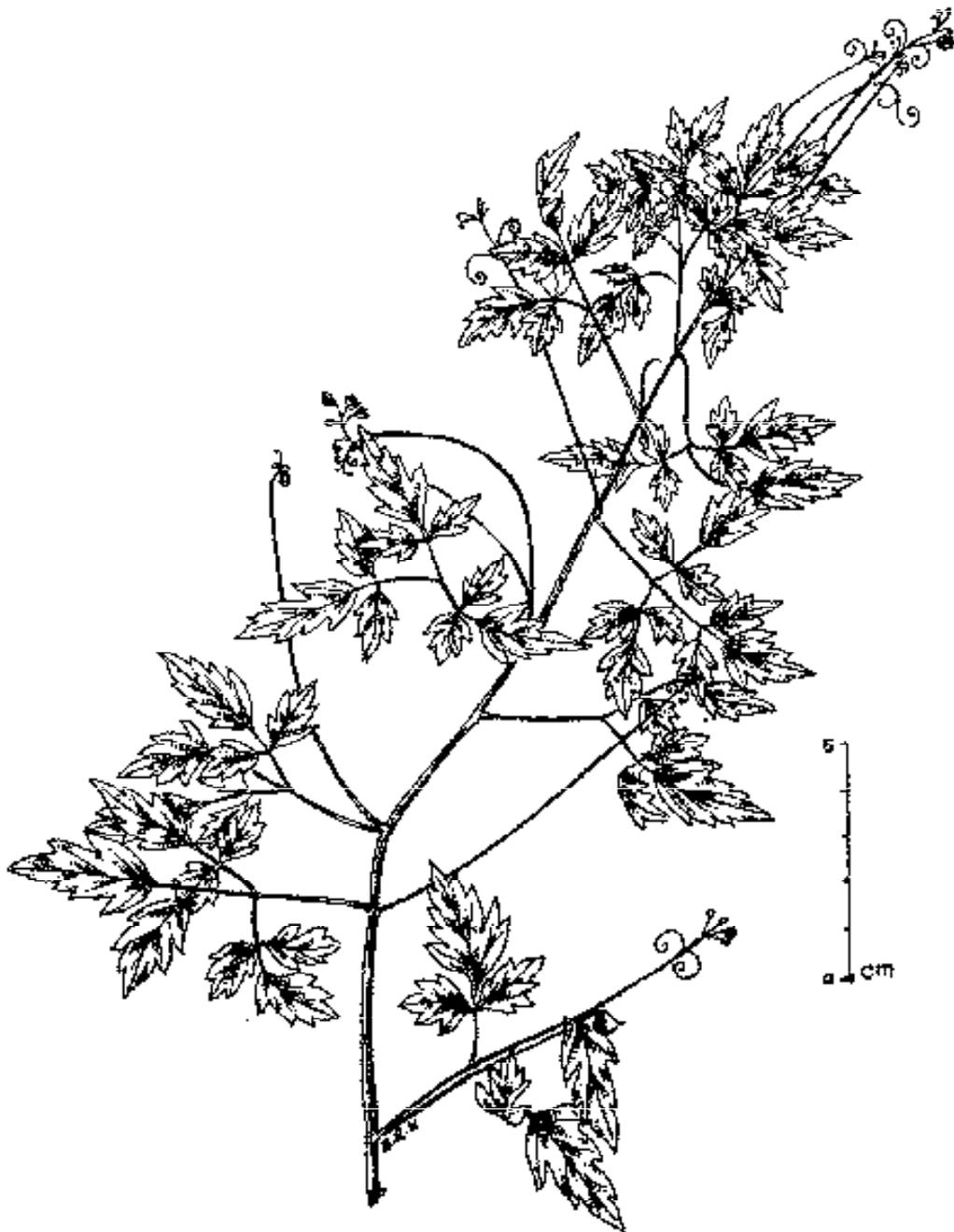


Fig. 73. *Cardiospermum halicacabum* L.

shorter than petals, 1.5 mm long. Capsules 3-celled, inflated, broadly pyriform, winged at the angles, 2-5 cm long. Seeds up to 5 mm diam., black, smooth with a white aril.

Fl. & Fr. : Throughout the year. Throughout the plains, common in wastelands.

Plants used in the treatment of chronic rheumatism.

4. DIMOCARPUS Lour.

Trees, 10-15 m high. Leaves paripinnate; leaflets coriaceous, 3-4 pairs, 9-16 × 3-4 cm, elliptic to oblong or obovate, glabrous, acuminate, entire; lateral nerves 16 pairs, prominent. Flowers in axillary or terminal panicles, yellowish-white. Sepals 5, rusty villous. Petals 5-6, villous. Disc angular. Stamens 6-8, exserted. Ovary verrucose, 2-3-lobed and 2-3-celled with one ovule in each cell. Fruit of 1-3-cocci, indehiscent, globose, covered with indistinct flattened tubercles. Seeds with a pulpy aril.

A genus with ca 5 Indo-Malayan species; 1 species in West Bengal.

Dimocarpus longan Lour., Fl. Cochinch. 233, 1790. Leenhouts in Blumea 19: 122, 1971. *Euphoria longan* (Lour.) Steud. Nom. 323, 1821. *Nephelium longana* (Lam.) Camb. in Mem. Mus. Hist. Nat. Paris 18: 30, 1829; Hiern, in Hook. f., l.c. 688; Prain, l.c. 244. "Ashphal" (Beng.).

Trees, 8-14 m high, young shoots rusty brown tomentose. Leaves 15-40 cm long; leaflets 3-4 pairs, 7-16 × 2.5-4 cm, elliptic-oblong, linear-oblong or lanceolate, acute; petiolules 2-5 mm long. Flowers numerous in large rusty tomentose terminal or upper axillary panicles; pedicels up to 1 mm long. Sepals 5, ovate, 2 mm long, rusty tomentose. Petals 5. Stamens 8, exserted. Ovary 2-3-lobed, verrucose, 2-3-celled with one ovule in each cell. Fruits with persistent calyx, globose, 2 cm diam.; Covered with flattened tubercles. Seed 1, shining black.

Fl. : March - May ; *Fr.* : June - Sept. Calcutta, Howrah, Murshidabad and 24-Parganas.

Seed aril is eaten, seeds contain a saponin used for washing hairs in China. The wood is red and used for posts, agricultural implements, furniture and building purposes.

5. DODONAEA L.

Shrubs. Leaves simple, alternate, exstipulate. Flowers minute, polygamous or polygamo-dioecious, in lateral and terminal cymes. Sepals 2-5, imbricate, or valvate. Petals absent. Disc obsolete in male flowers, small in bisexual flowers. Stamens 5-10, but usually 8, inserted on the outer side of the disc. Ovary 3-6-angled and 3-6-celled; style 3-6-angled; apex 3-6-cleft; ovules 2, colateral or superposed or occasionally 1, in each locule. Capsules 2-5-angled, membranous

or coriaceous, septicidally 2-6 valved, valves dorsally winged. Seeds 1-2 in each cell, subglobose or compressed lenticular, without aril.

A genus of ca 60 species in tropical and subtropical regions, specially in Australia; 1 species reported from West Bengal.

Dodonaea viscosa (L.) Jacq., Enum. Pl. Carib. 12, 1790; Hiern in Hook. f., *Lc.* 697; Prain, *Lc.* 244. *Ptelea viscosa* L., Sp. Pl. 118, 1753. "Sinatha, *Aliar*" (H.); "Mohra" (Or.).

Evergreen shrubs. Leaves elliptic or obovate, 7-10 × 1-2.5 cm, apex acute, more or less viscid with a shining yellowish resin. Flowers in axillary or terminal cymes, greenish, polygamous or polygamo-dioecious. Sepals 5, ovate, 2 mm, hirsute. Petals absent. Disc obsolete in male flowers, small in bisexual flowers. Stamens 8, outside of the disc. Ovary 2-3-locular; stigmas 2-3; ovules 2, colateral or superposed or occasionally 1 ovule in each locule. Capsules membranous, winged. Seeds 1 or 2 in each cell, black, subglobose, without aril.

Fl. : Jan. - March; *Fr.* : April - June. Commonly planted as a hedge throughout West Bengal, also wild in the sub-Himalayan tracts.

Leaves are used for the treatment of wounds, swellings and burns, also used as a fish-poison.

6. ERIOGLOSSUM BL.

Trees. Leaves alternate, odd-pinnate, exstipulate; leaflets entire. Flowers irregular, white, polygamo-dioecious. Sepals 5, unequal orbicular, two outer ones smaller. Petals 4, unequal obovate, clawed, place of the fifth petal vacant, scale hairy, hooded, with an apical lobed appendage. Disc unilateral, lobed. Stamens 8, more or less turned to one side, unequal; filaments hairy. Ovary stipitate, obcordate, 3-lobed, 3-celled; style slender, stigma 3-lobed; ovule solitary in each cell. Fruit 1-3-lobed at the base, indehiscent. Seeds oblong, albuminous.

A monotypic genus; occurring in Indomal and Australia.

Erioglossum rubiginosum (Roxb.) Bl. in Rumphia 3 : 118, 1847. *Sapindus rubiginosum* Roxb., Pl. Corom. 1 : 44, 1795. *Erioglossum edule* Bl. Bijdr. 5 : 229, 1825; Hiern in Hook. f., *Lc.* 672; Prain, Bengal Pl. 1 : 242, 1963 (repr. ed.). "Reetha" (Beng.).

Trees, 5-10 m high. Leaves 30-45 cm long; leaflets 4-6 pairs, usually subopposite, ca 17 × 6 cm, elliptic or ovate-oblong, entire; petioles 2-3 mm long, tomentose. Flowers 6 mm long, white, fragrant, in terminal or axillary elongated racemes; bracts small, villous. Fruits fleshy, 2-3-lobed.

Fl. : Dec. - March; *Fr.* : March - April. Sub-Himalayan tracts of North Bengal; occasionally planted.

Tender shoots used as vegetable in Java. Leaves and roots are used as poultice in Malaya. Decoction of roots and seeds are used in fever and whooping cough respectively.

7 LITCHI Sonn.

Trees. Leaves exstipulate, paripinnate; leaflets subopposite, entire or rarely serrate. Flowers small, regular. Calyx 4-6-lobed, cupular. Petals absent. Disc small, swollen. Stigma 6-8 exerted. Ovary pubescent, verrucose, 2-3-lobed and 2-3-celled with one ovule in each cell; style with 2-3 recurve stigmatic lobes. Fruit 1-3 coccus, indehiscent, oblong or globose, covered with prominent tubercles. Seeds enveloped in a pulpy aril.

A genus with 10-12 species in S. China, S. E. Asia and W. Malaysia; 1 species cultivated in West Bengal.

Litchi chinensis Sonn., Voy. Ind. Or. Chine 2 : 230, t. 129. 1782. *Nephelium litchi* Camb., Mem. Mus. Hist. Nat. Paris 18 : 30. 1829; Hiern in Hook. f., l.c. 687; Prain, l.c. 244. "Lichi" (Beng.).

Small trees. Leaflets 2-4 pairs, 9-13 × 2.5-3.5 cm, elliptic-oblong or lanceolate, acuminate, entire. Flowers small, numerous. Ovary 2-3-lobed, verrucose; style with 2-3 recurved stigmatic lobes. Fruits 1-3 cm long, indehiscent, globose, covered with tubercles, aril white, fleshy, with sweet juice.

Fl. : Jan. May; Fr. : May Aug. Native of S. China. Cultivated in Hooghly and South 24-Parganas, for fruits.

Aril of fruits eaten. Seeds used for intestinal troubles and neuralgic disorders.

8. SAPINDUS L.

Trees or shrubs. Leaves alternate or subverticillate, exstipulate, usually paripinnate; leaflets coriaceous, entire. Inflorescence terminal or axillary. Flowers polygamous, regular. Sepals 4-5, widely imbricated in 2 rows. Petals 4-5 with or without scales. Disc angular, fleshy. Stamens 8-10, inserted within the disc; filaments pilose; anthers versatile. Ovary entire or 2-4-lobed, 2-4-celled; style terminal; stigma 2-4-lobed, ovules solitary. Fruit fleshy or coriaceous, 1-2-coccus; cocci oblong or globose, indehiscent. Seeds with a crustaceous or membranaceous testa.

A genus with ca 13 species in tropics and sub-tropics of Asia, Pacific and America; 2 species widely cultivated in West Bengal.

1. Leaflets 4-6, pubescent beneath; anthers apiculate;
ovary hairy ... 1. *S. emarginatus*

1. Leaflets 10-16, glabrous; anthers obtuse; ovary
glabrous ... 2. *S. mukorossi*

1. *Sapindus emarginatus* Vahl, Symb. Bot. 3: 54. 1794; Mukerjee, J. Eco. Tax. Bot. 1: 81, 1980. *S. trifolius* L., Sp. Pl. 367. 1753, nom. ambig.; Hiern. in Hook.f., l.c. 682; Prain, l.c. 242. *S. laurifolia* Vahl, Symb. Bot. 3: 54. 1794. "Reetha" (H.); "Bara-ritha" (Beng.).

Trees. Leaves alternate, even-pinnate; leaflets 4-6, 9-14 × 4-6 cm, entire, elliptic or oblong, pubescent beneath with curved or stellate hairs, apex acuminate or emarginate, base obtuse. Panicles terminal. Flowers white, hoary

Sepals 5, elliptic, obtuse. Petals 4-5, narrower and longer than sepals, a dense mass of white hairs attached to the claw and inner surface of the petals. Stamens 8, anthers apiculate. Disc concave with a raised fleshy hirsute edge. Ovary 3-lobed, ferruginous-tomentose. Fruits fleshy, 2-3-lobed, 2 cm diam., saponaceous. Seeds black, round.

Fl.: Sept. - Dec.; *Fr.*: Feb. - March. Birbhum - occasionally planted.

Fruit decoction used as detergent, tonic, astringent and for curing asthma, leaves used as manure.

2. *Sapindus mukorossi* Gaertn., *Fruct.* 1:342, f. 70, 1788; Hiern, in Hook.f., *l.c.* 623; Prain, *l.c.* 242. "Reetha" (H.); "Ritha" (Beng.).

Trees. Leaves alternate, paripinnate or sometimes imparipinnate; leaflets 10-16, lanceolate or ovate-lanceolate, 8-18 × 2.5-5.5 cm, entire, acuminate. Panicles terminal. Flowers small, yellowish or purple. Sepals 4-5. Petals 5, longer than sepals, with tuft of hairs on the edge and inner surface. Stamens 8, ovary 3-cornered, glabrous. Fruits pale brown, globose, wrinkled before falling. Seed solitary, black, globose, 10-13 mm in diam., loosely contained in a fleshy pericarp.

Fl.: May - June; *Fr.*: Aug. - Jan. Usually planted; sometimes wild by escape. Native of China and Japan.

Saponin in fruits used as detergent for washing clothes and hairs, as a medicine for excessive salivation, epilepsy, chlorosis and also as a fish-poison.

9. SCHLEICHERA Willd.

Trees. Leaves alternate exstipulate, pinnate; leaflets sub-opposite, entire or slightly serrate. Flowers regular, polygamo-dioecious, fasciated in simple racemes or panicles. Calyx 4-5-fid, small, cupular; lobes valvate or subvalvate. Petals absent. Disc complete annular. Stamens 6-8, inserted within the disc. Ovary ovoid, 3-4-locular, narrowed to the rigid style; stigma 3-4 cleft; ovules erect, solitary in each cell. Fruit dry; indehiscent, 1-3-celled, firmly but thinly coriaceous. Seeds erect, arilate.

Monotypic, Indo-Malayan in distribution.

Schleichera oleosa (Lour.) Oken, *Allg. Naturgesch.* 3(2) : 1341, 1841, *S. trijuga* Willd., *Sp. Pl.* 4: 1896, 1805; Hiern, in Hook.f., *l.c.* 681; Prain, *l.c.* 243. "Kusum" (H., Beng.).

Fig. 74

Large trees. Leaves odd-planate; leaflets usually 3 pairs, elliptic, entire, coriaceous, lowest pair smallest, 5-9 × 2.5-6 cm, terminal pair 10-21 × 4-10 cm, young leaves bright red; petioles and rachis pubescent; petiolules very short, articulated with the rachis. Flowers white or yellowish. Fruits ellipsoid, 2-3 cm long, smooth or spinulose, apiculate. Seed 1 or 2, enclosed in a palpy edible aril.

Fl.: Feb. - March; *Fr.*: April - Aug. Bankura, Burdwan and Purulia.

A good timber tree, commonly used for producing lac; bark cures leprosy, skin diseases and ulcers.

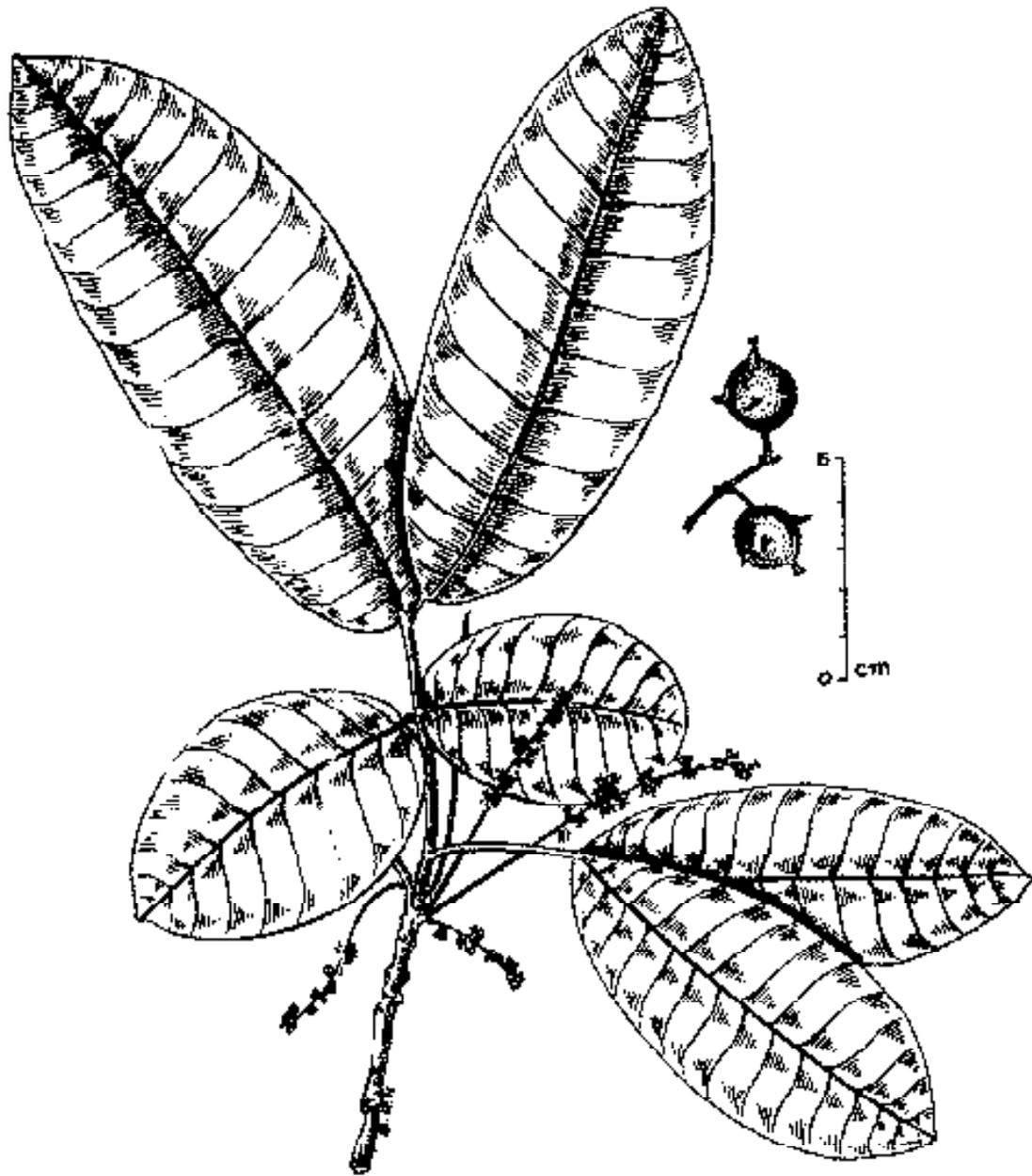


Fig. 74. *Schleicheria oleosa* (Lour.) Oken

* HIPPOCASTANACEAE
(N.R.Mandal)

A family of about 2 genera and 15 species, mainly in the North- temperate and North & South American regions of the World; 1 species in West Bengal.

AESCULUS L.

Trees or shrubs. Leaves opposite, exstipulate, digitate; leaflets pinnately nerved. Flowers bisexual or polygamous, zygomorphic, in terminal panicle or racemes, white, red or yellow. Sepals 4-5 tubular or campanulate, basally connate, imbricate. Petals 4 to 5 clawed, free unequal imbricate. Disc entire, annular or unilateral. Stamens 5-9 inserted within the disc; filaments free; anthers 2 celled, longitudinally dehiscent. Pistil syncarpous; ovary 3 locular or less by abortion; style long *ca* 7 mm; stigma simple; ovules 2 in each locule. Fruit a leathery capsule, smooth or spiny, loculicidally dehiscent.

13 species in the South-east Europe, Eastern Asia and North America; 1 species in West Bengal.

Aesculus assamica Griff. Notul. 4:540. 1854; Kurz. For. Fl. Brit. Burma 1: 286. 1877. *A. punduana* Wall, ex Hiern. in Hook. f. Fl. Brit. India 1: 675. 1875.

Deciduous trees or shrubs with spreading branches. Leaves palmately compound, opposite, exstipulate; Petiole 17.5-19.5 cm long, leaflets up to 7 (20.5-23 × 4.4-7 cm), gradually smaller from terminal one; terminal leaflet 12.7 - 38.1 × 5.8-12.7 cm. Petiolules very short (3-5 mm); Leaflets oblanceolate, acuminate, base acute, finely serrulate, glabrous, subcoriaceous; main lateral nerves 20-25 pairs. Inflorescence rachis up to 30-50 cm long, terminal thyrsoid panicle. Flowers irregular, white 1.27-1.52 cm long excluding stamens. Sepals 5, imbricate, 5-7 mm, tubular, rounded at the apex. Petals 4 or rarely 5 in number, with a yellow spot at the base, unequal, clawed, pubescent outside. Stamens slender, usually 7, free, much exerted, 2-3 cm long. Ovary 3-celled with two superposed ovules; style slender elongated *ca* 7 mm, stigma linear.

Fruit a brown apiculate loculicidal, capsule, 5.8-7.6 cm long. Seeds brown, smooth.

Fl. & Fr. : March - June. Coochbehar, Darjeeling, Jalpaiguri.

The powdered bark is reported to be employed as a fish poison. Ethanolic extract (50%) of the aerial parts exhibited anti- amphetamine-activity in mice. The seeds yield a fatty oil. The wood is white, soft, close-grained. It can be utilized for handicrafts like cups, plates, vases and toys.

* Frequently treated as a part of Sapindaceae

ACERACEAE

(Silpi Das)

A family of 2 genera and nearly 120 species mainly in the temperate northern hemisphere and tropical and subtropical Asia; 1 genus and 12 species in the temperate areas of Darjeeling in West Bengal.

ACER L.

Trees rarely shrubs, with perulate buds; usually deciduous, rarely evergreen. Leaves petiolate, simple or pinnately or palmately compound. Inflorescence in 2-4 leafy terminal branches or in leafless lateral or terminal branches. Petals equal to or shorter than sepals, often yellowish green. Disc rarely reduced or absent, often intrastaminal rarely extrastaminal or having stamens on the middle. Anthers introrse, in male flowers exerted, in bisexual flowers included. Ovules colateral or superposed. Seed in each locule very often solitary through abortion.

A genus with about 200 species in North temperate regions and tropical mountains; 12 species in West Bengal.

1. Plants having either lobed or simple leaves, both conditions not present together :
 2. Leaves simple :
 3. Inflorescence racemose:
 4. Leaf margin prominently serrate; samaras on 0.7-5 cm long stalk :
 5. Samaras 1.8-2.5 cm long; fruit stalk 0.7-1.2 cm long ...4. *A. hookeri*
 5. Samaras 2.5-5 cm long; fruit stalk 3.5 cm long ...10. *A. stachyophyllum*
 4. Leaf margin subentire to finely serrulate; samaras indistinctly stalked ...9. *A. sikkimense*
 3. Inflorescence paniculate or corymbose.
 6. Upper leaf surface pale green, lower surface glaucous; petiole long ...6. *A. oblongum*
 6. Upper leaf surface olive green, lower surface brownish; petiole short ...5. *A. laevigatum*
 2. Leaves lobed :
 7. Leaves 3-lobed ...12. *A. thomsonii*
 7. Leaves 5-lobed the lower lobations not prominent, sometimes 7-lobed:
 8. Leaf margin entire ...2. *A. cappadocicum*
 8. Leaf margin serrate:

9. Samara erect, the angles of divergence 90° or less than that:
10. Leaf margin incisu-serrate, apex caudate ...3. *A. caudatum*
10. Leaf margin remotely serrate, apex acuminate ...11. *A. sterculiaceum*
9. Samara slanting, the angles of divergence more than 90° :
11. Leaf lobes deltoid, apex caudate-acuminate, leaf margin deeply serrate ...8. *A. pectinatum*
11. Leaf lobes ovate-caudate, leaf margin subentire to serrulate ...1. *A. campbellii*
1. Plants having both lobed and simple leaves ...7. *A. osmastonii*

1. ***Acer campbellii*** Hook. f. & Thoms. ex Hiern in Hook. f., Fl. Brit. India 1: 696. 1875; Hara in Fl. East. Himal. 191. 1966. "Kabashi" (Nep.); "Daom Yatli" (Lep.); "Kilol" (Bhut.). Fig. 75

Trees, 12-30 m tall, andro-monoecious; branches greyish green or yellow. Leaves palmately 5-7-lobed, chartaceous, broader than long, 10-12 × 12-15 cm, both surface light green, shining, base truncate-cordate, 5-7-nerved, glabrous or at the axis and along the nerves beneath sparsely pilose. Inflorescence terminal, corymbose, appearing with leaves, 5-15 cm, long. Flowers 5-merous, greenish white. Stamens 8, somewhat included, reddish, filaments short. Disc extra-staminal. Ovary glabrescent. Samaras 1.7-3 cm long, glabrous, wings horizontal or divergent.

1. Lamina truncate at base, margin serrulate, nerves glabrous ...var. *campbellii*
1. Lamina cordate at base, margin serrate, nerve pubescent on lower surface ... var. *serratifolium*

var. ***campbellii***

Fl.: April-May; Fr.: June-Aug. Darjeeling.

Wood moderately hard, shining, extensively used for planking.

var. ***serratifolium*** Banerji in Journ. Bombay Nat. Hist. Soc. 306. 1961; H. Hara in Hara et Williams, Enum. Fl. Pl. Nepal. 2: 97. 1979.

Fl.: May - June; Fr.: July - Aug. Darjeeling.

2. ***Acer cappadocium*** Gleditach in Schrift. Ges. Naturf. Freunde Berl. 6: 116. t. 2. 1785; Hara & Williams, Enum. Fl. Pl. Nepal 2: 98. 1979. *A. pictum sensu* Hiern. in Hook. f., Fl. Brit. India 1: 696. 1875, non Thunb.; R.N. Parker, For. Fl. Punjab 105. 1918. "Tilpattar, Kalpattar" (Garhw.).

Deciduous trees, 15-20 m tall. Leaves chartaceous, light green, lustrous, 4-14 × 6-20 cm, under surface hairy at the axil of nerves at base, lobes equal, ovate, sinuses rounded, apex acuminate, base truncate or sub-cordate, 5-7 nerved. Inflorescence a terminal corymbose panicle, appearing with leaves. Flowers

5-merous, long stalked, yellowish green. Sepals and petals 3-4 mm long. Stamens 8, inserted on disc, included. Ovary glabrous; styles 2, free. Samaras 3.5-5 cm long, widely divaricate to sub-horizontal, compressed; wings diverging in almost a straight line.

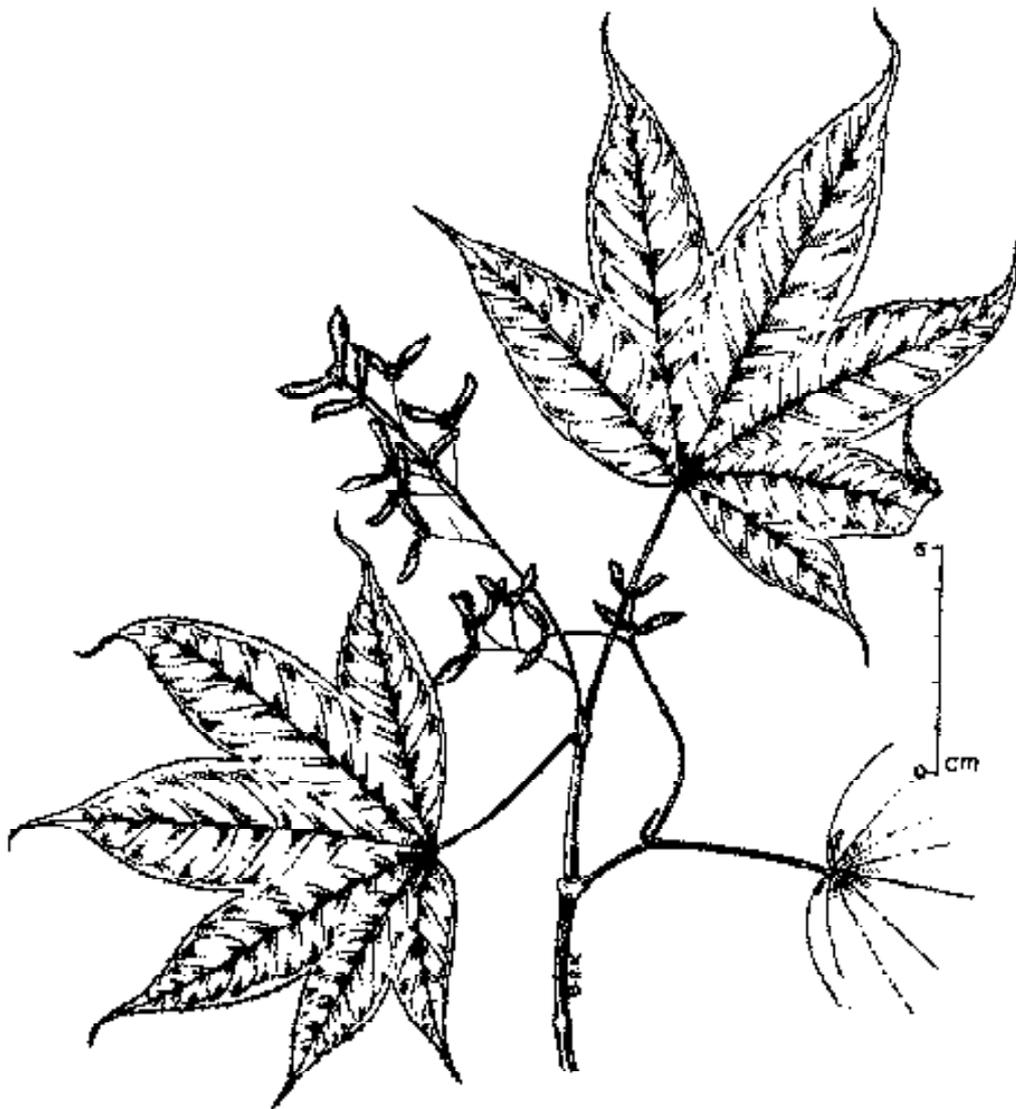


Fig. 75. *Acer campbellii* Hook. f. & Thoms. ex Hiern

Fl.: April-May; *Fr.*: June-Sept. Darjeeling.

The commonest Himalayan Maple. Wood used for making farm implements, poles and bed-stands.

3. *Acer caudatum* Wall. Pl. Asiat. Rar. 2:4. 1830 & 2 : 28. t. 132. 1831; Hiern. in Hook.f., *l.c.* 695; H. Hara. *l.c.* 98. *A. papilio* King in J. Asiat. Soc. Bengal 63(2) : 115. 1896 et in Ann. Roy. Bot. Gard. Calcutta 9:17. t. 24. 1901. "Kanzla" (Garhw.); "Khansing, Kabarhi" (Nep.); "Yelishim" (Bhut.).

Trees or shrubs, up to 15 m tall, andro-monoecious; branches flaky, grey-brown or rust-coloured; buds pubescent. Leaves 7.5-15 × 8-18 cm, chartaceous, basal lobes small or often obscure; adult leaves barbate in the axils of nerves below, base cordate, margin inciso-serrate, 5-7-nerved, apex long, linear, cuspidate-serrulate; petioles 5-10 cm long, pubescent. Inflorescence terminal, villous. Flowers 5-merous, yellowish. Stamens 8, exserted. Disc large, extra-staminal. Ovary pubescent; style elongate; stigma short. Samara wings divergent or sub-parallel, locules carinate, convex.

Fl.: March - May ; *Fr.* : July - Oct. Darjeeling.

4. *Acer hookeri* Miq. in Arch. Neerl. Sci. Nat. 2: 471. 1852; Hiern. in Hook.f., *l.c.* 694; Hara, *l.c.* 98. "Lahara Kapasi, Lal Kapasi" (Nep.); "Pale" (Lep.).

Trees, 12-16 m tall, andro-monoecious or dioecious; branches green with whitish stripes, later grey-brown. Leaves cordate to subcordate, chartaceous or coriaceous, ovate, 7-14 × 5.5-8.5 cm, apex caudate-acuminate to cuspidate, base 5-nerved. Inflorescence appearing with leaves, bracteate, puberulous, brown to greenish-yellow. Flowers yellowish-green. Sepals and petals equal, 2.5-3 mm long. Stamens 8, exserted; filaments 1.5-2 mm long. Ovary glabrous. Samaras subhorizontal, nuts rounded, wings widely divergent, extrorsely falcate or straight.

1. Leaves 7-12 × 3.5-6.5 cm, adult leaf papery or chartaceous, leaf margins biserrate, serratures cuspidate; samara wings extrorsely falcate or widely divergent ... var. *hookeri*

1. Leaves 10-14 × 5.5-8.5 cm adult leaf coriaceous, leaf margins imperfectly biserrate, serratures less cuspidate; samara wings straight ... var. *majus*

var. *hookeri*

Fl. : April-June; *Fr.*: May-Nov. Darjeeling; common between 2250-1200 m.

The seeds of the plant carried by wind are often deposited in crevices or hollows of other large trees and hence, the plant grows as an epiphyte.

var. *majus* Pax in Bot. Jahrb. 7: 216. 1886.

Fr. : Oct. Darjeeling.

5. *Acer laevigatum* Wall., Pl. Asiat. Rar. 2 : 3-4. t. 104. 182. 1830; Hiern. in Hook.f., *l.c.* 693; Hara, *l.c.* 98. "Thali Kabashi" (Nep.); "Tungnyok" (Lep.); "Dieng-than, Dieng-soh-tyrkhum" (Kh.); "Thing-khim" (Lush.).

Trees, 10-15 m tall, andro-monocious; branches olive-green or purplish; bark grey, furrowed. Leaves coriaceous, elliptic-oblong or oblong-lanceolate, 7-15 × 4-5 cm, prominently reticulate, margin entire to minutely and remotely serrate. Inflorescence appearing with leaves. Flowers 5-merous, minute. Sepals purplish green, 2 mm long. Petals obovate, obtuse, white, equal to sepals. Stamens 5-8, exserted; anthers dorsifixed. Disc extra-staminal. Ovary villous; style elongate. Samaras 2-3 cm long, purplish, wings acutely divergent, straight or somewhat introrsely falcate.

Fl.: March - July; *Fr.*: May - Aug. Darjeeling.

Wood used as building material.

6. *Acer oblongum* Wall. ex DC. Prodr. 1:593. 1824; Hiern. in Hook.f., *l.c.* 693; Hara, *l.c.* 98. "Dieng-soh-khtu" (Kh.); "Buzim-pala" (Nep.); "Kirmoli" (Garhw.).

Trees, evergreen, 15-18 m tall, andro-monocious, buttressed at base; bark smooth to wrinkled, white and green. Leaves coriaceous, ovate-lanceolate or oblong, 10-17 × 5-7 cm, glabrescent, minutely reticulate, dark green above, pale to glaucous beneath, base obtuse or rounded, 3-nerved. Inflorescence appearing with leaves, pubescent, lateral shoots 5-15 cm long. Flowers 5-merous, greenish white to yellowish green, 7-8 mm across. Sepals linear or lanceolate, outside barbate, 2-4 mm long. Petals elliptic-lanceolate, equal to or shorter than sepals. Stamens 8, inserted on or inside the disc. Ovary densely pubescent. Samaras 2-3 cm long; wings divergent.

Fl.: Feb. - April; *Fr.*: May - Sept. Darjeeling.

Wood reddish, used for agricultural implements.

7. *Acer osmastonii* Gamble in Bull. Misc. Inform. Roy. Bot. Gard. Kew 446. 1908; Delendick in Brittonia 30(4): 473-476. 1978.

Trees up to 30 m tall, polygamous; branches olive to purplish-brown. Leaves 12-15 × 6-8 cm, glabrous above, closely reticulate beneath, when lobed with 2-3 lobations in upper half, lobes erect, ovate lanceolate, apex long, caudate-acuminate, base round or slightly cordate, margin acutely serrate. Inflorescence pedunculate; cymes in terminal 7-10 cm long panicles. Flowers greenish to cream yellow, 5-merous. Stamens 8, inserted inside the disc; filaments subulate; anthers oblong, minutely papillose. Ovary silky-villose. Samaras erect to divergent.

Fl.: July - Aug.; *Fr.*: Oct. - Nov. Darjeeling.

Notes: Delendick has reported that the species is a hybrid between two other species of Sect. Palmata, *A. campbellii* Hook. f. & Thoms. (Ser. Sinensia) and *A. laevigatum* Wall. (Ser. Penninervia). This was Osmaston's view and Gamble cited it in protologue but did not support it. Delendick reaffirmed Osmaston's observation and concluded that the taxon is a hybrid one (Mehra, Khosla & Sareen in Silvae Genet. 21: 96-102. 1972.).

8. *Acer pectinatum* Wall. ex Pax in Bot. Jahrb. 7: 249. 1886; Hara, *l.c.* 98; *A. caudatum* Wall. f. *pectinatum* Hiern. in Hook. f., *l.c.* 695.

Trees, 10-15 m tall, andro-monoecious; branches purplish brown. Leaves chartaceous, 3-5-lobed, 6-14 × 6.5-15.0 cm, lobes deltoid or ovate-caudate, basal lobes small, often inconspicuous, base deeply cordate, axils of nerves hairy; petioles 6-10 cm long. Inflorescence racemose, terminal appearing with leaves. Flowers 5-merous. Sepals purplish red. Petals whitish. Stamens 8, included. Ovary glabrous, stigma pubescent. Samaras glabrous, locules flat, wings horizontal, somewhat introrsely falcate, scarcely or not attenuate at base.

Fl. : May - June; *Fr.* : July - Oct. Darjeeling.

9. *Acer sikkimense* Miq. in Arch. Neerl.Sci. Nat. 2: 471. 1852; Hiern. in Hook.f., *l.c.* 694; Hara, *l.c.* 98.

Tall trees, andro-monoecious or dioecious; branches green to reddish brown or grey. Leaves ovate, 9-17 × 7-9 cm, subcoriaceous, entire or subentire, glabrous dark green above, paler beneath, apex caudate to cuspidate, base subcordate to cordate, 5-nerved. Inflorescence appearing with leaves, bracteate, densely spicate. Flowers 5-merous, yellowish green. Sepals lanceolate, 2 mm long, petals short, 1.5-2 mm long. Stamens 8, filament 2.5 - 3 mm long. Ovary glabrous. Samaras 1.5 - 1.8 cm long, nuts globular, wings divergent, nearly straight, base narrowed.

Fl. : Nov. - April; *Fr.* : April - Aug. Darjeeling.

10. *Acer stachyophyllum* Hiern. in Hook. f., *Fl. Brit. India* 1:694. 1875; Hara, *l.c.* 98.

Small dioecious trees. Leaves ovate, submembranaceous, 9-10 × 3.5- 6 cm, base rounded or broadly cordate, 7-nerved, apex caudate-acuminate. Inflorescence elongate, usually branched, equalling the leaves; pistillate inflorescence terminal, staminate inflorescence lateral. Flowers yellowish. Sepals 3.5-4 × 2.5 mm. Petals membranaceous, 3.2 × 1.8 - 2 mm. Stamens 4, 4-4.5 mm long; anthers 1-1.5 mm long, dorsifixed. Samaras carinate-convex, nuts erect, ovoid, base cuneate; wings introrsely falcate, angles divergent.

Darjeeling.

11. *Acer sterculiaceum* Wall., *Pl. Asiat. Rar.* 2: 3. t. 105. 183; Hara, *l.c.* 98. *A. villosum sensu* Wall., *l.c.* 2 : 4. 1831; non Presl; Hiern. in Hook.f., *l.c.* 695.

Trees, 10-15 m tall, dioecious; branches brownish, young branchlets villous. Leaves subcoriaceous, 3-5-lobed, 12-20 × 13-22 cm, basal lobes smaller, often obscure, both surfaces dull green, upper glabrate, older leaves rusty-brown, base deeply cordate, 5- 7-nerved, apex acuminate; petiole densely villous, 8-15 cm long, canaliculate. Inflorescence pubescent, appearing with or before leaves, lax. Flowers 5-merous, greenish yellow, bracts and pedicels villous. Stamens 5-8(7-10), perigynous, exserted. Ovary greenish brown, prominent green disc present. Samaras puberulent, brownish, wings erect and parallel.

Fl. : March-April; *Fr.* : April - Oct. Darjeeling.

12. *Acer thomsonii* Miq. in Arch. Neerl. Sci. Nat. 2 : 470. 1867; Hara, *l.c.* 98. *A. villosum* Wall. var. *thomsonii* (Miq.) Hiern. in Hook.f., *l.c.* 695. "Kabashi" (Nep., Beng.).

Large trees, dioecious. Leaves chartaceous or coriaceous, glabrescent, 3-lobed, bright green above, pale green beneath; middle lobe broadly triangular, laterals very short, sinuses between lobes obtuse, apex shortly acuminate, margin entire, repand or remotely serrate, base cordate, 5-nerved; petioles glabrescent, canaliculate, 5-15 cm long. Flowers 5-merous, yellowish green, stamens 6, exserted; filaments glabrous; anthers versatile. Samaras brown, wings straight, broadest above middle, base very narrow.

Fl: Nov. - Dec.; *Fr*: Jan. - July. Darjeeling.

*STAPHYLEACEAE

(D. Mitra)

A family of ca 5 genera and ca 40 species usually occurring in Northern Hemisphere, a genus of ca 10 species distributed in the tropical and sub-tropical region; 1 genus and 2 species are reported from West Bengal.

TURPINIA Vent.

Evergreen trees or shrubs; glabrous and shining, terete branches. Leaves compound, opposite, usually odd-pinnate, leaflets opposite, serrulate; stipule interpetiolar, deciduous. Flowers polygamous or bisexual in panicles, axillary or terminal. Sepals 5 partite, imbricate, persistent. Petals 5, free, imbricate, spatulate or oblong. Stamens 5, epipetalous, filaments flattened inserted outside the lobed or crenulate raised disc. Ovary sessile, 3-celled; style 3, united or distinct; stigma sub-capitate 3-lobed; ovules usually 1, when many in 2 rows. Fruits subglobose, slightly 3-lobed, indehiscent, usually fleshy pericarp. Seed 1-many in various shape, testa hard and shining.

2 species are reported from West Bengal.

1. Leaves about 30 cm long, leaflets elliptic-oblong; flowers 3.5-4 mm diam., pericarp somewhat fleshy ... 2. *T. pomifera*
1. Leaves about 20 cm long, leaflets obovate or variable in shape; flowers 2-2.5 mm diam., pericarp scarcely fleshy ... 1. *T. cochinchinensis*

1. *Turpinia cochinchinensis* (Lour.) Merr. in J. Arn. Arb. 19:43. 1938. *Tricera cochinchinensis* Lour. Fl. Cochinch. 184. 1790. *Turpinia nepalensis* Wall. ex Wight et Arnott, Prodr. 156. 1834; Kanjilal *et al.*, Fl. Assam 1(2): 310. 1936; Hara in Fl. East. Himal. 1: 191. 1966. *T. pomifera* auct. non DC.; Hiern. in Hook. f., Fl. Brit. Ind. 1: 698. 1875, p.p.

Large shrub or small tree. Leaves about 20 cm long, leaflets 3- 5, obovate, or variable in shape, acuminate, $\pm 10 \times 3-4$ cm. Inflorescence panicle usually axillary 10-15 cm long. Flowers white. Sepals 5 partite. Petals 5, spatulate. Stamens 5, anthers almost globose. Ovary 3-celled, style 3 combined, stigma sub-

* Frequently treated as a part of Sapindaceae

capitate. Fruits sub-globose, stipulate, indehiscent berry, pericarp scarcely fleshy, 0.5-1 mm thick.

Fl. : April - July; *Fr.* : Aug. -Oct. Darjeeling.

2. *Turpinia pomifera* (Roxb.) DC, Prodr. 2:3, 1825; Hiern. in Hook.f., *l.c.* 698, *p.p.*; Kanjilal *et al.*, *l.c.* 309; Prain, Bengal Pl. 1:245, 1903. *Dalrymplea pomifera* Roxb., Pl. Corom. 3: 76.t. 279, 1819. "Janoki jam" (Beng.).

Tree. Leaves 30-40 cm long, leaflets usually 7, elliptic-oblong, long acuminate, 12-15 x 4-6 cm. Inflorescence panicle much branched, axillary or terminal, 20-30 cm long. Flowers whitish. Sepals 5, ovate 2-3 mm long. Petals 5, spatulate ca 3.5 x 1.5 mm. Stamens 5, anthers oblong-ovate, 2.5 mm long. Ovary 3 celled; style 3 united; stigma 3 lobed, sub-capitate. Fruit globular with 3 grooves at the apex, pericarp very thick. Seeds small brown and glossy.

Fl. : June - July; *Fr.* : Oct. - Dec. Darjeeling, Jalpaiguri.

Leaves are used as fodder.

SABIACEAE (S.C. Majumdar)

A family of 4 genera and about 46 species distributed in S. E. Asia, China, Japan and Mexico to Brazil in the New World; 2 genera and 8 species in West Bengal.

- 1. Small to large trees; sepals and petals unequal, stamens 5, unequal, outer 3 staminodial, inner 2 fertile ...1 MELIOSMA
- 1. Scandent shrubs; sepals and petals equal, stamens 4-5, all equal and perfect, fertile ...2 SABA

1. MELIOSMA Bl.

Trees without persistent bud scales. Leaves alternate, simple or imparipinnate with subopposite leaflets. Inflorescence terminal or sometimes an axillary panicle. Flowers numerous, small, bisexual, irregular. Sepals distinct, sometimes surrounded by several persistent small bracts and indistinguishable from them, altogether 5-13. Petals 5, outer 3 larger, convex, inner 2 smaller, bifid and opposite to fertile stamens. Disc annular, more or less irregularly 5-dentate. Stamens 5, outer 3 staminodial, inner 2 fertile, with large globose anthers. Ovary 2-locular, each locule with 2 superposed ovules; style and stigma simple. Fruits oblong to globose, a 1-seeded drupe without endosperm.

A genus of about 25 species in S. E. Asia and C. & S. America; 3 species in West Bengal.

- 1. Leaves compound ...2. *M. pinnata*
- 1. Leaves simple :
 - 2. Nerves straight ...1. *M. dilleniaefolia*
 - 2. Nerves curved ...3. *M. simplicifolia*

Meliosma dilleniaefolia (Wall. ex Wt. & Arn.) Walp., Rep. 1: 423. 1842 (*dilleniaefolia*); Hook. f., Fl. Brit. India 2: 4. 1876; Hara, Fl. East. Himal. 194. 1966. *Millingtonia dilleniifolia* Wall. ex Wt. & Arn. Edinb. New Phil. J. 15: 179. 1833. "Gwep or Gweb, Gulpha, Goguna, Goi, Shapra, Bakarshang" (H.); "Lekhgugum, Ranigogum, Maigosa" (Nep.).

Small trees. Leaves ovate or elliptic-oblong, cuneate or attenuate at base, closely and finely dentate, sparsely to densely pubescent; nerves 13-27 pairs. Panicles erect, 14-28 cm long. Sepals 5 or 4, broadly ovate, more or less unequal. Petals 5, inner petals bifid to about half-way down, the lobes acute. Stamens 5, inner 2 fertile, outer 3 staminodial. Ovary 0.5-0.7 mm, glabrous.

Fl.: May - July; Fr.: Aug. - Oct. Darjeeling.

2. **Meliosma pinnata** (Roxb.) Maxim. in Bull. Acad. Sci. St. Pet. 12: 64. in Obs. 1867; Hook. f., l.c. 6; Prain, Bengal Pl. 1: 246. 1963. (repr.ed.). *Millingtonia pinnata* Roxb. Fl. Ind. 1: 104. 1820.

Medium-sized evergreen trees. Leaves odd-pinnate; leaflets variable, oblong, lanceolate or linear-lanceolate, acuminate, shortly petiolulate, subentire or serrate. Panicles large, terminal; bracts subulate, caducous. Flowers subsessile, minute, white. Sepals 4-5, broadly ovate or orbicular. Petals subvalvate. Disc 3-angled.

1. Ovary glabrous; leaves 6-10-jugate, glabrous ssp. *pinnata*

1. Ovary densely pubescent; leaves 3-7-jugate, pubescent ssp. *barbulata*

ssp. *barbulata* (Cufod.) Beus. in Dessanayak, Rev. Handb. Fl. Ceylon. 3: 384. 1981. *M. rhoifolia* Maxim. ssp. *barbulata* Cufod. in Oest. Bot. 88: 254. 1939. *M. arnottiana* (Wt.) Walp. Rep. 1: 423. 1842. *M. pinnata* ssp. *arnottiana* (Wt.) Beus. in Blumea 19: 499. 1971. nom. illeg. *Meliosma wallichii* Planch. ex Hook. f., l.c. 6. *Millingtonia arnottiana* Wt., Ill. 1: 144. t. 53. 1840.

Leaflets increasing in size towards the leaf top, entire to dentate, moderately pubescent beneath and on midrib above. Panicles spreading. Sepals 5, ovate, unequal, glabrous, or outer ones with few hairs, all with ciliolate margins. Inner petals deeply bifid. Fruits globose.

Fl.: May - July; Fr.: Aug. - Sept. Darjeeling.

The timber is used for rafters, clogs, boxes and small objects. The young leaves may be eaten and are used as fodder for pigs.

ssp. *pinnata* Hook. f., l.c. 6; Prain, l.c. 246 "Banpasola, Hingoni, Hengnua, Mamori, Seonia" (Assm.); "Bativa" (Beng.); "Dabclabe, Dhahdabia, Dagdakti" (Lep.).

Trees up to 15 m tall. Leaves 6-11-jugate, sub-opposite; leaflets sometimes oblong, up to 20 × 5 cm, acute at the base, more or less dentate, glabrous. Panicles erect, not dense. Sepals 4-5, ovate, unequal, glabrous. Petals 5, outer 3 larger and convex, inner 2 smaller.

Fl.: April - June; Fr.: Aug. - Sept. Darjeeling, Jalpaiguri.

Young leaves are eaten as vegetable; timber is used in constructing houses, fruits are edible.

3. *Meliosma simplicifolia* (Roxb.) Walp., Rep. 1 : 423, 1842; Hook. f., *l.c.* 5; Prain, *l.c.* 246. *Millingtonia simplicifolia* Roxb. Pl. Corom. 3 : 50, t. 354, 1820. "Patpati, Dant-rangi, Dibru" (Beng.); "Hengunia, Thowthowa, Pichala, Larubaudha" (Assm.); "Kosru, Churii, Swrtalabara" (Nep.).

Leaves ovate-oblong to obovate-lanceolate, up to 50 × 18 cm, entire, base long cuneate or acute, apex shortly cuspidate; nerves 8-23 pairs. Panicles lax, sparsely to densely pubescent. Flowers more or less crowded, sessile, bracteate. Sepals 5. Petals 5, outer 3, orbicular, entire, inner over half-way bifid. Stamens adnate to petals. Ovary glabrous. Drupes subglobose, 6-8 mm in diam.

Fl. : Nov. - Feb.; *Fr.* : March - June. Coohbehar, Darjeeling, Jalpaiguri.

Flowers and young leaves eaten by natives; timber is used for various purposes.

2. SABIA Colehr.

Woody climbers or scandent shrubs with persistent bud scales at the base of branches. Leaves alternate, simple, entire, ovate or elliptic to lanceolate, petiolate, exstipulate. Inflorescence a solitary axillary cyme, rarely a panicle or a raceme. Flowers small, actinomorphic, bisexual, 5-merous. Sepals 5, equal, persistent. Petals 5, equal, imbricate. Disc 5-lobed. Stamens 5, all fertile, basally adnate to the petals; anthers globular ovoid. Carpels 2; ovary ovoid or conical, 2-locular; styles 2, slightly united. Fruit of 1 or 2 almost free reniform or subglobose drupes with pitted or reticulate bony endocarps. Seeds reniform with brittle testa.

A genus of about 19 species mainly confined to S. E. Asia; 5 species in West Bengal.

- | | |
|---|-----------------------------|
| 1. Flowers solitary | ...1. <i>S. campanulata</i> |
| 1. Flowers in few to many-flowered cymes: | |
| 2. Cymes few-flowered, simple | ...5. <i>S. purpurea</i> |
| 2. Cymes many-flowered, compound (sometimes simple in <i>S. limoniacea</i>): | |
| 3. Cymes 10-20-flowered, shorter than leaves | ...4. <i>S. parviflora</i> |
| 3. Cymes many-flowered, generally larger than leaves: | |
| 4. Lateral cymes simple, glabrous | ...2. <i>S. limoniacea</i> |
| 4. Lateral cymes compound, pubescent | ...3. <i>S. paniculata</i> |

1. *Sabia campanulata* Wall. in Roxb. Fl. Ind. 2 : 311, 1824; Hook. f., Fl. Brit. India 2 : 1, 1876; Hara, Fl. East. Himal. 3 : 194, 1966. "Bakalpata, Lohari" (H.); "Payongrik" (Lep.); "Simali" (Nep.).

Woody climbers or scandent shrubs with pubescent young shoots. Leaves oblong or oblong-ovate to lanceolate, 3-10 × 1-3.5 cm. Sepals 5, united at base, ca 3 mm long. Petals 5, free, 8-12 mm long, obtuse. Stamens 5; filaments somewhat dilated towards base. Ovary bilobed. Drupe one or two lobed, reniform, wrinkled.

Fl. : March - May; *Fr.* : May - June. Darjeeling.

2. *Sabia limonacea* Wall. ex Hook. f. & Thoms., Fl. Ind. 1 : 210. 1855; Hook. f., *L.c.* 3; Prain, *L.c.* 246. *Sabia malabarica* Bedd. Leon. Pl. Ind. Or. 1 : 39. 1874.

Evergreen woody climbers. Leaves oblong-ovate or oblong-lanceolate 4-18 × 1.5 - 6.5 cm, glabrous to sparsely pubescent. Cymes small, arranged in long narrow axillary panicles, 7-15 cm long. Sepals 5, glabrous, margins ciliolate. Petals 5, elliptic to ovate, 1.7 - 2.5 × 1.2 mm, nerves 5. Stamens 5, unequal, 1.5-2 mm; filament somewhat flattened. Ovary ovoid or conical, glabrous, styles short 0.5 mm; stigma minute. Drupelets globular to obovoid.

Fl. : Sept. - Jan; *Fr.* : Dec. - April. Jalpaiguri.

3. *Sabia paniculata* Edgew. ex Hook. f. & Thoms., Fl. Ind. 1 : 211. 1855; Hook. f., *L.c.* 3. "Bakalpata" (H.).

Evergreen woody climbers. Leaves oblong or oblong-ovate to sub lanceolate, 8-22 × 2.5-8 cm, glabrous, apex acute; nerves 5-7 pairs. Cymes solitary axillary but often arranged in a thyrsoid inflorescence. Sepals ovate, 1-1.3 × 0.7-1 mm densely pubescent, ciliolate-margined. Petals oblong or oblong-ovate, 2.2 - 3.5 × 0.7 mm. Ovary glabrous. Drupelets globular to ovoid, without persistent petals and stamens at the base.

Fl. : Jan. - April; *Fr.* : March - Aug. Darjeeling, Jalpaiguri.

4. *Sabia parviflora* Wall. in Roxb., Fl. Ind. 2 : 310. 1824; Hook. f., *L.c.* 2; Hara, Fl. East. Himal. 2 : 74. 1971.

Scandent shrubs up to 6 m tall. Leaves oblong or sometimes oblong-ovate to sublanceolate, 3-12 × 1-5 cm, base acute to rounded, margin elegantly wavy; nerves 6-9 pairs, straight or curved. Cymes solitary axillary, 2-8 cm long, 7-25 flowered. Sepals ovate, 0.7 - 1.5 × 0.5-1 mm, acute to rounded, glabrous to pubescent, ciliolate-margined. Petals oblong-lanceolate, 2-4 × 0.7 - 1.3 mm. Stamens 1.2 - 2.2 mm; filaments flattened. Ovary globular to subreniform, glabrous. Drupelets globular-obovoid.

Fl. & Fr. : Probably throughout the year. Darjeeling.

5. *Sabia purpurea* Hook. f. & Thoms., Fl. Ind. 1 : 209. 1855; Hook. f., *L.c.* 2. "Jermineirangchhai" (Assm.).

Shrubs or climbers, up to 4.5 m tall. Leaves oblong, oblong-ovate to sublanceolate, 3-12 × 1.5 - 4.5 cm; nerves 4-6 pairs. Cymes solitary axillary, up to 4.5 cm long, 3-6-flowered, glabrous. Sepals subequal or unequal. Petals 5, ovate, elliptic or oblong-ovate, 3-4.5 × 1.2-2 mm. Stamens 5, 1.5 - 1.75 mm. Ovary ovoid, glabrous, 0.5 - 0.7 × 0.7-1 mm. Drupelets 5-7 × 5.5 - 7.5 mm.

Fl. : Feb. - April; *Fr.* : April - June. Darjeeling.

ANACARDIACEAE

(K.C. Malick)

About 70 genera with over 600 species distributed throughout the tropics; 10 genera and 13 species in West Bengal

1. Trees; leaves simple or when imparipinnate leaflets definite:
 2. Leaves simple:
 3. Ovary superior:
 4. Drupes on much enlarged apex of the peduncle :
 5. Stamens 8-10; fruits reniform ...1. ANACARDIUM
 5. Stamens 4-5; fruits oblong or subglobose ...9. SEMECARPUS
 4. Drupes not on enlarged apex of the peduncle :
 6. Drupes large fleshy with fibrous compressed stone; seeds compressed ...6. MANGIFERA
 6. Drupes small with crustaceous stone; seeds gibbous ...2. BUCCHANANIA
 3. Ovary inferior ...4. DRIMYCARPUS
 2. Leaves imparipinnate :
 7. Stamens 4-5 ...8 RHUS
 7. Stamens 8-10 :
 8. Drupes 1-celled, 1-seeded; styles 3 ...5. LANNEA
 8. Drupes 2-5-celled, 2-5 seeded, style 5:
 9. Leaves entire with intra-marginal nerve; petals valvate; stone fibrous, hard ...10. SPONDIAS
 9. Leaves serrate on young shoots without intramarginal nerve; petals imbricate; stone hony ...3. CHOEROSPONDIAS
 1. Scandent shrubs; leaflets numerous ...7. PEGIA

1. ANACARDIUM L.

Small trees. Leaves simple, alternate, petioled. Flowers small, polygamous, in terminal bracteate panicles. Calyx 5-lobed, lobes erect, imbricate, deciduous. Petals 5, linear-lanceolate, recurved, imbricate. Disc filling the base of the petals. Stamens 8-10, all or some fertile; filaments connate, adnate to the disc. Ovary obovoid or obcordate; style filiform, excentric; stigma minute; ovule solitary. Fruit a reniform nut seated on a large pyriform fleshy mass derived from the accrescent disc and top of the peduncle; pericarp cellular. Seeds reniform ascending.

About 8 species in tropical America; 1 species cultivated in West Bengal.

Anacardium occidentale L., Sp. Pl. 383. 1753; Hook.f., Fl. Brit. India 2:20. 1876; Prain, Bengal Pl. 1: 250. 1963 (repr.ed.). "Kaju" (H. Beng.).

Fig. 76

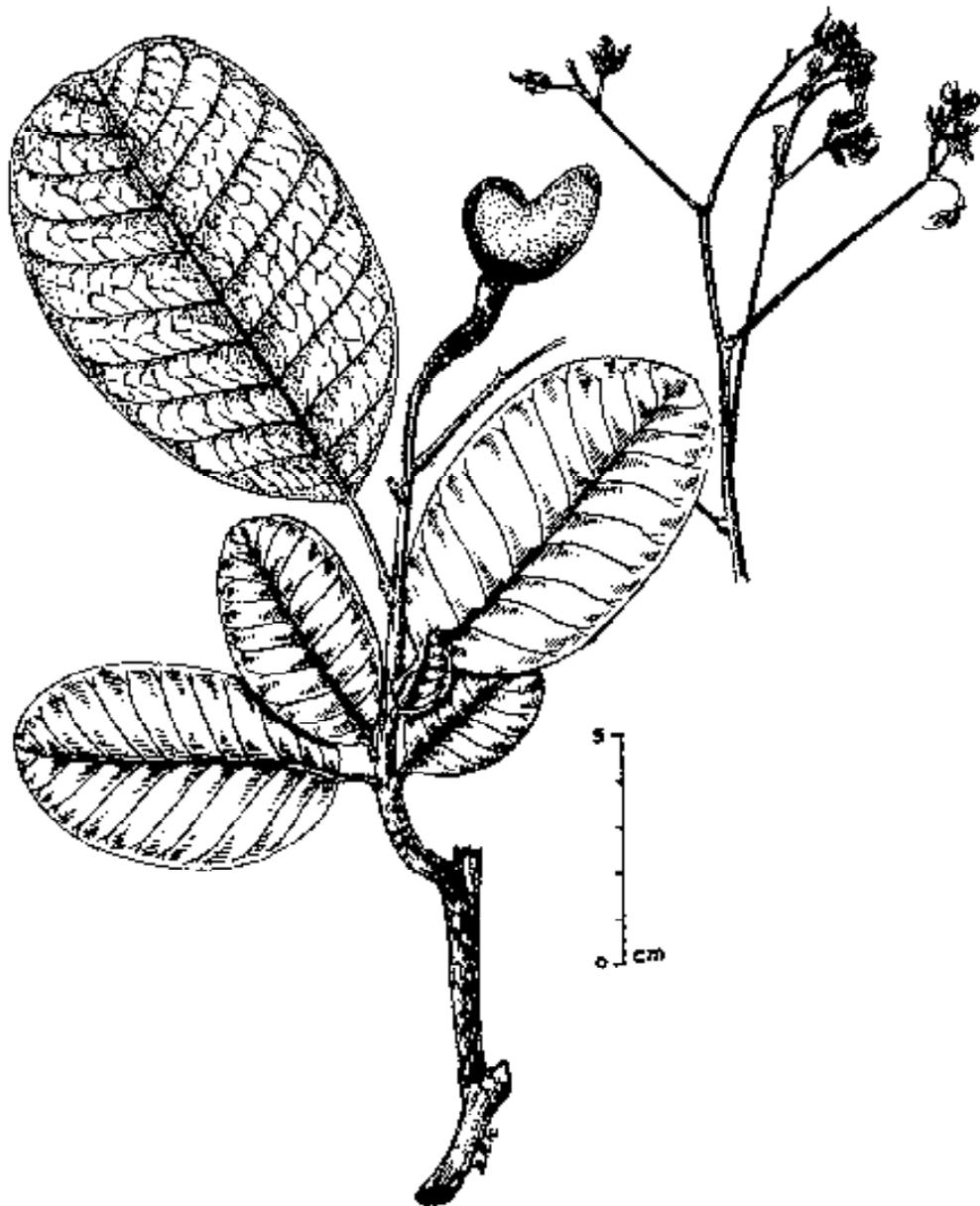


Fig. 76. *Anacardium occidentale* L.

Trees, up to 10 m high; bark rather smooth. Leaves clustered at ends of branches, obovate or obovate-oblong 10-20 × 7-10 cm, glabrous, entire, obtuse, retuse or rounded at tip, rounded or cuneate at base; nerves about 10 pairs; petioles 0.5-2 cm long. Panicles as long as or exceeding the leaves. Flowers unisexual and bisexual on the same plant, rather small, subsessile, fasciculate, dull greenish yellow on the branches of a stout pubescent panicles; pedicels 2-3 mm long; bracts 5-10 mm long. Sepal lobes 3-5 mm long, unequal, ovate-lanceolate. Petals 7-15 mm long, linear, reflexed at anthesis, at first pale greenish creamy with red stripes, soon turning red. Stamens usually 9, one longer than the rest; anthers up to 1 mm long. Ovary 1 mm diam.; styles 4-10 mm long. Drupes 2-3 × 1.5-2 cm, reniform, greenish brown when fresh, on 5-7 cm long pyriform receptacle. Seeds reniform.

Fl.: Feb. April; *Fr.* : April May. Planted : Bankura, Burdwan, Jalpaiguri and Midnapore.

The hypocarp and seeds are eaten.

2. BUCHANANIA Spreng.

Trees. Leaves simple, alternate, entire, subcoriaceous, petioled. Flowers small, white, bisexual, in dense terminal and axillary panicles. Calyx short, 4-5-toothed or lobed, persistent lobes imbricate. Petals 4-5, imbricate. Disc shortly cupular, usually sulcate outside, margins crenulate. Stamens twice the number of the petals, free, inserted at the base of the disc. Carpels 5-6, free, situated in the cavity of the disc, one fertia the other four imperfect. Ovary ellipsoid; style short, stout; stigma oblique, truncate; ovule solitary, pendulous from a basal funicle; sterile carpels smaller. Drupes small, slightly fleshy, 1-celled, with crustaceous or bony 2-valved endocarp. Seed globose, acute at one end, testa free from endocarp.

About 25 species in S.E. Asia and Australia; 1 species in West Bengal

Buchanania lanzan Spreng. in Schrad. J. 4: 234. 1800. *B. latifolia* Roxb., Fl. Ind. 2: 385. 1832; Hook.f., *l.c.* 23; Prain, *l.c.* 247. "Piyal" (Beng.). **Fig. 77**

Trees, 12-18 m tall; young branches villous. Leaves broadly elliptic to elliptic-oblong, 12-20 × 6-12 cm, more or less villous beneath, entire, apex obtuse or emarginate, base rounded, veins 10-20, impressed on the upper surface; petioles 1-1.5 cm long. Flowers small, 5-6 mm in diam., greenish-white, in dense terminal and axillary pyramidal ferruginous-pilose stiff panicles; bracts small, caducous. Sepals 5-toothed, lobes short, broadly ovate, ciliate. Petals triangular or oblong, 2-3 × 1-1.5 mm. Stamens 10, slightly shorter than the petals, spreading. Disc fleshy. Ovary 1, perfect, conical, pubescent, other 4 reduced to filaments. Drupes subglobose, ca 7 mm, slightly compressed, black; stone hard, 2-valved, obliquely attached to pedicel.

Fl. & Fr. : Dec. - April. Bankura, Birbhum, Burdwan, Purulia.

Wood is not much used. Fruits are largely eaten.

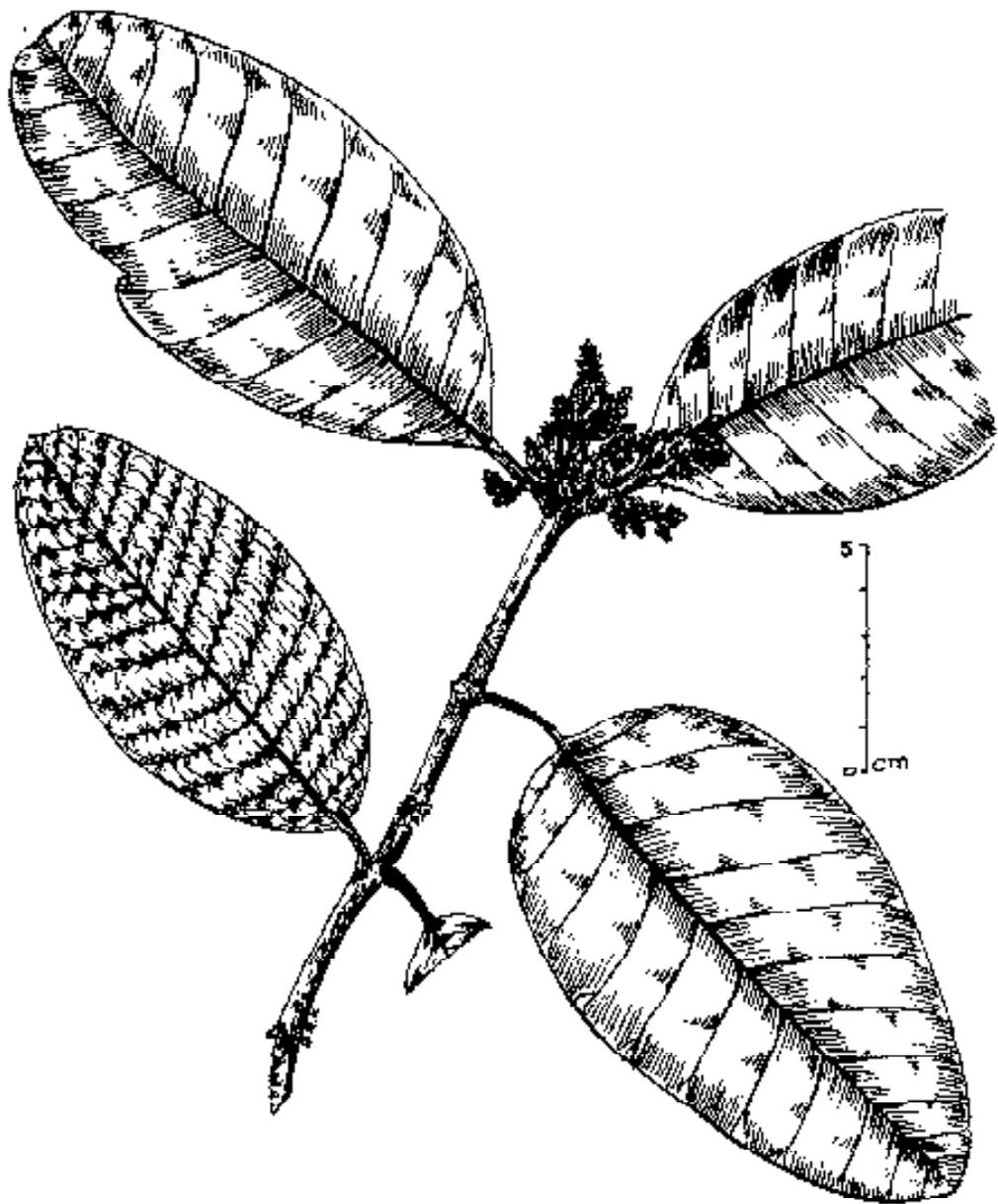


Fig. 77. *Buchanania lanzan* Spreng.

3. CHOEROSPONDIAS Burtl & Hill

Trees, evergreen or partly deciduous. Leaves spiral, imparipinnate, petioled; leaflets alternate, serrate or crenate on young shoots, entire or sub-entire otherwise. Flowers polygamous, female flowers solitary or sub-solitary; male and sub-hermaphrodite in panicles; pedicels long, filiform. Calyx cup-shaped, 5-lobed. Petals 5, elliptic, imbricate. Stamens 10. Disc annular. Ovary 5-celled, with 5 styles. Drupes up to 2.5 cm long; endocarp bony. Seeds 5.

1 species in eastern India.

Choerospondias axillaris (Roxb.) Burtl & Hill in Ann. Bot. n.s. 1: 254, 1937.
Spondias axillaris Roxb. Fl. Ind. 2:453, 1832; Hook.f., *l.c.* 42.

Small trees with horizontal branches. Leaves large, 30-45 cm long; petioles slender; leaflets 7-17, sub-opposite, ovate-lanceolate, 5-10 × 1.7 - 3.7 cm, deeply serrate on young shoots, entire elsewhere, membranous, puberulous on the nerves and along the margins when young, pale beneath, caudate or acuminate at apex, cuneate to rounded and oblique at base, main lateral nerves 10-12 pairs; petiolules 2-5 mm long. Flowers polygamous, greenish-white; pedicels 2-3 mm long. Sepals *ca* 2 mm long, connate to half way up, lobes oblong, hairy on margins. Petals 5, imbricate, elliptic, 2.5 mm long. Stamens generally 10. Disc annular, 10-lobed, almost absent sometimes in male flowers. Ovary with 5 erect styles. Drupes oblong, *ca* 2.5 × 1.5 cm, flesh fibrous, stone bony. Seeds 5.

Fl. : Feb. - April; *Fr.* : July - Sept. Darjeeling, Jalpaiguri.

4. DRIMYCARPUS Hook.f.

Tall trees. Leaves simple, alternate, petiolate, exstipulate. Flowers polygamo-dioecious, in axillary fasciated racemes. Calyx lobes 5, rounded, imbricate. Petals 5, erect orbicular, imbricate. Disc broad, annular. Stamens 5, inserted at the base of disc.

Ovary inferior, 1-locular; style short; stigma capitate; ovule 1, lateral. Fruit a fibrous drupe with resinous flesh. Seed 1, attached to the wall of the cell.

2 or more species in S.E. Asia; 1 species in West Bengal.

Drimycarpus racemosus (Roxb.) Hook.f. in Benth. & Hook.f., Gen. Pl. 1: 424, 1862; Hook.f., *l.c.* 36; Prain, *l.c.* 249. *Holigrana racemosa* Roxb., Fl. Ind. 2: 82, 1832.

Large trees; bark corky, rather grey outside, reddish-brown inside. Leaves linear-oblong or oblong-lanceolate, 15-30 × 6-10 cm, coriaceous, shining above, glaucous beneath, wavy at the margins, base attenuate, apex short to long acuminate; nerves 20-30 pairs, prominent beneath; petioles 1-2 cm long. Racemes branched, in axillary fascicles, shorter than the leaves, pubescent or glabrate. Flowers small, crowded, males sessile, females on slender pedicels. Calyx lobes oblong, *ca* 1 mm, acute. Petals ovate-orbicular, *ca* 1 mm long. Stamens *ca* 0.5 mm long. Drupes 1.5-2.5 diam., fruiting pedicels 1-2.5 cm long. Seeds 5 × 1 cm.

Fl. : March - April; *Fr.* : April - Nov. Darjeeling, Jalpaiguri.

5. LANNEA A. Rich.

Trees with few stout soft branches. Leaves imparipinnate, petioled leaflets opposite; stipules absent. Flowers small, unisexual or polygamous, fascicled in a short terminal racemes or panicles; pedicels short. Calyx 4-5-lobed, persistent. Petals 4-5, imbricate. Disc annular, 4-5-lobed. Stamens in male flowers 8-10, inserted within the disc; anthers dorso-basifixed, abortive and small in females. Ovary in male flowers rudimentary, 4-5 parted; in females sessile, oblong, 1-celled; styles 3-4, stout; stigma simple or capitellate. Ovules pendulous from the top. Drupes small, compressed, reniform, crowned by the distant style, 1-4-celled, usually 1-seeded. Seeds compressed.

About 40 species in tropical S. Africa; 1 species in West Bengal.

Lannea coromandelica (Houtt.) Merr. in J. Arn. Arb. 19: 353. 1938. *Dialium coromandelicum* Houtt. in Nat. Hist. ser. 2.2: 39. t. 5. f.2, 1774. *Odina wodier* Roxb. Fl. Ind. 2. 293. 1832.

Usually small deciduous trees; bark exfoliating, ash-coloured twigs thick with large leaf scars; young parts rusty stellate hairy. Leaves crowded at the end of branches, 20-40 cm long; leaflets 3-7 pairs with a terminal one, ovate-oblong, elliptic-oblong, broadly elliptic or ovate, 8-15 × 3-4 cm, puberulous beneath specially on midrib, base acute or rounded, often oblique, apex acuminate; petiolules very short or absent. Inflorescences 7-25 cm long, appearing before the leaves, crowded at the apical parts of branches on a short shoot in the axil of leaf scars; bracts ovate, ciliate; male in compound racemes and females in simple racemes. Flowers small, yellowish green, tinged with red unisexual; pedicels short. Calyx 4-lobed, lobes ca 1 mm long. Petals 4, about twice the calyx lobes. Stamens ca 2 mm long, abortive in females. Disc ca 1 mm in diam. Ovary in female ovoid-oblong, rudimentary in males. Drupes red, broadly ellipsoid or sometimes sub-reniform, 1.5-2 × 1.1-5 cm. Seeds reniform, ca 1.5 × 1 cm.

Fl. : Dec. April; *Fr.* : March May. Bankura, Birbhum, Hooghly, Howrah, Midnapore, Purulia and 24-Parganas.

6. MANGIFERA L.

Trees. Leaves simple, spiral, coriaceous glabrous, petioled. Flowers small, polygamous, in terminal panicles, often crowded at the apices of the twigs, sometimes seemingly fasciculate; pedicels articulated. Calyx 4-5-partite, lobes imbricate deciduous. Petals 4 or 5, free or adnate to the disc, imbricate, longitudinal nerves thickened on the inner surface. Disc 5-lobed, fleshy. Stamens 4-5, inserted between the lobes of the disc, usually 1 fertile and longer, others smaller and reduced teeth or absent; anthers dorsifixed. Ovary 1-celled, sessile, abortive in males; style excentric or lateral; stigma simple. Drupes 1-celled, large, fleshy with compressed fibrous stone. Seed 1, large, compressed.

About 35 species in South-east Asia; 4 species in India; 1 species in West Bengal.

Mangifera indica L., Sp. Pl. 1: 200. 1753; Hook.f., *l.c.* 13; Prain, *l.c.* 248. "Aam" (H. Beng.).

Large spreading evergreen trees up to 20 m high. Leaves crowded at the ends of the branches, oblong or oblong-lanceolate 10-25 × 3-7 cm, shining, often undulate, apex acute or acuminate base narrowed, secondary nerves 30 pairs, parallel; petioles 2-7 cm long, swollen at base. Inflorescence usually densely branched tomentose. Flowers yellow, odorous, subsessile, male and female flowers in same panicles. Sepals ovate-oblong, ca 1 mm long, densely pubescent. Petals linear, 1-3 × 0.5-1 mm, reflexed, ridges 3.5, orange. Disc short, cupular, rarely pulvinate and concave above, usually 4-5-lobed, papillose. Stamens inserted on the disc; filaments free, ca 1.5 mm long. Drupes 7-10 cm long, fleshy obliquely pyriform or subovoid. Seed 1, large.

Fl. : Jan. - March; *Fr.* : April - July. Several cultivars are planted throughout the plains for its delicious juicy fruits.

Wood commonly used for house-building and furniture.

7. PEGIA Colebr.

Scandent shrubs. Leaves alternate, exstipulate, imparipinnate; leaflets numerous, subopposite. Flowers small, greenish, polygamous, in axillary and terminal panicles. Calyx 5-partite, lobes imbricate, persistent. Petals 5, small, oblong, imbricate. Disc 5-lobed. Stamens 10, inserted at the base of the disc. Ovary sunk in male flowers with 4-5 lobes and 4-5 styles; in females ovary ovoid, more or less free, 1-tubular with short conical style and simple stigma; ovule pendulous from the apex. Fruits obliquely oblong fleshy drupes. Seeds oblong.

About 4 species distributed from eastern Himalaya to S. China and Philippines; 1 species in West Bengal.

Pegia nitida Colebr. in Trans. Linn. Soc. 15: 364, 1827. *Tupiria hirsuta* Hook.f. in Benth. & Hook.f., Gen. Pl. 1: 423, 1862 & Fl. Brit. India 2: 28, 1876; Prain, *l.c.* 251.

Scandent shrubs, more or less tomentose; old branches blackish. Leaves petiolate, 15-30 cm long; leaflets 6-8 pairs with a terminal one, 2.5-7 × 1.5-3 cm, oblong, membranous, entire or often distantly serrate, more so towards the apex, base cordate, rarely oblique, apex acuminate; petiolules 1-2 mm long. Panicles villous, often longer than the leaves, spreading; bracts ovate-lanceolate, ca 1 mm long; pedicels ca 1.5 mm long. Calyx lobes ovate, acute, less than 1 mm long. Petals oblong, ca 1.5 × 1 mm. Stamens ca 1 mm long. Drupes oblong, 4-7 × 3-5 mm. Seed thin, 3-5 × 2-4 mm.

Fl. : Jan. - March; *Fr.* : April - May. Darjeeling, Jalpaiguri.

Leaves are eaten as vegetable; fruits possess sub-acidic aromatic pulp.

8. RHUS L.

Trees or shrubs, often with acrid juice. Leaves alternate, petioled, exstipulate, imparipinnate, unifoliolate or trifoliolate; leaflets entire or serrate. Flowers small, in terminal and axillary panicles, polygamous. Calyx 5-lobed. Petals 5, imbricate, glabrous, rarely hairy on the inner surface. Stamens 5, inserted at the base of disc; filaments subulate; anthers dorsifixed, imperfect or sterile in female. Ovary sessile, ovoid or globose, 1-celled, abortive in male; styles distinct or obscure, ovule pendulous from a basal funicle. Drupes small, dry; endocarp coriaceous, crustaceous or bony. Seed pendulous from basal funicle, testa adhering to the endocarp.

About 250 species in sub-tropical and warm temperate regions; 3 species in West Bengal.

1. Leaflets pubescent or tomentose beneath; pericarp dehiscent or indehiscent:
 2. Petioles winged; panicles equalling the leaves; pericarp indehiscent ...1. *R. chinensis*
 2. Petioles not winged; panicles shorter than the leaves; pericarp dehiscent ...2. *R. hookeri*
1. Leaflets quite glabrous beneath; pericarp dehiscent ...3. *R. succedanea*

1. **Rhus chinensis** Mill., Gard. Dict. ed. 2, sub. n. 7, 1768. *R. semialata* Murray, Comm. Soc. Goett. 5: 27, t. 3, 1784; Hook.f. in Fl. Brit. India 2: 10, 1876.

Small trees or shrubs, 4-12 m high, clothed with dense soft pubescence. Leaves imparipinnate, 10-35 cm long; petioles 8-10 cm long, rachis sometimes winged; leaflets 4-5 pairs with a terminal one, oblong or ovate-oblong, 5-15 × 2.5-8 cm, subcoriaceous, crenate-dentate, upper surface pubescent on the midrib and nerves, lower surface densely pubescent, cuneate at base, acuminate at apex; nerves 10-20 pairs; petiolules absent or very short. Panicles terminal or very rarely also one or more in leaf axils at the ends of twigs, about equalling the leaves, tomentose; bracts triangular or lanceolate, up to 1 mm long. Flowers ca 2 mm in diam., white or pale yellowish green; pedicels less than 1 mm long. Calyx lobes triangular less than 1 mm long. Petals oblong, ca 2 × 1 mm, sparsely pilose at the inner surface. Stamens exceeding the petals. Disc cup-shaped, 10-lobed. Ovary globose, ca 0.5 mm in diam., densely pubescent; styles rather long. Drupes sub-globose, ca 5 mm in diam., compressed.

Fl. & Fr. : Sept. - Oct. Darjeeling.

2. **Rhus hookeri** Sahní & Bahad. in Ind. For. 96: 769, 1970. *R. insignis* Hook.f., Fl. Brit. India 2: 11, 1876.

Small trees up to 12 m high; branchlets stout with rusty villous ends. Leaves 20-40 cm long, imparipinnate; petioles terete but slightly angled towards base; leaflets 3-4 pairs besides the terminal one, elliptic or ovate, or ovate-oblong, 7-20 × 5-10 cm, subcoriaceous, softly rusty tomentose beneath, entire at margins,

caudate acuminate at apex, rounded at base, often oblique, lateral nerves 20-30 pairs, parallel, slightly arched; petiolules 2-6 mm long. Panicles axillary, shorter than leaves; peduncles long. Flowers pale yellowish green, ca 2 mm across, in axillary lax panicles. Calyx lobes 0.5 mm long, triangular, pubescent outside. Petals ca 1.5 mm long and less than 1 mm broad, linear-oblong. Stamens shorter than petals. Drupes globose, compressed, ca 6 mm in diam., red, shining, pericarp thin, dry, endocarp waxy. Stone crustaceous.

Fl. : May - June; *Fr.* : July - Oct. Darjeeling.

3. *Rhus succedanea* L., Mant. Pl. 2. 221. 1771; Hook.f., *l.c.* 12. "Kakra-sing" (Beng.).

Small trees up to 8 m tall. Leaves crowded at the end of branches, imparipinnate; petioles terete, slender, 4-8 cm long; petioles and rachis glabrous or slightly puberulous; leaflets 3-5 pairs besides a terminal one, elliptic-lanceolate or elliptic-oblong or oblong, 5-8 × 2-3 cm, often sparsely pubescent on the midrib and nerves beneath, membranous, acuminate at the apex, base obliquely cuneate, nerves 10-25 pairs; lateral petiolules 2-4 mm long, terminal one 0.5-1 cm long. Panicles slender, axillary, lax, much shorter than leaves; bracts ca 2 mm long. Flowers creamy white, 2-3 mm in diam.; pedicels 2-3 mm long. Calyx lobes minute, triangular. Petals 1-2 mm long, less than 1 mm broad, ovate or slightly oblong. Disc 5-lobed, discoid. Stamens 1-2 mm long; anthers broadly ovoid. Drupes 5-8 mm in diam., gibbose, yellow when ripe.

Fl. & Fr. : May - July, Darjeeling, Jalpaiguri.

9. SEMECARPUS L.f.

Trees. Leaves simple, exstipulate, alternate, entire, coriaceous. Flowers small, polygamous or dioecious, usually in terminal, rarely in axillary, panicles. Calyx 5-6-fid, lobes deciduous. Petals 5-6, imbricate. Stamens 5-6, inserted at the base of disc, imperfect in female flowers. Disc broad, annular. Ovary 1-locular on an enlarged receptacle; styles 3; stigma sub-clavate; ovule solitary, pendulous from a sub-apical lateral funicle. Drupes fleshy or firm, oblong or sub-globose, oblique, seated on a fleshy receptacle formed of the accrescent disc and calyx base; pericarp resinous, acrid. Seeds pendulous, testa coriaceous.

About 50 species in S.E. Asia; 1 species in West Bengal.

Semecarpus anacardium L.f., Suppl. 182. 1781; Hook.f., *l.c.* 30; Prain, *l.c.* 250. "Vela" (Beng.).

Medium-sized trees with a crown of leaves, dioecious, exuding dark sap; young branches pubescent. Leaves clustered at ends of branches, leathery, oblong or oblong-elliptic or oblanceolate, 15-30 × 10-15 cm, densely grey pubescent and strongly net-veined beneath, rounded or cordate at base, obtuse or rounded at apex; nerves 15-26 pairs; petioles 2-3.2 cm long. Panicles stout, equalling or sometimes longer than leaves; bracts lanceolate. Flowers small, green, sessile fasciated. Calyx segments ca 1 mm long, pilose outside. Petals ovate, acute, 4-5 × 2 mm, ovate, acute, greenish-white. Filaments subulate. Drupes obliquely ovoid

or oblong, up to 2.5×2 cm, smooth, black; cup orange-red, up to 1.5×1.5 cm. Seeds $1.2 \times 1-1.5$ cm.

Fl. : June Sept.; *Fr.* : Oct. Feb. Bankura, Birbhum, Jalpaiguri, Midnapore, Purulia.

Juice of the pericarp is used in marking clothes by the washermen. Ripe fruits are medicinally used.

10 SPONDIAS L.

Trees, wholly or partly deciduous. Leaves spiral, usually crowded at the top of branches imparipinnate; leaflets alternate, sub-opposite or opposite, entire with distinct and thickened intramarginal nerve, usually caudate acuminate. Flowers small, polygamous, in terminal spreading panicles. Calyx 4-5 lobed, lobes spreading, valvate. Stamens 8-10. Disc cupular, broad, crenate. Ovary 4-5-celled, glabrous; styles 5, free. Drupes 4-5-celled, fleshy; endocarp woody, fibrous. Seed pendulous.

About 10 species in S.E. Asia and tropical America; 2 species in West Bengal.

1. Flowers distinctly pedicelled in spreading paniculate inflorescence; intramarginal nerve of leaflets thinly thickened ...1. *S. cythera*

1. Flowers sessile in dense clustered inflorescence; intramarginal nerve distinctly thickly thickened ...2. *S. pinnata*

1. *Spondias cythera* Sonn., Voy. Ind. Or. & Chine 3: 242. t. 123. 1782. *S. dulcis* Parkins. in J. Voy. South Sea 39. 1773; Hook.f., *l.c.* 42; Prain, Bengal Pl. I: 252. 1963 (repr.ed.). "Bilati Amrah" (Beng.).

Trees, usually up to 15 m high but, sometimes as tall as 20 m, sometimes buttresses present; bark greyish, light to reddish brown, shallowly fissured. Leaves 20-40 cm long, imparipinnate; petioles 9-15 cm long; leaflets 4-10 pairs, elliptic-oblong or oblong, $5-15 \times 3-8$ cm, entire, apex shortly acuminate, base unequally obtuse or cuneate; nerves 14-24 pairs; petiolules 4-6 mm long. Flowers pedicellate, polygamous, greenish white, in terminal up to 3-5 cm long paniculate inflorescence; pedicels 3-4 mm long. Calyx lobes 5, lobes ca 3×0.5 mm. Petals ca 3×1 mm. Disc fleshy, 5-lobed. Stamens 10, 1-1.5 mm long. Ovary 0.5 mm long, 5-celled; styles 5. Drupes oblong, $3-4 \times 2-3$ cm, green; endocarp hard with fibrous processes. Seeds 1-5.

Fl. : March May; *Fr.* : July Oct. Planted throughout the plains of West Bengal.

Fruits are eaten raw and after cooking.

2. *Spondias pinnata* (L.f.) Kurz in Rep. For. & Veg. Pegu Append. A. 44, App. B. 42, 1875. *Mangifera pinnata* L.f., Suppl. 156. 1781. *Spondias mangifera* Willd. Sp. Pl. 2: 751. 1799; Hook.f., *l.c.* 42; Prain, *l.c.* 252. "Amrah" (Beng.).

Small trees, up to 10 m high with pleasant aromatic smell; bark grey or brown. Leaves 25-45 cm long, imparipinnate; leaflets 4-6 pairs, subopposite,

elliptic-oblong 8-12 × 3-6 cm, acuminate at the apex, sub-rounded at base, oblique; nerves 10-20 pairs; petiolules ca 6 mm long. Flowers polygamous, greenish white, sessile or subsessile in 25-40 cm long terminal panicles. Calyx cup-shaped, 5-6-lobed, lobes ca 0.5 mm long. Petals elliptic, valvate, 2.5-3 × 1-1.5 mm. Disc fleshy, 10-lobed. Stamens 8-10, 1-1.5 mm long; anthers versatile. Ovary 5-celled, subglobose; styles 5, short, conniving. Drupes oblong or ovoid, 3-5 × 2-3 cm, greenish yellow when ripe, 1-5-seeded; endocarp hard, fibrous, polished.

Fl.: Feb. - April; *Fr.*: April - Nov. Throughout West Bengal, often planted.

Inflorescence and fruits eaten after cooking; fruits often eaten raw.

MORINGACEAE

(M. K. Manna)

A family with a single genus and about 10 species distributed from north Africa to north of Pakistan and Bangladesh; 1 species in West Bengal.

MORINGA Lamk.

Deciduous trees with soft white wood and gummy bark. Leaves alternate, 2-3 pinnate, exstipulate or stipules but sometimes represented by glands at the base of the petiole and pinnules. Flowers in dense axillary or subterminal panicles, zygomorphic, bisexual. Calyx tube short with 5 unequal, petaloid spreading lobes. Petals 5, unequal; posterior 2 smaller, lateral ascending, anterior one largest; both sepals and petals inserted on a cup like disc. Stamens 5, alternating with 5 staminodes inserted on margin of disc; anther 1-celled longitudinally dehiscent, dorsifixed. Ovary tricarpellate, pubescent; style slender with perforated or truncate stigma. Fruit an elongated capsule, pod-like, 3-valved, corky and pitted within. Seeds many, large, winged or wingless.

Native of old world tropics, widely introduced; 1 species in West Bengal.

Moringa oleifera Lamk. Encycl. Meth. 1 : 398, 1785; Hook.f., Fl. Brit. India 2.45.1876; *Gualandiana moringa* L. Sp. Pl. 1, 381, 1753. *M. pterygosperma* Gaertn. Fruct. 2: 314.1791; Prain, Bengal Pl. 1, 252, 1963 (repr.ed.). "Sajina" (Beng.); "Shjan" (H.); "Drumstick" (Eng.).

Trees, 5-20 m high. Leaves up to 60 cm long, tripinnate pinnae 4-11 pairs; rachis pubescent, stipitate glands present at the base of the petiole and pinnae; leaflets up to 2.3 cm long and 1.5 cm broad, elliptic or obovate with acute or obtuse tips. Flowers white, up to 2.5 cm long. Sepals unequal, subpetaloid linear-lanceolate largest one up to 1.5 cm long. Petals white. Stamens 0.5 cm - 1 cm long and staminodes 0.3 cm - 0.6 cm long; filaments villous at base. Ovary 1-focular with pariegal placentae style slender with perforated stigma, ovules many, 2-seriate on each placenta. Fruit a 9-ribbed pendulous pod, 30-45 cm long. Seeds many, winged, blackish and rounded.

Fl.: Jan. - April. Commonly planted throughout the plains.

Flowers and fruits are eaten as vegetable. Several parts also considered medicinal. "Ben oil" is extracted from the seeds. Branches are commonly chopped for fodder. Roots are a source of a condiment. Gum can be used in calico-printing.

