

THE
FOREST FLORA
OF
NORTH-WEST AND CENTRAL INDIA.

THE
FOREST FLORA
OF
NORTH-WEST AND CENTRAL INDIA.

A HANDBOOK OF THE INDIGENOUS TREES AND SHRUBS
OF THOSE COUNTRIES.

COMMENCED BY THE LATE
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PREFACE.

(80)

THE object of this work is entirely practical. As Forest administration in India advanced, the want of handbooks was felt, to enable forest officers to acquire a knowledge of the trees and shrubs in the forests, and of the climbers, epiphytes, and other plants which impede and injure the growth of trees. This want has led to the preparation of three works. *First*, The Flora Sylvatica of Madras, by Lt.-Col. R. H. Beddome, head of the Forest Department in that Presidency, commenced in 1868 and completed in 1873. It contains 325 plates of trees, with full descriptions, and a Manual giving a systematic account of 76 Natural Orders, comprising all trees and the more important shrubs of South India and Ceylon; 27 additional plates, with the analysis of 146 genera not figured in the work, are appended. *Second*, The Forest Flora of British Burma, by Sulpiz Kurz, Curator of the Herbarium at Calcutta, now under preparation. *Third*, The present work. When these three books are complete, they will comprise descriptions of most trees, a knowledge of which is needful to foresters, in British India. Thus the trees of the Bombay forests will be found either in Colonel Beddome's or in this work; and the more important trees of the Eastern Himalaya and Eastern Bengal will probably occur, some in this book, others in the Burma Flora. Eventually a Forest Flora of Bengal and Assam, and another of the Bombay Presidency, with local habitats and vernacular names, may become necessary; but at present the requirements of foresters in the different provinces of India will be sufficiently met by the publication of these three works.

The geographical limits of this Flora are necessarily artificial. The object was to give an account of the arborescent vegetation in the forest tracts of the Panjab, the North-West Provinces, and of those forests in the Central Provinces which are situated on the Maikal and Satpura range of mountains. The northern limit may be defined as the arid treeless zone of the inner Himalaya; while to the south the territory is bounded by the open forestless plain which skirts the base of the Maikal and Satpura range from Bilaspur to Berar. The western limit is the Panjab frontier,

along the foot of the Suliman range; and eastward the territory is bounded by a broken line, which follows the Nepal frontier, first along the Sarda or Kali river, and afterwards parallel with the foot of the Himalaya, until it touches the great Gandak river. From that point, a straight line drawn in a south-south-westerly direction through Benares to Amerkantak and Bilaspur, may be regarded as the eastern boundary. Between the British territory of the Panjab and the North-West Provinces in the north, and the Central Provinces in the south, intervene the large and important native States of Rajputana, Malwa, and Bandelkhand, and as the arboresecent vegetation of these States is very similar to that of the surrounding British territory, they have been included, as far as possible. For these districts my materials were scanty. It is much to be desired that the results of Dr. George King's botanical exploration of this country may soon be published, and thus supply the deficiencies of this work in that respect. Most of the trees and shrubs of Sindh, and of the forest tracts of Guzerat, in the vicinity of the Mhye river, and south as far as the Mandevi forests on the right bank of the Tapti, are noticed.

The northernmost point is the head of the Kaghan valley, drained by a tributary of the Jhelam, in lat. 35° ; and the forest tracts furthest west are the Belas, along the Indus in Sindh, in long. 68° .

It would be too large a subject were I to give a detailed account of the climatic conditions which influence the forest vegetation of this large territory. It must suffice to state that the following great climatic zones are included: *First*, The entire arid region of India, with a scanty and uncertain rainfall, and an atmosphere dry nearly throughout the year (South Panjab, Sindh, the States of Bhawalpur, Kairpur, Bikanir, Jessulmir, and the greater part of Marwar). *Second*, The entire northern dry zone, surrounding the arid region on the north and east, forming a belt from 100 to 200 miles wide, with a normal annual rainfall between 15 and 30 inches, which includes the plains of north and north-east Panjab, outside the sub-Himalayan tract, Delhi, Ajmir, Gwalior; and of the Rajputana States, Bhurtpur, Jeypur, and Meywar. *Third*, The western end of the north-eastern moist zone, with a heavy monsoon and an annual rainfall exceeding 60 inches, which comprises the Burma coast, Bengal, the sub-Himalayan tract, and the outer ranges. That portion of this moist zone which extends into the territory of this Flora is a narrow belt, probably nowhere more than 30 miles wide, narrowing gradually towards the north-west, and terminating at the Ravi. It includes part of the Gorakhpur and the northern Oudh forests, the Siwalik tract, the Doons, and the outer ranges of the north-west Himalaya. *Fourth*, A portion of the large intermediate region, which comprises the whole of Central and a large portion of the plains of North India, as well as the intermediate Himalaya, which is situated between the outer narrow moist

belt and the inner arid region of Tibet. Entirely beyond the limits of the present Flora are the southern, dry region, including eastern Mysore and part of the Dekkan, and the moist zone of Western India, comprising the Western Ghats from the Khandeish Dangs to Travancore, the country below the Ghats, and a narrow strip of country above the Ghats.

A glance at this handbook will show that in many instances Indian trees or shrubs have been maintained distinct which had been referred to European species by Dr Stewart and other botanists. It will also be noticed that a considerable number of Himalayan trees and shrubs have been identified with species indigenous in Europe and the Mediterranean region. This identification has in every case been based upon critical research. The following are well-known European species included in this Himalayan Flora: *Berberis vulgaris*, *Myricaria germanica*, *Rhus Cotinus*, *Prunus prostrata*, *P. Padus*, *Rubus fruticosus*, *Rosa moschata*, *Pyrus Aria*, *Cratægus Oxyacantha*, *C. Pyracantha*, *Ribes Grossularia*, *R. nigrum*, *Hedera Helix*, *Lonicera alpigena*, *Sambucus Ebulus*, *Hippophaë rhamnoides*, *Elæagnus hortensis*, *Viscum album*, *Celtis australis*, *Platanus orientalis*, *Buxus sempervirens*, *Salix alba*, *S. hastata*, *S. daphnoides*, *S. viminalis*, *Populus alba*, *Quercus Ilex*, *Corylus Colurna*, *Ephedra vulgaris*, *Juniperus communis*, *Pinus excelsa*, and *Taxus baccata*. The forester who is transferred from Europe to the north-west Himalaya thus finds himself surrounded by trees belonging to the same families and genera as those which compose the forests of Europe, and also in many instances recognises the very species with which he was familiar in his native country.

In the forests of the plains and lower hills, three remarkable features attract attention. *First*, The large number of trees of South India and Burma which occur in the moist forests of the sub-Himalayan tract. Some of these extend no farther than the Sarda, and within our limits are only found in the Gorakhpur and Oudh forests; for example, *Dillenia aurea*, *Polyalthia suberosa*, *Amoora Rohituka*, *Heynea trijuga*. Others, such as *Dillenia pentagyna*, *Millettia velutina*, *Schleichera trijuga*, have the same north-western limit, but are likewise found in the forests of the Satpura range. Others, again, extend along the foot of the Himalaya to the Indus (*Bombax malabaricum*, *Odina Wodier*, *Cassia Fistula*, *Albizzia odoratissima* and *stipitata*, *Acacia Catechu*, *Terminalia bellerica*, and *Eugenia Jambolana*). Rattan-brakes (*Calamus Rotang*) extend only to the Dehra Doon; the last patches of *Sal* are found on the Siwaliks between the Sutlej and Bias, and in the Kangra valley north of the latter river; and the most western Bamboo forest (*Dendrocalamus strictus*) is on the west bank of the Jhelam river. The *second* prominent feature is, that a number of trees attain their northernmost point in Central India, and are not found in the sub-Himalayan tract—as, for example, *Ailanthus ex-*

celsa, *Soymida febrifuga*, *Chloroxylon Swietenia*, *Pterocarpus Marsupium*, *Hardwickia binata*, *Cordia Macleodii*, *Spathodea xylocarpa*, and *Tectona grandis*. The third remarkable feature of the arboreous vegetation of North-West India is the large number of African and Arabian species, many of which find their eastern limit within the territory of this Flora. *Capparis aphylla* extends from Timbaktu on the Niger to Bandelkhand, *Tamarix articulata* from Central Africa to the Jumna, *Salvadora oleoides* from Aden to Agra, *Cordia Rothii* from Abyssinia to Rajputana, and *Calligonum polygonoides* from Algeria to Meywar. Other western trees, which do not, however, extend to Africa, are *Acacia rupestris* (unless, as seems probable, it should be referred to *A. Senegal*, in which case it would rival *Capparis aphylla* in the extent of its range), *Acacia modesta*, *Prosopis spicigera*, and *Diospyrus Lotus*.

The number of indigenous shrubs and trees described is about 700, and about 80 introduced and cultivated plants have been added. Of these, many, such as *Michelia Champaca*, *Mangifera indica*, *Saraca indica*, are natives of other parts of India, Burma, or Ceylon; a few are natives of Western Asia—*Prunus Amygdalus*, *Ficus Carica*, *Salix babylonica*, *S. Caprea*, *Populus nigra*, and *Cupressus sempervirens*. Africa has furnished *Adansonia digitata*, *Indigofera tinctoria*, *Sesbania ugyptiaca*, *Coffea arabica*, *Euphorbia Tirucalli*, and (probably) *Tamarindus indica*. The number of American trees and shrubs introduced into Northern India is remarkable: *Anona squamosa*, *Bixa Orellana*, *Parkinsonia aculeata*, *Pithecolobium dulce*, *Acacia Farnesiana*, *Psidium Guava*, *Carica Papaya*, *Opuntia Dillenii*, and *Plumeria acutifolia*, are old introductions; while *Swietenia Mahagoni* and the *Cinchonas* are of recent date, as also *Eucalyptus*, *Albizia*, and *Acacia*, from Australia.

The selection of the indigenous and cultivated species to be included was to a certain extent arbitrary, and the guiding principles were different from those adopted in the other Forest Floras. The scanty vegetation on the extensive wastes and dry hills of the arid region often consists of low shrubs, which, in the moister regions of the Peninsula, Burma, and Bengal, would not be noticed by the forester; while in North-West India they are of great importance for the wellbeing of the population, and are therefore included. On the other hand, many shrubs of the Himalaya have been omitted. The numerous species of *Clematis* were excluded, because their admission would have necessitated the addition of the Order *Ranunculaceæ*, mainly composed of herbaceous plants of no particular interest to the forester. *Spiræas* are also omitted, though they are showy and conspicuous, and several are considerable shrubs. It would have been a great advantage if the large gregarious grasses *Saccharum*, *Andropogon*, *Imperata*, and others, which cover extensive areas in the Himalayan Terai, and on the Sailaba land along

the main rivers, and the large herbaceous plants of *Compositæ*, *Acanthaceæ*, *Labiatae*, and other Orders, could have been included, which come up on clearings in the forests (Schlagpflanzen), or form dense under-wood in moist forests. This, however, must be reserved for a separate publication.

Again, the great similarity between the forest vegetation of the north-west Himalaya and of Europe suggested a brief notice of the more important European forest-trees. The fact is now becoming recognised that a knowledge of forests and forest management in Europe is useful to foresters in India. A considerable number of the younger forest officers have received their professional education in the public and private forests of France, Germany, and Britain; others have devoted their furlough to the study of forest management in those countries: and the connection between European and Indian foresters thus established will prove a great advantage to the development of forestry in India. Under these circumstances it was desirable that Indian foresters should have a brief account of European trees side by side with their congeners and allies of the Himalaya. Special reference has in this respect been made to the arborescent vegetation of the Mediterranean region, which is visited by many Indian officers on their way to and from England.

It was also necessary to include the more important trees and shrubs cultivated in North-West India, and to allude to those which, though not yet introduced or extensively cultivated, merit special attention, and which may perhaps be introduced with advantage. With the view of making the book more useful to persons engaged in Indian arboriculture, reference has been made to useful trees of other countries allied to those described in these pages.

These remarks will explain that this book must not be regarded as a local Flora, similar to the Colonial Floras which are emanating from Kew; for on the one hand it includes only the more important trees and shrubs, and on the other its scope has for practical purposes been extended far beyond its territorial limits. It has been written, not for botanists, but for practical men, especially for those who have the care of the public forests in the different provinces of India. It may, however, be said, that this object might have been attained by a smaller volume, giving only a popular description of the larger trees, and unencumbered with remarks regarding the identification of species and the priority of systematic names. Such objections will be supported by those who hold that the sole legitimate duty of forestry in India is to provide fuel and timber, and that the forester has no concern with bark, lac, gums, resins, caoutchouc, wax, oil, dyes, fruits, and other marketable products of trees and shrubs. Such views will continue to be maintained until it comes to be acknowledged that the principal aim and object of forest management in India is the

formation of public estates, to be managed so as to secure large benefits to the country of an indirect nature, as well as a continuous and increasing yield of all descriptions of forest produce necessary to supply the requirements of the people and their export trade. Foresters in India will gradually understand that they are expected to make the utmost of the estates intrusted to their charge for the benefit of the present generation, while steadily improving the capital value and productiveness of their estates; and this will lead them eagerly to seek information regarding the various trees and shrubs which may be turned to account. It is not possible to predict in what respect any particular plants may not eventually be found useful, either by their produce, or because they further the growth of the more useful kinds by their shade and shelter, or in other ways. The only safe plan, therefore, is at the outset to take a comprehensive view of the whole forest vegetation, instead of confining our attention to those trees which we are accustomed, often erroneously, to regard as most important. Again, such study, to be profitable, must be conducted upon true scientific principles. Unless the identification of species and their systematic names are established, so as to command the assent of botanists, there can be no certainty as to what plant is meant, and the result of studies in the field will be confusion and waste of time. It may be well to state that the fault of this book is not that it is too scientific, but that it is not scientific enough. When the material here collected has been sifted by the criticisms of botanists in Europe, and tested by the studies in the field of Indian foresters and botanists, it may then be useful to prepare popular books of a smaller size for the use of those who have not the leisure or the inclination to study this handbook.

The botanical terms employed are explained in a small volume on Indian botany by Professor Oliver,* which should be in the hands of all who use this work without having had the advantage of previous botanical instruction. A list of terms not explained in that book is appended. Bentham's *Outlines of Botany*, reprinted in the commencement of *Beddome's Manual*, will also be found a most useful guide in this respect.

To the end of Rubiaceæ the systematic arrangement followed is that of Hooker's and Bentham's *Genera Plantarum*, and that standard work has been quoted under each Natural Order, in addition to Royle's and Wight's *Illustrations*. The remaining Orders have been arranged mainly in accordance with Bentham's *Flora Australiensis*. Standard works on Indian botany have invariably been quoted under each species, including Hooker's *Flora of British India* up to p. 306 of the first volume. Boissier's *Flora Orientalis* has also, as a rule, been referred to, as far as the end of the second volume. Under species common to North India and

* *First Book of Indian Botany*. By Daniel Oliver, F.R.S. London, Macmillan and Co., 1869.

Europe, some standard European work has always been quoted—viz., Hooker's *Students' Flora for British Plants*, Reichenbach's *Icones Floræ Germanicæ*—wherever it seemed desirable to quote a good illustration, and when necessary for special reasons—Mathieu's admirable *Flore Forestière de la France*, and Willkomm's *Forstliche Flora von Deutschland und Oesterreich*, as far as that work had appeared. Reichenbach's *Icones* were selected, because vols. xi. and xii., which contain most arborescent genera of Central Europe, are sold separately at a moderate price. Other botanical works have been quoted where it appeared necessary for purposes of identification, but as sparingly as possible. A few Synonyms have been added, but only those used in standard books on Indian botany. Exceptions have occasionally been made in favour of names occurring in Wallich's catalogue, De Candolle's *Prodromus*, and a few other works.

The spelling of botanical names in Bentham and Hooker's *Genera Plantarum* has been adhered to, and in the subsequent Orders the practice of the leading botanists has been followed. Hence, among others, the old spelling of *Pyrus*, *Cinchona*, *Plumeria*, and *Bridelia*, has been maintained, though if the names were to be altered in accordance with their derivation, it would be necessary to write *Pirus*, *Chinchona*, *Plumiera* and *Brideliet*; but these are not the names under which the genera were originally described, and by which, with few exceptions, they have been known ever since.

After the systematic, English, and other European names of the tree, the Sanskrit name has been given wherever it seemed probable that it referred to the species described. In a few instances, Arabic and Persian names have also been added. The vernacular names which follow are, as a rule, arranged according to the provinces or districts in which they are used, but in many cases it was impossible to indicate the language to which they belong. In spite of all the labour bestowed on it, this portion of the book may be found one of its weakest points. Yet the critical examination of the vernacular names of the different Indian languages, and their derivation from the Sanskrit or other root, will be found a most interesting and important study. Forestry in India is as yet too much like an exotic plant. I have no greater wish in connection with it than to see it naturalised; and one of the first steps in that direction must be the establishment of fixed names and technical terms in the vernacular. The forester should not despise vernacular names, for in many instances they have a fixity which systematic names do not yet possess. We all know the evergreen *Khirni*, and there can be no mistake about it; but botanists are not yet agreed whether the tree shall be called *Mimusops indica*, *hexandra*, or *Kauki*. *Kamela*, or *Kamila*, is a well-known small tree; its systematic name among Indian botanists, however, which for more than half a century was *Rottlera tinctoria*, has now and properly

been changed into *Mallotus philippinensis*. Again, there can be no doubt as to the tree designated by the name of *Kāo*, *Kāu*, although some botanists call it *Olea europæa*, others *Olea cuspidata*, and others *Olea ferruginea*. *Kuddam* and *Huldu* were formerly well known as *Nauclea parvifolia* and *cordifolia*; now the forester has to learn the new generic names *Stephegyne* and *Adina*. These changes of systematic names are not arbitrary—as a rule, they are dictated by the progress of scientific research; but they are apt to discourage the student—and on that account, also, vernacular names merit attention. All North Indian names have been spelt according to the system of Sir William Jones, now adopted in public documents, but with as few diacritical marks as possible. When it seemed necessary to indicate a long vowel, this has been done, in accordance with the practice of Forbes's Hindustani Dictionary, by a horizontal line, thus—*ā*, *ē*, *ī*, *ū*. Names which have acquired a fixity of spelling in English, such as *Teak*, *Toon*, *Sissoo*, *Neem*, *Hoom*, *Bamboo*, *Peepul*, *Banyan*, have not been interfered with. As a rule, North Indian names only have been given, but in a few instances Canarese, Telugu, and Burmese names have been added, in order to facilitate the use of the book in other provinces besides those for which it has mainly been written.

It may be useful to mention that trees which under ordinary circumstances do not exceed 20 ft. in height are termed small, while large trees are those which exceed 50 ft., and moderate-sized trees those between these limits. In indicating the rate of growth, the terms slow, moderate, and rapid have occasionally been used. These comparative terms are intended to relate to average conditions, for it is well known that the same kind may be a rapid grower under certain circumstances, and a slow grower under others. With this reservation, the following terms have been adopted in this handbook:—

Growth slow: more than 12 rings per inch of radius; age of a tree of 6 ft. girth, above 138 years.

Growth moderate: 4-12 rings per inch of radius; age of a tree of 6 ft. girth, 46 to 138 years.

Growth rapid: less than 4 rings per inch of radius; age of a tree of 6 ft. girth, less than 46 years.

Pure Forests are now commonly called those which consist entirely or nearly of one kind of tree, in contradistinction to mixed forests, composed of various kinds. The term *leaf-bearing trees*, though not literally correct, is used, in contradistinction to coniferous trees, in the sense of the French "*Bois feuillus*," and the German "*Laubholzer*."

Concerning the information given on the physical properties of the different kinds of timber, it will suffice to state that the weight of a cubic foot is always that of seasoned timber, unless otherwise stated. Of the

numerous experiments made to determine the mechanical properties of Indian timbers, the results of those only which relate to transverse strength have been given. P is the constant represented by the following well-known formula :—

$$P = \frac{L \times W}{b \times d^2}$$

L being the length in feet of the scantling tested between supports (bearing length), W the weight producing fracture of the scantling loaded in the middle, b breadth of scantling in inches, d depth of scantling in inches.

It now remains briefly to narrate the history of this work, to enumerate the materials upon which it is based, and to acknowledge the assistance received during its preparation. In 1869, the late Dr Stewart, then Conservator of Forests in the Panjab, came home on furlough, and the Government of India intrusted him with the preparation at Kew of this work, for which he had been collecting materials for several years. While officiating in 1860-61 for Dr Jameson as Superintendent of the Botanic Garden at Saharanpur and of the Government Tea Plantations in the North-West Provinces, and subsequently while Civil Surgeon at Bijnaur in Rohilkhand, he became familiar with the forest vegetation in the plains and in the Himalaya between the Jumna and Kali rivers. In 1864 he returned to the Panjab, where he had passed his first years of medical service, principally on the western frontier, and being then appointed to the charge of the forests in that province, he devoted the greater part of his time to the botanical exploration of the Panjab Himalaya, Kashmir, and the adjoining districts of Tibet, and to repeated careful examinations of the Rakhs and brushwood tracts in the plains west of the Jumna river, including the adjoining province of Sindh. He thus acquired an extensive knowledge of the forest vegetation of a large portion of North-West India, and the copious notes taken on the spot in all his travels contained a rich store of information. In order to enable him to include the forest vegetation of Oudh and the Central Provinces, a forest officer of the North-West Provinces, Mr Richard Thompson, who had formerly served under Dr Stewart at Saharanpur, was at his suggestion deputed to visit the principal forest tracts of those provinces; and the notes and collections made by that officer were sent to him at Kew. Dr Stewart's previous publications in various scientific journals, as well as the numerous and valuable official reports submitted by him as Conservator of Forests, and his excellent book on the "Useful Plants of the Panjab," fully warranted the expectation that, after the needful preparatory study at home, he would be equal to the important task intrusted to him. He accordingly devoted a large part of his furlough, from 1869 to 1871, to this work,

and would doubtless have completed it in a satisfactory manner if his health had not given way. During the latter part of his residence in England, it was evident to his friends that his general health was impaired; and when the first sheets of his manuscript were printed, it was clear that the work, as prepared by him, would neither be a useful one, nor one creditable to himself. He returned to India in October 1872, and died from an affection of the brain at Dalhousie on the 5th July 1873. Under these circumstances, as I had, while in India, recommended that this task should be intrusted to Dr Stewart, and as I happened to be in England for the restoration of my health, I was directed in March 1872, by her Majesty's Secretary of State for India in Council, to complete the work for publication; and the past two years have been devoted to this duty.

The following materials, besides the published literature and official reports, have been at my disposal: 1. The rich collections of the Royal Herbarium, Museum, and Gardens at Kew. 2. Dr Stewart's manuscript, comprising the description of 444 species. 3. Mr Richard Thompson's notes, and a portion of the collections made by him. 4. The greater portion of my own herbarium, which was in charge of Mr Sulziz Kurz at Calcutta, and which I sent for as soon as I received orders to undertake the work. 5. A small collection of plants made by me on a journey through Rajputana and the forest tracts of Guzerat in 1869-70, with my journal and notes. A large portion of the notes and journals relating to my other tours in North-West and Central India, and some of the botanical collections made on those tours, were unfortunately in India, and could not be made available for the preparation of this work.

My personal knowledge of the arboreous vegetation of the territory included in this Flora has been acquired during a series of tours of inspection in the forests of the Satpura range, Bijoragogarh, and Oudh, the Nepal Terai, Kamaon, Garhwal, Rohilkhand, Dehra Doon, Jaunsar, and Gorakhpur, in 1863; the Deodar forests of Kunawar, the outer hills and a portion of the plains of the Panjab, in 1864; Kangra, the plantations and Rakhs of the Panjab, Sindh, Berar, and the western part of the Satpura range, in 1868-69; Kunawar, Rajputana, the Panch Mahal and Mandevi forests of Guzerat, and the Rakhs and plantations of the Panjab plains, in 1869-70; and during a residence of six summer seasons at Simla, and numerous excursions and smaller tours in the vicinity of that place. Unfortunately, I was never able, owing to continued pressure of official duties, to devote much time during those journeys to botanical studies. With the Flora of Tibet, Chamba, Kashmir, Kaghan, and the trans-Indus territory, I have no personal acquaintance.

The identification and description of species, and the botanical part generally, is entirely mine, and the result of my independent researches. I am alone responsible for them. But Dr Stewart's MSS. furnished me

with much useful information regarding the vegetation of those districts, with which he was personally acquainted. In numerous cases they supplied data concerning the geographical distribution of plants, which I could not have obtained from any other source; and I invariably consulted them regarding vernacular names, the habit, mode of growth, and products of the trees. Where I had no personal knowledge of the plant—as, for instance, *Chamaerops Ritchieana*, *Reptonia*, *Parrotia*, and other exclusively western trees—I have for the general remarks mainly relied on his manuscripts. For the trees and shrubs of those districts with which he was not acquainted, the work has been based upon other sources of information. With regard to the Panjab, I could not have completed this handbook without the assistance of Dr Stewart's manuscript, unless I had returned to India and devoted several years to a botanical exploration of the same ground where he had collected his information.

I have utilised the materials collected by my late colleague as far as they were embodied in his manuscripts, and in his various publications and official reports. Many months have we spent together in the fierce heat of the Kamaon Doons, in the Deodar forests of Kunawar near the limits of arboreous vegetation, and in other districts of North-West India. We have shared many a hard day's work, and have keenly discussed many botanical questions. It is a melancholy satisfaction to me to record the extent and value of his labours. Three new species were described in Dr Stewart's manuscripts: *Acer pentapomicum*, *Rhus punjabensis*, and *Adenanthera Oudhensis*—the two former discovered by him in the N.W. Himalaya, and the third by Mr Richard Thompson in the Oudh forests. These species have been accepted by me as defined and named by him; and at the end of this volume, an analytical key to the chief arboreous conifers of the N.W. Himalaya, by Dr Stewart, will also be found. Regarding the limitation of certain species, I have formed views differing considerably from those of Dr Stewart. This divergence of opinion mainly relates to the following genera: *Grewia*, *Zizyphus*, *Rhus*, *Acacia*, *Embelia*, *Diospyros*, *Olea*, *Ehretia*, and the *Bamboos*. I wished to have placed the views Dr Stewart entertained regarding those species before Indian botanists in his own words, but the state of his manuscripts prevented the adoption of this course. They are, however, deposited in the Library of the Royal Herbarium, Kew, and are available to those interested in the arboreous vegetation of North India.

A list of Dr Stewart's publications bearing on the subject of this book will be found at p. xx.

I have constantly consulted Jacquemont's *Voyage dans l'Inde*; Hoffmeister's *Travels*; Dr Hooker's admirable *Himalayan Journals*; Dr T. Thomson's clear and accurate description of the North-West Himalaya and its vegetation; Madden's excellent papers on the Terai and outer

TABLE OF CONTENTS.

PREFACE,	PAGE v
LIST OF THE PRINCIPAL BOOKS REFERRED TO,	xviii
ABBREVIATIONS,	xxi
EXPLANATION OF TERMS,	xxi
SYNOPSIS OF NATURAL ORDERS,	xxii
REMARKS ON THE STRUCTURE OF WOOD,	xxx
FOREST FLORA,	1
ADDITIONS AND CORRECTIONS,	571
ANALYTICAL KEY TO CONIFERS OF N.W. HIMALAYA,	579-580
INDEX TO SANSKRIT, ARABIC, AND PERSIAN NAMES,	581
INDEX TO VERNACULAR NAMES,	582
INDEX TO BURMESE NAMES,	583
INDEX TO EUROPEAN NAMES,	583
INDEX OF ORDERS, GENERA, AND SPECIES,	586

TABLE OF CONTENTS.

PREFACE,	5
LIST OF THE PRINCIPAL BOOKS REFERRED TO,	11
ABBREVIATIONS,	12
EXPLANATION OF TERMS,	13
SYNOPSIS OF NATURAL ORDERS,	15
REMARKS ON THE STRUCTURE OF WOOD,	17
FOREST FLORA,	1
ADDITIONS AND CORRECTIONS,	57
ANALYTICAL KEY TO CONIFERS OF N.W. HIMALAYA,	57-58
INDEX TO SANSKRIT, ARABIC, AND PERSIAN NAMES,	59
INDEX TO VERNACULAR NAMES,	59
INDEX TO BURMESE NAMES,	59
INDEX TO EUROPEAN NAMES,	59
INDEX OF BURMESE GENERA AND SPECIES.	59

LIST

OF THE

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ABBREVIATIONS.

C.S.	Cold Season	Dec.	Jan.	Feb.
H.S.	Hot "	March,	Apr.	May.
R.S.	Rainy "	June,	July,	Aug.
	Autumn.	Sept.	Oct.	Nov.
Pb.		Panjab.		
N.W.P.		North-Western Provinces.		
C.P.		Central Provinces.		

Note—For a full account of the climatic regions of India, see "Distribution of Forests in India," in *Ocean Highways* for October 1872, and *Transactions of Scottish Arboricultural Society*, vii 88 (1873).

Eastern India. (Sikkim to Burma, including Bengal.)

North-West India. (Sindh, Panjab, N.W.P., Bandelkhand, and Rajputana.)

South India. (The Peninsula, south of the Satpura range.)

EXPLANATION OF TERMS.

Acuminate, terminating in a tapering point.

Estivation, applied to the relative position of the parts of the calyx and corolla in bud.

Arillus, a dilatation from the funicle or placenta more or less covering the seed as it matures.

Arrested (as applied to the *axis*), when the internodes are undeveloped

Berry, a succulent indehiscent (syncarpous) fruit.

Caruncle, a thickening of the mouth of the ovule as the seed matures

Convolute (in vernation), a leaf rolled longitudinally on itself.

Divaricate, spreading at a wide angle.

Flexuose, alternately bending from side to side.

Glabrate, becoming glabrous on full development.

Hyaline, translucent.

Interpetiolar (applied to stipules), between two petioles.

Intrapetiolar (applied to stipules), between the petiole and branch.

Moniliform, beaded, constricted at intervals.

Pencilate, tufted like a camel's hair brush.

Ruminate, interrupted in internal structure, usually applied to albumen.

Scrobiculate, marked with minute shallow depressions.

Strigose, covered with short stiff more or less appressed hairs.

Strophole, an appendage of the testa of some seeds, usually on the raphe, but independent of the funicle and micropyle.

Thyrse, a compact pyramidal panicle.

Trinerved, with 3 nerves distinct from the base.

Triplinerved, with 3 nerves more or less confluent near the base.

Vigiparous, developing leafy shoots from the inflorescence.

SYNOPSIS OF NATURAL ORDERS.

THE distinguishing characters are selected with special reference to the trees and shrubs described in this work: a few Orders not here described, but containing important Indian trees or shrubs, are added in brackets.

FIRST CLASS, **DICOTYLEDONS.**

Pith surrounded by concentric layers of wood and bark. Wood and bark separated in the growing stem by a continuous layer of soft cells (*cambium*), which is transformed into new wood on the outside of the wood-cylinder, and into new bark on the inside of the bark. Ultimate venation of the leaves usually irregularly reticulate. Embryo with two or more cotyledons. In germination the cotyledons are generally raised above ground, the radicle lengthens, forming a tap-root, which at a later period branches.

FIRST SUB CLASS. **ANGIOSPERMÆ.**

The wood consists of wood-cells, vessels, and medullary rays. Parts of calyx, corolla, or perianth usually in fours or fives. Ovules in a closed ovary, fertilised by the pollen-tubes penetrating into the ovary through the opening or loose tissue of the stigma. Embryo with two cotyledons, with or without albumen.

I. Polypetalæ.—Flowers with both calyx and corolla, the latter of distinct petals.

A. Thalamifloræ.—Petals hypogynous

1. *Dilleniaceæ*, p. 1. Leaves alternate, simple, with prominent lateral nerves. Sepals persistent. Stamens indefinite. Pistil usually of several distinct carpels. Embryo minute in fleshy albumen.

2. *Magnoliaceæ*, p. 3. Leaves alternate, simple; stipules conspicuous, commonly convolute. Sepals and petals conform in 2-7 whorls of three, imbricate, deciduous. Stamens indefinite. Numerous distinct carpels. Embryo minute in a fleshy, oily, uniform albumen.

3. *Anonaceæ*, p. 4. Leaves alternate, entire, without stipules. Sepals and petals in threes or multiples of three. Stamens indefinite. Carpels distinct in fruit (united in *Anona*). Embryo minute in a ruminated albumen.

4. *Menispermaceæ*, p. 7. Climbers with broad medullary rays and otherwise anomalous wood structure. Leaves alternate, simple, mostly palminnerved, without stipules. Flowers unisexual, usually trimerous, sepals free. Stamens definite, often monadelphous. Fruit usually of several distinct one-seeded carpels. Embryo curved with or without albumen.

5. *Berberideæ*, p. 11. Leaves alternate. Sepals and petals usually trimerous, conform, caducous. Stamens mostly 6, free, opposite to petals; anthers opening by valves. Carpels one or several, distinct. Seeds albuminous.

6. *Cypripideæ*, p. 13. Leaves alternate. Sepals 4. Petals 4. Stamens often indefinite. Ovary stipitate, syncarpous. Seeds numerous, attached to parietal placentas, generally without albumen.

7. *Bixineæ*, p. 16. Leaves alternate, simple. Sepals 4 or 5. Stamens indefinite; anthers bursting longitudinally by slits or pores at the apex. Ovary syncarpous, one-celled. Seeds generally few, on parietal placentas. Embryo with foliaceous cotyledons in a fleshy albumen.

8. *Pittosporæ*, p. 19. Leaves alternate, simple, exstipulate. Flowers bisexual, regular, pentandrous and pentamerous. Sepals free. Ovary syncarpous. Embryo minute in a copious albumen.

9. *Tamariscineæ*, p. 20. Leaves alternate, small, generally scale-like. Flowers usually bisexual, regular, pentamerous, rarely tetramerous; stamens as many as petals, or twice that number. Ovary one-celled, syncarpous. Seeds numerous, tufted or winged.

[*Guttiferae*. Resinous, often coloured juice. Leaves coriaceous, glabrous, opposite, undivided, penniveined. Flowers regular, generally unisexual. Sepals free. Stamens numerous. Ovary syncarpous. Seeds few, without albumen. Embryo fleshy, oily.—*Garcinia victoria*, Roxb.; Bedd. Fl. Sylv. t. 87. *Xanthochymus pictorius*, Roxb.; ib. t. 88. *Calophyllum elatum*, Bedd.; ib. t. 2. (Poon); *Mesua Roxburghii*, Wight (*M. ferrea*, Roxb.)]

10. *Ternstroemiaceæ*, p. 24. Leaves alternate, coriaceous, simple, penniveined. Flowers regular, usually pentamerous and bisexual. Sepals 5. Stamens numerous. Ovary syncarpous, 3-5-celled. Seeds generally few and exalbuminous. Embryo fleshy, oily.

11. *Dipterocarpeæ*, p. 26. Resinous. Leaves alternate, generally entire, penniveined. Flowers bisexual, pentamerous, regular. Calyx often adnate to ovary, and its segments enlarged in fruit. Stamens 5, 10, 15, or indefinite. Ovary syncarpous. Seeds one, rarely two. Embryo with thick fleshy cotyledons, albumen none.

12. *Malvaceæ*, p. 28. Wood soft and light. Leaves alternate, stipulate, simple, often palminnerved, with stellate hairs. Calyx-lobes valvate. Stamens numerous, monadelphous; anthers 1-celled. Fruit a dehiscent capsule, or often separating ultimately into distinct carpels, rarely indehiscent.

13. *Sterculiaceæ*, p. 32. Wood soft. Leaves simple or digitate, usually alternate and stipulate. Calyx-lobes valvate. Stamens monadelphous or free; anthers 2-celled. Fruit a dehiscent capsule, or a whorl of distinct carpels.

14. *Tiliaceæ*, p. 36. Leaves alternate, simple, with deciduous stipules. Calyx-lobes valvate. Stamens indefinite, usually free; anthers 2-celled. Ovary syncarpous, 2-10-celled.

[*Linææ*. Leaves alternate, entire, stipulate. Flowers bisexual, regular, 5-rarely 4-merous. Stamens as many as petals or double their number, connate at the base into a tube or ring. Disc of 5 or 10 glands, often inconspicuous. Seeds few.—*Erythroxylon indicum*, DC.; Bedd. Fl. Sylv. t. 81.]

15. *Malpighiaceæ*, p. 44. Climbers with opposite entire leaves. Flowers

regular, bisexual, pentamerous. Stamens 10. Fruit of 1-3 winged one-seeded carpels. Seed without albumen.

16. *Geraniaceae*, p. 45 (*Averrhoa*). Leaves alternate, imparipinnate, without stipules. Sepals 5; petals 5; stamens 10. Fruit oblong, fleshy, 6-ribbed.

17. *Rutaceae*, p. 46. Leaves compound or simple, usually alternate, without stipules, aromatic, dotted with translucent glands. Disc annular, thick. Flowers 4- or 5-merous. Stamens as many as petals, or twice that number, rarely indefinite.

18. *Simarubaceae*, p. 58. Bark bitter. Leaves usually alternate, compound, without stipules, not dotted with glands. Flowers small, generally unisexual, regular, 3-5-merous. Stamens as many as petals, or double their number.

19. *Ochnaceae*, p. 60. Leaves alternate, simple, shining, coriaceous. Flowers regular, bisexual. Sepals 6; petals 5 or 10. Stamens 10 or indefinite; anthers linear. Fruit usually of 3-10 distinct, 1-seeded drupes.

20. *Burseraceae*, p. 61. Balsamic or resinous. Leaves alternate, 3-foliolate or imparipinnate, without stipules. Stamens usually 8 or 10. Seeds one or few, without albumen.

21. *Meliaceae*, p. 65. Leaves alternate, pinnate, without stipules. Flowers regular, bisexual, in large panicles. Stamens generally 8-10, monadelphous.

22. *Oleaceae*, p. 74. Leaves alternate, simple, exstipulate. Flowers small, 4-5-merous. Stamens as many as petals or twice their number. Fruit indehiscent, 1-seeded.

23. *Ulmaceae*, p. 75. Leaves evergreen, alternate, simple, glabrous. Petals 4-5; stamens as many as petals. Fruit a drupe with three or more 1-seeded pyrenes.

24. *Ampelideae*, p. 97. Climbers. Leaves alternate, simple or compound. Calyx small; petals valvate in bud. Stamens opposite to petals. Fruit a berry with one or a few hard seeds.

25. *Sapindaceae*, p. 103. Leaves alternate or opposite, simple or compound. Flowers polygamous, often irregular. Stamens usually more than petals, not double their number. Seeds few.

26. *Sabiaceae*, p. 115. Leaves alternate, without stipules. Flowers tetramerous or pentamerous. Stamens opposite to petals. Anther-cells distinct. Seeds few, without albumen.

27. *Anacardiaceae*, p. 117. Often resinous. Leaves various, without stipules. Fruit generally drupaceous, 1-celled, 1-seeded (2-5-seeded in *Spondias*). [*Coriaria*. Leaves opposite, simple. Flowers bisexual, regular, pentamerous. Stamens 10. Disc none. Fruit of 5-8 distinct one-seeded carpels, enclosed in the persistent coriaceous or succulent petals.—*Coriaria nepalensis*, Wall. p. 128.]

28. *Moringaceae*, p. 129. Leaves alternate, 2- or 3-pinnate; leaflets caducous, with glands in the place of stipules. Flowers large, bisexual, pentamerous, paniced; petals unequal. Fertile stamens 5, opposite to petals, alternating with sterile stamens. Fruit a long 1-celled 3-valved pod.

[*Connaraceae*. Leaves alternate, without stipules, pinnate, 3- or 1-foliolate; leaflets coriaceous, entire. Flowers generally bisexual, pentamerous. Stamens 5 or 10. Ovary of five distinct 1-celled, hirsute carpels, one or more of which only comes to maturity, forming a 1-seeded oblique capsule.—*Connarus pinatus*, Linn.; Bedd. Fl. Sylv. Man. 82.]

B. Calyciflorae. Calyx gamosepalous, often adnate to ovary. Petals inserted on the calyx.

29. *Celastrineae*, p. 77. Leaves simple, alternate or opposite, generally coriaceous; stipules none, minute or early deciduous. Calyx small; lobes imbric-

cate. Stamens 3-5, alternating with petals. Disc large, surrounding the base of the 3-5-celled ovary. Fruit a fleshy drupe, or a capsule dehiscing loculicidally, or 3 distinct carpels.

30. *Rhamneæ*, p. 84. Branchlets and stipules often spinescent. Leaves alternate, simple. Calyx-lobes valvate. Stamens opposite to petals. Disc annular, cupular, or coating the calyx-tube. Ovary 2-3-celled.

31. *Leguminosæ*, p. 130. Leaves alternate, stipulate, pinnate 3-foliate or unifoliate. Carpel 1, free. Fruit a 1-celled pod. Seeds generally without albumen; cotyledons filled with starch, or oily.

32. *Rosaceæ*, p. 189. Leaves simple or compound, stipulate, usually alternate. Stamens numerous. Carpels solitary few or numerous, free or enclosed in and adherent to the calyx-tube. Seeds without albumen.

33. *Saxifrageæ*, p. 210. Leaves simple, alternate or opposite. Flowers regular, generally bisexual. Calyx free or adnate to ovary. Carpels 2 or more, usually syncarpous. Seeds small; embryo minute, in a copious albumen.

34. *Hamamelidææ*, p. 215 (*Parrotia*). Leaves deciduous, alternate, crenate; stipules large, deciduous. Flower-heads enclosed in large, membranous bracts.

35. *Rhizophoreæ*, p. 217. Leaves opposite, petiolate, coriaceous, entire; stipules interpetiolar, early caducous. Calyx adnate to ovary, 4-14-lobed; lobes valvate, coriaceous, persistent.

36. *Combretaceæ*, p. 220. Leaves simple, petiolate, entire; no stipules. Calyx-tube adnate to ovary; limb 4-5-cleft; lobes valvate. Stamens as many as calyx-lobes, or twice the number. Fruit winged or angled, 1-celled, 1-seeded. No albumen; cotyledons fleshy, oily.

37. *Myrtaceæ*, p. 230. Leaves simple, penninerved, generally entire, either alternate, or (more commonly) opposite, with translucent glands. Flowers regular, bisexual, 4-5-merous. Calyx-tube adnate to ovary; limb often closed in bud, and bursting irregularly or coming off entire. Stamens indefinite; anthers dehiscing longitudinally. Seeds generally numerous.

[*Malvatomaceæ*. Leaves simple, with 3-9 basal nerves (in *Memecylon* penninerved). Flowers regular, bisexual, 4-5-merous. Calyx-tube more or less adnate to ovary; lobes imbricate in bud. Stamens definite, as many as petals, or twice that number. Anthers basifix, opening at the apex with two pores or short slits, connective often thick and appendiculate.—*Memecylon umbellatum*, Burm., Bedd. Fl. Sylv. t. 206—Syn. *M. tinctorum*, Wight Ill. t. 93.]

38. *Lythrariceæ*, p. 237. Leaves simple, entire, generally opposite; no stipules. Calyx free, gamosepalous; lobes valvate in bud. Stamens definite or indefinite; anthers dehiscing longitudinally. Fruit generally a 2-many-celled capsule. Seeds numerous, without albumen.

39. *Samydaceæ*, p. 242 (*Casearia*). Leaves alternate, distichous, simple, often with translucent glands; stipules small, deciduous. Flowers inconspicuous, axillary, fasciculate. Ovary free. Capsule 1-celled. Seeds numerous; embryo straight, in a fleshy albumen.

40. *Passifloreæ*, p. 244 (*Carica*). Stem simple, with few branches, tufts of palmnerved leaves at the ends of branches. Flowers unisexual. Fruit large, succulent. Seeds numerous, parietal; embryo straight, in a fleshy albumen.

[*Datisceæ*. Leaves alternate, without stipules. Flowers dioicous, petals often wanting. Calyx 3-9-lobed. Ovary inferior, 1-celled, with as many placental and styles as calyx-lobes. Seeds parietal, numerous, minute.—*Tetrameles nudiflora*, R. Brown, p. 245.]

41. *Cactææ*, p. 245. Flat and articulate, or columnar, succulent stems with minute leaves. Flowers large, bisexual; calyx adnate to ovary; lobes numerous. Stamens indefinite; filaments long, filiform. Fruit fleshy, with numerous seeds.

42. *Aratiaceæ*, p. 247. Leaves alternate, simple or compound. Flowers

regular, umbellate, or capitate. Calyx adnate to ovary; limb short. Petals caducous. Seeds few; embryo minute in fleshy albumen.

43. *Cornaceæ*, p. 250. Leaves entire, without stipules. Calyx adnate to ovary. Fruit a berry or drupe, 1- or 2-celled, 1- or 2-seeded. Albumen fleshy; cotyledons thin, foliaceous.

II. Gamopetalæ. Flowers with calyx and corolla, the latter gamopetalous.

A. Ovary inferior.

44. *Caprifoliaceæ*, p. 254. Leaves opposite, simple or pinnate. Fruit a berry or drupe, 1- or many-seeded; embryo minute in copious fleshy albumen.

45. *Rubiaceæ*, p. 260. Leaves opposite or whorled; stipules interpetiolar or intrapetiolar. Stamens as many as corolla-lobes, alternating with them, and inserted in the tube. Albumen fleshy or horny.

[*Compositæ*. Leaves alternate or opposite. Flowers in involucrate heads. Calyx-limb a pappus of scales, hairs, or bristles, rarely none. Stamens 5; anthers connate in a tube. Ovary 1-celled, with one erect ovule. Style of fertile flowers 2-lobed.—*Vernonia*, *Blumea*.]

B. Ovary free (except *Marsa* and *Styracæ*).

46. *Ericaceæ*, p. 279 (*Andromeda*, *Rhododendron*). Leaves alternate, simple, without stipules. Anthers 2-celled, opening by terminal pores. Capsule 5-18-celled, with numerous minute seeds.

47. *Myrsinæ*, p. 282. Leaves alternate, simple, without stipules. Calyx free, rarely adhering to ovary. Fruit a fleshy or dry berry, or a drupe, 1- or few-seeded. Seeds albuminous.

48. *Sapotacæ*, p. 288. Milky juice. Heartwood well defined, hard and heavy. Leaves alternate, entire, usually coriaceous, without stipules. Flowers bisexual. Stamens numerous, in 2-3 series, or as many as corolla-lobes, and opposite to them, often alternating with staminodes. Fruit a 1- or few-seeded berry; testa hard, shining.

49. *Ebenaceæ*, p. 294. Leaves alternate, rarely subopposite, entire, without stipules. Flowers usually polygamous. Fruit a few-seeded berry. Albumen cartilaginous.

50. *Styracæ*, p. 298 (*Symplocos*). Leaves alternate, simple, without stipules. Calyx adnate to ovary. Fruit crowned by the calyx-lobes, 1-seeded. Embryo in the axis of a fleshy albumen.

51. *Oleaceæ*, p. 301. Leaves opposite, entire or pinnate; no stipules. Stamens 2. Ovary 2-celled. Seeds few.

52. *Salvadoracæ*, p. 314. Leaves opposite, entire, with minute stipules. Flowers small, regular, tetramerous. Stamens 4, alternating with corolla-lobes. Ovary 2-celled. Fruit a 1-seeded berry.

53. *Loganiaceæ*, p. 317 (*Strychnos*, *Buddleia*). Leaves opposite, connected by interpetiolar stipules or a raised line. Flowers regular, 4-5-merous. Seeds numerous, rarely few, albuminous.

54. *Apocynæ*, p. 319. Juice often milky. Leaves opposite or whorled. Flowers regular, bisexual, pentamerous, pentandrous. Calyx divided to the base. Corolla-lobes contorted in bud, throat hairy inside, or closed with scales. Anthers five. Ovary of 2 distinct carpels, or 2-celled, rarely 1-celled. Seeds numerous, often with a tuft of hairs.

55. *Asclepiadææ*, p. 329. Juice milky. Leaves opposite entire, without stipules. Flowers regular, pentamerous, pentandrous. Calyx divided to the base.

Anthers connate into a tube, enclosing the style. Ovary of 2 distinct carpels. Seeds numerous, with a tuft of hairs.

56. *Boraginæ*, p. 335. Leaves alternate, without stipules. Inflorescence cymose usually unilateral. Flowers regular, 4-6-merous, 4-6-androus. Calyx persistent; lobes 4-6, valvate in bud. Ovary 2- or 4-celled, often 2-4-lobed. Seeds solitary in each cell or lobe.

57. *Convolvulaceæ*, p. 341. Climbers. Leaves alternate, without stipules. Flowers large, regular, bisexual, pentamerous, pentandrous. Calyx of 5 distinct sepals, persistent, often enlarged in fruit. Ovary 2- or 4-celled. Seeds few.

58. *Solanææ*, p. 345. Leaves alternate, without stipules. Flowers regular, bisexual, usually pentamerous and pentandrous. Calyx usually gamosepalous.

59. *Bignoniaceæ*, p. 346. Leaves opposite, usually compound, without stipules. Flowers bisexual, pentamerous, often irregular. Calyx gamosepalous. Stamens 2 or 4, rarely 5. Ovary 2-celled. Fruit often elongated. Seeds numerous, often winged, without albumen.

60. *Verbenaceæ*, p. 353. Leaves opposite, without stipules. Flowers irregular, 4-5-merous. Calyx gamosepalous, persistent, often enlarged in fruit. Stamens usually 4. Ovary 2- or 4-celled. Seeds few, solitary in each cell.

III. *Apetalæ* or *Incompletæ*. Flowers with a single perianth, consisting of distinct or connate leaves or scales, or without perianth (calyx, and corolla only in *Loranthaceæ* and in a few *Euphorbiaceæ* genera).

[*Nyctagineæ*. Nodes tumid. Leaves usually opposite, unequal; no stipules. Flowers bisexual or (*Pisonia*) dioicous. Perianth tubular, campanulate or infundibuliform, coloured, base persistent, often hardened, enveloping the 1-seeded achene.—*Pisonia aculeata*, Linn.; Wight Ic. t. 1763-64; Bedd. Fl. Sylv. Man. p. 175. *Bougainvillea spectabilis*, Willd.]

[*Phytolacceæ*. Leaves alternate, entire. Flowers usually bisexual, regular. Perianth 4-5-partite, often coloured, imbricate in bud. Ovary a whorl of 1-celled more or less distinct carpels; fleshy in fruit in *Phytolacca*.—*P. acinosa*, Roxb.; *P. dioica*, L., p. 371.]

61. *Polygonææ*, p. 371 (*Calligonum*, *Atraphaxis*). Leaves alternate, simple, with sheathing stipules. Flowers small. Perianth regular, 3-6-lobed or of 3-6 leaves. Ovary free. Fruit dry, 1-seeded, compressed, trigonous or tetragonous. Seed with farinaceous albumen.

62. *Laurinææ*, p. 373. Aromatic. Leaves alternate, usually entire and evergreen, without stipules. Perianth regular, deeply 6-cleft. Stamens normally 12, biseriate, but a portion of the stamens generally wanting. Fruit a 1-seeded berry or drupe. Albumen none; cotyledons fleshy, oily.

[*Myristicaceæ*. Leaves coriaceous, alternate, often distichous, entire, pinninerved, without stipules. Flowers inconspicuous, dioicous. Perianth 2-4 generally 3-lobed, coriaceous, tubular or campanulate; lobes valvate in bud. Stamens 3-18, monadelphous; anthers extrorse. Capsule fleshy, 2-valved. Seed 1, enveloped in a fleshy lacinate, often aromatic, aril. Embryo minute, in a copious aromatic ruminated albumen.—*Myristica moschata*, L. (*Nutmeg*); *M. laurifolia*, H. f. & Th.; Bedd. Fl. Sylv. t. 267; *M. corticosa*, H. f. & Th.; ib. t. 271; and other species in the dense evergreen forests of Burma and the Western Ghats.]

63. *Thymelacææ*, p. 384. Bark tenacious. Leaves alternate or opposite, entire, without stipules. Flowers regular, 4-5-merous, bisexual. Perianth gamophyllous. Stamens as many as, or twice the number of, perianth-lobes. Ovule pendulous, solitary. Fruit 1-seeded.

64. *Elceagneæ*, p. 387. Leaves lepidote, entire, alternate, without stipules. Ovule erect, solitary. Fruit indehiscent, 1-seeded, enclosed within the succulent persistent base of the perianth.

[*Proteaceæ*. Leaves usually alternate, coriaceous, persistent; no stipules. Flowers usually bisexual, massed together in heads, spikes, or panicles, with imbricate bracts, and often with a general involucre. Perianth of 4, more or less connate, coriaceous leaves. Ovary free, 1-celled. Seeds without albumen.—*Helicia robusta*, Wall.; Bedd. Fl. Sylv. t. 301.]

65. *Loranthaceæ*, p. 391. Parasitic. Leaves coriaceous, entire, usually opposite, often wanting. Ovary inferior, with a solitary erect ovule.

66. *Santalaceæ*, p. 398. Leaves alternate or opposite, entire, without stipules. Flowers regular, 3-4-merous, 3-4-androus; stamens opposite to lobes of perianth. Ovary inferior, 1-celled. Fruit 1-seeded. Seed albuminous.

67. *Urticaceæ*, p. 400. Leaves stipulate, alternate, rarely opposite. Flowers unisexual. Perianth generally 3-5-lobed. Ovary free, 1- rarely 2-celled. Fruit 1-seeded, many often united in one syncarpium.

68. *Platanæ*, p. 434. Leaves alternate, palmatifid; stipules caducous. Flowers unisexual without perianth, intermingled with scaly bracteoles, collected in globose pendulous heads.

[*Casuarinæ*. Branches whorled, articulate. Leaves reduced to many-toothed sheaths at the nodes. Flowers monoicous or dioicous. Male flowers in catkins, monandrous, with 4 connate bracts, in the axils of sheaths. Female flowers in bracteate heads, without perianth. Fruit a globose head of woody bracts and bracteoles, each pair of bracts including a 1-seeded caryopsis.—*Casuarina equisetifolia*, Forst., p. 435.]

69. *Euphorbiaceæ*, p. 436. Leaves alternate or opposite, usually stipulate. Flowers unisexual. Perianth various, sometimes a calyx and corolla, or wanting. Ovary free, generally 3-celled. Fruit 3-seeded, often 3 lobed. Seeds oily; cotyledons flat, in a fleshy albumen.

70. *Betulaceæ*, p. 457. Leaves alternate, simple, penniveined; stipules deciduous. Flowers monoicous in drooping catkins. Ovary free, compressed, 2-celled. Fruit 1-seeded.

71. *Salicinæ*, p. 461. Wood soft and light. Leaves alternate, simple, stipulate. Flowers dioicous in lateral catkins. Ovary free, 1-celled. Seeds numerous, minute, enclosed in long silky hair.

72. *Cupulifera*, p. 477. Leaves alternate, simple; stipules deciduous. Flowers monoicous. Ovary inferior, generally 2-3-celled. Albumen none; cotyledons thick, fleshy.

73. *Myricaceæ*, p. 495. Leaves alternate, often aromatic, without stipules. Flowers unisexual, in catkins or spikes. Ovary free. Fruit a 1-seeded nut, clothed with fleshy or waxy pericarp. Albumen none; cotyledons fleshy.

74. *Juglandæ*, p. 496. Leaves alternate, pinnate, often aromatic, without stipules. Flowers monoicous, the male in catkins, the female solitary. Ovary inferior, 1-celled. Seed 1, oily, without albumen.

SECOND SUB-CLASS. GYMNOSPERMÆ.

The wood, excepting that of the first year, which encloses the pith, consists of wood-cells and medullary rays, and has usually no vessels. Flowers unisexual, without calyx, corolla, or perianth. Ovules (not enclosed in an ovary) fertilised by direct contact with the pollen. Embryo in copious albumen, often with more than 2 whorled cotyledons.

75. *Gnetaceæ*, p. 500. Stem and branches articulate at the nodes. Leaves opposite, or reduced to a short bidentate sheath. Flowers enclosed by sheathing bracts. Anthers 2-8, filaments connate into a fleshy column. Seeds 1 or 2, enclosed in the persistent, more or less succulent bracts. Cotyledons 2, foliaceous.

76. *Coniferae*, p. 502. Branches often whorled, not articulate. Leaves alternate, usually acicular, often tufted. Male flowers in deciduous catkins, with antheriferous scales. Seeds at the base of carpellary scales, fleshy or more commonly woody, forming a cone. Cotyledons 2-15, whorled.

[*Cycadeæ*. Stem usually unbranched with a terminal crown of rigid pinnate leaves, and marked with the scars of fallen leaves. Pith large, often with scattered vascular bundles; medullary rays broad. Flowers dioicous in erect terminal or axillary cones. Antheriferous scales large, bearing on their under side numerous anther-cells. Scales of female cones peltate or pinnatifid, bearing the ovules on their edges. Cotyledons 2, unequal, the upper part remaining enclosed in the farinaceous albumen of the germinating seed.—*Ocyas circinalis*, Linn.; Bedd. Fl. Sylv. Manual, 227.]

SECOND CLASS. MONOCOTYLEDONS.

Vascular bundles scattered in the cellular tissue of the stem, closely packed near the circumference and more sparse near the centre. Pith, wood, and bark not distinct, no continuous cambium layer, and no regular increase in thickness of the stem by the formation of concentric layers of new wood and bark. Leaves with sheaths or broad-based petioles, the blade usually with longitudinal nerves, with or without cross veins, but without irregularly reticulate venation. Perianth, where present, stamens, and usually carpels, in threes, or multiples of three. Embryo generally small, usually surrounded by copious albumen; cotyledon 1, partly remaining enclosed in the germinating seed. The radicle gives off fibres during germination, forming a fibrous root.

77. *Palmeæ*, p. 541. Stem solid, usually unbranched, with a terminal crown of petiolate, pinnately or palmately divided, leaves. Calyx 3-fid. Corolla 3-petalous. Ovary 3-celled. Albumen horny, cartilaginous, or oily.

[*Pandaneæ*. Stem solid, dividing into dichotomous branches, each branch with a tuft of linear sheathing leaves in spiral rows. Flowers unisexual, without perianth, sessile in large heads or spikes. Ovary 1-celled. Albumen fleshy or horny.—*Pandanus odoratissimus*, Roxb.; *P. furcatus*, Roxb.]

78. *Gramineæ*, p. 560. Stems above ground hollow, jointed, often with fasciated branches at nodes. Leaves simple, entire, usually linear, on long split sheaths. Flowers usually bisexual, in the axils of distichous bracts (glumes), with inner, usually 2-nerved bracts (paleæ). Perianth incomplete, of 2-3 membranous scales. Seed 1, pericarp closely adhering to testa. Albumen farinaceous.

REMARKS ON THE STRUCTURE OF WOOD.

THE peculiar structure of the wood of Coniferous trees, Palms, and Bamboos, is sufficiently explained at pages 502, 541, and 561. In this place it is intended to draw attention to the character of the main classes of Dicotyledonous woods, so far as they can be distinguished under the lens without the aid of a microscope. The classification here suggested is not complete; it only applies to the trees mentioned under each class. Orders and genera with anomalous wood-structure, and climbers, are not included. The object of these remarks is to offer a few practical hints, which may induce Foresters and others, who have to deal with Indian timbers, to examine the structure of the different kinds.

FIRST CLASS.—Pores equal in size and uniformly distributed, sometimes a narrow belt with few pores at the outer edge of the annual ring, or a narrow belt with more numerous pores at its inner edge.

A. Medullary rays narrow or fine, generally all of one width.

1. Annual rings distinct.—*Eucalyptus europæus*, *Zizyphus vulgaris*, *Acer campestre*, *A. dasycarpum*, *Æsculus*, *Schleichera trijuga*, *Odina Wodier*, *Pyrus*, *Mespilus*, *Cratægus*, *Eriobotrya*, *Careya arborea* (pores scanty, in oval groups of 3-8, uniformly distributed, a narrow belt of darker wood at each ring), *Punica Granatum*, *Cornus*, *Viburnum*, *Coffea*, *Diospyrus Lotus*, *Ligustrum vulgare*, *Cinnamomum Camphora* (pores large, in radial lines), *Elæagnus*, *Burus*, *Betula*, *Salix* (*S. tetrasperma*, from Burma, however, has larger and more numerous pores in the spring wood, and *S. caprea* has a similar structure, but less marked), *Populus*, *Juglans regia*.

2. Annual rings more or less indistinct.—The division between this and the first group is uncertain, for the wood of the same kind often has the annual rings distinct when grown in dry places or at high elevations, while under other circumstances the zones of annual growth cannot be distinguished. *Bombax malabaricum* (pores large, numerous), *Capparis aphylla*, *Shorea robusta*, *Melia Azedarach*, *Mangifera indica*, *Terminalia tomentosa*, *Conocarpus acuminata*, *Eugenia Jambos*, *Lagerstræmia parviflora* (pores large, numerous whitish wavy concentric bands, not annual rings), *Nauclea cordifolia*, *N. parvifolia* (pores fine, in radial lines between medullary rays), *Olea europæa*.

B. Medullary rays of two classes, broad and narrow, the broad rays very marked.

1. Annual rings distinct.—*Dillenia indica*, *Acer pseudoplatanus*, *Negundo*, *Staphylea pinnata*, *Platanus orientalis*, *Alnus nepalensis*, *A. glutinosa*, *Fagus sylvatica*, *Carpinus orientalis*, and *Betulus*.

2. Annual rings more or less indistinct.—To this section probably belong several species of *Dillenia* and *Carallia integerrima*.

SECOND CLASS.—Pores nearly equal in size, but not uniformly distributed, crowded in the spring wood and scanty in the autumn wood, annual rings always distinct. *Tamarix* (medullary rays broad), *Rhamnus catharticus*, *R. Frangula*, *R. Alaternus* (pores in wedge-shaped branching tails in most species of *Rhamnus*), *Prunus* (medullary rays fine or moderately broad, broad in *P. Mahaleb*), *Terminalia chebula* (a narrow belt of autumn wood without pores), *Hippophaë rhamnoides*, *Alnus incana*.

THIRD CLASS.—Pores unequal in size, large and numerous in the spring wood, smaller and scanty in the autumn wood; annual rings always distinct.

A. Medullary rays narrow or fine, generally all of one width. *Cedrela Toona* (annual rings marked by a single line of larger pores), *Rhus Cotinus*, *Frazinus*, *Tectona grandis*, *Morus alba*, *Celtis australis* (medullary rays short, moderately broad, but uniform), *Ulmus montana*, *U. campestris* (the smaller pores of the autumn wood in narrow wavy bands), *U. effusa*, *Broussonetia papyrifera*, *Castanea vesca*.

B. Medullary rays of two classes, broad and narrow, the broad rays very marked.—*Ailanthus glandulosa*, *Quercus pedunculata*, *Q. sessiliflora*, *Q. Cerris* (the smaller pores of the autumn wood generally arranged in irregular tails).

Quercus Suber and *Q. Ilex* have a peculiar structure, fully described in Mathieu's Fl. For. 256 and 263. The pores are arranged in wavy radial lines or tails; in *Q. Ilex* they are fine and not crowded in a belt of spring wood, in *Q. Suber* they are large and more numerous at the inner edge of each annual ring, without, however, forming a porous belt. *Q. serrata* has broad medullary rays and middle-sized pores, and *Q. semecarpifolia* has fine and numerous medullary rays. The wood of the other Indian Oaks has not yet been sufficiently examined.

The wood of the Indian Leguminous trees merits special study. It is often marked by wavy concentric bands of lighter-coloured tissue, which must not be confused with annual rings. *Albizia odoratissima*, *Lebbek*, *procera* and *stipulata*, have large pores uniformly distributed, the pores often in groups of 2 or 3, and always enclosed in a patch of more open tissue, consisting of wood-cells different from the mass of the wood. These patches are arranged in more or less concentric lines, having the appearance of wavy bands. The medullary rays are fine and numerous, and the annual rings are generally distinct. The structure of *Dalbergia Sissoo*, *Cassia Fistula*, *Xylia dolabriformis*, *Tamarindus indica*, and *Acacia Catechu*, is similar, but the wood of the two last-named trees has no distinct annual rings. In *Acacia arabica* the pores are often close together in the inner part of each annual ring, and scanty in the outer belt. *Pterocarpus indicus* (Padouk) has large scanty pores, more numerous and larger in the spring wood, the pores of the autumn wood joined by white wavy concentric lines; medullary rays numerous, very fine. *Sophora japonica*, *Robinia Pseudacacia* and *Gleditschia triacanthos*, have a porous belt of spring wood, the autumn wood being firmer, with few pores. Another group is marked by having the pores arranged in wavy, concentric, or oblique lines. *Cytisus Laburnum*, *C. alpinus*, and *Cercis Siliquastrum*, a small tree with cordate leaves and pink flowers of the Mediterranean region (cultivated at Kabul as *Arghawan*, J. L. Stewart), have a belt of larger pores in the spring wood, while those of the autumn wood are arranged in concentric and oblique wavy lines and patches. *Ulex europæus*, the common Furze, has all pores in oblique belts, forming a network of rhomboid meshes. *Tamarindus indica* has a similar structure, but no distinctly marked annual rings.

FOREST FLORA

OF

NORTH-WEST AND CENTRAL INDIA.

ORDER I. DILLENiaceæ.

TREES or shrubs, rarely herbs, not aromatic, with simple alternate leaves and dilated petioles, or more rarely with deciduous stipules. Sepals 5, persistent, imbricate. Petals hypogynous, 5 or 4, imbricate, deciduous. Stamens hypogynous, numerous, in many series. Anthers dehiscing longitudinally or by terminal pores. Carpels one or more, free, or cohering with the axis. Seeds solitary, few, or many, albuminous; albumen fleshy; embryo minute. In most genera, but not in *Dillenia*, the seeds are arilate.—Gen. Pl. i. 10; Royle Ill. 58; Wight Ill. i. 6.

1. DILLENIA, Linn.

Trees with large penniveined leaves, lateral nerves prominent; leaves generally approximate at the end of branches, leaving large scars when they fall. Flowers large, bisexual, solitary or fascicled, yellow or white. Petals 5. Anthers linear, bursting at the top by small slits or pores. Carpels 5 to 20, cohering in the axis; styles as many as ovaries, spreading. Fruit globose, enclosed in the thickened calyx.

Flowers white; seeds pilose	1. <i>D. indica</i> .
Flowers yellow; seeds glabrous.	
Flowers fascicled; leaves oblong-lanceolate	2. <i>D. pentagyna</i> .
Flowers solitary; leaves obovate	3. <i>D. aurea</i> .

1. *D. indica*, Linn.; Wight Ic. t. 823; Bedd. Fl. Sylv. t. 103; Hook. Fl. Ind. i. 36.—Syn. *D. speciosa*, Thunb.; Roxb. Fl. Ind. ii. 650; W. & A. Prodr. 5. Vern. *Chulta*, Beng.; *Mota Karmal*, Mahr.; *Tha-byulen*, Burm.

Leaves oblong-lanceolate, 8-10 in. long, deeply and sharply serrate, with numerous parallel stout ribs ending in the points of the serratures, coriaceous, hard when old. Petioles 1-1½ in. long, channelled and sheathing. Flowers with the leaves, solitary, large, sometimes 9 in. across, odorous. Sepals concave, thick and fleshy, edge thin and membranous. Petals oblong, waved, white. Outer stamens erect, inner longer, recurved.

Ovaries 20. Fruit large, 3 to 4 in. diam., hard outside, fleshy inside, with numerous reniform seeds embedded in a pellucid, glutinous pulp.

Wild along the base of the Himalaya from Nepal to Assam, in Bengal, South India, Ceylon, Burma, and the Malayan Peninsula; cultivated in most parts of India. Evergreen; fl. June, July, fruit ripens Feb.

A middle-sized tree, with a short erect bulky trunk, branches spreading into a broad rounded shady head. Bark of the trunk and larger branches about $\frac{1}{2}$ inch thick, coarse and brittle, internally reddish brown, outer surface grey, shining, rugose, with many small cracks and exfoliating scales.

Sapwood white; heartwood light brown or pinkish white, close and smooth-grained, with numerous medullary rays close together, as many as 15 to 20 or the quarter-inch, and large distinct annual rings. Weight of cub. ft. 41-42 lb. Made into gunstocks and helms, and in some places used in the construction of houses and ships. The rough old leaves, like those of other species of *D.*, are employed to polish ivory and horn; the fleshy leaves of the calyx, which surround the ripe fruit, have an agreeable acid taste, and are eaten raw or cooked in curries, or made into sherbet. A palatable jelly is made from them.

2. *D. pentagyna*, Roxb. Cor. Pl. t. 20; W. & A. Prodr. 5; Bedd. Fl. Sylv. t. 104, Hook. Fl. Ind. i. 38.—Syn. *D. angusta* and *D. pilosa* Roxb. Fl. Ind. ii. 652. *Colbertia coromandeliana*, D.C. Vern. *Aggai* Oudh; *Kullai*, C.P.; *Zimbyūn*, Burm.

Leaves oblong-lanceolate, decurrent into short sheathing petioles, very large, 1-2 ft. long, longer on shoots and young trees, denticulate, with numerous parallel ribs, silky-downy when young, smooth and shining when old. Flowers before the leaves, sweet-scented, on slender pedicels in loose fascicles on tuberosities along 2- or 3-year old branches, about 1 inch across or less. Sepals ovate-obtuse. Petals oblong, yellow. Outer stamens erect, inner longer spreading. Ovaries 5. Fruit pendulous, size of a gooseberry, the fleshy leaves of the calyx enclosing 5 small capsules which contain a soft transparent gluten. Seeds few.

Along base of Himalaya from Oudh to Assam. In Bengal, Central India, South India, and Burma. Sāl forests of Oudh, and the Central Provinces on low flat ground, not on the hills. Sheds its leaves in March and April, comes into flower soon afterwards. Fruit ripens in May.

A moderate-sized tree in North and Central India, with an erect trunk 4 ft. girth, and straggling long ascending branches, with drooping ends. A stately tree in the south. Bark of smaller branches grey, shining, subrugose, of the trunk about $\frac{1}{2}$ inch thick, compact, brittle, internally red, externally grey or pale brown, smooth, but with shallow depressions of irregular shape caused by the exfoliation of the outer layers.

Wood hard, fibrous, porous, tough and strong, heavy and durable. Not easy to work, apt to warp and crack. Weight 45-48 lb. Used for construction and shipbuilding, for rice-mills; the leaves are laid under grass thatch, and are used as plates. Flower-buds and young fruit have a pleasant acid flavour, are eaten, raw or cooked, in Oudh and Central Provinces; the ripe fruit also eaten.

3. *D. aurea*, Smith; Hook. Fl. Ind. i. 37.—Syn. *D. ornata* Wall. Pl. As. Rar. t. 23. Vern. *Chamaggai*, Oudh; *Dheugr*, Nepal; *Byūden*, Burm.

Leaves on deep-channelled sheathing petioles, oblong or obovate 9-15 in. long, remotely crenulate, the ends of the parallel side-ribs promi-

ment; when young, softly hairy or rufous silky on both sides; when old, glabrous above and pubescent beneath. Flowers before the leaves, solitary, at the end of short lateral branchlets, with ovate bracts at base of peduncle, 2-3 in. across. Sepals oblong, obtuse, concave, fleshy, with thin ciliated margins, at last reflexed, with long silky hairs on the back. Petals yellow, obovate from a narrow base. Stamens numerous, the inner longer spreading or recurved. Ovaries 6-12. Fruit on thick pilose peduncle, enclosed by fleshy calyx, size of a small apple. Seeds several, glabrous in a viscid pulp.

Northern Oudh forests; Burma. Sheds its leaves in February; the new foliage begins to show in April, generally after the numerous fine golden flowers.

A small tree in Oudh, rarely over 2 ft. girth, and 20 ft. high; in Burma a large handsome tree. Bark of trunk about $\frac{1}{2}$ inch thick, reddish, compact, internally viscid, externally whitish, ashy, or brown, quasi tessellated by longitudinal and transverse cracks into subquadrangular scales, which eventually exfoliate. Heart- and sap-wood not distinct, close and hard. Weight, 45 lb.

ORDER II. MAGNOLIACEÆ.

Trees or shrubs, often aromatic, with convolute deciduous stipules and alternate leaves. Flowers often large, trimerous. Sepals and petals usually similar, in 2-7 whorls of 3, imbricate, deciduous. Stamens numerous, free, inserted on the torus; anther-cells adnate to connective. Ovaries numerous, often spirally arranged on the elongated torus. Ovules 2 or more on the ventral suture. Seeds with an abundant albumen, and minute embryo.—Gen. Plant. i. 16; Royle III. 58; Wight III. i. 9.

1. MICHELIA, Linn.

Trees with shining leaves; buds enveloped in the convolute stipules. Flowers bisexual. Sepals and petals conform, 9 or more, in 3 or more series. Gynophore stalked. Filaments flat. Anthers introrsely adnate. Carpels numerous, spirally arranged on an elongated conical torus, each with 3 or more ovules. Fruit a loose spike of coriaceous, 2-valved, 1-12 seeded carpels; seeds with a fleshy outer testa.

1. *M. champaca*, Linn.—Tab. I.—Roxb. Fl. Ind. ii. 656; W. & A. Prodr. 6; Hook. Fl. Ind. i. 42.—Syn. *M. aurantiaca*, Wall. Pl. As. Rer. t. 147. *M. Doltsopa*, Ham.; Wall. Tent. Fl. Nep. t. 3. Sans. *Champakā*. Vern. *Chamba*, *Champa*.

Leaves petiolate, ovate-lanceolate, acuminate, 8-10 in. long, strongly reticulated, shining and glabrous above, pallid, more or less pubescent beneath when young, glabrate afterwards. Flowers axillary, each with a deciduous, coriaceous, cinereous bract. Sepals and petals 15-20, the outer obovate, the inner narrow-linear, yellow or orange, with dark longitudinal veins. Capsules sessile on an elongated stalk, orbicular or broadly oval, opening on the back in two thick valves, dark-coloured, with large white round specks. Seeds 1-12, oval, compressed, brown, about the size of a small pea.

Cultivated in the outer Himalays as far as the Rāvi (up to 3000 ft., at Almora to 5400 ft.), occasionally in Bandelkhand and the C.P.; on Mt. Abo, commonly in Bengal and South India (3000-5000 ft.) Evergreen. Flowers appear at various seasons, chiefly about May; seeds ripen in Nov. and Dec.

A handsome tree, in favourable localities from 60 to 100 ft. high, with a straight trunk 7 to 9 ft. in girth, branches ascending and spreading, forming a close, shady, oval head. Bark of younger branchlets with callous whitish points on a yellowish ground, of the trunk and older branches about $\frac{1}{2}$ inch thick, inside greyish or reddish brown, outside light cinereous. Sapwood whitish, heartwood glossy, olive or dark brown, often beautifully mottled, coarse-grained, brittle, with numerous fine medullary rays, more than 30 in the quarter-inch, and distinct annual rings; prized for furniture, polishes well; used in Kamaon and Nepal for housebuilding, in the Peninsula for carriage-work, verandah posts, and made into drums. Planted at Hindoo shrines; flowers prized on account of their sweet scent.

ORDER III. ANONACEÆ.

Trees or shrubs, with alternate, simple, entire, exstipulate leaves. Flowers bisexual, rarely unisexual. Sepals 3, free or connate, usually valvate. Petals 6, hypogynous, biseriate, usually valvate in the following genera, the 3 inner sometimes wanting; deciduous. Stamens numerous; filaments short or none; anthers adnate, 2-celled, commonly extrorse. Ovaries usually numerous, 1-celled; style short or stigma sessile. Fruit of one or more 1- or many-seeded carpels, dry or succulent, often stalked, rarely united into a fleshy fruit (*Anona*). Seeds large, with a ruminant albumen; embryo small.—Gen. Pl. Ant. i. 20; Royle Ill. 59; Wight Ill. i. 15.

Petals not conform to sepals.

Ripe carpels distinct, one-seeded.

Ripe carpels confluent into a succulent many-seeded fruit.

Outer petals conform with the sepals, carpels 1-many-seeded.

Inner petals flat; ovules 1-4.

Inner petals saccate at base; ovules numerous.

1. POLYALTHIA.

2. ANONA.

3. MILIUSA.

4. SACCOFETALUM.

1. POLYALTHIA, Blume.

Flowers usually bisexual. Sepals 3, short. Petals 6, longer than sepals. Stamens indefinite, short, cuneate, closely crowded on a convex torus, anther-cells concealed by the overlapping connectives. Ovaries numerous, terminating in short thick styles; ovules 1-2. Fruit consisting of one or numerous one-seeded carpels, dry or fleshy, on long stalks, inserted on the pubescent or tomentose torus.

Glabrous; leaves lanceolate, acuminate; flowers fascicled, petals equal.

Pubescent; leaves oblong, obtuse or acute; flowers solitary; petals unequal, pubescent; stalks twice the length of berries.

Pubescent; leaves oblong-lanceolate, acuminate; flowers solitary or 2-3; petals equal, thick, glabrous; stalks more than twice the length of berries.

1. *P. longifolia*.

2. *P. ruberona*.

3. *P. cerasoides*.

1. *P. longifolia*, Benth. & H. f.; Hook. Fl. Ind. i. 62; Bedd. Fl.

Sylv. t. 38.—Syn. *Guatteria longifolia*, Wall. ; W. & A. Prodr. 10 ; Wight Ic. f. 1. *Uvaria longifolia*, Lam. ; Roxb. Fl. Ind. ii. 664. Sans. *Devadāru*. Vern. *Asok*, *Asokan*, *Debduri*, *Deviduri*.

A large glabrous tree ; leaves on short petioles, long-acuminate, undulate, 5 to 8 in. long, pellucid-dotted, glabrous, shining. Flowers numerous, yellow green, on long slender pedicels, umbellate on short, leafless, tuberculate branchlets. Sepals broad-ovate. Petals equal, linear-lanceolate from a broad base. Carpels ovoid, $\frac{3}{4}$ in. long, on stalks about $\frac{1}{2}$ in. long.

Indigenous in Ceylon ; commonly planted in avenues along roads in Bengal and South India ; occasionally in North-West India, as far as Hushiarpur. A tall, handsome, shady tree, with a fine straight trunk, attaining a girth of 6 ft. and a height of 50 ft., with a close symmetrical head. Evergreen ; flowers between February and May ; the seed ripens in July and August. Wood whitish yellow, fairly close and even-grained. The cubic foot weighs between 30 and 40 lb.

2. *P. suberosa*, Benth. & Hook. f. ; Hook. Fl. Ind. i. 65 ; Bedd. Ic. Pl. Ind. Or. t. 56.—Syn. *Uvaria suberosa*, Roxb. ; Cor. Pl. t. 34 ; *Guatteria suberosa*, Dun. ; W. & A. Prodr. 10. Vern. *Bara Chali*, Beng.

A shrub or small tree ; leaves bifarious, nearly sessile, 2-5 in. long, oblong, obtuse or acute, glabrous, pubescent beneath when young. Flowers pubescent, small, greenish white, on long slender pedicels, with a linear bract below the middle, mostly solitary, rarely two, on short woody tubercles. Sepals small, triangular. Petals unequal, the three outer ovate, $\frac{1}{4}$ in. long, 2-3 times the length of sepals, the three inner oblong $\frac{1}{2}$ in. long. Carpels dry, numerous, globular, size of a pea, on stalks about twice their length.

Oudh forests (not common), Bengal, South India. Evergreen ; flowers throughout the year, but chiefly in April and May ; the seed ripens in Feb and March. A large shrub or small tree. Bark of trunk and branches often with a thick rough cork layer. Wood close, hard, tough, and durable, weighs about 40 lb. per cubic ft.

3. *P. cerasoides*, Benth. & Hook. fil. ; Hook. Fl. Ind. i. 63 ; Bedd. Fl. Sylv. t. 1.—Syn. *Uvaria cerasoides*, Roxb. Corom. Pl. t. 33 ; Fl. Ind. ii. 666 ; *Guatteria cerasoides*, Dun. ; W. & A. Prodr. 10. Vern. *Hoom*, Bombay.

A moderate-sized or large tree. Leaves distichous, short-petiolate, 4-7 in. long, oblong-lanceolate, acuminate, glabrous above, pubescent beneath, with long soft hairs ; main lateral nerves 6-8 pair, prominent beneath, with shorter intermediate nerves. Flowers greenish white, on pedicels $\frac{1}{2}$ -1 in. long, solitary, or 2-3 on short, lateral, woody branchlets, occasionally with 1 or 2 small leaves. Sepals broad-ovate, acuminate, pubescent. Petals lanceolate, thick, glabrous, $\frac{1}{2}$ in. long. Berries numerous, dark red, $\frac{1}{4}$ in. diam., stalks slender, $\frac{3}{4}$ in. long.

South India, Western Ghats, Behar. Flowers Feb. to May. Evergreen. Wood prized on the Western Ghats, where the *Hoom* is an important tree of the evergreen forests in the Sattara district.

2. **ANONA**, Linn.

Flowers bisexual. Sepals 3, small, valvate. Petals 3 or 6. Stamens indefinite, crowded round a hemispherical torus, top of connective ovoid, overtopping the cells. Carpels united into a large fleshy fruit, with numerous seeds embedded in a soft pulp.

1. *A. squamosa*, Linn.; Hook. Fl. Ind. i. 78; Bot. Mag. t. 3095. — *Custard-apple* (*Sweet-sop* or *Sugar-apple* in America). Vern. *Ata*, Bengal; *Sharifa*, *behl*, North-West; *Sita phal*, Bandelkhand.

Leaves petiolate, oblong or oblong lanceolate, 2-3 in. long, glaucous beneath, pellucid-dotted, with a peculiar heavy smell. Flowers solitary or in pairs, on pedicels as long as the flower, inserted on short, leafless, terminal or extra-axillary branchlets. Sepals triangular, acute, united at base. Petals, 3 exterior an inch long, lanceolate, triquetrous, thick and fleshy; 3 interior minute or wanting. Fruit large, from 2 to 4 inches across, yellowish green, embossed with prominent oblong, obtuse, adnate scales, filled with as many pulpy cells as there are united carpels, some abortive, the rest one-seeded, all radiating from the central conical torus, from which, when ripe, the pulp readily separates. Seeds oblong, deep brownish black, with a pale swelling at the hilum.

Indigenous in the West Indies, but completely domesticated over a great part of India; cultivated as far north as Gurdaspur in the Panjab. Almost wild in Central Provinces and Bandelkhand (near old forts), and in swamps near Burmdeo in the Kamaon Bhabar.

A shrub or small tree with an erect short trunk. Nearly evergreen in the Panjab; the new leaves appear about March. Flowers in the hot season; the fruit ripening from July to Oct. Chiefly valued for its fruit; seeds acrid, fatal to insects.

Other species cultivated in India: *Anona muricata*, L.; *Sour-sop*; *Anona reticulata*, L.; *Bullock's-heart* or *Custard-apple* of the West Indies.

3. **MILIUSA**, Leschenault.

Flowers bisexual or diœcious. Sepals 3, small. Petals 6, 3 outer minute, conform to the sepals, 3 inner much larger; aestivation valvate. Stamens loosely imbricated on a cylindrical torus; anthers exserted, distinct, attached to a thick connective which scarcely overtops the cells. Ovaries numerous, style oblong; ovules one or two, rarely more.

1. *M. velutina*, H. f. & Th.—Tab. II.—Bedd. Fl. Sylv. t. 37; Bedd. Ic. Pl. Ind. Or. t. 87; Hook. Fl. Ind. i. 87.—Syn. *Uvaria villosa*, Roxb. Fl. Ind. ii. 664. Vern. *Gidar-rûkh*, *gûrya*, *goâ-sâl*, *dom-sâl*, N.W.P.; *Bari Kâri*, *Kujrauta*, *Kharrei*, Oudh; *Kâri*, C.P.; *Thabutgyi*, Burm.

Young branches, leaves, and flowers densely tomentose. Leaves on short petioles, ovate or oblong with cordate base, softly tomentose or pubescent on both sides, softly ciliate, 3 to 6 inches long. Flowers greenish yellow, on slender pedicels 2-4 in. long, in lax 3- to 6-flowered racemes on peduncles $\frac{1}{2}$ -1 in. long. Sepals and 3 outer petals small, ovate; 3 inner petals three times their length, broad-ovate, outside densely tomentose,

inside smooth, dark brown. Fruit consisting of a number of black dry berries, $\frac{1}{2}$ in. long, 1- or 2-seeded, on short stalks.

Burma, Bengal, Orissa, Northern Circars, Central Provinces, Oudh. Along the base of the Himalaya to the Gauges, ascending to 1500 ft. Deciduous; bare of foliage for great part of the hot weather, the new leaves appearing in April. Flowers from March to May; the fruit ripens in June and July, remaining long on the tree.

A middle-sized tree, with an erect short trunk to 4 ft. girth; in Burma a large tree. Bark of trunk nearly 1 inch thick, rough with cracks, and tessellated in subquadrangular, thick, grey, exfoliating scales. Heart- and sap-wood not distinct, sulphur yellow when fresh, light brown when old, with shining, hard, medullary rays. The seasoned wood weighs from 40 to 50 lb. per cubic foot; easily worked and durable, but liable to warp; used for small beams, cart-poles, yokes, agricultural implements, spear-shafts, and oars.

4 SACCOPETALUM, Bennett.

Trees. Flowers bisexual. Sepals 3, small, valvate. Petals 6, valvate in 2 series; the 3 outer small, conform to the sepals; the inner much larger, saccate at the base, erect or conniving. Stamens loosely imbricate round a subglobose torus; anthers extrorse, distinct, adnate to a thick connective, which overlaps the cells. Ovaries numerous, ovules 6 or more.

1. *S. tomentosum*, H. f. & Th.; Hook. Fl. Ind. i. 88.—Syn. *Uvaria tomentosa*, Roxb. Cor. Pl. t. 35, Fl. Ind. ii. 667, W. & A. Prodr. 8. Vern. *Karri*, Oudh; *Huon*, Bombay.

A large tree. Young shoots clothed with soft silky tomentum. Leaves elliptic or ovate-oblong, 6-12 in. long, on short petioles barely $\frac{1}{4}$ in. long, pubescent beneath, nearly glabrous and somewhat rough above. Flowers greenish yellow with a broad streak of brown, in leaf-opposed or subterminal 2-4-flowered cymes, on short peduncles, $\frac{1}{4}$ in. long. Pedicels slender, 2-3 in. long. Sepals and outer petals nearly equal, lanceolate, $\frac{1}{2}$ in. long, inner petals ovate-oblong, obtuse, $\frac{3}{4}$ in. long. Flowers and pedicels clothed with soft silky down. Carpels purple, tomentose, 3 or more, globose, 1 in. diam., 3-4-seeded, on stalks $\frac{1}{2}$ in. long.

Oudh forests, Nepal Terai adjoining Oudh, Goruckpur, Behar, Orissa. Evergreen forests of the Western Ghats. Leaves are shed in March, turning orange yellow before falling, renewed April, flowers with the young leaves. Fruit June.

In Oudh attains 50 ft. with an erect short trunk, 5-6 ft. girth, often gnarled and knotty from lopping. Bark 1 in. thick, brown or black, cracked and furrowed. Wood yellow, like that of *Narclea cordifolia*, cracks in seasoning; used (in Oudh) for huts and cattle-sheds; reckoned as a good timber on the Western Ghats, where it is called by the same name as *Polyalthia cerasoides*, which, however, has one seeded berries. Leaves used as cattle-fodder.

S. longiflorum, H. f. & Th.; Hook. Fl. Ind. i. 88. Eastern Bengal. Has solitary flowers on short pedicels $\frac{1}{2}$ in. long, and long pointed petals $1\frac{1}{2}$ in. long.

ORDER IV. MENISPERMACEÆ.

Climbing or twining, rarely erect shrubs. Leaves alternate, entire or lobed, usually palminerved, exstipulate. Flowers small, diceious or poly-

gamous. Sepals commonly 5, free, the outer 3 often minute. Petals commonly 6, or wanting. Male flowers: stamens commonly 6, opposite to petals, rarely fewer or more; anthers 2-4-celled, frequently extrorse or dehiscent laterally. Female flowers: carpels free, distinct, 3, rarely 1 or more than 3; ovules solitary. Ripe carpels generally drupaceous, the seed enclosed in the woody or coriaceous endocarp, usually curved or reniform, with or without albumen, the radicle pointing towards the scar of the style, which is often near the base of the fruit.—Gen. Pl. i. 30; Royle III. 61; Wight III. i. 19.

- Sepals 6; anthers sessile on a stout central column; drupes subglobose on a stout 3-fid gynophore; style near the base; endocarp hard, woody. 1. *ANAMIRTA*.
 Sepals 6; stamens free; ovaries 3-12. 2. *TINOSPORA*.
 Drupes with scar of style near the apex, anthers bilocular, dehiscent longitudinally. 3. *COCCULUS*.
 Drupes with scar of style near the base. 4. *TILIACORA*.
 Dry fruit circular, compressed, strongly tubercled, anthers 4-lobed, dehiscent transversely. 5. *CIPSAMPELOS*.
 Dry fruit obovate-oblong, not tubercled, anthers 2-lobed, dehiscent longitudinally.
- Male flower sepals 4, petals connate into a 4-lobed cup; stamens monadelphous; female flowers in the axils of large leafy bracts; drupes with scar of style near the base, dry fruit circular, strongly tubercled.

1. *ANAMIRTA*, Colebrooke.

1. *A. Cocculus*, W. & A. Prodr. 446.—Syn. *Menispermum Cocculus*, Linn.; Roxb. Fl. Ind. iii. 807. Vern. *Kakmāri*.

A glabrous climbing shrub, bark corky. Leaves coriaceous, cordate or ovate, blade 4-8 in. long, petiole 2-6 in. Flowers greenish, in long pendulous panicles. Sepals 6, with two small adpressed bracts; petals none. Anthers numerous, 2-celled, on the top of a thick central column. Carpels 3 on a stout trifid gynophore $\frac{1}{2}$ in. long. Drupes subglobose, $\frac{1}{2}$ in. diam., black, glabrous. Seed globose, enclosing the intruded endocarp.

South India, Eastern Bengal, Oudh forests (R. Th., but I have not seen specimens). The *Cocculus* berries are bitter, used in India to intoxicate and poison fish, and in England to adulterate beer.

2. *TINOSPORA*, Miers.

1. *T. cordifolia*, Miers; Hook. Fl. Ind. i. 97.—Syn. *Cocculus cordifolius*, DC.; W. & A. Prodr. 12; Wight Ic. t. 485, 486. *Menispermum cordifolium*, Willd.; Roxb. Fl. Ind. iii. 811. Vern. *Butindu*, Pb.; *Gulwail*, Bombay.

A glabrous, climbing, succulent shrub, bark corky. Leaves cordate, acute or acuminate, blade 2-4 in. diam., petiole $1\frac{1}{2}$ -3 in. Flowers small yellow, in long slender racemes, male flowers fascicled, female flowers usually solitary. Sepals 6. Petals 6, half the length of sepals, wedge-shaped. Filaments 6, thick, clavate, the 2 anther-cells obliquely adnate to the top. Ovaries 3. Drupes 1-3, red, succulent, plane-convex,

size of a small cherry, with glutinous pulp, scar of style near the top. Endocarp kidney-shaped, albumen ruminant.

Common in hedges in most parts of India. Fl. H.S.R.S. Long filiform roots from the branches. Used in native medicine. Sold in the bazaars as *Gulo*, Pb.; *Gulo*, Bombay; *Guluncha*, Bengal.

3. COCCULUS, DC.

Male flowers: sepals 6, biseriata; petals 6, shorter than sepals, concave, embracing the stamens; anthers terminal, subglobose. Female flowers: sepals and petals similar to those of male flowers, stamens sterile or none, carpels 3. Drupes circular, compressed, generally 3, scar of style on the inner side near the base, endocarp tuberculate, horseshoe-shaped.

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| A small tree; leaves lanceolate, glabrous; flowers in long axillary panicles | 1. <i>C. laurifolius</i> . |
| A climbing shrub; leaves glabrate, linear oblong or trapezoid; flowers axillary, male sessile fascicled, female solitary short-pediculate | 2. <i>C. Leaba</i> . |
| A climbing shrub; leaves villous, ovate oblong, male flowers in short panicles, female 1-3 on short axillary panicles | 3. <i>C. villosus</i> . |

1. *C. laurifolius*, DC.; Hook. Fl. Ind. i. 101.—Syn. *Menispermum laurifolium*, Roxb. Fl. Ind. iii. 815. Vern. *Parura*, Pb.; *Tilpara*, *hakra*, *dāl chām*, N.W.P.

Leaves lanceolate, 3-5 in. long, short-petiolate, entire, 3-nerved, coriaceous, shining, dark green when young, light green when old, paler beneath. Flowers numerous, small, in long branched panicles, axillary or in the axils of fallen leaves; axis of panicle frequently bearing 1 or 2 leaves.

Outer Himalaya from the Ravi to Nepal, ascending to 5000 ft. An erect shrub, often a considerable tree, with a short, erect, straight trunk, spreading branches, and fine shining bright-green foliage.

2. *C. Leaba*, DC.; Hook. Fl. Ind. i. 102.—Syn. *C. glaber*, W. & A. Prodr. 13. Vern. *Vallūr*, *illar*, *billar*, Pb.

A climbing shrub, often with a stem 3-4 ft. girth; branchlets pubescent. Leaves glabrate or glabrous, oblong or trapezoid, entire or lobed, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long. Male flowers on short pedicels, in axillary panicles; female flowers solitary, on slender axillary peduncles $\frac{1}{4}$ in. long. Drupe $\frac{1}{8}$ in. diam.

Dry and arid regions of India. Panjab, Sindh, Dekkan, Afghanistan, Arabia. Dry regions of Africa. Fl. throughout the year.

3. *C. villosus*, DC.; Hook. Fl. Ind. i. 101.—Syn. *Menispermum hirsutum*, Linn.; Roxb. Fl. Ind. i. 814. Vern. *Kārsūne*, Oudh.

A climbing undershrub; branchlets, leaves, and inflorescence villous with greyish tomentum. Leaves ovate or ovate-oblong, obtuse, often mucronate, 1-3 in. long. Male flowers in axillary panicles, 1-1 $\frac{1}{2}$ in. long, often with 1 or 2 leaves. Female flowers 1-3 on axillary pedicels $\frac{1}{4}$ - $\frac{1}{2}$ in. long. Drupes 1-3, dark purple, $\frac{1}{8}$ in. diam.

Common in the plains and lower hills of most parts of India. Tropical Africa. Fl. Feb., March. The juice of the ripe berries makes a durable bluish-purple ink. The leaves rubbed in water thicken into a green jelly. Roots and leaves used in native medicine.

4 TILIACORA, Colebrooke.

1. *T. racemosa*, Colebrooke; Hook. Fl. Ind. i. 99.—Syn. *Cocculus acuminatus*, W. & A. Prodr. 12. *Menispermum polycarpon*, Roxb. Fl. Ind. iii. 816. Vern. *Tilukoru*, Beng.; *Karicant*, *Kurrauth*, *rangoe*, Oudh.

A large climber, with entire, coriaceous, glabrous, ovate, acuminate leaves, blade 3-6 in., petiole 1 in. long. Fl. yellow, dioecious or polygamous, in axillary raceme-like panicles 6-12 in. long, with branches 1 in. long, bearing either one female, or 3-7 male flowers. Sepals 6, in two series, the outer much smaller. Petals 6, minute. Stamens 6, ovaries 3-12, styles short. Drupes 3-12, compressed, obovoid, $\frac{1}{2}$ in. long, stalked, style-scar near the base, endocarp thin, crustaceous. Seed hooked, albumen oily, ruminant. Cotyledons linear, fleshy.

Oudh forests, Bengal, Orissa, Concan, Ceylon. Fl. most part of the year. Fruit ripe March. Evergreen, enveloping the tallest forest-trees in its dense dark-green foliage. The long flexible branches are used for thatching and basket-work.

5 CISSAMPELOS, Linn.

Mostly climbers with peltate leaves. Male flowers cymose, tetramorous petals connate into a 4-lobed cup. Stamens monadelphous, anthers united into a peltate disc, dehiscing round the margin. Female flowers racemose, crowded in the axils of large leafy bracts; perigonium of 1 or 2 lateral scales. Carpel one with a short trifid or tridentate style. Drupe circular, style-scar near the base; endocarp horseshoe-shaped, compressed, tubercled on the back. Seed curved.

1. *C. Pareira*, Linn.; Hook. Fl. Ind. i. 103.—Syn. *C. convolvulacea*, Willd.; W. & A. Prodr. 14; Roxb. Fl. Ind. iii. 842. Vern. *Katori*, *par-bik*, *patuki*, *tikri*, Ph.; *Dakh-nirbisi*, N.W.P.; *Harjeeri*, Oudh.

A climbing undershrub, with a short stem, throwing out long herbaceous twining branches, generally covered with grey tomentum. Leaves peltate, broad-ovate or reniform. Male flowers in axillary usually branched, and corymbose racemes, with few small bracts. Female flowers on elongate, generally simple racemes, with numerous, broad, alternate, foliaceous bracts, and several 1-flowered pedicels in their axils.

Common in most parts of India, in the north-west, along the foot of the Himalaya, as far west as the Jhelum river, but not in the arid parts of the Panjab and Sind. Fl. March-Oct. Leaves and root used medicinally. A plant of very wide distribution. Also in tropical America, where it yields the *Radix Pareira* of druggists, and in tropical Africa.

The structure of the wood of Menispermaceæ is remarkable, and differs in several respects from the wood of other dicotyledons. The vascular bundles of a young branch (which in most dicotyledons unite and form concentric

rings of wood and liber) generally remain distinct in Menispermaceæ, and are separated by broad radial masses of cellular tissue, corresponding to the medullary rays of ordinary wood. After some time these original wood fascicles cease growing, and in the cortical cellular tissue exterior to the liber originates a second circle of bundles, similar to the first formed, excepting in the absence of spiral vessels. After these bundles have attained full development, they in turn cease to grow, and a third circle forms in the cellular tissue of the bark, and so on. There is great variety in the wood structure of the genera of this family.

ORDER V. BERBERIDEÆ.

Usually shrubby, sometimes climbing, glabrous plants. Leaves simple or compound, stipules rare. Sepals and petals free, hypogynous, very caducous, usually trimerous, 2-4-seriate. Stamens hypogynous, 4-6 (rarely 8), opposite the petals, anthers adnate, erect, dehiscing by 2 revolute or ascending valves or by lateral or dorsal slits. Carpels 1-3, rarely more, oblong, ovules usually indefinite. Seeds with a copious, dense albumen. — Gen Pl. i. 40; Royle III. 62; Wight III. i. 22.

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| Erect shrubs; flowers bisexual; one carpel | 1. BERBERIS. |
| Climbing shrubs; flowers unisexual; carpels 3 | 2. HOLBOELLIA. |

1. BERBERIS, Linn.

Spiny shrubs with yellow wood, yellow flowers and fasciculate leaves, the leaves of elongate shoots often reduced to simple or 3-7-forked spines. Sepals 6, with 2-3 adpressed bracts, imbricate in 2 series. Petals 6, in 2 series, imbricate. Stamens 6, free, anther-cells opening by recurved valves. Stigma peltate, sessile, or on a short style. Fruit a berry with few seeds. Albumen fleshy, embryo straight.

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| Leaves simple, membranous or thinly coriaceous, not lacunose, serrate, serratures equal, cuspidate; stigma sessile | 1. <i>B. vulgaris</i> . |
| Leaves simple, obovate or oblanceolate, coriaceous, not lacunose, entire, or with large spinescent serratures; flowers on compound racemes; stigma small, on a short style | 2. <i>B. aristata</i> . |
| Leaves simple, narrow, lanceolate or oblanceolate, coriaceous, not lacunose, entire or spinose-dentate; flowers pale, small, on corymbose racemes; style distinct | 3. <i>B. Lycium</i> . |
| Leaves simple, obovate or orbicular, coriaceous, hard, lacunose, reticulate, entire; or with large, distant, spinescent teeth; flowers fasciculate or in short racemes; style distinct | 4. <i>B. asiatica</i> . |
| Leaves imparipinnate, leaflets 2-12 pair | 5. <i>B. nepalensis</i> . |

1. *B. vulgaris*, Linn.; Hook. Fl. Ind. i. 109; Hook. Stud. Fl. 13. — *Burberry*. Vern. *zirishk*, Pb.

An erect, spinous shrub. Leaves deciduous, membranous, or thinly coriaceous, serrate with equal spinulose teeth, generally fasciculate on short lateral branchlets, in the axil of a 3-7-forked, rarely simple spine, on a thick broad base. The leaves vary exceedingly from oblanceolate, cuneate, or obovate, to broadly ovate. Flowers in racemes, elongated or shortly corymbose, on the short leaf-bearing branchlets. Berry ovoid-oblong or ovoid, red or black when ripe, terminated by the broad sessile stigma.

Western Himalaya 8000-12,000 ft., eastward as far as Nepal, Western Tibet, Afghanistan, and Beluchistan, Europe, North and West Asia. Fl. March, April. The pleasantly acid berries of this and some of the following species are dried and imported from Afghanistan under the name of *zirishk-tursh* (sour currants).

B. Kunawarensis, Royle III. 64, may belong to this species.

2. *B. aristata*, DC.; Hook. Fl. Ind. i. 110.—Syn. *B. tinctoria*, Leschenault; W. & A. Prodr. 16; Wight Ill. t. 8. Vern. *Chitra*, *chotra*, *totar*, N.W.P. The following names probably apply to this and the two following species in the Panjab Himalaya: *Šimlu*, *simlu*, *kemal*, *kemlu*, *kamla*, *kusmal*, *kammal*, *tūtrān*, *chitra*.

An erect, spinous shrub. Leaves more or less persistent, coriaceous, obovate or oblanceolate, entire, or with few, large, distant, spinescent teeth, fasciculate on very short lateral branchlets, in the axil of a trifid or simple spine with a broad base. Flowers in compound racemes, pedicels often fasciculate. Berries often thickly covered with glaucous bloom, cylindrical, tapering into a short style terminated by a small subglobose stigma.

Outer Himalaya 6000-10,000 ft., from the Sutlej to Bhutan Mountains of South India and Ceylon. Fl. May-April. Hardy in England. The root of this and the two following species (*dārhabā*, *dārhab*), and the dried extract (*rasaut*, *rusot*, *rasul*), are used in native medicine, and highly prized in ophthalmia. The wood is used as fuel.

3. *B. Lycium*, Royle; Hook. Fl. Ind. i. 110.—Vern. *Kushmul*, N.-W.P.

A rigid, erect, spinous shrub; bark white. Leaves simple, narrow, lanceolate or oblanceolate, coriaceous, mucronate, generally entire, bright green above, glaucous beneath, with prominent, lax, reticulate veins, fasciculate on short tuberculate branchlets in the axils of trifid spines on a broad base. Flowers pale, small, on elongate racemes. Berries violet, ovoid; stigma capitate, on a distinct style.

Outer North-West Himalaya 3000-9000 ft., from Hazara to Garhwal. Fl. April. Chiefly employed in Simore and Garhwal for making *rusot* (Royle).

4. *B. asiatica*, Roxb. Fl. Ind. ii. 182; Hook. Fl. Ind. i. 110.

A stout, erect, spinous shrub; bark pale. Leaves simple, fasciculate, on short tuberculate branchlets, often $\frac{1}{2}$ in. long in the axils of short trifid spines, which are often wanting; obovate or orbicular, hard, coriaceous, white beneath, with strong reticulate venation, lacunose between the veins, subentire, or with large, distant, spinescent teeth. Flowers in short corymbose racemes. Berries large, ovoid or often subglobose, red or black, glaucous; stigma capitate on a distinct style.

Outer Himalaya 3000-7500 ft., Garhwal, Bhutan, Afghanistan. Parturath in Behar. Fl. March, April. The berries are eaten.

5. *B. nepalensis*, Spreng.; Hook. Fl. Ind. i. 109.—Syn. *B. Leachian-aubii*, Wall.; W. & A. Prodr. 16; Wight Icones t. 940. *Beluchiana Nepalensis*, DC. Vern. *Amūdanda*, *chiror*, Pb.

An evergreen shrub 3-6 ft. high. Leaves coriaceous, shining, imparipinnate, from 6-18 inches long. Petiole stiff, articulate at the insertion of the leaflets, broad-sheathing at the base, with 2 subulate stipules. Leaflets 2-12 pair, ovate or lanceolate, often falcate, spinous-serrate; the near pair—the base—often smaller and suborbicular. Upper leaves reduced to sheathing bracts. Flowers on long erect racemes, several together near the ends of branches. Bracteoles coriaceous, oblong or broadly ovate. Berry oblong or globose, dark blue or purple.

Outer Himalayan ranges, 6000-8000 ft., from the Ravi to Bhutan, Khasia hills, Burma, and the Nilgherries. Bark soft, corky, wood yellow, with fine medullary rays and light-coloured blotches between. The fruit is eaten.

2. HOLBOELLIA, Wall.

1. *H. latifolia*, Wall. Tent. Fl. Nep. t. 16. Hook. Fl. Ind. i. 108.

A climbing shrub; stem with corky bark, wholly glabrous. Leaves 3-9-foliolate, leaflets 3-6 in. long, petiolulate, ovate-lanceolate or linear, acuminate. Flowers monocious, in lateral sessile corymbs, purplish green, sweet-scented. Sepals 6, 2-seriate, the outer valvate. Petals 6, minute. Stamens 6. Ovaries 3; fruit of 1-3 many-seeded oblong berries 2-3 in. long.

Himalaya, Kamaon to Assam, ascending to 9000 ft. Khasia hills. Fl. April, May. *H. angustifolia*, Wall., ib. t. 17, is a variety with linear-lanceolate leaves.

ORDER VI. CAPPARIDÆ.

Herbs, shrubs, or trees, with alternate leaves. Flowers, with rare exceptions, bisexual. Sepals 4, rarely 3 or 5, free or connate. Petals generally 4. Stamens almost always more than 4, often indefinite, hypogynous, inserted at the base of a long or short gynophore; anthers 2-celled, versatile, generally on long slender filaments. Ovary often stipitate, style short or stigma sessile. Ovules indefinite on 2-6 parietal placentas. Fruit syncarpous, either more or less fleshy, or a dry, mostly elongated, capsule. Seeds in most cases without albumen; embryo incurved; cotyledons convolute or folded, rarely plane.—Gen. Plant. i. 103; Royle III. 72; Wight III. i. 38.

Spinescent shrubs or small trees; leaves simple; petals not clawed, imbricate in bud.

An unarmed tree; leaves trifoliolate; petals long clawed; open in bud.

1. CAPPARIS.

2. CRATÆVA.

1. CAPPARIS, Linn.

Shrubs, rarely trees, generally with stipular thorns, young parts often with caducous tomentum. Leaves simple. Sepals 4, usually free. Petals 4, sessile, imbricate. Stamens indefinite; filaments slender, filiform, inserted on the torus at the base of the long gynophore. Ovary stipitate, generally one-celled. Fruit stalked, with many seeds embedded in a soft or fleshy pulp.

Leaves linear, minute; older branches leafless; flowers brownish red

1. *C. aphylla*.

Leaves ovate or elliptic; flowers white or rose-coloured.

2. *C. spinosa*.

Flowers solitary, large; fruit 1-3 in. long

3. *C. horrida*.

Flowers 2-4, supra-axillary, large; fruit 1-1½ in. diam.

4. *C. sepiaria*.

Flowers corymbose, small; fruit ½ in. diam.

1. *C. aphylla*, Roth.—Tab. III.—W. & A. Prodr. 27; Hook. Fl. Ind. i. 174.—Syn. *Sodada decidua*, Forskal; *Capparis Sodada*, R. Br., Boissier Fl. Orient. i. 419. Vern. *Karil*, *Kari*, Pb. N.W.P.; *Kiral*, Sindh; *Sodāda*, Arab.

Glabrous. Leaves on young shoots only, caducous, sessile, linear-subulate, mucronate, ½ in. long, occasionally spatulate, varying to ½ in. long; stipules thorny, nearly straight, brown. Flowers brownish red or scarlet, corymbose, corymbs nearly sessile. Sepals unequal; the anterior outer sepal larger and deeply concave. Petals ovate, longer than sepals, scarlet. Stamens 8-20; filaments long, filiform. Ovary on slender gynophore as long as stamens; style subulate. Fruit globose or ovoid, ½-¾ in. diam.; red when ripe; on a gynophore 1 in. in length.

Common in dry places and on stony hills throughout the Panjab, Sindh, and Rajputana, Bandelkhand, the Central Provinces, Guzerat, the Dekkan, and occasionally as far south as Tinnevely. Flourishes in the driest deserts of North-West India, frequently associated with *Prosopis spicigera* and the *Salvadoras*. Extends westward as far as Arabia, Egypt, and Nubia.

New leaves on young shoots Nov. to March. Fl. March, April, sometimes as late as June; the bushes often crowded with the conspicuous brilliant scarlet blossoms.

Generally a scrubby bush, but under favourable circumstances a small tree, rarely 20 ft. high, with a short, erect trunk, often 4-5 ft., rarely 7-8 ft. girth. Branches numerous, divaricating, forming a depressed subglobose crown of dark-green colour; branches occasionally flattened into horny ribbons. Roots immense, spreading deep and wide. The natural reproduction and propagation of this tree should be studied; it is stated that it has never been raised by hand from seed or cuttings. Bark of trunk ½ inch thick, dark grey, furrowed with deep irregular longitudinal and diagonal cracks.

Wood with more or less distinct annual rings; whitish or light yellow, close-even-grained, tough, weighs about 54 lb. per cubic foot, when seasoned. It is bitter, and is not touched by white ants. Used for small beams and rafters in roofs (in Sindh for the knees of boats), for oil-mills and agricultural implements. As fuel, it answers well for brick-burning; for locomotives, it must be mixed with other wood. Burns off quickly with much flame, and leaves much ash.

The flower-buds (*pari*) are used as pickle in Sindh, the unripe fruit is cooked and eaten; both the ripe and unripe fruit are prepared with salt and pepper into a bitter-tasted pickle which is exported into Hindustan.

2. *C. spinosa*, Linn.; Hook. Fl. Ind. i. 173; Boissier Fl. Orient. i. 420.—Syn. *C. obovata*, Royle; Jacq. Voy. Bot. t. 21. *C. Murqayana*, Graham; Wight Ic. t. 379. *Caper plant*. Vern. *Kabbar*, Arab.; *Kabarra*, Afg.; *Kōbra*, Tibet; *Kaur*, *hiāri*, *kaleri*, *kanden*, *taker*, *ber*, *barāri*, *bauri*, *bassar*, Pb.; *Kalrūri*, Sindh.

Glabrous, but the young parts frequently covered with a white yellowish or greenish, soft, and caducous tomentum; armed with recurved or nearly straight stipular spines. Leaves petiolate, broad-ovate or obo-

vate, retuse or entire, mucronate, thick, glabrous or glabrate. Flowers large, 1-3 in. across, white, solitary, axillary, on a pedicel equal to or longer than the leaf. Sepals unequal, ovate, obtuse, concave. Petals obovate, unguiculate, undulate, longer than calyx, at first pure white, then pink and purplish-red as they fade. Stamens numerous, longer than petals; filaments slender, purple. Ovary on a slender filiform gynophore as long as stamens; nectariferous glands at the base of gynophore. Fruit oblong, 1-3 in. long, on a strong gynophore, bent downwards when ripe; opening irregularly by 3-4 valves, crimson inside. Seeds numerous, reniform. This species varies exceedingly in the size, shape, pubescence, and consistence of the leaves. One form (var. *galeata*) is found in Sindh, with glabrous, often glaucous, fleshy leaves; the anticonic sepal very saccate. Another (var. *leucophylla*) is found in the lower Himalayan valleys, floccose all over with white pubescence.

Panjab, Sindh, Guzerat, Mahableshwar, N.W. Himalaya, ascending to 12,000 ft. in the inner arid valleys. South Europe, North Africa, Western Asia. Time of flowering varies according to locality and elevation. In the Peshawur valley and the trans-Indus territory, it flowers from April to July, the fruit ripening about Nov.; in the inner Himalaya flowers from June to Oct.

A small trailing shrub on hot dry rocks and stony hills, with long green branches, a thick woody root, penetrating deep into the clefts of the rock. Strikingly handsome with its large flowers, long purple stamens, and the long-stalked ovary protruding from among them.

The flower-buds pickled are the capers of Europe, and might be prepared in India. The fruit is pickled and eaten in Sindh and the Panjab salt range. The leaves and ripe fruit are a favourite food of goats and sheep.

3. *C. horrida*, Linn. fil.; Wight Ic. t. 173; Hook. Fl. Ind. i. 178; W. & A. Prodr. 26.—Syn. *C. zeylonica*, Roxb. Fl. Ind. ii. 567. Vern. *Hir, karvili*, Pb.; *karrulica*, Oudh.

The entire plant when young covered with a dense ferruginous, caducous pubescence. Stipules laterally compressed, thorny, hooked. Leaves from elliptic-oblong to broadly ovate, mucronate. Pedicels supra-axillary, 2 to 4 in a vertical line, the uppermost flower opening first; flowers large, at first white, later rose-coloured. Stamens numerous, filaments long, filiform, purple. Gynophore as long as stamens. Fruit 1-1½ in. diam., globose or obovate, red when ripe, on a thick gynophore 1½ in. long.

Plains and lower hills in most parts of India, from the Panjab to Ceylon and Burma. Blooms from January or February to April; flowers often so numerous that the bush looks like a mass of white and rose colour. The fruit ripens after June, and remains on the plant for some time.

A scrambling shrub, found climbing at times to a great extent over the tallest trees. Wood used for fuel; the twigs, shoots, and leaves are greedily eaten by elephants and goats. In the Southern Panjab and Sindh the fruit is pickled.

4. *C. sepiaria*, Linn.; Roxb. Fl. Ind. ii. 568; W. & A. Prodr. 26; Hook. Fl. Ind. i. 177.—Vern. *Hün gurna* (crooked Carissa), Panjab.

Young parts pubescent. Stipules thorny, hooked. Leaves ovate or elliptic, occasionally emarginate, glabrate above, pubescent beneath. Flowers

small, $\frac{1}{2}$ inch across, on filiform pedicels, in many-flowered corymbs. Sepals oval, concave. Petals oblong, white, inequal. Stamens much longer than petals. Fruit a globose berry $\frac{1}{2}$ in. diam. on a short slender carpophore, one-seeded, black when ripe.

Here and there in the Panjab and the North-West. Common in the Peninsula, Burma, Ceylon, in the Andamans, Timor, and the Philippines. A middle-sized shrub, with numerous and strong branches, makes excellent hedges (Mysor, Coimbatore), easily raised from seed or from cuttings. Flowers May; fruit ripens about July.

2 CRATÆVA, Linn.

Trees; leaves trifoliolate. Sepals and petals inserted on hemispherical disc. Sepals 4. Petals 4, long-clawed, open in bud. Stamens numerous, filaments slender, filiform, free. Ovary on a long gynophore, with 2 placentas bearing numerous ovules. Stigma sessile.

1. *C. religiosa*, Forst.; Bedd. Fl. Sylv. t. 116; Hook. Fl. Ind. i. 172. —Syn. *C. Roxburghii*, R. Br.; W & A. Prodr. 23. *Capparis trifoliata*, Roxb. Fl. Ind. ii. 571. Sans. *Varana*, *varuna*, *setu*. Verr. *Brarna*, *Bilāsi*, *bila*, *biliāna*. (Kadatben, Burm.)

A moderate-sized tree. Leaves trifoliolate, clustered towards the ends of branches on common petioles 4 in. long, leaflets ovate lanceolate, acuminate, on articulate petioles. Flowers large, 2 inches across, on long filiform pedicels, in many-flowered corymbs, with centripetal expansion. Sepals 4, ovate, deciduous, inserted with the petals on the broad-lobed hemispherical disc. Petals 4, long-clawed, larger than sepals, limb roundish ovate. Filaments longer than petals, inserted above the disc on the base of gynophore. Fruit ovoid or globose, about the size of an apple, on a strong thick gynophore, partially bilocular, owing to the cohesion of the placentas, with many reniform seeds $\frac{1}{2}$ in. long, nestling in a yellow pulp. Rind hard, subligneous, rough, with numerous whitish specks.

Subhimalayan tract, extending west to the Ravi, ascending to 2000 ft. Bandelkhand, Rajputana, South India, Assam, Burma, and Ceylon. Low and shady places, particularly near banks of rivers. Cultivated throughout India, in the north-west to the Jhetum river. Fl. April, May, when the tree has a striking appearance, with its large, cream-coloured blossoms. The old leaves at times remain on the tree till the flowers appear, but usually the tree is bare for some time. The young leaves appear with and after the flowers. Attains 30 to 40 ft. and a girth of 6 ft. Bark dark grey, even and smooth, with long horizontal wrinkles. Pith large; wood yellowish white, with sometimes a pinkish tinge, even, close and smooth-grained. It is easy to work, fairly tough and durable, and not heavy. Used for drums, models, writing-boards, combs, boxes, and in turnery. In the Panjab the viscid pulp of the fruit is said to be mixed with mortar as a cement, and is also used as a mordant in dyeing.

ORDER VII. BIXINÆ.

Trees or shrubs, with alternate simple leaves. Stipules minute or none. Flowers regular, uni- or bi-sexual. Stamens usually hypogynous, indefinite, rarely definite. Anthers 2-celled, bursting by slits or pores. Torus often glandular, or expanded into a disc. Ovary syncarpous, free, gener-

ally, one-celled. Ovules parietal, generally numerous. Seeds with fleshy albumen; embryo axile, with broad foliaceous cotyledons.—Gen. Pl. i. 122; Royle III. 73; Wight III. i. 36, 38.

Flowers bisexual; petals large.

Seeds covered with cotton; leaves palmate 1. COCHLOSPERMUM.

Seeds naked; leaves entire 2. BIXA.

Flower dimorphic; petals none.

Ovary 2-8-celled; styles 2 or more. 3. FLACOURTIA.

Ovary 1-celled; style 1 4. XYLOSMA.

1. COCHLOSPERMUM, Kunth.

Flowers bisexual. Sepals 5, deciduous. Petals 5, contorted in bud. Stamens indefinite, inserted on a disc without glands; anther-cells opening with a short slit at the top. Ovary with numerous ovules on 3 to 5 parietal placentas. Style one, filiform; stigma toothed. Capsules 3-5-valved. Seeds numerous, cochleate; testa hard, woolly; embryo curved.

1. *C. Gossypium*, DC.; W. & A. Prodr. 87; Hook. Fl. Ind. i. 190.—Syn. *Bombax gossypium*, Linn.; Roxb. Fl. Ind. iii. 169. Vern. *Kūmbī*, N.W.P. *Gabdi*, Bandelkhand and Central Provinces.

A soft-wooded tree. Leaves alternate, large, near the ends of branches, on long thick petioles, palmately 5-lobed; lobes acuminate, grey-tomentose beneath; stipules linear, caducous. Flowers on terminal panicles, large, 3-4 in. across, bright yellow, rachis and pedicels covered with grey pubescence. Sepals broad-oval unequal, covered with a grey silky down, margin white-ciliate. Petals spreading, obovate, emarginate or irregularly cleft, with numerous parallel veins. Filaments filiform, shorter than petals; anthers linear, acuminate. Fruit in bunches, capsules oval, nearly the size of a goose-egg, 5-valved, divided by incomplete dissepiments. Seeds numerous, covered with a soft silky woolly substance.

Dry stony hills along the foot of the North-West Himalaya from the Sutley to the Sardah, ascending to 3000 ft. Behar, Bandelkhand, Central Provinces, Dekkan and eastern districts of the Peninsula. Deciduous; the new leaves appear in May. Flowers from February to April; the fruit ripens in June and July. A small tree, with short thick spreading branches, the younger branches marked with great scars of the fallen leaves and fruit-stalks. Wood soft and light, not much used. A clear white gum (*Katira*) exudes from the bark. Bellows for iron-smelting are made of the leaves.

2. BIXA, Linn.

Flowers bisexual. Sepals 5, imbricate, deciduous. Petals 5, large, contorted in the bud. Stamens indefinite, inserted on a thick torus below the ovary; anthers oblong, opening at the apex with two short slits. Style filiform; stigma minutely 2-lobed. Capsule coriaceous, one-celled, two-valved, with numerous seeds on parietal placentas along the middle of each valve. Seeds obovoid on a thick funicle, covered with a farinaceous red pulp; embryo large; cotyledons flat.

1. *B. Orellana*, Linn.; Wight III. t. 17; Roxb. Fl. Ind. ii. 581; W. & A. Prodr. 31; Hook. Fl. Ind. i. 190.—*Arnotto*. Vern. *Latkan*, (*Thidin*, Burm.)

Young shoots and inflorescence rusty-puberulous. Leaves cordate, acuminate, entire or angular. Flowers in terminal panicles, large, 1-2 in. across, white or pink. Capsule ovoid, covered with long bristles.

Indigenous in America, but long cultivated in India. Flowers in summer; the fruit ripens in the cold season. A small tree with few branches, the leaves approximate at the end of the branches. The *Arnotto* (annotto) or pulp surrounding the seeds, is employed to tinge butter, and as a dye. Exported from Guiana, Brazil, and the West Indies.

3. FLACOURTIA, Commerson.

Flowers dioecious. Sepals 4-5, small, imbricate. Petals none. Male flowers with numerous stamens; anthers short, versatile. Female flowers with a 2-5-celled ovary on an annular, lobed disc. Styles 2 or more; stigmas notched or 2-lobed. Fruit a berry with few seeds, each surrounded by a distinct shell of hard woody endocarp. Cotyledons orbicular.

1. *F. Ramontchi*, L'Hérit.; Hook. Fl. Ind. i. 193; Wight Ic. t. 85. —Syn. *F. sapida*, Roxb. Pl. Cor. t. 69; W. & A. Prodr. 29; Roxb. Fl. Ind. iii. 835. Sans. *Sarab kantuka*. Vern. *Kāhui, kakon, kangū, kandeī*, Panjab; *Bilangra, bhunber, kandi, kattūr*, N.W.P.; *Kutti*, Oudh; *Kuikun*, Mairwarra; *Kānk, Kānki, bilāti*, C.P.

Armed; leaves alternate, shortly petiolate, varying much in shape, ovate-oblong ovate obovate or suborbicular, obtusely serrate or crenate, generally tomentose beneath, glabrous above. Flowers small, greenish yellow, in short racemes, or panicles with short side-branches. Styles 5-11, united at base. Fruit dark red or black, about $\frac{1}{2}$ in. long. Seeds 8-16, generally in two layers, one above the other. This species, as defined in Flora Indica (1872), comprises the two old species *F. Ramontchi* and *sapida*; the forms vary extremely, and require further study. Very remarkable is a tomentose form (var. *occidentalis*) from Behar, the Dekkan, Oudh, Rohilkhand, and the Panjab.

Throughout India, mostly on dry rocky hills, and in open bare warm localities; cultivated in Bombay. The leaves fall in January and February, and the tree remains bare until the new foliage appears in spring, sometimes in March, but usually in May; the young leaves are first red, afterwards light green. Fl. from November-March, usually after the fall of the leaves; the fruit ripens May-June.

Generally a large shrub, but under favourable conditions grows into a moderate-sized tree, with a short trunk up to 4 and 5 ft. in girth, with straggling branches, generally thorny, the thorns being either terminal, forming the end of leaf-bearing branchlets, or axillary, being naked thorny branches without leaves. Bark of stem light or dark grey, or nearly black, somewhat rough, with exfoliating scales.

Sapwood and heartwood conform; close, fine, and even-grained; when dry, weighs about 50 lb. per cub. ft. Does not warp, is durable, and not attacked by insects. Combs are made of it; it is employed in turnery and for agricultural implements, and though not large, it is occasionally used for building. Young twigs and leaves are lopped for cattle-fodder. The fruit is eaten.

F. sepiaria, Roxb., a thorny shrub, thorns long, usually bearing fl. and fruit, has been found in Kansaon (Malden).

XYLOSMA, Forster.

Character of *Flacourtia*, but ovary 1-celled, with 2, rarely 3-6, few-ovuled parietal placentas; style one, short; stigma capitate. Fruit a small, globose, 2-8-seeded berry.

1. *X. longifolium*, Clos—Tab. IV.—Hook. Fl. Ind. i. 194.—Vern. *Chopra*, *chirūda*, *chīrudi*, *drendu*, Pb.; *Kattūma*, Oudh. *Dandūl*, *katāri*, *kandhāra*, N.W.P.

A moderate-sized tree, often armed with strong, straight, axillary spines 1 in. long or more. Leaves alternate, short-petioled, oblong-lanceolate, obtusely serrate, coriaceous, glabrous, shining, from 2-6 in. long. Flowers small, yellow, in short, axillary, glomerate panicles; pedicels bracteate; stigma indistinctly lobed. Berry $\frac{1}{2}$ in. diam.

Outer hills of the North-West Himalaya, ascending to 5000 ft. Also in Assam. Fl. Jan.-May. Wood used for fuel and charcoal. Fruit sweetish bitter.

ORDER VIII. **PITTOSPOREÆ.**

Trees or shrubs. Leaves alternate, simple, entire, exstipulate. Flowers usually bisexual. Sepals 5, imbricate. Petals 5, imbricate. Stamens hypogynous, 5, distinct, alternating with petals; anthers 2-celled, versatile. Ovary syncarpous, of 2 (rarely 3-5) carpels, with 2-5 parietal placentas; 1-celled or 2-5-celled by the projection of the placentas. Style one; stigma 2-5-lobed. Ovules many. Fruit capsular or indehiscent. Seeds usually numerous; albumen copious; embryo small, next the hilum.—Gen. Plant i. 130; Royle III. 77; Wight III. i. 172.

1. **PITTOSPORUM**, Banks.

Petals connivent or connate at the base or beyond the middle. Filaments subulate; anthers erect, introrse, dehiscing longitudinally. Ovary incompletely 2-3-celled. Capsule 1-celled, 2- rarely 3-valved, the placenta in the middle of each valve. Seeds smooth, embedded in a viscid pulp.

Leaves, young branches, and capsule glabrous . . . 1. *P. floribundum*.
Leaves, young branches, and capsule tomentose . . . 2. *P. eriocarpum*.

1. *P. floribundum*, W. & A. Prodr. 154; Hook. Fl. Ind. i. 199.—Syn. *Celastrus verticillata*, Roxb. Fl. Ind. i. 624. Vern. *Yekuddi*, Mahratti.

A small tree; leaves lanceolate or oblong-lanceolate, glabrous, shining, pale below, thinly coriaceous, 4-6 in. long. Flowers numerous, yellowish, in short, compact, terminal panicles. Petals free, linear-oblong, obtuse, patent, at last recurved. Capsules $\frac{1}{2}$ in. diam, glabrous, rugose, opening into two hard broad-ovate valves. Seeds 1-4, occasionally 8.

Outer Himalaya. Jumna to Sikkim, ascending to 3500 ft. (in Kamaon to 7000 ft.) Kasia hills. Western Ghats. Mostly on dry rocky sites. Fl. Jan.-June. Fr. April-Sept. A handsome tree, with a short, straight trunk and spreading branches. Bark of a greenish ash-colour, or yellowish grey, scabrous with small whitish specks. Wood light-coloured, strong and tough.

2. *P. eriocarpum*, Royle III. 77; Hook. Fl. Ind. i. 199.—Vern. *Meda tūmri*, *gar-silung*, *gar-shūna*, N.W.P.

A small tree with spreading branches; leaves, young branches, and inflorescence yellow-tomentose. Leaves ovate obovate or broad-lanceolate. Flowers numerous, in short terminal dense panicles. Petals free, linear, erect. Capsule $\frac{1}{2}$ in. diam., tomentose, dividing into two broad ovate thick woody valves.

Outer Himalaya. Jumna to Sardah, between 3000 and 6500 ft. Fl. March, April. Fr. June, July. Bark dark grey.

ORDER IX. TAMARISCINEÆ.

Shrubs, rarely trees or herbs. Leaves alternate, small, often scale-like and imbricating. Stipules none. Flowers regular, usually bisexual, either solitary or in spikes racemes or panicles. Sepals 5, rarely 4, free or connate at the base, imbricate. Petals as many as sepals, imbricate, free or united in a tube. Stamens 5, 10, or numerous, inserted on an annular indented or lobed disc, with 10 glands; anthers versatile, with 2 cells, dehiscent longitudinally. Ovary syncarpous, of 3-5 carpels; ovules numerous, placentas 3-5, from the base of the cavity or attached to the carpels, sometimes enlarged so as to divide the ovary into cells. Capsule one-celled, dehiscent into 3-5 valves. Seeds either with a crust of long hairs at the apex, or winged, or covered with down all over. Albumen small or wanting; embryo straight.—Gen. Plant. i. 159; Royle Ill. 213; Wight Ill. i. 50.

Stamens free or connate at base only; styles 3-4

1. TAMARIX.

Stamens monadelphous, stigma sessile

2. MYRICARIA.

1. TAMARIX, Linn.

Shrubs with scale-like or inconspicuous leaves. Flowers white or pink, in spikes or dense racemes. Sepals free. Petals free. Stamens 5-10, free or connate at base only. Ovary 1-celled, placentas short at the bottom of the ovary; styles 3 or 4 (rarely 2 or 5), short, thick. Seeds small, smooth, not beaked, with a long coma consisting of a setiform axis studded with long hairs; albumen none.

Leaves semi-amplexicaul; flowers in large panicles, composed of long slender spikes

1. *T. gallica*.

Leaves sheathing, apex of leaf erect or adpressed to branchlets.

Branchlets continuous; flowers in close cylindrical spikes

2. *T. dioica*.

Branchlets articulate; spikes interrupted

3. *T. articulata*.

1. *T. gallica*, L.—Tab. V.—Wight Ill. t. 24; W. & A. Prodr. 40; Hook. Fl. Ind. i. 248.—Syn. *T. indica*, Roxb. Fl. Ind. ii. 100. Sans. *Jhāvuka*. Vern. *Koān*, *rūkh*, *leinya*, *ghazlei*, *pāleh*, Ph.; *Lei*, *lūi*, *jhau*, Sindh; *Felta*, *ryelta*, Tibet; *Jhau*, Beng.

A shrub or small tree; leaves minute, apex patent or loosely adpressed, acute from a semi-amplexicaul base, not sheathing, glaucous, white-margined. Flowers mostly bisexual, pentamerous, generally white, rarely pink, crowded in long slender numerous spikes, collected into panicles at the ends of branches, and forming large irregular masses of flower; lateral spikes sessile or on short peduncles. Bracts shorter than flowers, semi-

amplexicaul, membranous. Disc shallow, 10-crenate. Capsule attenuated from ovoid base, $\frac{1}{2}$ in. long, when ripe more than twice the length of the withered sepals which enclose its base. Petals generally deciduous.

Throughout the Panjab and Sindh. In Tibet at 11,000 ft. Yarkand (Henderson), Bengal, the Peninsula, and Ceylon. This species has a wide range—it is found in Afghanistan, Persia, the countries round the Mediterranean, Africa, in Siberia, China, and Japan. In India, mostly on sand or gravel, along the banks of rivers and near the sea-coast; often on soil impregnated with salt; associated with *Salvadora*. Fl. July, August. Seed ripe Dec.-Feb. Grows moderately quick when young, the stems often attaining 10-12 in. girth in 10-12 years, but soon reaches maturity, and decays early, stems over 15 in. girth being generally hollow, especially in dry tracts with sandy soil. Easily propagated from seed and cuttings.

A shrub or small tree, attaining a girth of 3 and height of 30 ft. Stems crooked, dividing into numerous branches, which are more ramified than those of *T. dioica*. Branchlets leathery and often drooping. Bark of young branches reddish brown, smooth, with small whitish specks, that of stem and larger branches thin, greenish brown, rough with darker cross-lines. Foliage bright dark-green or glaucous. Flowers usually white in North India, pink in South Europe, Ladak, and Tibet.

Wood whitish, occasionally with a red tinge, open and coarse-grained, fairly hard and tough, but not strong. Medullary rays numerous, broad but short. Annual rings distinct. Its chief use is to supply fuel for steamers and otherwise; in Sindh and South Panjab agricultural implements are made of it, and it is used for turning and lacquered work.

It is with some diffidence that I follow Wight & Arnott in identifying this Tamarisk with *T. gallica*, Linn. But without further study of these variable shrubs on the spot, it appeared to me that I had no alternative. The figure in Sibthorp's *Flora Græca*, tab. 291, of *T. gallica*, seems to me to represent the ordinary form of the Indian species; but this is referred by Boissier, *Fl. Orient.* i. 773, to *T. Pallasii*, Desv., from Afghanistan, Beluchistan, and Bokhara, with smaller flowers, the disc deeply cleft into 5 emarginate lobes; petals persistent to the ripening of the capsule.

2. *T. dioica*, Roxb.—Tab. VI.—Roxb. *Fl. Ind.* ii. 101; W. & A. *Prodr.* 40; Hook. *Fl. Ind.* i. 249; Boissier *Fl. Orient.* i. 777.—Sans. *Pichula*. Vern. *Leinya*, *koān*, *kachlei*, *pilchi*, Pb.; *Gaz*, *lāo*, *jāu*, Sindh; *Lal Jhau*, Beng.

A shrub. Leaves minute, closely adpressed, sheathing, sheath tubular, apex deltoid, acuminate, green, with a broad white margin. Flowers dioecious, pentamerous, purple or light rose-tinged, in compact cylindrical spikes, either terminal or clustering at the ends of branches into loose racemose panicles; lateral spikes stalked. Bracts as long, or nearly as long as flowers, broad-ovate from a sheathing base, acuminate, membranous, reddish brown with white margin. Male flowers: stamens 5, inserted on the 5-lobed fleshy disc, alternate with the lobes; no rudiment of ovary. Female flowers: stamens abortive. Capsule oblong, tapering, $\frac{1}{2}$ in. long, surrounded by the withered sepals and petals, and about twice their length.

Throughout Northern India, ascending to 2500 ft. in the Outer Himalaya. In the plains along the ~~Jyṃna~~ and Ganges, abundant on the Hooghly in Bengal, also on the Brahmaputra and in the Peninsula. Grows gregariously like *T.*

gallica, and forms extensive forests on the low, moist, alluvial lands along the Indus and its principal tributaries. The new formations of alluvial land along the banks of these rivers get covered in early spring with a dense mass of Tamarisk seedlings, mixed more or less with young plants of the *Populus euphratica* and *Acacia arabica*. It is believed that *T. dioica* is the principal species in these forests, and that *T. gallica* is less common. It is, however, a matter for further inquiry how far the distribution of these two species, and prevalence of one or the other, is affected by soil, locality, and other circumstances. *T. dioica*, like *gallica*, grows freely where the soil is impregnated with salt. Both species are often planted in gardens for ornament. Fl. from May-July; the seed ripens in the cold season.

These two species are easily confounded. *T. dioica*, however, is usually a very much smaller plant than *T. gallica*. A moderate-sized shrub, 6 or 7 ft. high, rarely attaining 15 ft., with little or no trunk, and numerous, virgate, long spreading branches, generally simple, their extremities bending down gracefully, especially when laden with flower. The twigs are reddish, brownish, or grey; the bark of the larger branches is dark grey or brown. The foliage is of a greyer green than that of *T. gallica*.

The wood is white with a pinkish tinge, loose- and open-grained, with numerous broad medullary rays. It is occasionally used for the supporting sticks of roofs, but mainly for fuel, like the preceding species. The Tamarisk forests are of great importance as sources of fuel, and the production of these two species from coppice-shoots requires special study. It has hitherto been supposed that they coppice well under favourable circumstances; but recent experience seems to show that the power of reproduction from coppice-shoots of these species has been overestimated.

3. *T. articulata*, Vahl.—Tab. VII.—Hook. Fl. Ind. i. 249, Boissier Fl. Orient. i. 777.—Syn. *T. orientalis*, Forsk. Vern. *Frāsh*, *farās*, *farwa*, *rūkh*, *ūkhān*, *khurlei*, *malei*, Pb.; *Asreler*, Sindh.

A tree. Leaves minute, sheathing; branchlets apparently articulate at base of sheath; sheath thin, tightly adpressed, $\frac{1}{10}$ in. long, obliquely truncate, white-margined, with a triangular acute tooth in the place of the lamina; sheath and tooth covered with impressed-punctate glands, often hoary with saline efflorescence. Flowers bisexual or monœcious, pentamerous, loosely scattered on long slender spikes, generally clustering at the ends of branches into loose racemose panicles. Bracts triangular from a sheathing base, concave, acute, shorter than flowers. Disc indistinctly 5-lobed. Capsule oblong, tapering, surrounded by the persistent sepals and petals.

Panjab (ascending to 1200 ft.) Upper and Middle Sindh, eastwards to the Jumna. In Rindkhand only cultivated. Beyond India, in Afghanistan, Persia, Arabia, North and Central Africa. Grows well on saline soils. The leaves and extremities of branchlets are shed (partly) during the cold season, the new shoots and leaves come out about May. Flowers from May to July, the fruit ripening later in the season. Growth rapid; trees 12 years old on an average attain a girth of 2-3 ft., one 15 years old measured 4 ft. 10 in. in girth, and it is stated that at times it attains 5 ft. in 7 years. Springs up freely from seed, and is readily propagated from cuttings. Coppices well.

In the Panjab it grows to be a moderate-sized tree, to 60 ft. high, with an erect trunk, often 6 or 7 ft. in girth, occasionally attaining 10-12 ft., tapering rapidly, with spreading branches, forming a close, oval head. The slender twigs are frequently hoary with saline inflorescence; bark of branchlets smooth,

reddish brown or light grey, that of the larger branches and upper part of stem dark bluish brown or dull grey, with a few dark brown scars and seams, that of the lower part of the stem light grey or brownish grey, and rough with many close deep longitudinal furrows and grooves, crossed by short shallow cracks. Except the very young shoots in spring, the foliage of *T. articulata* is much more grey and glaucous than that of the other species; this, with its arborescent habit, distinguishes it readily. There is a variety in the Panjab with adpressed and upright branches.

Sapwood distinct, heartwood whitish, open, coarse-grained, with conspicuous large white medullary rays. The weight varies from 40 to 60 lb. when seasoned, it is fairly strong and durable. Used for many kinds of ordinary work, made into ploughs, Persian wheels, and in Sindh is turned into small ornaments. The green wood burns with an offensive odour; when seasoned there is no smell, and it is then a good fuel.

The bark is employed for tanning; the small irregularly-rounded tuberculate galls (*Mā*, Panjab; *Sakun*, Sindh), often abundantly produced on the branchlets by the puncture of an insect, are used as a mordant in dyeing, and also in tanning. Similar galls are collected from the two other species, and sold under the same name. Tamarisk manna (*Mirre ler*, sugar of Tamarisk) is produced on the twigs by the puncture of an insect, in parts of the Panjab and in Sindh. It is chiefly collected during the hot weather, and used medicinally or to adulterate sugar, will not keep more than a year, especially if exposed to damp. Manna is also produced by the two other species in Sindh, and by *T. gallica* in the Southern Panjab.

2. MYRICARIA, Desvieux.

Flowers bisexual, pink or white, in long racemes. Sepals 5, free. Petals free. Stamens commonly 10, inserted on the disc, and more or less united into a short tube. Ovary one-celled, with 3 sessile, more or less united, stigmata, ovules numerous, on short placentas at the bottom of the cavity. Seeds numerous, small, with a long coma.

1. *M. germanica*, Desv.—Tab VIII.—Hook. Fl. Ind. i. 250; Boissier Fl. Orient. i. 763.—Syn. *M. bracteata*, Royle Ill. t. 44. Vern. *Bās*, *shālanāt*, *kālhi*, *hūmbu*, *hombu*, *umbu*, N. W. Himalaya.

A shrub; leaves sessile, linear-lanceolate, varying much in size, generally crowded, less than $\frac{1}{2}$ in. long. Racemes terminal or lateral, up to 12 in. long; flowers pink, on short pedicels, crowded; bracts longer than pedicels, ovate-lanceolate, with broad membranous lacerated margins, caducous. Petals obovate, twice the length of sepals, white above, red below. Stamens shorter than petals; filaments united in tube. Seeds with a stalked coma.

Abundant in the inner, more acid parts of the Himalaya, from Iskardo to Sikkim, at elevations between 5000 and 10,000, ascending occasionally to 15,000 ft. Beyond India, in Afghanistan, Western and Northern Asia, and in the mountainous parts of Europe. Fl. July, Aug.; the seed ripens soon afterwards. Grows chiefly in sandy beds of streams, where it often covers considerable areas, becoming a shrub of considerable size, massed in clumps, peculiar and striking in its twiggy erect habit. A dwarf prostrate Alpine form grows at great elevations.

Young branches smooth, shining and striated; bark of trunk dark grey, fibrous and ragged. Foliage of a dull-greyish green colour, often covered by a saline efflorescence. The wood is small, and used as fuel; in Ladak the twigs are browsed by goats and sheep.

Nearly allied is *M. elegans*, Royle; Hook. Fl. Ind. i. 240; with white flowers and longer oblanceolate leaves, from Ladak, Zaskar, and Kinnawar, where it is most valuable as yielding fuel, and often found associated with *M. germanica*. It attains a larger size; old gnarled trunks have 7-8 ft. in girth, with a rounded crown often 15-20 ft. high.

ORDER X. TERNSTROMIACEÆ.

Trees or shrubs, with alternate simple leaves. Stipules none, or very rarely minute. Flowers regular, bisexual, rarely unisexual. Sepals usually 5, imbricate. Petals usually 5, hypogynous, imbricate or twisted, frequently united into a short tube. Stamens usually numerous, hypogynous, the filaments often cohering at the base and united with the petals. Ovary plurilocular, ovules 2 or more in each cell, placentation axile; styles 2-7, distinct or more or less combined. Fruit 2-5-celled, coriaceous and indehiscent, or capsular and opening by valves. Albumen scanty or wanting; embryo frequently oily.—Gen. Pl. i. 177; Royle Ill. 107; Wight Ill. i. 89.

Flowers small, dioecious, sepals 5, nearly equal, anthers adnate,

fruit dry, indehiscent

1 EURYA

Flowers small, bisexual, sepals 5, nearly equal, anthers versatile;

fruit indehiscent, dry or fleshy, leaves penninerved

2 SAURAUJA.

Flowers large, bisexual; sepals 5-6, inner larger, anthers versatile;

fruit a woolly capsule, dehiscing longitudinally

3 CAMPLIA.

1. EURYA, Thunberg.

Flowers dioecious. Sepals 5, strongly imbricate. Petals 5, imbricate, more or less united at the base. Stamens 12-15, attached to the base of the corolla in a single series; anthers adnate, opening longitudinally. Ovary mostly 3-celled; styles 3, distinct or united. Fruit a dry indehiscent berry. Seeds with a fleshy albumen.

1. *E. japonica*, Thunb.; Thwaites Enum. Pl. Zeyl. 41.—Syn. *E. Wightiana*, Wight Ill. t. 38; *E. acuminata*, Royle Ill. t. 24. Vern. *Baumra, gonta, deura*, N.W.P.

A shrub 10-12 ft. high; leaves alternate, on short petioles, oblong-lanceolate, acuminate, obtusely serrate, coriaceous, glabrous or hairy when young, and underneath along the midrib. Flowers white, solitary or in fascicles, axillary, or from the axils of fallen leaves. Ovary ovoid; styles distinct, or united at the base. Fruit globose, $\frac{1}{2}$ in. diam., crowned by the persistent base of style.

Widely spread over Eastern Asia, in China, Japan, and Java. In India it is found on the mountainous regions of Burma, Ceylon, South India, Eastern Bengal, and the Outer Himalaya, alt. 3500-9000 ft., extending west as far as the Jumna, resembling somewhat the Tea plant. Fl. May-Sept. The specimens from the north-west are always hairy (extremities and midrib). In Burma, South India, and Ceylon, both the hairy and glabrous forms are found. In Hook. Fl. Ind. i. 284, the glabrous form with 2-flowered fascicles is referred to *E. japonica*, Thunb., and the hairy form with more numerous flowers to *E. acuminata*, DC.

2. SAURAUJA, Willd.

Leaves penniveined, with prominent parallel lateral nerves. Flowers bisexual. Sepals 5, strongly imbricate. Petals 5, imbricate, connate at base. Stamens numerous, adherent to base of corolla; anthers versatile, opening at the top by a pore or short slit. Ovary 3-5-celled; styles 3-5, distinct or united. Fruit 3-5-celled, indehiscent, dry or fleshy. Seeds small, immersed in pulp, with copious albumen.

1. *S. nepalensis*, DC.; Wall. Pl. As. rar. t. 178; Hook. Fl. Ind. i. 286. — Vern. *Gogina*, *goganda*, N.W.P.

A large shrub; branchlets, young leaves, and inflorescence covered with stiff long brown hairs. Leaves on thick hirsute petioles, oblong, acuminate, 7-14 in. long, acutely serrate; lateral nerves prominent, 25-30 on each side of midrib. Flowers pink, in panicles, on a long common peduncle, axillary or from the axil of a fallen leaf. Styles 4 or 5, distinct, $\frac{1}{4}$ in. long.

Outer Himalaya, alt. 2500-7000 ft., from the Jumna to Bhutan. Fl. about May, the fruit ripening some weeks afterwards. The palatable viscid fruit is eaten.

3. CAMELLIA, Linn.

Trees or shrubs, with evergreen, coriaceous, serrate leaves, and large axillary bracteate flowers. Sepals 5-6, the inner larger. Petals cohering at the base. Stamens numerous, the outer in many series, more or less connate, and adhering to the base of the petals, the inner 5-12 free; anthers versatile. Ovary 3-5-celled, ovules 4-5 pendulous in each cell. Capsule woody, dehiscing longitudinally. Seeds large, oily, generally one in each cell; albumen 0; embryo straight; cotyledons thick, oily; radicle superior.

1. *C. Thea*, Link.—Syn. *C. Bohea*, Griff. Not. iv. 553 (the China plant); *C. theifera*, Griff. l. c. 558 (the indigenous Assam plant); Hook. Fl. Ind. i. 292. *Thea chinensis*, Linn., *The Tea plant*.

*A shrub, glabrous or slightly pubescent. Leaves elliptic, oblong, acuminate. Flowers solitary on short 2-3-bracteate peduncles. Sepals persistent, rotundate, very obtuse, glabrous or with silky pubescence. Petals white, obovate, obtuse, glabrous or pubescent on the back. Stamens glabrous, the inner 5 free. Ovary villous; styles 3, glabrous, connate beyond the middle. Capsule glabrous. Testa hard, smooth, shining.

Indigenous in Upper Assam (discovered 1834). Cultivated ages ago in China and Japan. Since 1840 cultivated extensively in Assam, Cachar, Sikkim, the North-West Himalaya, and other parts of India. The spread of Tea cultivation in North-West India is mainly due to Dr W. Jameson, who established the Government plantations in Dehra Doon, Kamaon, and Kangra. It was at one time supposed that there were two species in China, of which *Thea Bohea* yielded the black, and *T. viridis* the green Tea. These species, however, cannot be maintained. Though the varieties of the Tea plant are numerous, it is not at present possible to distinguish them by definite specific characters. The indigenous Assam plant is marked by larger, more acuminate leaves, and it is not certain whether it should not be regarded as a distinct species.

Camellia japonica, the well-known Camellia, is indigenous in Japan, and cultivated there as well as in China from time immemorial. Introduced into Europe in the beginning of the eighteenth century.

ORDER XI. DIPTEROCARPEÆ

Trees (one genus of climbing shrubs), usually resinous, with alternate penniveined simple leaves. Flowers regular, bisexual. Calyx-tube campanulate, free or connate with the torus or ovary, 5-lobed; lobes imbricate, persistent and generally enlarged when the fruit ripens. Petals 5, twisted, united at the base, or free. Stamens free, either 10 or 5 in one series, or 15 in two series, or indefinite and multiseriate, inserted on the torus. Ovary sessile with a broad base on, or partly immersed in, the torus, 3-celled, rarely 1- or 2-celled. Fruit free, or enclosed in the enlarged calyx, with 1, rarely 2 seeds. Seed large, exalbuminous.—Gen. Pl. i. 189; Royle Ill. 105; Wight Ill. i. 85.

To this family belong the Wood oil trees (*Dipterocarpus*) of Burma, the Indian Copal-tree (*Vateria Indica*) of the Western Ghats, and the Lac-tree (*Shorea lacifera*) of Mysore.

1. SHOREA, Roxb.

Calyx-tube short, adnate to torus, all segments enlarged into long wings when in fruit. Stamens indefinite (rarely 15), connective subulate, over topping the anthers. Ovary 3-celled, ovules 2 in each cell. Fruit coriaceous, indehiscent, tightly enclosed by the base of the calyx-segments. Seed 1, ovoid; cotyledons fleshy.

1. *S. robusta*, Gaertn.—Tab. IX.—Roxb. Cor. Pl. t. 212; Fl. Ind. ii. 615; Bedd. Fl. Sylv. t. 4; Hook. Fl. Ind. i. 306. *The Sāl tree*.—Sans. *Sāla*, *asvakarna*. Vern. *Sāl*, *sāla*, *sālua*, *sākhā*, *sāku*, *sukher*. Local names: *Sarye*, *sarai*, *rinjal*, *gūgal*, C P.; *Koroh*, Oudh.

A large tree, young branches, petioles, young leaves and inflorescence hoary or pubescent. Leaves glabrate, shining when full grown, 4-8 in. long, petiolate, broad-ovate, from a rounded or cordate base, entire, more or less acuminate, ending in an obtuse point; stipules caducous. Flowers yellowish, shortly pedicellate, in unilateral racemes, arranged in long, compound axillary panicles; inflorescence, calyx, and outside of petals clothed with soft grey pubescence. Segments of calyx enlarged in fruit into 5 unequal, obtuse, oblong or spatulate wings 3-4 in. long, contracted above the base, brown, with 10-15 parallel longitudinal veins and fine reticulation between. Petals (at the time of flowering) 4 times the length of calyx, orange inside. Stamens 25-30 or more, anthers pilose at the apex, style subulate. Fruit ovoid, acuminate, $\frac{1}{2}$ in. long, hoary.

The area at present occupied by the Sāl tree, forms two irregular, but fairly-defined belts, which are separated by the Gangetic plain. The northern or sub-Himalayan belt extends from Assam to the Kangra valley in the Panjab. Within these limits Sāl forms extensive forests, skirting the foot of the hills and entering into the Doons and valleys, ascending in places to 3000 ft. Near the western end of this belt the Sāl forests are less extensive, and they terminate near the Bias river in a number of scattered patches of limited area. West of the Ganges the Sāl is not found in the plains; but in Rohilkhand, Oudh, Gorakhpur, and Bengal, Sāl forests exist, or existed formerly, at a considerable distance from the hills. The second, or central Indian belt, occupies the hilly country of Behar, Rewah, Chota Nagpur, Midnapur, and the Malhal

range of hills between the Nerbudda river and the open country of Raipur, and extends south to the Godavery river and the Northern Circars. The Pachmarhi hills mark the western limit of the tree in this belt; the Sāl on the sandstone of these hills and in the Deiwah valley at their foot is an outlying and isolated patch of considerable extent, the last in that direction. The Sāl tree does not thrive on heavy binding soils; it requires a loose soil which transmits water freely. I have never found it on trap, and this probably explains its absence on the greater part of the Satpura Range in Central India. Sāl forests are generally found on sandstone, on conglomerate, the gravelly and shingly soil of the sub-Himalayan tract; and the tree attains perfection where loose water-transmitting soils are mixed with a large proportion of vegetable mould. Sāl is eminently gregarious. Wherever found, it is always the prevailing tree; a limited number of other species are associated with it, but they are always less numerous in individuals. The climatic conditions within the area occupied by the Sāl tree may, as far as known, be expressed as follows:—A mean annual rainfall between 40 and 100 inches, and a mean temperature during the four seasons within the following limits—C. S., 55°-70°; H. S., 77°-85°; R. S., 80°-88°; Autumn, 74°-77°. As to extremes of cold, the Sāl can stand several degrees below freezing-point. I have seen the leaves frostbitten in the Kotridoon, and in Kangra and Hushiarpur it is exposed to severe cold. As to heat, it will suffice to say that during the hot season the extremes in the Kamaoory Doons and the Deiwah valley are nearly as high as anywhere in India, but that the tree does not seem to stand the hot winds of the open plains in North-West India.

Sāl is never quite leafless: the young foliage issues in March, with the flowers; the seed ripens in June, and germinates immediately, often before falling. Large quantities of seed ripen, and an abundant crop of seedlings springs up annually, clothing the ground with a dense mass of young Sāl, to the exclusion of other trees. The circumstance that the seed ripens at the commencement of the rains, after the jungle-fires have passed through the forest, materially assists the reproduction and spread of Sāl. Other species of this family, particularly the *En* tree of Burma (*Dipterocarpus tuberculatus*, Roxb.), also produce a similarly abundant crop of seedlings, and form nearly pure forests of great extent. The Sāl tree coppices, but not under all circumstances. Regarding its rate of growth, our information is as yet incomplete. The annual rings in the wood are generally very indistinct; and the individuals, the age of which is known from other sources, are not numerous. For the Oudh forests (Kherree Division), the following was assumed as the mean rate of growth when the first regular plan for working them was framed in 1863:—

Age 15 years, girth 18 inches.

"	50	"	"	54
"	80	"	"	72

Subsequent data seemed to indicate a somewhat slower rate; and in 1868, Capt. Wood's estimate was 65 years for 54, and 95 years for 72 in. girth. The following cultivated trees of known age were measured by me in 1863:—

Saharanpur,	13	years,	girth	27	inches	(average of 33 trees).
"	30	"	"	54½	"	
"	35	"	"	79½	"	
Calcutta,	25	"	"	69	"	

Under favourable conditions—for instance, in the gorges at the foot of the hills in the Nepal Terai—the Sāl tree attains 100-150 ft., with a clear stem to the first branch of 60-80 ft., and a girth of 20-25 ft. But such dimensions are exceptional; as a rule, it attains 60-90 ft., with clear stems 30-40 ft. long, and a girth of 6-8 ft. Young trees have generally a long narrow conical head of foliage.

age; in old trees the branches spread at the top. Of young trees the bark is moderately smooth, occasionally with a few long deep vertical cracks. The bark of old trees is 1-2 in. thick, dark-coloured and rough, with longitudinal furrows.

The wood of the Sāl tree has a distinct sapwood, small, about 1-2 in. thick, whitish, not durable. The heartwood is dark brown, coarse-grained, hard, heavy, strong, and tough, with a remarkably fibrous and cross-grained structure. The fibres of successive concentric strata do not run parallel, but at oblique angles to each other; so that when the wood is dressed, the fibres appear interlaced. Medullary rays numerous, narrow; pores very numerous, moderate, uniformly distributed. The weight of a cub. ft. (seasoned) is generally found to vary between 50 and 60 lb.; but extreme cases are on record of weights as low as 40, and as high as 69 lb. The transverse strength has been tested by numerous experiments. The average value of P (coefficient of transverse strength), as determined by Baker, Cunningham, Clifford and others, ranges from 609 to 972; and in a large series of experiments with Sāl timber from different sources made by me in Calcutta in 1864 and 1865, with the assistance of Mr Clifford and Baboo Tincowry Ghose, the mean value of P was found to fluctuate between 708 and 916. Sāl timber takes a long time to season; and after it has been seasoned and worked up, it is apt to split and warp with the change of dry and wet seasons. Its durability is considerable, though not equal to that of Teak. In Lower Bengal it is liable to be eaten by white ants. For building, gun-carriages, river-boats, and railway-sleepers, it is the most important timber of North India. Sāl timber cannot be floated without the assistance of boats or floats of lighter woods. *Semul* (*Bombar malabaricum*) is often used for that purpose.

The tree, when tapped, exudes large quantities of a whitish, aromatic, transparent resin or dammar (*śāl, dhūna*), which is collected and sold; is used to caulk boats and ships, and also as incense. Large extents of Sāl forest have been destroyed by the practice of tapping the trees for this purpose.

(ORDER XII. MALVACEÆ.

Herbs, shrubs, or trees, with a soft light wood; young parts mostly covered with stellate hairs. Leaves stipulate, alternate, generally palmi-nerved. Flowers large, purple pink or yellow, regular, generally bisexual. Sepals generally 5, more or less connate, valvate in bud. Petals 5, hypogynous, usually adnate to staminal column, twisted and imbricate in bud. Stamens indefinite, monadelphous; anthers 1-celled, bursting lengthwise. Ovary syncarpous; carpels generally numerous, usually in one whorl round a conical torus. Fruit either a dehiscent capsule or a number of distinct carpels. Seeds solitary few or numerous, in most cases without albumen.—Gen. Pl. i. 195; Royle Ill. 83; Wight Ill. i. 55, 66 (Bombacæ).

Bracteoles 4-6, enlarged in fruit, forming an epicalyx or involucrel 1. *KTDL*.

Bracteoles wanting.

Fruit large, woody, filled with pulp 2. *ADANSONIA*.

Capsule 5-valved, densely woolly inside 3. *BOMBAX*.

Hibiscus Rosa-Sinensis (Shoe-flower) from China, the Moluccas; *H. Sabdariffa* (Roselle, Red Sorrel), from the West Indies; *H. aculeatus*, the edible *Hibiscus* (*Okra, Bendi*), from the West Indies; and *Gossypium herbaceum* (*Cotton*), are well-known cultivated plants, and require no notice here. *Thespesia Lampas*, Benth. and Hook. f.—Syn. *Hibiscus Lampas*.

Cav., a small soft-wooded tree, with large yellow and crimson flowers, is found in Kamaon (Madden).

1. KYDIA, Roxb.

Flowers unisexual, numerous, in long panicles. Calyx campanulate, 5-lobed, persistent, surrounded by and united at the base with a 4-6-leaved involucl. Petals 5, longer than calyx, attached by their claws to the base of the staminal column. Stamens monadelphous, the tube divided down to the middle into 5 segments, each bearing from 3-8 sessile anthers closely placed together at the apex. Style one, 3-cleft; stigma large, fleshy. Capsule globose, 3 celled, opening loculicidally, 3-seeded.

1. *K. calycina*, Roxb.; Cor. Pl. t. 215, Fl. Ind. iii. 188; W. & A. Prodr. 70; Wight Ic. t. 879, 880—Syn. *K. fraterna*, Roxb.; Cor. Pl. t. 216. *K. Roxburghiana*, Wight Ic. t. 881. Vern. *Pūhi, pilau, pinlon, pathu, pattāh, pattia, potari*. Local n Barranga, bhōti, C.P.

Young leaves, branches, inflorescence, involucl, and calyx covered with a grey tomentum of stellate hairs. Leaves on petioles about half the length of blade, from 4-6 in. long, and about equally broad, with 5 or 7 palmate nerves, lobed, angled or round, margin more or less dentate, dark-coloured above, and pale beneath. Flowers polygamous, in axillary or terminal panicles; petals white or pale yellow, longer than calyx; involucl 4-6-leaved, in the male flowers at the time of flowering as long as the calyx, in the fertile flowers longer than calyx, enlarged afterwards, and when the seed ripens about three or four times longer than calyx. Capsule covered with fuscous tomentum.

Common in the dry forests of most parts of India, not in the arid region. Sub-Himalayan tract from the Indus to Assam. Oudh, Bengal, Central Provinces, the Peninsula, and Burma.

In North India generally a large shrub, in favourable localities a small tree to 40 ft. high, with a short erect trunk to 3 ft. in girth. The old leaves are shed in Feb., the new foliage appears in April and May. Flowers generally from July to Oct., the fruit ripens in the cold season, and hangs on the tree for months, conspicuous by the brown shining calyx and involucl. Bark of trunk and large branches about 1 inch thick, inside viscid, mucilaginous, outside greyish brown, or almost black, dotted with white specks, and undulated with longitudinal wrinkles.

Sap and heartwood conform, close and straight-grained, when seasoned, weight from 40 to 45 lb. per cub. ft. Used occasionally for building, ploughs and oars, and for carving. In Garhwal a strong coarse cordage is made of the inner fibrous part of the bark. In North India the mucilaginous bark (*chukla patha*) is employed for the clarification of sugar.

2. ADANSONIA, Linn.

Trees with digitate leaves. Flowers large, solitary. Calyx ovoid or oblong, deeply splitting into 3 to 5 lobes. Staminal column divided at the top into numerous filaments, each bearing a terminal anther. Ovary 5- to 10-celled, with many ovules in each cell; style divided at the summit into as many radiating stigmas as there are cells. Fruit oblong, woody,

indehiscent, filled with pulp, mealy when dry; cotyledons very much folded, enclosing the radicle; albumen thin.

1. *A. digitata*, Linn.; Roxb. Fl. Ind. iii. 164; W. & A. Prodr. 60; Bot. Mag. t. 2791/2—*Baobab* or *Monkey-bread* tree.—Vern. *Gorakimli*. (*Kalp, braksh*, near Ajmere.)

Leaves on petioles as long as leaflets; leaflets generally 5 or 7, lanceolate or obovate, acuminate, long-attenuate at base, smooth above and downy beneath. Peduncle axillary, tomentose, often very long, more than 12 in. The structure of the fruit-bearing peduncle is curious, it has 5 distinct masses of ligneous tissue, each enclosing pith. Flowers pendulous. Calyx thick coriaceous, outside tomentose, inside thickly covered with long silky hairs. Petals white, obovate, broadly unguiculate. Staminal tube thick, longer than the free portion of filaments; anthers long, linear, contorted. Ovary ovoid, silky-tomentose, tapering into a long filiform style, which is bent downwards after flowering. Fruit pendulous, a large downy oblong-obovoid capsule 8-12 in. long, when dry filled with tough stringy fibres and a mealy, slightly acid substance, in which the kidney-shaped, brown hard shining seeds are immersed.

Indigenous in tropical Africa (the village-tree, or place of assembly in the highlands of Eastern Africa). Originally introduced into India by Arab traders and cultivated in many places in the Peninsula, Bengal, and Central India. It grows near Ajmere and in the North-West, not in the Panjab. Leafless during the dry season. Fl. in May and June; the new leaves appear with or soon after the flowers.

A large tree, attaining 60 or 70 ft., remarkable for its disproportionately thick trunk, which is often irregularly-shaped, rapidly tapering upward, soon dividing into large limbs, the lower frequently spreading horizontally with drooping extremities. At Deogarh in the Central Provinces are three trees, measuring respectively 16, 22, and 40 ft. in girth, and trees of much larger girth exist elsewhere. Bark of boughs and trunk thick, hard, grey or reddish brown, partially cut into irregular plates; inner bark fibrous. The Baobab was formerly supposed to attain a greater age than any other known tree. Adanson estimated the age of trees 30 ft. diameter in Senegambia at 5150 years, and Humboldt called the Baobab the oldest organic monument of our planet. This, however, seems to be erroneous. In India, certainly, it is a fast-growing tree. Roxburgh states that the largest of the trees in the Calcutta Botanic Garden was then (early this century) about 25 years old, with an irregular, short, subconical trunk, 18 ft. in circumference, from 4 to 5 ft. above ground. And recent information from Dr Kirk, H.M.'s Consul at Zanzibar, seems to show that the huge Baobabs of Africa are not of the vast age usually attributed to them.

The wood is light, soft and porous, made into rafts to support fishermen in tanks. On the western coast the dry fruit is used as floats for fishing-nets. Cordage and paper are made of the bark, and in Africa the pulp of the fruit is used for preparing an acid beverage, and the leaves, dried and powdered, are mixed with food as a condiment. It is a useful tree, which thrives well in most parts of India, and its cultivation should be encouraged.

3. *BOMBAX*, Linn.

Trees with digitate leaves. Calyx cup-shaped, truncate, or splitting into 3 to 5 lobes. Staminal tube short, split into 5 or more bundles, divided

at the top into numerous filaments, each bearing a terminal anther. Ovary 5-celled, ovules numerous. Capsule ligneous or coriaceous, opening loculicidally in 5 valves; the seeds embedded in a woolly substance. Seeds obovoid or subglobose, cotyledons very much folded, enclosing the radicle; albumen thin.

1. *B. malabaricum*, DC.; Wight Ill. t. 29; Bedd. Fl. Sylv. t. 82; W. & A. Prodr. 61.—Syn. *Bombax heptaphyllum*, Cav.; Roxb. Cor. Pl. t. 247; Roxb. Fl. Ind. 167. *Salmalia Malabarica*, Schott. *The Cotton Tree*. Saus. *Salmali*. Vern. *Sintul*, *semul*, *shembal*, *semur*, *sam*, *samul*, *stinual*. Local: *Wallaikei*, Gonds, C.P.; *Letpan*, Burm.

Glabrous, young stem and branches covered with conical prickles, $\frac{1}{2}$ in. long, with a black point, surrounded at the base by concentric scaly layers of cork. Common petiole as long as, or longer than leaflets; leaflets 5 or 7, petiolulate, lanceolate, acuminate, generally from 4-8 in. long. Flowers large, scarlet, occasionally white, appearing before the leaves, on short thick pedicels, clustered towards the ends of branches. Calyx cup-shaped, coriaceous, irregularly cleft into short obtuse lobes, outside smooth, inside white-silky. Petals oblong, obtuse, 3-6 in. long, stellate, tomentose outside, pubescent or nearly glabrous inside. Staminal column short, filaments much longer, but shorter than petals, 5 innermost forked at the top, each branch bearing an anther, about 10 intermediate ones simple, and the numerous outer ones shortly united in 5 clusters; anthers long, reniform, afterwards contorted. Style longer than stamens, 5-lobed at the top. Fruit on short peduncle, a hard, oblong, obtuse, ligneous capsule, 4-5 in. long. Seeds numerous, smooth, enveloped in much fine silky fibre.

Indigenous throughout India and Burma, and often cultivated. In the sub-Himalayan tract extends to the Indus, ascending to 3500 ft. in the N.W. Himalaya, and cultivated as high as 6000 ft. Leafless from Nov. Dec. until April. Covered with the large scarlet flowers in Feb. March; the fruit ripens in April, May. A very large tree, of rapid growth, attaining a height of 150 ft. and a girth of 40 ft. in Burma and Southern India, and nearly the same dimensions in the moist and hot valleys of the outer Himalaya. The trunk is straight, the upper part cylindrical, at the base generally with large buttresses, running up the trunk to some distance, and often 5 to 6 ft. deep near the ground. Similar buttresses are formed by many trees in India (*Vitex*, *Antiaris*, *Lagerstromia*, *Hymenodictyon*, *Nauclea*, and others) and in other tropical countries. The branches are in whorls of 5 to 7, spreading nearly horizontally, and forming a broad conical symmetrical head. The branches and stem of young trees are covered with sharp thick-set prickles. Bark of trunk and older branches grey, ash-coloured, corky, even between deep longitudinal and cross-cracks.

Wood greyish white, with darker streaks, light, coarse-grained and porous. No distinct heartwood. Weight 23-34 lb. per cub. ft. (seasoned), and 58½ lb. (green). Value of P. between 642 and 697 (Cunningham). Not durable, except under water. Used for planking, packing-cases, toys, scabbards, fishing-floats, and for the lining of wells. Often rafted with heavier timber to make it float. In Burma canoes are made of it, said to last 3-4 years. A light-brown transparent gum exudes from wounds in the bark, which is employed in native medicine. The calyx of the flower-bud is eaten as a vegetable. The fruit is collected before it opens, and the cotton with which it is filled is used to stuff quilts and pillows.

ORDER XIII. STERCULIACEÆ.

Trees, shrubs, or herbs, with soft wood, frequently tomentose with stellate hairs. Leaves alternate, mostly stipulate. Flowers commonly regular, bisexual or unisexual. Calyx more or less deeply divided into 5, rarely 4 or 3, valvate lobes or segments. Petals 5 or none. Stamens commonly monadelphous, with 5, 10, or 15 2-celled anthers. Fruit-carpels either distinct or united into a loculicidally dehiscent capsule. Seeds with or without albumen.—Gen. Pl. i. 214; Royle III. 102; Wight III. i. 72 (Büttneriaceæ).

Flowers unisexual or polygamous; petals none; fruit of 5 distinct or nearly distinct carpels

1. STERCULIA.

Flowers bisexual; petals 5; anther-cells divaricate; fruit-carpels distinct, or spirally-twisted

2. HELICTERES.

Flowers bisexual, with an involucre of 3-5 caducous bracts; petals 5; anther-cells parallel; fruit a capsule dehiscing loculicidally.

Staminal column divided into 20 filaments, 5 without anthers; capsule 5-valved

3. PTEROSPERMUM.

Staminal column composed of numerous multiseriate filaments, all bearing anthers; capsule 5-10-valved

5. ERIOLÆNA.

1. STERCULIA, Linn.

Trees, with entire, lobed, or digitate leaves. Flowers unisexual or polygamous. Calyx more or less deeply 5-cleft, rarely 4-cleft, usually coloured. Petals none. Carpels 5, distinct or nearly so, with two or more ovules in each, stalked on a long gynophore, adnate to which is the staminal column, bearing at the top 10 or 15 anthers. Fruit-carpels distinct, spreading, coriaceous or woody, dehiscent along the inner edge, or thin, foliaceous, opening long before maturity. Seeds one or more in each carpel; albumen adhering to the cotyledons, often splitting in two; cotyledons flat and thin.

Fruit-carpels coriaceous, opening at maturity.

Leaves deeply 5-7-lobed, lobes toothed or cleft; flower panicles drooping; carpels villose, with rust-coloured tomentum

1. *S. villosa*.

Leaves shallowly 5-lobed, lobes entire; flower panicles pyramidal, erect; carpels covered with sharp bristles

2. *S. urens*.

Fruit-carpels membranous, opening long before maturity

3. *S. colorata*.

1. *S. villosa*, Roxb. Fl. Ind. iii. 153.—Tab. X.—W. & A. Prodr. 63.—Vern. *Gūlkandār*, *massu*, *osha*, *gūdḡudāḡa*, Pb.; *Udāl*, Kamaon; *Udār*, *udalla*, Oudh.

A tree, with grey or brown bark; leaves on long petioles, crowded at the end of branches, tomentose beneath, nearly glabrous above, deeply 5-7-lobed; lobes oblong or ovate-oblong, toothed or cleft. Stipules broad-lanceolate, deciduous. Flowers yellow, on slender pedicels, as long or nearly as long as the calyx, loosely arranged in long drooping panicles, 5-8 panicles at the end of the leafless branch; bracts linear, caducous; male and bisexual flowers mixed, the former by far the most numerous. Calyx campanulate, membranous, border yellow, bottom of the calyx pink,

outside with scattered stellate hairs. Flowers bisexual; ovary globose, on a gynophore as long as the calyx, surrounded at its base by 10 anthers inserted on a membranous ring, which is adnate to the gynophore. Fruit consisting of 2 to 7 sessile, oblong or obovoid, coriaceous carpels, 1½-3 in. long, clothed inside and outside with thick brown tomentum of stellate hairs; seeds several in each carpel.

Outer Himalaya to the Indus, ascending to 3500 feet. Panjab Salt range. Oudh forests, not common. Western coast from Guzerat southwards. South India. The old foliage is shed Dec., Jan.; new leaves issue May, June, after the flowers, which appear in March, April; the fruit ripens June, July.

Near its north-western limit this species is often only a shrub 8-10 ft. high, with a straight, somewhat irregular trunk, and a few large spreading branches. Further east and south it is a moderate-sized tree, 40-50 ft. high, with a short trunk to 5 ft. in girth, and a broad head. Bark grey or brown, smooth or somewhat rough with exfoliating scales. Wood soft and light, no distinct heartwood. The inner bark yields a coarse, very strong fibre, which is made into ropes and coarse canvas for bags. The ropes for dragging timber by elephants and buffaloes in South India are made of the bark of this species. A pellucid gum (*katila*) exudes from the trunk.

2. *S. urens*, Roxb. Pl. Corom. t. 24; Fl. Ind. iii. 145; W. & A. Prodr. 63.—Vern. *Gūlu, kūlu, kūlru, gular, gulli*, C.P.; *Kalanuri*, Panch Mehals.

A tree, with white bark. Leaves on long petioles crowded at the ends of branches, tomentose beneath, nearly glabrous above, sinuately 5-lobed; lobes entire, acuminate, sinuses shallow. Stipules caducous. Flowers small, numerous, greenish yellow, on short pedicels, supported by linear bracts longer than the bud, and deciduous after flowering. Panicles crowded, generally pyramidal, erect, every part covered with a glutinous yellow tomentum; a few bisexual mixed with a large number of male flowers. Gynophore shorter than calyx; filaments 10, alternately longer, united below into a thin sheath, which girds the gynophore. Fruit of 5 sessile radiating, ovate-lanceolate, hard, coriaceous carpels, 3 in. long, red when ripe, covered outside with many stiff bristles, which sting like those of the Cow-itch (*Mucuna*). Seeds oblong, dark chestnut-brown, from 3 to 6 in each carpel.

Terni forests and Siwalik tract, extending west to the Ganges. Behar, Central Provinces, especially the Satpura range, Bandelkhand, Gwalior, Western India from the Mhye river southwards. Common throughout the Peninsula and Ceylon, mostly on dry, rocky hills, often associated with *Boswellia thurifera*. Leafless during winter, fl. Jan.-March, the fruit ripening in April and May, and the young leaves appearing about the same time. The flowers, when touched, have an unpleasant smell, and so have the young parts of this and other species of *Sterculia*, hence the name.

A moderate-sized tree, from 30 to 50 ft. high; trunk short, often crooked and irregular, rarely exceeding 6 ft. in girth, with large spreading branches. Bark thick, cream-coloured, pink and white, smooth, shining, with a thin, white, transparent outer coat, peeling off like that of the birch. The wood is white, except the reddish part near the centre of large old trees, soft, light, used as fuel; *Sitars* (native guitars) and toys are made of it on the western coast. From cracks and incisions made in the bark exudes a white gum, which is

collected and sold under the name of *katila*, *katira*, with the gum of *S. villosa*, *Cochlospermum*, and other trees. The seeds are roasted and eaten by Gonds and Kurkus in the Central Provinces.

3. *S. colorata*, Roxb. Pl. Corom. t. 25; Fl. Ind. iii. 146; W. & A. 63. —Syn. *S. Wallichii*, Falc.; *Firmiana colorata*, R. Br. Vern. *Bodula*, *walena*, Pb., N.W.P.; *Samarri*, Oudh; *Khovsey*, *bhāikoi*, Bomb.

A tree. Leaves on long petioles crowded at the ends of branches, glabrous, 5-lobed, lobes acuminate. Panicles lateral or terminal, numerous, erect, bright orange-red; peduncles and calyx clothed with dense stellate pubescence. Flowers numerous, showy, about an inch long, on short pedicels. Calyx cylindrical-clavate, leathery, mouth 5-toothed. Anthers about 30, sessile on the gynophore below the ovaries. Carpels 5, oval; styles 5, short, recurved. Fruit of 1-5, stalked, oblong-lanceolate obtuse membranous carpels, opening out flat long before the seed ripens, pink outside, yellowish inside. Seeds generally 2, adhering one to each margin of the carpel near its base, size and shape of a small bean.

Forests along the foot and in the outer valleys of the Himalaya, from the Jumna south-eastward, ascending occasionally to 4000 ft. Oudh forests (rare), Central Provinces, the Peninsula, and Burma. In the dry deciduous forest. Leafless during winter, fl. March-April; the young leaves appear with or soon after the flowers. The seeds ripen June, July.

A moderate-sized tree, 50 to 60 ft. high, with an erect stem, often fluted, attaining a girth of 6 ft. Bark dark grey, reddish or brownish, with short longitudinal wrinkles, a few broad fissures, with a papery epidermis exfoliating. Wood of a dirty-white colour, with bands forming concentric lines, and conspicuous medullary rays, heartwood not distinct. Employed for ordinary agricultural work. Bark made into rope, less strong than that of *S. villosa*. Twigs and leaves lopped for cattle-fodder.

2. *HELICTERES*, Linn.

Calyx tubular, 5-cleft at the top, often oblique. Petals 5, equal, or the 2 upper ones broader, the claws elongated. Staminal column adnate to gynophore, bearing 5 or 10 anthers; anther-cells divaricating, often confluent into one. Ovary 5-lobed, 5-celled, with several ovules in each cell; styles 5, subulate, more or less connate. Fruit-carpels distinct or separating, opening along their inner edge, straight or spirally twisted. Seeds with little albumen; cotyledons leafy, folded round the radicle.

1. *H. Isora*, Linn.; Roxb. Fl. Ind. 143; W. & A. 60; Wight Ic. t. 180. —Syn. *Isora corylifolia*, Schott et Endl. Vern. *Muror phal*, *jonka-phal*, *kapāsi*, Pb., N.W.P.; *Bhēndu*, Oudh; *Antēri*, Banawarra; *Kewan*, *maradving*, Bomb.

Young branches and leaves covered with rough pubescence, chiefly of stellate hairs. Leaves on short petioles, broadly obovate or orbicular, shortly acuminate, base slightly cordate, often oblique, irregularly toothed, scabrous above, tomentose beneath; stipules deciduous. Peduncles short, axillary, bracteate, usually 2 or 4. Calyx about $\frac{1}{2}$ in. long or longer, obliquely and unequally 5-toothed. Petals red, twice as long, reflexed. Gynophore at the time of flowering as long as petals, afterwards elongated. Anthers 10, on short filaments, alternating with the teeth of the staminal

tube. Fruit 1-2 in. long, on a gynophore nearly as long, cylindrical, composed of 5 spirally twisted tomentose carpels.

Bengal, South and Central India. Banswara. Ondh forests (common). Sub-Himalayan tract as far west as the Jhelam. A shrub, or small tree; new leaves in April; fl. April, May, and throughout the rainy season; the ripe fruit on the tree in winter. The branches are used for fencing, and thatching; the bark yields a strong white fibre, made into coarse cordage and canvas for gunny-bags. Fruit and leaves used in native medicine.

3. *PTEROSPERMUM*, Schreb.

Trees or shrubs, pubescent with stellate hairs. Calyx 5-cleft, deciduous. Petals 5, deciduous. Staminal column adnate to the gynophore, divided at the top into 20 filaments, 5 without anthers (staminodia), 15 with linear anthers, the cells parallel, opening longitudinally. Ovary sessile on the top of the column, 5-celled, with several ovules in each cell; style undivided, club-shaped and 5-furrowed at the top. Capsule woody or coriaceous, opening loculicidally in 5 valves. Seeds produced into a wing at the top; albumen little or none; cotyledons wrinkled or folded.

Leaves peltate or obovate-oblong 1. *P. acerifolium*.

Leaves lanceolate 2. *P. lanceifolium*.

P. semisagittatum, a large tree from Burma, Chittagong, distinguished by lanceolate, semisagittate leaves; large, broad, lacinate stipules, which fall after the leaves are fully developed; broad lacinate bracts, large obovate petals, and an oblong fruit 3 in. long; is cultivated at Saharunpore and elsewhere in North-West India, but is not indigenous.

1. *P. acerifolium*, Willd.—Tab. XI.—Roxb. Fl. Ind. iii. 158; W. & A. Prodr. 69; Wight Ic. t. 631; Bot. Mag. 620.—Sans. *Karnikāra*. Vern. *Kanak-champa*, Beng.; *Tau-paivun*, Burm.

A large tree. Young branches and calyx covered with thick ferruginous tomentum. Stipules many-cleft, caducous. Leaves large, peltate or obovate-oblong, sinuately lobed, glabrous above, and grey tomentose beneath. Flowers fragrant, axillary, on short pedicels, with many-cleft bracts. Calyx deeply 5-cleft; segments linear, up to 5 in. long. Petals linear or obliquely wedge-shaped, pure white. Capsule ligneous, brown-tomentose, pentagonal, 2-6 in. long. Seeds numerous, obliquely oval, compressed, with large, brown, thin membranous wings.

Burma and hills of Eastern Bengal. Doons between Jumna and Sarda. Banks of the Jumna below Mussoorie (wild ?). Cultivated throughout India. Fl. from March to June, fruit ripens in the cold season. Wood of a light-red colour, firm. In the N.W. a moderate-sized tree, attains a large size in Burma.

2. *P. lanceifolium*, Roxb. Fl. Ind. 163.—Vern. *Ban kalla*, Beng.

A large tree. Young shoots and underside of leaves with short white or tawny tomentum. Stipules subulate. Leaves alternate, bifarious, lanceolate, acuminate, entire. Flowers fragrant, axillary, on peduncles longer than calyx, with 2 or 3 linear, lacinate bracts. Sepals linear, revolute, 1 in. long. Petals obliquely cuneiform, white. Capsules lanceolate, hoary, 5-celled. Seeds 2-4 in each cell, winged.

Burma, hills of Eastern Bengal. Sub-Himalayan tract as far west as the Jumna (wild ?). A tree of considerable size. Fl. May-June.

4. **ERIOLENA**, DC.

Shrubs or trees, with cordate leaves and deciduous stipules. Flowers on axillary few-flowered peduncles. Calyx deeply 5-cleft, with an involucrel (epicalyx) of 3-5, often laciniate bracts. Petals 5, with a broad, coriaceous, hairy claw. Stamens numerous, all fertile, monadelphous, in many rows, the outer ones gradually shorter; anthers linear-oblong, with parallel cells. Style one; stigma 10-lobed. Capsule woody, 5-10-celled, dehiscing loculicidally, the dissepiments attached to the valves. Seeds numerous in each cell, terminated by a broad, oblong, or tapering wing.

1. **E. Hookeriana**, W. & A. Prodr. 70; Bedd. Fl. Sylv. anal. gen. t. v.

A shrub or small tree. Leaves cordate, shortly acuminate, toothed, 3 in. broad, and about as long, petioles half the length of leaf; stipules linear, caducous. Young shoots, petioles, under side of leaves, inflorescence, bracts and outside of calyx clothed with dense light-grey stellate tomentum; upper side of leaves with scattered tufts of stellate hairs, or glabrate. Flowers 3-5, peduncles as long as or longer than leaf. Calyx-segments lanceolate, $\frac{3}{4}$ -1 in. long. Bracts deeply cut into numerous linear segments. Style hairy. Capsule 7-9-celled, ovoid, 1 in. long or nearly so, valves not keeled, tubercled outside.

South India. Behar. Common Satpura range. Guma (Gwalior). Fl. March, April. Fruit autumn and cold season.

A sp. of *Eriolana*, with leaves 5-6 in. across; petioles nearly as long as leaf, I found (in leaf only) in the Panch Mehals in Jan. 1870. (Vern. *Jehāti, bud-jāri-dhamin*.) It resembles *E. Stocksii*, Hf. & Th. (from the Concan); but I am inclined to think that the differences between *E. Hookeriana*, *E. flavescens*, Gareke, and *E. Stocksii*, are not very great.

In Nov. 1863 I found a tree on the Choti Gandak in Gorakhpur, vern. *Beem*, with large cordate, dentate leaves 6 in. broad, petioles 2 in., and oblong capsules, valves 8 villous, and obtusely keeled on the back, but not tubercled, which may possibly belong to *E. spectabilis*, Wall., a tree in Nepal with fine, close-grained wood; and among the plants collected by R. Thompson in Oudh, are young shoots of an *Eriolana*, buds clothed with stellate tomentum of long soft white hairs, stipules lanceolate, laciniate, bracts ovate, laciniate to about the middle, which may be referred to the same species. A tree of this genus from Burma (*Doani*) has beautiful red wood, which polishes well, and is not heavy, the cub. ft. weighing 47 lb.

ORDER XIV. **TILIACEÆ**.

Mostly trees or shrubs, with alternate simple leaves, and deciduous stipules. Flowers regular, generally bisexual and pentamerous. Sepals free or connate, valvate. Petals free. Stamens numerous, free or connate; anthers 2-celled. Ovary free, 2-10-celled; ovules definite or indefinite; placentation axile. Fruit generally 2-10-celled. Seeds with or without albumen.—Gen. Pl. i. 228; Royle III. 103, 104; Wight III. i. 79, 82.

Leaves 3-7-nerved at base; anthers bursting longitudinally. . . . 1. GREWIA.

Leaves penniveined; anthers opening by slits at the top 2. ELEOCARPUS.

To this family belong *Berrya Ammonilla* of Ceylon, distinguished by a 6-winged capsule, which yields the *Trincomalee* wood; the *Lime-tree* of Europe, *Tilia europæa*, with wing-like bracts, and globose indehiscent 1-2-seeded fruit,

and *Corchorus capsularis*, extensively cultivated in Bengal, and now one of the principal articles of export from Calcutta, yielding the Jute of commerce, with a round, 5-celled, many-seeded capsule.

1. GREWIA, Linn.

Trees or shrubs; extremities and leaves pubescent or tomentose with stellate hairs. Leaves with 3-7 basal nerves, generally with lateral nerves from midrib, and more or less distinct transverse veins at right angles. Flowers regular, bisexual, pentamerous; inflorescence cymose. Sepals distinct, deciduous, coriaceous, coloured on the inner side. Petals clawed, with a gland or hollow on the inside of the thickened base, sometimes wanting. Stamens indefinite, all fertile, free, inserted on a raised, often glandular torus. Ovary 2-4-celled; style subulate, stigma shortly 2-4-lobed. Fruit a drupe, 1-4-stoned, entire or lobed, stones 1- or more-seeded, and divided by spurious dissepiments between the seeds. Embryo with flat leafy cotyledons in a fleshy or horny albumen.

Peduncle generally one, opposite to leaf.

A tree; flowers yellow, in umbellate cymes 1. *G. oppositifolia*.

A small shrub; flowers white, 2-3, or solitary 2. *G. populifolia*.

Peduncles axillary, generally more than one.

Leaves oblong, ovate, or cordate.

Drupe, when dry, with a distinct crustaceous or coriaceous rind.

Leaves oblong; drupes small, on long pedicels 3. *G. pilosa*.

Leaves orbicular, deeply cordate; drupes glomerate, nearly sessile, $\frac{3}{4}$ in. across 4. *G. villosa*.

Leaves ovate or obovate; drupes pedunculate, nearly 1 in. across 5. *G. sclerophylla*.

Drupe fleshy, wrinkled when dry, no distinct coriaceous rind.

Trees; peduncles varying in length, never as long as leaves.

Tomentose; leaves obliquely ovate, stipules linear; buds not ribbed, ovoid, petals yellow 6. *G. vestita*.

Tomentose; leaves obliquely cordate, stipules lanceolate, with broad, oblique base; buds ribbed, cylindrical or clavate, petals red and yellow 7. *G. asiatica*.

Pubescent or hoary; leaves obliquely ovate-rhomboid, often with cordate base; stipules falcate, auriculate; buds cylindrical or obovoid 8. *G. tiliifolia*.

Herbaceous undershrubs; pedicels long slender 9. *G. sapida*.

Leaves lanceolate or ovate-lanceolate.

Leaves nearly glabrous, ovate-lanceolate 10. *G. laxigata*.

Leaves grey-tomentose or hoary beneath, lanceolate.

Flowers mostly unisexual; leaves sharp-serrate 11. *G. polygama*.

Flowers bisexual; leaves entire or serrulate, margin often undulate 12. *G. salvifolia*.

1. *G. oppositifolia*, Roxb. Fl. Ind. ii. 583.—Tab. XII.—Wight Ic. t. 82.—Vern. *Pastūvāne*, Afg.; *Dhamman*, *bhamman*, *pharica*, Ph.; *Būl*, *būng*, *bewal*, *bāhūl*, *bemal*, *bhīmal*, *bhengūl*, N.W.P.

Branches, leaves, and inflorescence rough with stellate hairs. Leaves 2-4 in. long, on short petioles, ovate, acuminate, often unequal at base, obtusely

serrate, 3 or 5 nerves proceeding from the base, scabrous-tomentose on both sides, the stellate hairs closer together beneath; stipules subulate, early deciduous. Inflorescence umbellate. Peduncle generally one, inserted more or less opposite the petiole; pedicels 3 to 7 or more, with linear bracts at their base, about $\frac{3}{4}$ in. long when in flower; peduncles $\frac{1}{2}$ -1 in. long. Flowers large, yellowish. Sepals linear, about $\frac{3}{4}$ in. long or longer, outside densely tomentose, with a prominent midrib between 2 deep furrows, giving the appearance of 3 nerves, inside reddish, smooth, with 3 to 7 parallel nerves. Petals linear, shorter than sepals, yellowish red. Drupe consisting of from 1 to 4 more or less distinct lobes, each the size of a small pea, fleshy, first olive-green, then wrinkled black, with scattered stellate hairs, glabrous when ripe.

Common; wild in the North-West Himalaya, from the Indus to Nepal, ascending to 6000 feet. Occasionally in the Salt range and other hills in the Panjab; also in the Suliman range, trans-Indus. Frequently planted near villages and houses in the hills. Leaves shed in March; the new foliage issues in April or early in May; fl. March-June, chiefly in May; fruit ripens Oct.-Dec.

A moderate-sized tree, 40 ft. high, with a straight short trunk, attaining 3 to 4 ft. in girth. Branches spreading, branchlets somewhat bifarious. Bark of trunk and larger branches $\frac{1}{2}$ inch thick, ash-coloured, smooth, longitudinally rugose. Wood white, light, very tough, used where strength and elasticity are required, for car-shafts, handles, shoulder-sticks for loads, bows (*goleit*) used to propel a ball as missile. The chief use of the tree is to furnish fodder for goats and sheep during winter; for this purpose the tree is lopped annually, the twigs and leaves are dried and stored between its branches. The inner bark is steeped in water 10 to 15 days, then beaten and made into cordage, used for sandals, boat and cattle ropes; but is not durable. Paper has also been made of it. The fruit is eaten.

2. *G. populifolia*, Vahl; W. & A. Prodr. 80; Boissier Fl. Orient. i. 843; Oliver Fl. Trop. Afr. i. 246.—Syn. *G. betulifolia*, Roth. Vern. *Ganger*, Pb.; *Gungo*, Sindh; *Gangerun*, Rajputana.

Branchlets rough with short stellate hairs. Leaves variable in form, generally broad-ovate, short-acuminate, more rarely obovate and obtuse or cuneate, sharp-dentate or irregularly serrate, and frequently thickened at the edges, greyish green on both sides, rough with short stellate hairs, with 3, rarely 5, nerves from base; petioles $\frac{1}{2}$ - $\frac{3}{4}$ in. long. Stipules subulate, early deciduous. Peduncles generally solitary, opposite to the leaves, 1-flowered or 2-3-flowered. Flowers large, white; sepals $\frac{1}{2}$ - $\frac{3}{4}$ in. long; petals shorter, the linear blade attached to the back of a ciliated scale (the claw), which fits round the angular torus. Drupe 2-lobed, shining, smooth, orange red when ripe; the lobes distinct, the size of small peas, each with a 2-celled stone.

Common on low hills trans-Indus, in the Salt range to 3000 ft., and in the more arid tracts of the Panjab as far as Delhi. Sindh, Afghanistan, Aden, N.W. Himalaya, ascending to 2000 ft. Dry hills of Rajputana. Peninsula. Tropical Africa, Egypt, Persia. A small shrub, with slender branches; the fruit, with a scanty but pleasant pulp, is eaten in Sindh. Fl. in the cold season. The wood makes good walking-sticks.

3. *G. pilosa*, Lam. ; W. & A. Prodr. 78.—Syn. *G. carpinifolia*, Roxb. Fl. Ind. ii. 587.

Branchlets, leaves, and inflorescence rough with short light-brown stellate tomentum. Leaves subcoriaceous, 2-4 in. long, on short petioles, oblong, shortly acuminate, serrate, base obtuse or cordate, the middle nerve with 4-5 main lateral nerves on either side, the lowest pair proceeding from near the base; transverse veins prominent. Peduncles axillary, 1-3, short, $\frac{1}{4}$ in. long; pedicels 1-3, same length. Flower-buds oblong, dilated at the base, constricted in the middle. Sepals linear, $\frac{1}{2}$ in. long. Petals one-third shorter than sepals, linear, emarginate. Drupe 1-4-lobed, $\frac{1}{2}$ in. across, on pedicels $\frac{1}{2}$ in. long, with a crustaceous rind, covered with stellate pubescence. Specimens in leaf only may be distinguished by the cordate or rounded base of the oblong, short-acuminate leaves, with prominent transverse veins.

North-West India, Behar, Bandelkhand, Central Provinces, Rajputana, Guzerat, and South India. A shrub; fl. July-Sept; the fruit ripens in the cold season. The fruit of a shrub near this, and probably the same, called *Karanto*, on the Bassi hills, east of the Bunass river in Meywar, is eaten.

G. hirsuta, Vahl. ; W. & A. Prodr. 78—syn. *G. pilosa*, Roxb. Fl. Ind. ii. 588—is a shrub in South India with some resemblance to *G. pilosa*, Lam., with lanceolate, thick and soft-tomentose, penninerved and wrinkled leaves; buds ovoid; sepals $\frac{1}{2}$ in. long, or less. Drupes slightly lobed, with long stiff hairs.

4. *G. villosa*, Willd. ; W. & A. Prodr. 79; Dalzell & Gibson, Bombay Flora, 25.—Vern. *Inzarra*, *pastucanne*, T.I.; *Jalidar*, *kaskūri*, *thamther*. Salt Range; *Gawāl kopra*, Kishengurh.

Young parts and leaves clothed with long soft hairs. Leaves 1-3 in. long, rugose above, villous beneath, nearly orbicular, deeply cordate, sharp-serrate, serratures bearded with tufts of long soft hairs. Petioles $\frac{1}{2}$ -1 in. long. Basal nerves 3-6; lateral nerves 3-4 on either side of midrib, and on the outer side of the basal nerves; transverse veins prominent. Stipules ovate-lanceolate, deciduous. Flowers dull yellow, in short compact axillary cymes. Sepals linear, clothed with long soft hairs; petals much shorter than sepals. Fruit globose, the size of a cherry when dry, with a crustaceous, brown or reddish rind, covered with tufts of long stellate hairs. Stones 4, 1-2-seeded, in a sweet edible pulp.

Sindh, Panjab, trans-Indus, Salt range, Rajputana, the Konkan. South India, tropical Africa and Cape de Verde Islands. Fl. June-Sept. A small shrub. The fruit is eaten.

5. *G. sclerophylla*, Roxb. Hort. Beng. 42.—Syn. *G. scabrophylla*, Roxb. Fl. Ind. ii. 584; Wight Ic. t. 89. Vern. *Pharsia*, Kamaon.

Branchlets, inflorescence, and under side of leaves clothed with soft tomentum. Leaves scabrous above, ovate or obovate, obtuse or shortly acuminate, unequally serrate, 3-9 in. long; petioles $\frac{1}{2}$ -1 in. long; transverse nerves distinct; stipules linear, deciduous. Peduncles axillary, generally 1-4 together, of various length, 2-3-flowered; bracts small subulate, caducous. Flowers white. Sepals linear-lanceolate, nearly 3 times the

length of the petals. Drupe the size of a large gooseberry, nearly round, when ripe brownish grey and a little hairy, with a coriaceous rind when dry, pulp sweet, glutinous, pale yellow. Nuts 4, obovoid, rugose, thick and hard, 1-2-seeded.

A small shrub or undershrub, 3-4 ft. high, common in the Doons and Siwaliks from the Jumna eastward. Oudh forests. Sikkim. Fruit eatable (*Gurbheli*). Fl. April-Sept.

G. abutilifolia—Juss. *G. aspera*, Roxb. Fl. Ind. ii. 591—arborescent, from South India, resembles this sp. in leaves and inflorescence.

6. *G. vestita*, Wall.—Syn. *G. elastica*, Royle Ill. t. 22. Vern. *Furri*, *phalwa*, *dhamman*, Pb.; *Pharsia*, *pharsai*, *pharsula*, *dhamun*, *dhamman*, N.W.P.; *Phalsa*, *dhamin*, *damon*, C.P.

Young branches, under side of leaves, and inflorescence with soft grey tomentum. Leaves 2-4 in. long, on short petioles, obliquely ovate, acuminate, serrate, sometimes indistinctly 3-lobed, with 5 or 6 basal nerves, pale beneath; stipules linear, nearly as long as petiole. Cymes compact, axillary. Peduncles short, 3 to 5 or more, generally not longer than $\frac{1}{2}$ in., each bearing 2 or 3 pedicels of about the same length, supported by linear bracts. Flower-buds ovoid. Sepals linear-lanceolate, about $\frac{1}{2}$ in. long; nerves indistinct, outside softly tomentose with long fine hairs, inside glabrous, yellow. Petals much shorter than sepals. Drupe pear-shaped or globose, of the size of a pea, fleshy, 2-4-lobed, black when ripe.

Outer Himalaya, as far west as the Indus. Salt range. Eastern Bengal. Behar and Central Provinces. New leaves appear in May; the flowers, which are orange-yellow, not very conspicuous, from Jan. to May; the fruit ripens Aug. to Nov.

A small tree, 25 ft. high, with a trunk rarely exceeding 2 ft. girth. Bark of stem cinereous or dark brown, smooth, longitudinally rugose. Sapwood white or light brown; heartwood pale yellow, reddish brown, or grey brown, fairly close, fine and even-grained, when seasoned weighing about 50 lb. per cub. ft., strong, tough, and elastic. Used for shoulder-poles for loads, bows, spear-handles. Fruit eaten.

7. *G. asiatica*, Linn.; W. & A. Prodr. 79; Roxb. Fl. Ind. ii. 586.—Vern. *Phalsa*, *phalsi*, *dhamin*.

Young branches, under side of leaves, and inflorescence with soft grey or yellowish tomentum. Leaves 2 to 7 in. long, obliquely cordate or broad-ovate, acuminate, irregularly toothed, with 5, 6, or 7 arching nerves proceeding from the base; stipules linear-lanceolate, often with a broad oblique base; petioles $\frac{1}{2}$ in. long. Peduncles axillary, 2 to 7, varying in length from $\frac{1}{2}$ -2 inches, but mostly 1-2 in. long, bearing from 3 to 5 flowers on bracteate divaricating pedicels, shorter than peduncle. Flower-buds ribbed, cylindrical or clavate. Sepals varying in length, generally $\frac{3}{4}$ in. long, whitish-tomentose outside, reddish brown or yellow inside. Petals red and yellow, emarginate, half as long as sepals. Drupe globose, dark brown when ripe, indistinctly lobed, with 1 or 2 nuts.

Cultivated throughout India, in Burma, and the Mauritius. Said to be wild

in the Poona district (Dalz. & Gibson, Bombay Fl. 26), the Salt range, Garhwal, the Oudh forests (R. Thompson), and the Banda district (Edgeworth). Outside India, in Upper Guinea and South Central Africa, with obliquely cordate leaves, soft tomentose on both surfaces (Oliv. Fl. Trop. Afr. i. 249). In Dec. 1869, I found a shrub (in leaf only) wild on the dry hills of the northern Aravalli near Todgarh, called *Dhāmin*, which I refer to this species. A month later, I found what appeared to me the same plant in Banswara as a tree, called *Damanat*. Eventually it may be right to unite *G. vestita* with *G. asiatica*. I admit that the specific differences here given are slight, and further researches may possibly remove them altogether. At present, however, it seems to me more convenient to keep the two species separate.

New leaves about the end of March. Fl. Feb. March; fruit ripens in the following months. A middle-sized tree, 25 ft. high, with short trunk 3-4 ft. in girth. Bark $\frac{1}{2}$ in. thick, grey or dark brown, undulating, smooth with shallow longitudinal cracks. Sapwood whitish; heartwood reddish brown, with many minute pores, close, even-grained, strong, tough, elastic. Bark employed for making rope, mucilaginous, used for refining sugar in Saharanpur district. Cultivated for the small, not very succulent, pleasantly acid fruit.

8. *G. tiliaefolia*, Vahl.; W. & A. Prodr. 80; Roxb. Fl. Ind. ii. 587; Bedd. Fl. Sylv. t. 108.—Vern. *Pharsa*, Oudh; *Dhāmin*, C.P.

Young branches and leaves pubescent, with scattered stellate hairs. Leaves on petioles $\frac{1}{2}$ -1 in. long, obliquely ovate, sometimes rhomboid, acuminate, bluntly toothed or serrate, with 5 basal nerves, 3 of which are prominent and penniveined, upper side at length glabrous, under side more or less pubescent. Stipules broad-lanceolate, often falcate and auriculate. Peduncles axillary, numerous (3-10), 3-5-flowered; bracts deciduous. Flower-buds cylindrical or obovoid. Sepals linear, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, pubescent outside, glabrous inside. Petals oblong, half the length of sepals. Drupes globose, size of a pea, indistinctly lobed.

Hot, dry forests throughout India, Siwalik tract from the Jumna to Assam. Oudh, Behar, Bandelkhand, Central Provinces, the Konkan and the Peninsula. Frequently associated with *Sāl*. Leaves shed in March; new foliage in April. Fl. in April and May; fruit ripens from June to October.

A moderate-sized tree, 30-35 ft. high, with an erect, straight trunk, 4-5 ft. in girth. Bark $\frac{1}{2}$ in. thick, cinereous, with dark blotches, rough with exfoliating scales. Sapwood whitish; heartwood light reddish brown, compact, close-grained. Weighs 30-40 lb. per cub. ft. Easily worked, elastic, durable. Contracts and expands much with wet and dry weather, but is valuable where strength and elasticity are required. Made into shafts, shoulder-poles for loads, pellet-bows, handles, masts, oars, employed in cart and carriage building. From the inner bark cordage is made in Bombay. Twigs and leaves lopped for fodder. Fruit eaten, of an agreeable acid flavour.

9. *G. sapida*, Roxb. Fl. Ind. ii. 590.—Syn. *G. nana*, Wall.

Pubescent or tomentose. Leaves ovate or obovate, serrate, 3-5-nerved, often shallow-lobed, pale beneath; petioles $\frac{1}{4}$ in. long. Stipules subulate. Peduncles 2-5, axillary, slender, 1 in. long, each with 2-5 flowers on short, divergent, often divaricate, pedicels. Flowers yellow; sepals linear-