

ON THE BOTANY OF MANAS WILD LIFE SANCTUARY IN ASSAM

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A B S T R A C T

The Manas Wild Life Sanctuary (26°30'–27° N and 91°–92° E) falls under the 'Tiger Project' area of Assam. The area is covered chiefly by dry or moist deciduous forests; tall grasses grow on vast areas and provide cover for rich wild life.

The paper enumerates 383 species of phanerogams, collected during three botanical excursions. There are about 90 tree species in the area, and same number of shrubs and undershrubs. The composition of the flora and dominant vegetation types are briefly discussed.

INTRODUCTION

The north-eastern region of India has a number of game sanctuaries and sacred groves, and only one National Park, namely the Kaziranga National Park.

The Manas Wild Life Sanctuary falls under the Tiger Project area of Assam. It is necessary to study the nature of plant life in the sanctuaries and National Parks of the country because it is the particular forest ecosystem which suits and supports particular fauna.

Till 20 years ago, almost nothing was written on our National Parks or on the subject of endangered species and conservation of flora. Late'y, several papers have emphasised the need to study the flora and vegetation of such areas, as well as the significance of conserving the rare and endangered species (Maheshwari, 1963, 1971; Naithani, 1966; Qureshi & Kaul, 1971; Sahni, 1971; Santapau, 1969, 1971; Subramanyam & Sreemadhavan, 1969, 1971; Subramanyam & Jain, 1972; Vartak, 1975).

There are several publications on the importance of preservation of wild life in India, but they deal primarily with animal life. (Burton, 1948; Gee, 1964; Lahan &

Sonowal, 1973; Sankhala, 1973; Spillett, 1967; Stracey, 1969; Waller, 1972).

The current research projects of Eastern Circle of the Botanical Survey of India include a survey of vegetation and flora of National Parks, sanctuaries and sacred groves of this region.

Manas Wild Life Sanctuary lies approximately between 26°30'–27°N and 91°–92°E. It is bounded in the north by the international boundary between India and Bhutan, in the south by the thickly populated regions of North Kamrup district of Assam; but in east and west, the different reserved forests of the sanctuary extend into other forests; at places they are separated by cultivated fields and gardens. Of the total area of 2837 sq. km under the 'Tiger Project' in Assam, Manas has about 580 sq. km. It was established in 1928 and is named after the Goddess 'Manasa'.

The terrain is a flat land gently sloping to the south with a number of rivers draining from north to south. The main rivers are Manas, Mora-Manas (or Beki), Jongrong, Gyati, Chorphuli, Garuchara and Rabang. The climate is warm and humid. Maximum temperature goes upto about 37°C and the mean minimum temperature is about 11°C. The soil is deep alluvium.

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This area had not been properly explored botanically. There are very few collections in the herbarium of Botanical Survey of India, Eastern Circle, Shillong (ASSAM) from this area, most of the earlier collections

(i.e. of Kanjilal and others) being from the areas on the boundary of the sanctuary.

The present account is based on three exploration tours during which several spots of the sanctuary were visited.



Plate I: An open spot in semi-evergreen forest showing dense growth of plants of *Laca*, *Alpina* & *Saccharum*.

GENERAL ACCOUNT OF VEGETATION

Though the general vegetation of eastern India was described by Rolla & Panigrahi (1961), there are no adequate accounts of vegetation of National Parks or game sanctuaries.

The vegetation of Manas Wild Life Sanctuary can be broadly classified into three types:

(a) Tropical semi-evergreen forests: (Plate I).

Semi-evergreen patches occur chiefly along the northern part of the sanctuary, on the India-Bhutan international boundary. The common trees in these forests are *Aphanaxis polystachya*, *Anthocephalus chinensis*, *Syzygium cumini*, *S. formosum*, *S. oblatum*, *Bauhinia purpurea*, *Mallotus philip-*

pensis, *Cinnamomum tamala*, *Actinodaphne obovata*, etc. These tree species occasionally form a dense canopy.

The undergrowth in these forests comprises mainly of *Leea aequata*, *Coffea bengalensis*, *Phlogacanthus thyrsiflorus*, *Adhatoda vasica*, *Clerodendrum viscosum*, *Holmskioldia sanguinea* and *Piper diffusum*.

(b) *Tropical moist and dry deciduous forests*: (Plate II)



Plate II : A view of mixed deciduous forest with tree species of *Careya*, *Gmelina*, *Tamarindia*, *Dillenia* etc.

This is the commonest vegetation type in the sanctuary. The common trees here are *Bombax ceiba*, *Sterculia villosa*, *Dillenia indica*, *D. pentagyna*, *Careya arborea*, *Lagerstroemia parviflora*, *L. speciosa*, *Terminalia bellirica*, *T. chebula*, *Trewia polycarpa*, *Gmelina arborea*, *Oroxylum indicum*, *Bridelia* spp. etc.

(c) *Alluvial grasslands*: (Plate III)

Extensive patches of grasslands are found in the western part of the sanctuary. They also occur in open areas at other spots. (Plate IV). The common grass species are *Apluda mutica*, *Brachiaria distachya*, *Capillipedium assimile*, *Chrysopogon aciculatus*, *Cynodon dactylon*, *Cyrtococcum accrescens*, *Digitaria ciliaris*, *D. longiflora*, *Echinochloa colonum*, *Eleusine indica*, *Erianthus*

longisetosus, *Hemarthria protensa*, *Imperata cylindrica*, *Neyraudia reynaudiana*, *Pogonatherum rufobarbatum*, *Polytoca digitata*, *Rottboellia exaltata*, *Saccharum procerum*, *S. spontaneum*, *Themeda villosa* and several species of the genera *Eragrostis*, *Panicum* and *Paspalum*. Several tree and shrub species grow scattered in the grasslands; these usually are *Dillenia pentagyna*, *Phyllanthus emblica*, *Bombax ceiba* and species of *Clerodendrum*, *Leea*, *Grewia*, *Premna* and *Mussaenda*.



Plate III : A grassland near Mothanguri, chiefly of *Saccharum* spp. and several trees of *Bombax ceiba*.

AQUATIC PLANTS

There is considerable aquatic flora in the region. In addition to river banks and beds, there are numerous pools and puddles in the sanctuary, which have a variety of aquatic flora. The more common aquatic plants can be classified as below (based on the system proposed by Mirashi, 1957).

(a) Free-floating hydrophytes: e.g. *Azolla pinnata*, *Eichhornia crassipes*.

(b) Suspended submerged hydrophytes: e.g. *Ceratophyllum demersum*.

(c) Anchored submerged hydrophytes: e.g. *Limnophylla sessiliflora*, *Ottelia alismoides*, *Vallisneria spiralis*, *Cryptocoryne*, etc.

(d) Anchored hydrophytes with floating leaves: e.g. *Nymphaea nouchali*, *Nymphaoides cristatum*.

(e) Anchored hydrophytes with floating shoots: e.g. *Limnophila heterophylla*.



Plate IV Another patch of grassland on outskirts of semi-evergreen forest. Trees of *Dillenia* in background ; grassland with some plants of large-leaved *Leea* in foreground.

(f) Emergent amphibious hydrophytes: e.g. *Polygonum posumbu*, *Typha elephantina*, *Monochoria hastata*.

(g) Wetland hydrophytes: e.g. *Cyperus brevifolius*, *Lasia spinosa* etc.

ANALYSIS OF FLORA

The plants collected from the area so far belong to 383 species of phanerogams. The dicotyledons plants belong to 74 families, 211 genera and 285 species, and the monocotyledons to 17 families, 67 genera and 98 species. These include 89 tree species, 49 shrubs, 37 undershrubs, 172 herbs and 36 climbers. In addition to these, 18 species of ferns were also collected; these belong to 6

families and 14 genera. Out of these 18 species of ferns, 11 are terrestrial, 6 epiphytic and 1 is aquatic.

A special mention may also be made of the orchids and grasses in the flora; 15 species of orchids, 3 terrestrial and 12 epiphytic, have been collected so far. Already 43 species of grasses belonging to 29 genera have been collected. Several exotic species have become almost completely naturalised in the area. Important among these are *Mikania micrantha*, *Eupatorium odoratum*, *Bidens biternata* and *Tridax procumbens* etc. *Mikania* is present in great abundance and is a very troublesome weed now. In ad-

jacent forests, where silvicultural operations are necessary, the only way of containing it is mechanical, that is, cutting of stems above ground level.

UTILITARIAN ASPECT OF THE FLORA

The vegetation and flora of the Game Sanctuary has considerable utilitarian value. This Game Sanctuary is inhabited by such wild life as elephants, rhinoceros, deer, wild buffalo and Indian bison. Recently 'golden lengur' has also been reported from this sanctuary. These animals depend on the animals and plants of the sanctuary for their food. The information gathered from the staff of the wild life sanctuary and observations on animals actually eating some plants or sometimes observations on droppings suggest that the following plants are eaten by wild animals. The local names of plants are given against each species.

<i>Alpinia allughas</i>	'Tora'
<i>Musa ornata</i>	'Kal-Goss'
<i>Saccharum procerum</i>	'Kush-Bon' or 'Ikara'
<i>S. spontaneum</i>	'Kush-Bon'
<i>Eichhornia crassipes</i>	'Pani-Meteca'
<i>Albizia odoratissima</i>	'Sirish'
<i>A. procera</i>	'Koroi'
<i>Bombax ceiba</i>	'Simolu'
<i>Dillenia indica</i>	'Ou-Tenga'
<i>Calamus floribundus</i>	'Bet'
<i>Ficus scandens</i>	'Dimoru'
<i>Lippia geminata</i>	'Bon-Tulshi'
<i>Alternanthera sessilis</i>	'Mati Kaduri'
<i>Oenanthe stolonifera</i>	'Bon-Joni'
<i>Hygroryza aristata</i> etc.	'Dal-Ghah'

The flora of the sanctuary includes also some well-known medicinal and economic plants such as: *Phyllanthus emblica* L., *Terminalia bellirica* (Gaertn.) Roxb., *Tchebula* Retz., *Rauvolfia serpentina* (L.) Benth. ex Kurz, *Hodgsonia macrocarpa* (Bl.) Cogn., *Stephania hernandifolia* (Willd.) Walp., *Dillenia indica* L., *Gmelina arborea* L., *Toona ciliata* Roem, *Calamus floribundus* Griff., *Dioscorea bulbifera* L. and *D. pentaphylla* L.

ENUMERATION

FERNS AND FERN ALLIES

EQUISETACEAE

Equisetum debile Roxb.

SCHIZAEACEAE

Lygodium japonicum (Thunb.) Sw.

PTERIDACEAE

Adiantum caudatum L.

A. philippense L.

Cheilanthes farinosa (Forsk.) Klf.

Microlepia speluncae (L.) Moore

Onychium siliculosum (Desv.) C. Chr.

Pteris biaurita L.

Pycnodoria cretica (L.) Small

ASPIDIACEAE

Cyclosorus unitus (L.) Ching

Thelypteris multiflineata (Wall. ex Hook.) Morton

POLYPODIACEAE

Antrophyum reticulatum (Forst.) Klf.

Drynaria quercifolia (L.) J. Sm.

Pyrrosia beddomeana (Gies.) Ching

P. flocculosa (D. Don) Ching

P. lanceolata (L.) Farewell

P. longifolia (N. L. Burm.) Morton

SALVINIACEAE

Azolla pinnata R. Br.

PHANEROGAMS

RANUNCULACEAE

Clematis gouriana Roxb. ex DC.

DILLENACEAE

Dillenia indica L.

D. pentagyna Roxb.

MAGNOLIACEAE

Magnolia pterocarpa Roxb.

ANNONACEAE

Polyalthia simiarum (Hook. f. & Thoms.) Hook. f. & Thoms.

MENISPERMACEAE

Stephania hernandifolia (Willd.) Walp.

NYMPHAEACEAE

Nymphaea nouchali Burm. f.

BRASSICACEAE

Rorippa indica (L.) Hiern.

CAPPARACEAE

Capparis olacifolia Hook. f. & Thoms.

Crataeva nurvala Buch.-Ham.

FLACOURTIACEAE

Casearia vareca Roxb.**Xylosma longifolium** Clos.

POLYGALACEAE

Polygala chinensis L.

PORTULACACEAE

Portulaca oleracea L.

TAMARICACEAE

Tamarix dioica Roxb.

SAURAUACEAE

Saurauia armata Kurz (*S. cerea* Griff.)

MALVACEAE

Abelmoschus pungens Roxb.**Kydia calycina** Roxb.**Sida veronicifolia** Lam.**Urena lobata** L.

BOMBACACEAE

Bombax ceiba L.

STERCULIACEAE

Pterospermum acerifolium Willd.**Sterculia villosa** Roxb.

TILIACEAE

Grewia elastica Royle**G. sapida** Roxb.**G. serrulata** DC.**Triumfetta rhomboidea** Jacq.

ELAEocarPACEAE

Echinocarpus assamicus Benth.

LINACEAE

Linum usitatissimum L.**Reinwardtia indica** Dumort.

GERANIACEAE

Biophytum reinwardtii (Zucc.) Klotz.

OXALIDACEAE

Oxalis corniculata L.

BALSAMINACEAE

Impatiens trilobata Coleb.

RUTACEAE

Glycosmis arborea (Roxb.) Corr.**Micromelum minutum** (Forst. f.) W. & A.**Murraya koenigii** (L.) Spreng.**M. paniculata** (L.) Jack.

BURSERACEAE

Garuga gamblei (King) W. W. Smith

MELIACEAE

Aphanamixis polystachya (Wall.) Parker
(*Amoora rohituka* W. & A.)**Chukrasia tabularis** A. Juss.**Dysoxylon binectariferum** (Roxb.) Hook. f.
ex Bedd.**Melia azedarach** L.**Toona ciliata** Roem.

OLACACEAE

Natsiatum herpeticum Buch.-Ham.**Olex nana** Wall.

CELASTRACEAE

Celastrus paniculata Willd.

RHAMNACEAE

Rhamnus nipalensis Wall.**Ventilago denticulata** Willd.**Zizyphus funiculosa** Buch.-Ham.**Z. mauritiana** Lamk.(Z. *jujuba* Laws.)

VITACEAE

Cayratia pedata (Lour.) Gagnep.**Cissus adnata** Roxb.**C. assamica** (Laws.) Craib**Tetrastigma leucostaphylum** (Dennst.) Balak.**Vitis planicaulis** Hook. f.

LEEACEAE

Leca aquata L.**L. alata** Edgew.**L. crispa** Willd.

SAPINDACEAE

Sapindus erectus Hiern.

HIPPOCASTANACEAE

Aesculus assamica Griff.

SABIACEAE

Meliosma simplicifolia (Roxb.) Walp.**Sabia paniculata** Edgew.

ANACARDIACEAE

Mangifera sylvatica Roxb.**Pegia nitida** Colebr.

PAPILIONACEAE (FABACEAE)

Butea parviflora Roxb.**B. monosperma** (Lamk.) Taub.**Cantharospermum scarabaeoides** (L.) Baill.[*Atylosia scarabaeoides* (L.) Benth.]**Crotalaria albida** Heyne ex Roth

Crotalaria anagyroides H. B. & K.

C. striata DC.

Dalbergia sericea G. Don

D. sissoo Roxb.

Derris robusta (Roxb. ex DC.) Benth.

Desmodium gangeticum (L.) DC.

D. pulchellum (L.) Benth.

D. triangulare (Retz.) Merr.

D. triflorum (L.) DC.

Flemingia congesta Roxb.

F. strobilifera R. Br. ex Ait.

Millettia pachycarpa Benth.

Mucuna prurita Hook. f.

Tephrosia candida (Roxb.) DC.

Uraria arborcum (D. Don) G. Don

U. picta Desv.

U. rufescens (DC.) Schindl.

Vigna trilobata (L.) Verd.

CAESALPINIACEAE

Bauhinia anguina Roxb.

B. purpurea L.

B. variegata L.

Cassia fistula L.

C. mimosoides L.

C. tora L.

Mezoneuron cucullatum (Roxb.) W. & A.

MIMOSACEAE

Acacia catéchu Willd.

A. oxyphylla Grah. ex Craib

Albizia odoratissima (L. f.) Benth.

A. procera (Roxb.) Benth.

Mimosa himalayana Gamble

M. pudica L.

MORINGACEAE

Moringa oleifera Lamk.

RHIZOPHORACEAE

Carallia brachiata (Lour.) Merr.

COMBRETACEAE

Terminalia bellirica (Gaertn.) Roxb.

T. chebula Retz.

MYRTACEAE

Syzygium cumini (L.) Skeels

S. formosum (Wall.) Masamune

S. oblatum (Roxb.) Wall. ex A. M. & J. M.
Cowan

BARRINGTONIACEAE

Careya arborea Roxb.

MELASTOMATACEAE

Melastoma malabathricum L.

Osbeckia nutans Triana

O. rostrata D. Don var. **pulchella** Benth.

LYTHRACEAE

Cuphea balsamona Ch. & Schl.

Duabanga grandiflora (Roxb. ex DC.) Walp.

Lagerstroemia parviflora Roxb.

L. speciosa (L.) Pers.

Woodfordia fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia octovalvis subsp. **sessiliflora** (Micheli) Raven

CUCURBITACEAE

Gymnopetalum cochinchinense (Lour.) Kurz

Hodgsonia macrocarpa (Bl.) Cogn.

Luffa aegyptiaca Mill.

Momordica dioica Roxb. ex Willd.

Solena heterophylla Lour.

Trichosanthes bracteata (Lamk.) Voigt

APIACEAE

Oenanthe benghalensis Benth.

O. javanica (Bl.) DC.

ALANGIACEAE

Alangium begoniaefolia (Roxb.) Bail.

CAPRIFOLIACEAE

Viburnum co'ebrookianum Wall.

RUBIACEAE

Anthocephalus chinensis (Lamk.) Rich. ex Walp.

(*A. cadamba* Miq.)

Coffea bengalensis Wall. ex Roxb.

Hedyotis costata (Roxb.) Kurz

H. scandens D. Don

H. tenelliflora Bl.

Ixora acuminata Roxb.

Mussaenda incana Wall.

M. roxburghii Hook. f.

Paederia foetida L.

Randia spinosa (L. f.) Poir.

Uncaria sessilifructus Roxb.

ASTERACEAE

Ageratum conyzoides L.

Artemisia nilagirica (Clarke) Pamp.
Bidens biternata (Lour.) Merr. & Sherf.
Blumea fistulosa (Roxb.) Kurz
B. sessiliflora Decais.
Cotula hemisphaerica (Roxb.) Wall. ex Cl.
Crassocephalum crepidioides (Benth.) S. Moore
Elephantopus scaber L.
Emilia sonchifolia (L.) DC.
Eupatorium odoratum L.
Gnaphalium purpureum L.
Lactuca rostrata (Thunb.) Miq.
Mikania micrantha H. B. K.
Senecio latiligulatus Balak.
S. sisymbriiformis DC.
Sonchus oleraceus L.
Synedrella nodiflora (L.) Gaertn.
Tridax procumbens L.
Vernonia cinerea (L.) Less. var. *cinerea*
V. cinerea (L.) Less. var. *hispida* (Bl.)
 Koster.
V. cinerea (L.) Less var. *linifolia* (Bl.) Koster.
V. saligna DC.

MYRSINACEAE

Ardisia solanacea Roxb.
Maesa indica Wall.

APOCYNACEAE

Alstonia scholaris (L.) R. Br.
Cryptolepis buechanani Roem. & Sch.
Holarrhena antidysenterica (L.) Wall. ex G.
 Don
Ichnocarpus frutescens (L.) R. Br.
Rauvolfia serpentina (L.) Benth. ex Kurz
Rhynchodia wallichii Benth.
Tabernaemontana divaricata (L.) R. Br.
 (*T. coronaria* Hook. f.)
Thevetia peruviana (Pers.) K. Schum.
Vallaris solanacea (Roth) O. Ktze.
Wrightia tomentosa Roem. & Sch.

ASCLEPIADACEAE

Calotropis acia Buch.-Ham.

BUDDLEJACEAE

Buddleja asiatica Lour.

GENTIANACEAE

Nymphoides cristatum (Roxb.) O. Ktze.

BORAGINACEAE

Cynoglossum furcatum Wall.

CORDIACEAE

Cordia dichotoma Forst. f.

CONVOLVULACEAE

Argyrea nervosa (Burm. f.) Boj.
A. roxburghii Choisy.
Cuscuta reflexa Roxb.
Merremia umbellata (L.) Hall. f.
M. vitifolia (Burm. f.) Hall. f.

SOLANACEAE

Capsicum minimum Roxb.
Physalis minima L.
Solanum aculeatissimum Jacq.
S. nigrum L.
S. torvum Sw.

SCROPHULARIACEAE

Limnophila heterophylla Benth.
L. sessiliflora Bl.
Lindernia ciliata (Colson.) Pennell
Scoparia dulcis L.
Torenia diffusa D. Don

BIGNONIACEAE

Oroxylum indicum (L.) Vent.
Radermachera gigantea (Bl.) Miq.

THUNBERGIACEAE

Thunbergia grandiflora (Roxb. ex Rottl.) Roxb

ACANTHACEAE

Adhatoda vasica Nees
Barleria cristata L.
Eranthemum nervosum (Vahl) R. Br.
E. scabrum Wall. ex T. And.
Goldfussia discolor Nees
Lepidagathis incurva Buch.-Ham. ex Don
Pharolopsis dorsiflora (Retz.) Santapau
Phlogacanthus thyrsiflorus Nees
Rungia parviflora (Retz.) Nees

VERBENACEAE

Callicarpa arborea Roxb.
Clerodendrum indicum (L.) Ktze.
C. serratum (L.) Moon
C. viscosum Vent.
Gmelina arborea L.
Holmskioldia sanguinea Retz.
Phyla nodiflora (L.) Green
Premna bengalensis Clarke
P. herbacea Roxb.

Premna latifolia Roxb.

Vitex glabrata R. Br.

LAMIACEAE

Anisochilus polystachys Benth.

Hyptis suaveolens (L.) Poit.

Leucas lavandulaefolia Sm.

Mosla dianthera (Buch.-Ham.) Maxim.

Plectranthus ternifolius D. Don

Pogostemon auricularius (L.) Hassk.

AMARANTHACEAE

Achyranthes aspera L.

Aerva sanguinolenta (L.) Bl.

Alternanthera sessilis (L.) R. Br.

Amaranthus gracilis Desf.

A. spinosus L.

Cyathula prostrata (L.) Bl.

Deeringia amaranthoides (Lamk.) Merr.

NYCTAGINACEAE

Boerhavia diffusa L.

POLYGONACEAE

Polygonum barbatum L.

P. chinense L.

P. perfoliatum L.

P. posumbu D. Don

P. strigosum Br.

PIPERACEAE

Piper diffusum Vahl

P. longum L.

LAURACEAE

Actinodaphne obovata (Nees) Bl.

Cinnamomum tamala Nees

Litsea glutinosa (Lour.) C. B. Robins

L. monopetala (Roxb.) Pers.

L. salicifolia (Nees) Hook. f.

Machilus villosa Hook. f.

ELAEAGNACEAE

Elaeagnus pyriformis Hook. f.

LORANTHACEAE

Macrosolen cochinchinensis (Lour.) van Tiegh.

EUPHORBIACEAE

Antidesma diandrum (Roxb.) Roth

A. ghaesembilla Gaertn.

Aporosa oblonga Muell.-Arg.

Bischofia javanica Bl.

Breynia rhamnoides Muell.-Arg.

Bridelia retusa Spreng.

B. stipularis (L.) Bl.

Chamaesyce hirta (L.) Millsp.

Croton caudatus Geisl.

C. joufra Roxb.

C. roxburghii Balak.

Glochidion assamicum Hook. f.

G. oblatum Hook. f.

Homonoia riparia Lour.

Macaranga denticulata (Bl.) Muell.-Arg.

Mallotus philippensis (Lamk.) Muell.-Arg.

Phyllanthus emblica L.

(*Emblica officinalis* Gaertn.)

P. debilis Willd.

P. virgatus Forst. f.

Ricinus communis L.

Sauropus androgynus (L.) Merr.

Securinega virosa (Roxb. ex Willd.) Pax & Hoffm.

Trewia polycarpa Benth.

ULMACEAE

Trema orientalis (L.) Bl.

MORACEAE

Allananthus kurzii Hook. f. & Thoms.

Ficus curtipes Corner

F. gasparriniana Miq.

F. geniculata Kurz

F. heterophylla L. f. var. *assamica* (Miq.) Corner

F. hispida L. f.

F. racemosa L.

F. semicordata Buch.-Ham. ex J. E. Sm.

Morus indica L.

Streblus asper Lour.

URTICACEAE

Boehmeria malabarica Wedd.

Distemon indicum Wedd.

Pouzolzia bennettiana Wight

P. pentandra Benn.

P. zeylanica (L.) Benn.

FAGACEAE

Quercus lanceaefolia Roxb.

CERATOPHYLLACEAE

Ceratophyllum demersum L.

HYDROCHARITACEAE

Ottelia alismoides (L.) Pers.*Vallisneria spiralis* L.

ORCHIDACEAE

Aerides odoratum Lour.*Cymbidium aloifolium* Roxb.*Dendrobium acinaciforme* Roxb.*D. aphyllum* (Roxb.) C. E. C. Fisch.*D. lindleyi* Steud.*D. moschatum* (Buch.-Ham.) Sw.*Ephemerantha macraei* (Lindl.) Hunt & Summerhays*Eulophia mannii* Hook. f.*Luisia inconspicua* (Wall. ex Hook. f.) K. & P.*Peristylus goodyeroides* Lindl.*Pholidota imbricata* (Roxb.) Lindl.*Saccolabium papillosum* Lindl.*Sarcanthus appendiculatus* Hook. f.*Smitinandia micrantha* (Lindl.) Holtt.*Vanda teres* Lindl.

ZINGIBERACEAE

Alpinia allughas (Retz.) Rosc.*Costus speciosus* (Koen.) Sm.*Globba clarkei* Baker*Parakaempferia synantha* Rao & Verma*Zingiber cassumunar* Roxb.*Z. rubens* Roxb.

MARANTACEAE

Phrynium pubinerve Bl.

MUSACEAE

Musa ornata Roxb.

HAEMODORACEAE

Ophiopogon intermedius D. Don

HYPOXIDACEAE

Curculigo orchiioides Gaertn.

DIOSCOREACEAE

Dioscorea bulbifera L.*D. hispida* Dennst. var. *daemona* (Roxb.)
Prain & Burk.*D. pentaphylla* L.

LILIACEAE

Chlorophytum arundinaceum Backer

SMILACEAE

Smilax prolifera Roxb.

PONTEDERIACEAE

Eichhornia crassipes (Mart.) Solms.*Monochoria hastata* (L.) Solms.

COMMELINACEAE

Aclisia subumbellata (C. B. Cl.) Bruckner*Aneilema scaberimum* (Bl.) Kunth.*Commelina appendiculata* C. B. Cl.*C. suffruticosa* Bl.*Cyanotis cristata* (L.) J. A. & J. H. Schult.

ARECACEAE

Calamus floribundus Griff.

TYPHACEAE

Typha elephantina Roxb.

ARACEAE

Cryptocoryne retrospiralis Fisch.*Lasia spinosa* (L.) Thw.

CYPERACEAE

Cyperus brevifolius (Rottl.) Hassk.*C. compactus* Retz.*C. compressus* L.*C. cyperoides* (L.) O. Ktze.*C. diffusus* Vahl*C. diffusus* Vahl var. *macrostachyus* Boeck.*C. digitatus* Roxb.*C. distans* L. f.*C. iria* L.*C. pilosus* Vahl*Fimbristylis dichotoma* (L.) Vahl*Scleria terrestris* (L.) Fass.

POACEAE

Apluda mutica L.*Brachiaria distachya* (L.) Stapf*Capillipedium assimile* (Steud.) A. Camus*Chrysopogon aciculatus* (Retz.) Trin.*Cynodon dactylon* (L.) Pers.*Cyrtococcum accrescens* (Trin.) Stapf*C. oxyphyllum* (Steud.) Stapf*Dendrocalamus hamiltonii* Nees et Arn.*Digitaria abludens* (Roem. & Schult.) Veldk.*D. ciliaris* (Retz.) Koel.*D. longiflora* (Retz.) Pers.*D. setigera* Roth apud Roem. & Schult.*Echinochloa colonum* (L.) Link*Eleusine indica* (L.) Gaertn.*Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult.

Erianthus longisetosus Anders.
Hemarthria protensa Steud.
Imperata cylindrica (L.) P. Beauv.
I. cylindrica (L.) P. Beauv. var. **major** (Nees)
 Hubb. ex Hubb. & Vaugh.
Neyraudia reynaudiana (Kunth) Keng ex
 Hitchc.
Opismenus compositus (L.) P. Beauv.
Panicum auritum Presl ex Nees
P. brevifolium L.
P. paludosum Roxb.
P. sarmentosum Roxb.
Paspalum conjugatum Berg.
P. longifolium Roxb. var. **lorikachis** Bor
P. orbiculare Forst.
Pogonatherum crinitum (Thunb.) Kunth
P. rufo-barbatum Griff.
Polytoca digitata (L. f.) Druce
Rottboellia exaltata L. f.
Saccharum procerum Roxb.
S. spontaneum L.
Sclerosachya fusca (Roxb.) A. Camus
Setaria g'auca (L.) P. Beauv.
S. palmifolia (Koen.) Stapf
Sporobolus diander (Retz.) P. Beauv.
S. fertilis (Steud.) Clayton
Themeda subsericans (Nees ex Steud.) Ridley
T. villosa (Poir.) A. Camus
Thyrsia zea (Cl.) Stapf
Thysanolaena maxima (Roxb.) O. Ktze.
Vetiveria zizanioides (L.) Nash

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