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Medicinal flowering plants distributed in both Vietnam and Indonesia: The diversity and proposing some solutions for development

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Abstract

The list of medicinal plants distributed in both Vietnam and Indonesia has not been published systematically, leading to many difficulties in developing medicinal plants distributed in both Vietnam and Indonesia. The most important goal is to build a list of medicinal flowering plants with information about specific medicinal uses. The paper assessed the diversity of species, genera, families and classes of the medicinal flowering plants (Magnoliophyta) distributed in both Vietnam and Indonesia. The study has enumerated 922 species, 600 genera, 140 families, 2 classes of Magnoliophyta, distributed in both Vietnam and Indonesia. Plants for timber with 61 species (1 class, 30 families, 55 genera). Ornamental plants with 93 species (2 classes, 32 families, 77 genera). Edible plants (edible fruits, seeds) with 86 species (2 classes, 38 families, 70 genera). Plants for essential oil with 11 species (2 classes, 7 families, 10 genera). Vegetables with 99 species (2 classes, 43 families, 80 genera). Dyed plants with 28 species (1 class, 13 families, 23 genera). Plants for fibre with 4 species (2 classes, 4 families, 4 genera). Plants for food of animal with 48 species (2 classes, 10 families, 32 genera). A model built for research and development of those species based on comprehensive cooperations and supports from agriculture, construction, fashion, forestry, food, ornamental and pharmaceutical organizations. The results provide a lot of valuable information, contributing to the development of cooperation of Vietnam and Indonesia on medicinal plant diversity research and application orientation.

Keywords: Magnoliophyta; Vietnam; Indonesia; Diversity; Development

1. Introduction

Scientific cooperations between Vietnam and Indonesia have been increasingly developed in recent years, including research on medicinal plant diversity. In order to facilitate the support of Vietnamese scientists to study plant diversity in Indonesia, as well as contribute to the development and application of useful plant species, while most plant taxonomists of Vietnam only know about Vietnamese plants, it is necessary to select a list of medicinal plant species that are distributed in both Vietnam and Indonesia. For that reason, we have studied on the diversity of taxon ranks of medicinal plants of Magnoliophyta distributed in both Vietnam and Indonesia.

Objectives: Compare medicinal taxa of Magnoliophyta (also known as flowering plants) which are distributed in both Vietnam and Indonesia, contributing to the development of cooperation for the 2 countries on plant diversity research and application orientation.

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2. Material and methods

2.1. The material studied

Specimens stored at the herbaria (HN herbarium of Institute of Ecology and Biological Resources (IEBR), Vietnam Academy of Science and Technology (VAST); VNM herbarium of Institute of Tropical Biology (ITB), VAST).

2.2. Research subjects

The medicinal plant taxa of the Magnoliophyta distributed in both Vietnam and Indonesia.

2.3. Research content

Building a list of medicinal plant species belonging to the Magnoliophyta distributed in both Vietnam and Indonesia; Evaluation of the diversity of taxon levels in the Magnoliophyta distributed in both Vietnam and Indonesia (species, genera, families, classes).

2.4. Research methods

Establish list of species in both Vietnam and Indonesia based on references [1-52], investigations and study on specimens at the herbaria. Identify species based on the morphological comparison method. Scientific names of species and families according to the Checklist of plants in Vietnam (Nguyen TB, 2003, 2005) [1]. Names of 49 diseases according to Vo VC (2012) [26].

Coding uses/diseases: C: Ornamental plant; Ed: Edible (fruit, seed); Es: Essential oil; G: Timber; Nh: Dye; S: Fibre; R: Vegetable; T: Medicinal plant; ThA: Food for animal.

1: Tranquillizer; 2: Vaginitis; 3: Paralytic; 4: Obese; 5: Flu; 6: Eyesore; 7: Toothache; 8: Detoxify; 9: Syphilis; 10: Asthma; 12: Gonorrhea; 13: Dysentery; 14: Galactopoietic; 15: Diuretic; 16: Mumps; 17: Snake bite; 18: Urolithiasis; 19: Malaria; 20: Rheumatism; 21: Diabetes; 22: Heart and blood pressure diseases; 23: Hemorrhoids; 24: Cancer; 25: Gastritis; 26: Hepatitis: 27: Keratitis: 28: Sore throat; 29: Encephalitis; 30: Nephritis; 31: Sinusitis; 32: Sterile; 33: Cirrhosis; 34: Brain hemorrhage; 35: Pimple; 36: Hemostatic; 37: Fracture; 38: Burned; 39: Pneumonia; 40: Bronchitis; 41: Hurt fall; 42: Irregular menstruation; 43: Kidney stone; 44: Measles; 45: Headache; 46: Inflammatory bowel; 47: Oedema; 48: Otitis; 49: Pertussis; 50: Scrofulous (Note: 11: a disease is not mentioned, therefore, there are 49 diseases / medical uses).

- Establishment of the list of medicinal flowering plants in both Vietnam and Indonesia.
- Coding families, order of families according to the Checklist of plants in Vietnam (Nguyen TB, 2003, 2005) (appendix 1) [1].
- Investigations in Vietnam from 2007 to 2021. Study on 11826 specimens of 3336 species collected from the investigations. Study on 19369 specimens of 5166 species stored at herbaria of Vietnam (HN, VNM).
- Application of Microsoft Access for data management and analysis.
- Based on the plant data of Magnoliophyta in Vietnam, statistic species distributed in Indonesia.
- Based on the plant data of Magnoliophyta in some neighboring countries, perform additional statistics of species also distributed in Vietnam and Indonesia.
- Compile a list of plant species belonging to Magnoliophyta distributed in both Vietnam and Indonesia. Collect data on their use values. Build the list of medicinal flowering plants.
- Nomenclature correction according to Checklist of Plant Species of Vietnam, vol. 2, 3 (Nguyen TB (editor) et al., 2003, 2005) [1], http://www.plantsoftheworldonline.org [50], www.tropicos.org [51].
- Evaluation of the diversity of plant taxon levels and the uses for Magnoliophyta (species, genera, families, classes).
- Proposing some solutions for development.

3. Results and discussion

3.1. List of flowering plants distributed in both Vietnam and Indonesia (appendix 2)

Diversity of species, genera, families and classes of Magnoliophyta distributed in both Vietnam and Indonesia.

The study has enumerated 922 species, 600 genera, 140 families, 2 classes of Magnoliophyta, distributed in both Vietnam and Indonesia.

3.1.1. Diversity of classes (2 classes)

Magnoliopsida has 766 species, accounting for 83.1% of the total species. Liliopsida has 156 species, accounting for 16.9% of the total species.

3.1.2. Diversity of families (140 families)

The 10 species-rich families are FABACEAE (97 species, 10.5%), ASTERACEAE (87 species, 9.4%), EUPHORBIACEAE (49 species, 5.3%), CYPERACEAE (46 species, 5.0%), LAMIACEAE (32 species, 3.5%), RUBIACEAE (28 species, 3.0%), ORCHIDACEAE (27 species, 2.9%), MORACEAE (24 species, 2.6%), VERBENACEAE (23 species, 2.5%), CAESALPINIACEAE (23 species, 2.5%). A total of 10 families includes 436 species, 47.3%.

3.1.3. Diversity of genera (600 genera)

The 10 genera with the highest number of species are *Cyperus* (20 species, 2.2%), *Ficus* (15 species, 1.6%), *Crotalaria* (13 species, 1.4%), *Indigofera* (9 species, 1.0%), *Blumea* (7 species, 0.8%), *Fimbristylis* (7 species, 0.8%), *Ardisia* (6 species, 0.7%), *Mallotus* (6 species, 0.7%), *Syzygium* (6 species, 0.7%), *Trichosanthes* (6 species, 0.7%). A total of 10 genera including 95 species, accounting for 10.3%.

Diverse in use value

- Plants for timber: 61 species (1 class, 30 families, 55 genera).
- 10 families with the highest number of species: EUPHORBIACEAE 13 species, MIMOSACEAE 5 species,
- APOCYNACEAE 4 species, CAESALPINIACEAE 4 species, FABACEAE 3 species, LAURACEAE 3 species, MORACEAE 3 species, ANACARDIACEAE 2 species, MYRTACEAE 2 species, SYMPLOCACEAE 2 species, Each of the other families has 1 species.
- 5 genera with the highest number of species: *Alstonia* 3 species, *Adenanthera* 2 species, *Albizia* 2 species, *Cinnamomum* 2 species, *Symplocos* 2 species. Each of the other genera has 1 species.
    - Ornamental plants: 93 species (2 classes, 32 families, 77 genera).
- 10 families with the highest number of species: ORCHIDACEAE 16 species, ASTERACEAE 14 species, FABACEAE 7 species, MORACEAE 7 species, CAESALPINIACEAE 5 species, LILIACEAE 4 species, ACANTHACEAE 3 species, ARECACEAE 3 species, RUBIACEAE 3 species, ZINGIBERACEAE 3 species. Each of the other families has less than 3 species.
- 9 genera with the highest number of species: *Ficus* 6 species, *Cymbidium* 3 species, *Erythrina* 3 species, *Ixora* 3 species, *Cassia* 2 species, *Chrysanthemum* 2 species, *Coreopsis 2* species, *Cyperus* 2 species, *Magnolia* 2 species. Each of the remaining genera has 1 species.
    - Edible plants (edible fruits, seeds): 86 species (2 classes, 38 families, 70 genera).
- 10 families with the highest number of species: MORACEAE 10 species, RUTACEAE 8 species, EUPHORBIACEAE 7 species, SAPINDACEAE 6 species, ANACARDIACEAE 5 species, ROSACEAE 5 species, MYRTACEAE 4 species, LAMIACEAE 3 species, RUBIACEAE 3 species, VERBENACEAE 3 species. Each of the other families has less than 3 species.
- 11 genera with the highest number of species: *Rubus* 4 species, *Syzygium* 4 species, *Artocarpus* 3 species, *Alpinia* 2 species, *Antidesma* 2 species, *Citrus* 2 species, *Clausena* 2 species, *Ficus* 2 species, *Glycosmis* 2 species, *Mangifera* 2 species, *Sonneratia* 2 species. Each of the remaining genera has 1 species.
    - Plants for essential oil: 11 species (2 classes, 7 families, 10 genera).
- ASTERACEAE 3 species, LAMIACEAE 2 species, MYRTACEAE 2 species. Each of the 4 families has 1 species: CYPERACEAE, LAURACEAE, MAGNOLIACEAE, ZINGIBERACEAE.
- genera, of which *Ocimum* has 2 species, Each of the remaining 9 genera has 1 species.
    - Vegetables: 99 species (2 classes, 43 families, 80 genera).
- ASTERACEAE 28 species, EUPHORBIACEAE 6 species, ARACEAE 5 species, LAMIACEAE 5 species, APOCYNACEAE 4 species, CUCURBITACEAE 4 species, FABACEAE 3 species, SCROPHULARIACEAE 3 species, APIACEAE 2 species, BEGONIACEAE 2 species, CAESALPINIACEAE 2 species, MORACEAE 2 species, MYRSINACEAE 2 species, VIOLACEAE 2 species. Each of the remaining families has 1 species.
- Genera with the highest number of species: *Blumea* 3 species, *Limnophila* 3 species, *Rauvolfia* 3 species; *Acmella* 2 species, *Ardisia* 2 species, *Artemisia* 2 species, *Begonia* 2 species, *Claoxylon* 2 species, *Clinopodium* 2 species, *Emilia* 2 species, *Ficus* 2 species, *Sesbania* 2 species, *Sonchus* 2 species, *Trichosanthes* 2 species, *Viola* 2 species, *Zehneria* 2 species. *Each* of the remaining genera has 1 species.
    - Dyed plants: 28 species (1 class, 13 families, 23 genera).

- CAESALPINIACEAE 4 species, FABACEAE 4 species, MIMOSACEAE 4 species, COMBRETACEAE 3 species ALANGIACEAE 2 species, EUPHORBIACEAE 2 species, RHIZOPHORACEAE 2 species, VERBENACEAE 2 species. Each of the other families has 1 species.
- *Alangium* 2 species, *Albizia* 2 species, *Avicennia* 2 species, *Butea* 2 species, *Terminalia* 2 species. Each of the remaining genera has 1 species.
    - Plants for fibre: 4 species (2 classes, 4 families, 4 genera).
- Each of the 4 families has 1 species: ARECACEAE, ASCLEPIADACEAE, EUPHORBIACEAE, STERCULIACEAE.
- Each of the 4 genera with 1 species: *Caryota, Gongronemopsis, Macaranga, Pentapetes*.
    - Plants for food of animal: 48 species (2 classes, 10 families, 32 genera).
- FABACEAE 20 species, CYPERACEAE 14 species, POACEAE 6 species, ASTERACEAE 2 species. Each of the other families has 1 species: ARACEAE, CAESALPINIACEAE, COMMELINACEAE, MORACEAE, RUTACEAE, STERCULIACEAE.
- Genera: *Cyperus* has 9 species, 2 genera have 3 species *Indigofera, Sesbania*. 4 genera have 2 species *Fimbristylis, Grona, Setaria, Vigna*. Each of the other genera has 1 species.

3.2. Proposing some solutions for development (figure 1)

Although the proposals are theoretically, but if the cooperations and comprehensive support from many agencies are achieved, the development of the medicinal plants will bring positive results. To achieve this, there must be a group of expertise, the above data and linking companies.

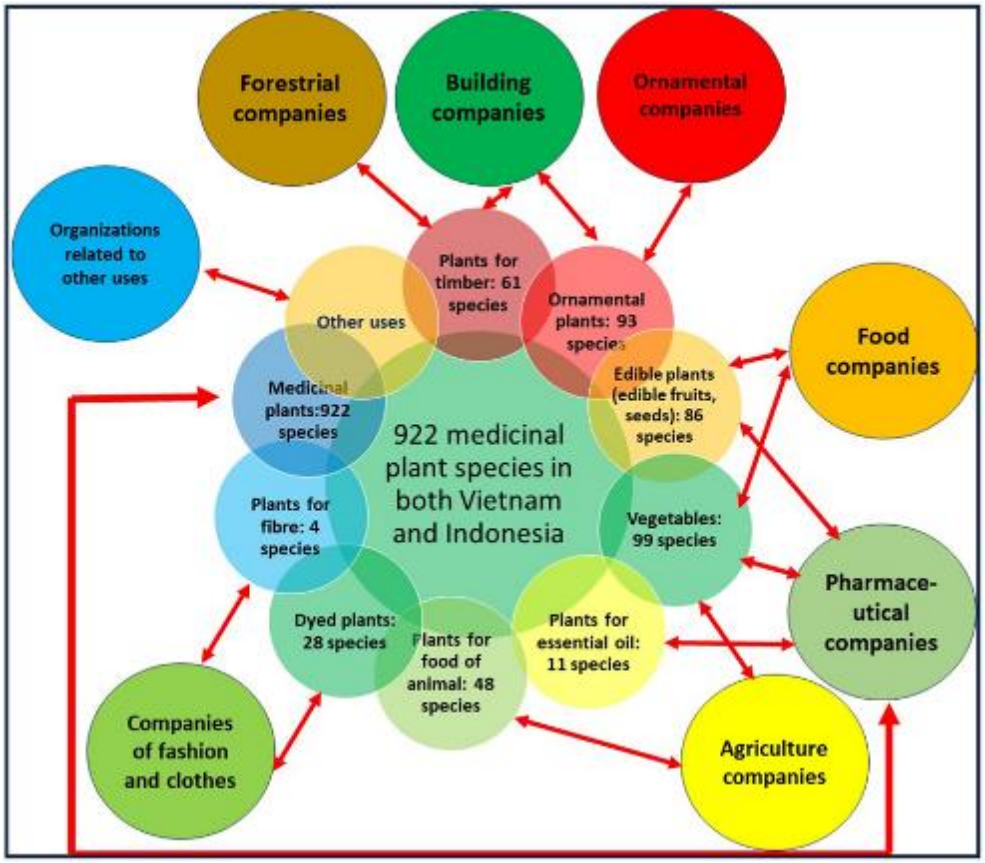

Figure 1 Comprehensive and reasonable combined model for developing 922 medicinal plant species in both Vietnam and Indonesia

Appendixes

Appendix 1. Coding families, order of families according to the Checklist of plants in Vietnam (Nguyen TB, 2003, 2005) [1]. Families coded from 1 to 219 belong to Magnoliopsida, families coded from 220 to 265 belong to Liliopsida.

1: MAGNOLIACEAE. 2: ANNONACEAE. 5: HERNANDIACEAE. 6: CHLORANTHACEAE. 8: LAURACEAE. 9: SAURURACEAE. 10: PIPERACEAE. 11: ARISTOLOCHIACEAE. 14: NYMPHAEACEAE. 16: CERATOPHYLLACEAE. 17: ILLICIACEAE. 19: NELUMBONACEAE. 21: SARGENTODOXACEAE. 22: MENISPERMACEAE. 23: RANUNCULACEAE. 24: BERBERIDACEAE. 25: PAPAVERACEAE. 26: FUMARIACEAE. 28: ALTINGIACEAE. 29: PLATANACEAE. 31: ULMACEAE. 32: MORACEAE. 33: CANNABACEAE. 34: URTICACEAE. 35: CASUARINACEAE. 36: FAGACEAE. 37: BETULACEAE. 40: JUGLANDACEAE. 42: NYCTAGINACEAE. 43: MOLLUGINACEAE. 47: PORTULACEAE. 48: BASELLACEAE. 49: CARYOPHYLLACEAE. 50: AMARANTHACEAE. 51: CHENOPODIACEAE. 52: POLYGONACEAE. 54: DILLENIACEAE. 57: DIPTEROCARPACEAE. 59: THEACEAE. 62: CLUSIACEAE. 63: HYPERICACEAE. 64: ELATINACEAE. 65: FLACOURTIACEAE. 67: VIOLACEAE. 70: PASSIFLORACEAE. 72: CARICACEAE. 73: CUCURBITACEAE. 75: BEGONIACEAE. 76: CAPPARACEAE. 78: BRASSICACEAE. 80: SALICACEAE. 87: STYRACACEAE. 88: SYMPLOCACEAE. 89: EBENACEAE. 90: SAPOTACEAE. 91: MYRSINACEAE. 92: PRIMULACEAE. 94: TILIACEAE. 95: STERCULIACEAE. 96: BOMBACACEAE. 97: MALVACEAE. 100: EUPHORBIACEAE. 102: THYMELEACEAE. 105: ITEACEAE. 106: HYDRANGEACEAE. 109: CRASSULACEAE. 111: ROSACEAE. 113: MIMOSACEAE. 114: CAESALPINIACEAE. 115: FABACEAE. 116: CONNARACEAE. 120: LYTHRACEAE. 123: RHIZOPHORACEAE. 125: COMBRETACEAE. 126: MYRTACEAE. 127: MELASTOMATACEAE. 128: ONAGRACEAE. 131: HALORAGACEAE. 132: ANACARDIACEAE. 133: SIMAROUBACEAE. 134: RUTACEAE. 135: MELIACEAE. 136: STAPHYLEACEAE. 138: SAPINDACEAE. 139: HIPPOCASTANACEAE. 141: SABIACEAE. 143: LINACEAE. 148:

OXALIDACEAE. 151: BALSAMINACEAE. 152: POLYGALACEAE. 156: AUCUBACEAE. 157: ALANGIACEAE. 161:

ARALIACEAE. 162: APIACEAE. 163: AQUIFOLIACEAE. 164: ICACINACEAE. 166: CELASTRACEAE. 168: RHAMNACEAE.

169: VITACEAE. 170: LEEACEAE. 171: OLEACEAE. 174: OPILIACEAE. 175: ERYTHROPALACEAE. 176: CARDIOPTERIDACEAE. 179: LORANTHACEAE. 182: ELAEAGNACEAE. 183: PROTEACEAE. 184: CAPRIFOLIACEAE. 185: VALERIANACEAE. 187: LOGANIACEAE. 189: APOCYNACEAE. 190: ASCLEPIADACEAE. 191: GENTINIACEAE. 192:

MENYANTHACEAE. 193: RUBIACEAE. 195: CONVOLVULACEAE. 196: CUSCUTACEAE. 197: HYDROPHYLLACEAE. 198: BORAGINACEAE. 199: SOLANACEAE. 200: BUDDLEJACEAE. 201: SCROPHULARIACEAE. 202: BIGNONIACEAE. 203: PEDALIACEAE. 205: GESNERIACEAE. 207: LENTIBULARIACEAE. 209: ACANTHACEAE. 211: VERBENACEAE. 212: LAMIACEAE. 213: CALLITRICHACEAE. 214: CAMPANULACEAE. 219: ASTERACEAE. 221: ALISMATACEAE. 229: CONVALLARIACEAE. 229: LILIACEAE. 230: HYPOXIDACEAE. 232: SMILACACEAE. 233: STEMONACEAE. 234:

DIOSCOREACEAE. 235: TACCACEAE. 238: IRIDACEAE. 244: COSTACEAE. 245: ZINGIBERACEAE. 246: CANNACEAE. 247: MARANTACEAE. 248: ORCHIDACEAE. 249: JUNCACEAE. 250: CYPERACEAE. 251: BROMLELIACEAE. 252: COMMELINACEAE. 259: POACEAE. 260: ARECACEAE. 261: ARACEAE. 262: LEMNACEAE. 265: TYPHACEAE.

Appendix 2. Data of flowering plants in both Vietnam and Indonesia for each species are "Coded family-Scientific name-Coded Use (present or absent)-Coded Medical value (present or absent) /"

115-Abrus melanospermus subsp. melanospermus-T 15 20 26 / 115-Abrus precatorius-T 35 / 100-Acalypha hispida-T C / 100-Acalypha siamensis-T 15 / 209-Acanthus ebracteatus-T / 50-Achyranthes bidentata-T 20 22 28 / 219-Acmella calva-T 7 / 219-Acmella oleracea -T R 7 45 / 219-Acmella paniculata -T 7 20 / 219-Acmella uliginosa-T R 15 / 261-Acorus calamus-T C / 134-Acronychia pedunculata-T 35 41 / 100-Actephila excelsa-T / 250-Actinoscirpus grossus-T / 113-Adenanthera microsperma-G T C Nh 13 / 113-Adenanthera pavonina-G T 20 / 70-Adenia heterophylla-T R 8 20 / 201-Adenosma glutinosa-T 3 17 20 26 / 201-Adenosma indiana-T 46 / 219-Adenostemma lavenia-T R 17 / 219-Adenostemma macrophyllum-T 7 20 / 206-Aeginetia acaulis-T 21 35 / 134-Aegle marmelos-T Ed R / 115-Aeschynomene aspera-T 17 / 115-Aeschynomene indica-T / 115-Aganope thyrsiflora-T / 229-Agave vivipara-T / 116-Agelaea macrophylla-T 20 / 219-Ageratum conyzoides-T ThA 31 / 219-Ageratum houstonianum-T 31 / 133-Ailanthus triphysa-G T 2 13 / 157-Alangium chinense-T Nh 17 20 22 41 45 / 157-Alangium kurzii-G T 20 41 / 157-Alangium salviifolium-T Nh 9 10 15 / 113-Albizia chinensis-G T Nh 17 / 113-Albizia corniculata-T C 17 / 113-Albizia lebbekoides-G T Nh 17 / 100-Alchornea rugosa-T / 229-Allium ramosum-T R 2 / 261-Alocasia longiloba-T R / 245-Alpinia conchigera-T 20 45 / 245-Alpinia galanga-T Ed 7 8 13 / 245-Alpinia malaccensis-T C Ed / 245-Alpinia mutica-T / 189-Alstonia macrophylla-G T / 189-Alstonia rostrata -G T / 189-Alstonia spatulata -G T / 252-Amischotolype hispida-T / 261-Amorphophallus paeoniifolius-T / 169-Ampelocissus arachnoidea-T Ed / 169-Ampelocissus polythyrsa-T 20 / 189-Amphineurion marginatum-T / 261-Anadendrum montanum-T R 17 19 / 58-Ancistrocladus tectorius-T / 209-Andrographis paniculata-T 8 11 13 28 35 / 248-Anoectochilus setaceus-T C 20 25 41 / 32-Antiaris toxicaria-T Ed 13 / 100-Antidesma acidum-T / 100-Antidesma bunius-T Ed / 100-Antidesma ghaesembilla-T Ed R / 100-Antidesma montanum-T / 135-Aphanamixis polystachya-T 17 / 115-Aphyllodium biarticulatum-T / 259-Apluda mutica-T ThA 17 / 100-Aporosa octandra var. octandra-G T Ed / 161-Aralia dasyphylla-T 20 41 / 161-Aralidium pinnatifidum-T / 22-

Arcangelisia flava-T 13 19 46 / 219-Arctium lappa-T R / 91-Ardisia colorata-T 12 / 91-Ardisia crispa-T R 7 13 35 / 91-Ardisia humilis-T Ed R / 91-Ardisia polysticta subsp. polysticta-T 37 41 46 / 91-Ardisia quinquegona-T 7 / 91-Ardisia villosa-T 41 / 260-Areca triandra-T C / 260-Arenga pinnata-T C 15 / 2-Artabotrys hexapetalus-T / 201-Artanema longifolium-T 6 9 18 20 / 219-Artemisia caruifolia var. caruifolia-T R / 219-Artemisia vulgaris-T Es R 20 / 32-Artocarpus altilis -T 13 17 47 / 32-Artocarpus integer-T Ed 1 14 22 / 32-Artocarpus lamellosus-T Ed / 32-Artocarpus rigidus-G T Ed 17 / 248-Arundina graminifolia-T C 17 20 26 47 / 190-Asclepias curassavica-T C / 231-Asparagus filicinus-T C / 219-Aster indicus-T C R 26 41 / 110-Astilbe rivularis-T C / 209-Asystasia gangetica-T C 8 / 211-Avicennia marina-T Ed Nh 13 / 211-Avicennia officinalis-T Nh / 219-Ayapana triplinervis -T 17 35 / 135-Azadirachta indica-T 17 19 20 / 165-Azima sarmentosa-T Ed 20 35 / 219-Baccharoides anthelmintica -T / 100-Balakata baccata -G T / 181-Balanophora fungosa subsp. indica-T / 181-Balanophora latisepala-T / 100-Baliospermum solanifolium -T / 130-Barringtonia acutangula-T R 17 / 130-Barringtonia asiatica-G / 130-Barringtonia racemosa-T 10 17 44 / 212-Basilicum polystachyon-T 2 20 / 114-Bauhinia hirsuta-T 17 / 114-Bauhinia viridescens-T / 75-Begonia aptera-T R 13 35 38 41 49 / 75-Begonia tenuifolia-T R 35 / 134-Bergera koenigii-T / 114-Biancaea decapetala-T 13 19 44 / 114-Biancaea sappan-G T Nh 13 / 219-Bidens biternata-T 17 46 / 219-Bidens pilosa-T R 23 / 148-Biophytum sensitivum-T 12 15 21 35 43 46 / 100-Bischofia javanica-G T Ed R / 219-Blumea balsamifera-T Es 5 / 219-Blumea densiflora-T / 219-Blumea fistulosa-T R / 219-Blumea hieraciifolia-T / 219-Blumea lacera-T R 8 35 / 219-Blumea lanceolaria-T R 15 / 219-Blumea sinuata-T 5 8 20 35 / 245-Boesenbergia rotunda-T 2 13 15 / 96-Bombax ceiba-T R 13 14 21 / 198-Bothriospermum zeylanicum-T C Ed 8 9 12 15 / 132-Bouea oppositifolia-G T Ed 38 / 115-Bowringia callicarpa-T 20 / 161-Brassaiopsis glomerulata-T 20 41 49 / 100-Breynia androgyna-T R / 100-Breynia temii-T C / 100-Bridelia ovata-G T / 100-Bridelia stipularis-T / 32-Broussonetia papyrifera-T Ed / 200-Buddleja asiatica-T 6 20 35 37 44 / 248-Bulbophyllum concinnum-T 25 40 / 250-Bulbostylis barbata-T / 250-Bulbostylis densa-T / 239-Burmannia coelestis-T / 115-Butea monosperma-T Nh 17 / 115-Butea superba-T Nh / 115-Cajanus scarabaeoides-T 20 / 115-Cajanus volubilis-T / 261-Caladium bicolor-T C 13 17 45 / 260-Calamus viminalis-T Ed / 248-Calanthe vestita-T C / 219-Calendula officinalis-T C 1 38 / 211-Callicarpa erioclona-T 12 / 211-Callicarpa longifolia-T 9 / 211-Callicarpa macrophylla-T 20 41 / 211-Callicarpa rubella-T Ed 2 8 20 / 62-Calophyllum inophyllum-T 20 26 35 38 41 42 50 / 190-Calotropis gigantea-T / 100-Calypha spiciflora-G T Ed / 2-Cananga odorata-T / 132-Canarium littorale-T / 115-Canavalia cathartica-T / 115-Canavalia rosea-T ThA / 193-Canthium horridum-T Ed / 76-Capparis micracantha-T Ed 10 15 22 40 / 123-Carallia brachiata-G T Ed 19 / 176-Cardiopteris quinqueloba-T R 7 17 / 250-Carex baccans-T / 250-Carex cruciata-T / 250-Carex filicina-T / 250-Carex phacota-T / 189-Carissa carandas-T / 219-Carpesium abrotanoides-T 28 40 / 219-Carpesium cernuum-T / 219-Carthamus tinctorius-T / 260-Caryota urens-T S 2 13 / 65-Casearia grewiifolia-T 15 / 114-Cassia fistula-T C Nh 17 / 114-Cassia grandis-T C Ed 13 17 19 44 / 193-Catunaregam tomentosa-T 17 / 169-Cayratia japonica-T 2 8 15 17 26 50 / 169-Cayratia mollissima-T / 169-Cayratia trifolia-T 2 35 / 166-Celastrus hindsii-T 12 26 42 / 166-Celastrus paniculatus-T / 31-Celtis timorensis-G T 23 41 / 219-Centipeda minima-T 1 6 13 17 19 31 40 49 / 189-Cerbera manghas-T / 189-Cerbera odollam-T / 123-Ceriops tagal-T Nh 19 / 114-Chamaecrista absus-T 6 23 / 114-Chamaecrista mimosoides-T ThA 17 30 47 / 114-Chamaecrista pumila-T / 193-Chassalia curviflora-T Ed 17 19 45 / 6-Chloranthus erectus-T 18 20 41 / 229-Chlorophytum laxum-T / 115-Christia obcordata-T / 115-Christia vespertilionis-T C 17 19 / 219-Chrysanthemum indicum-T C 13 17 22 26 29 35 45 / 219-Chrysanthemum vestitum-T C / 219-Cichorium intybus-T R 15 / 8-Cinnamomum burmanni-T 5 20 35 / 8-Cinnamomum iners-G T / 8-Cinnamomum subavenium -G T 20 41 / 135-Cipadessa baccifera-T 20 / 169-Cissus adnata-T / 169-Cissus discolor -T R / 169-Cissus quadrangularis-T 10 / 134-Citrus × aurantiifolia -T 5 49 / 134-Citrus × aurantium f. aurantium-T Ed / 134-Citrus × limon -T / 134-Citrus medica-T 18 / 134-Citrus reticulata-T Ed 8 / 100-Claoxylon indicum-T R 17 / 100-Claoxylon longifolium-T R / 134-Clausena anisata-T Ed 20 / 134-Clausena harmandiana-T ThA 40 45 / 134-Clausena lansium-T Ed 29 / 100-Cleistanthus monoicus-G T / 23-Clematis brevicaudata-T / 23-Clematis leschenaultiana-T / 76-Cleome chelidonii-T 5 10 17 26 / 211-Clerodendrum chinense-T C 2 17 20 22 35 42 / 211-Clerodendrum laevifolium-T / 211-Clerodendrum paniculatum-T 2 12 20 42 / 211-Clerodendrum petasites-T 13 26 / 59-Cleyera japonica -T 13 / 209-Clinacanthus nutans-T 38 / 212-Clinopodium chinense-T R 12 / 212-Clinopodium gracile-T R 13 35 41 / 115-Clitoria ternatea-T C Nh / 100-Cnesmone javanica-T / 116-Cnestis palala-T 13 35 / 260-Cocos nucifera-T 12 15 38 44 45 / 115-Codariocalyx gyroides-T ThA / 115-Codariocalyx motorius-T 20 37 / 214-Codonopsis javanica-T Ed / 248-Coelogyne articulata -T C 17 45 / 198-Coldenia procumbens-T 20 35 / 212-Coleus amboinicus-T R 5 17 28 / 212-Coleus pallidus -T 17 20 43 / 261-Colocasia esculenta-T R ThA 17 35 / 94-Colona auriculata-T / 168-Colubrina asiatica-T 33 / 125-Combretum densiflorum-T / 125-Combretum indicum -T 13 / 125-Combretum latifolium-T / 252-Commelina obliqua-T 35 / 116-Connarus semidecandrus-T R / 198-Cordia bantamensis-T / 198-Cordia dichotoma-T 17 / 229-Cordyline fruticosa-T C 13 20 46 / 219-Coreopsis lanceolata-T C / 219-Coreopsis tinctoria-T C 13 / 126-Corymbia citriodora-T Es 20 38 40 / 22-Coscinium fenestratum-T 13 17 46 / 219-Cosmos sulphureus-T C / 219-Cotula anthemoides-T R 20 45 / 63-Cratoxylum cochinchinense-T 12 13 42 46 / 219-Crepis rigescens-T 10 39 / 115-Crotalaria alata-T / 115-Crotalaria albida-T 17 19 35 / 115-Crotalaria bracteata-T / 115-Crotalaria calycina-T / 115-Crotalaria chinensis-T / 115-Crotalaria incana-T ThA 13 17 / 115-Crotalaria lejoloba -T 30 35 / 115-Crotalaria montana-T / 114-Crotalaria pallida-T 13 / 115-Crotalaria prostrata-T / 115-Crotalaria quinquefolia-T 17 / 115-Crotalaria sessilifolia-T 24 35 / 115-Crotalaria tetragona-T / 100-Croton argyratus-G T / 100-Croton cascarilloides-T / 100-Croton caudatus-T / 100-Croton

tiglium-T / 103-Crypteronia paniculata-G / 73-Cucumis maderaspatanus -T Ed 7 / 115-Cullen corylifolium -T 42 / 230-Curculigo capitulata-T 15 20 30 43 / 230-Curculigo latifolia-T Ed / 230-Curculigo orchioides-T 20 30 / 245-Curcuma aeruginosa-T / 245-Curcuma harmandii-T 17 38 46 / 245-Curcuma longa-T 17 38 46 / 245-Curcuma zanthorrhiza-T / 252-Cyanotis vaga-T / 219-Cyanthillium cinereum var. cinereum-T 35 46 / 22-Cyclea barbata-T 7 23 41 / 248-Cymbidium aloifolium-T C / 248-Cymbidium ensifolium-T C 15 / 248-Cymbidium lancifolium-T C 41 / 219-Cynara cardunculus subsp. cardunculus-T R / 198-Cynoglossum lanceolatum-T 17 30 42 / 114-Cynometra ramiflora-G T C R / 250-Cyperus alternifolius subsp. flabelliformis-T C / 250-Cyperus brevifolius-T ThA 6 15 19 49 / 250-Cyperus compactus-T C / 250-Cyperus compressus-T ThA / 250-Cyperus cuspidatus-T / 250-Cyperus cyperinus -T 35 / 250-Cyperus cyperoides -T ThA / 250-Cyperus difformis-T ThA / 250-Cyperus diffusus-T ThA / 250-Cyperus esculentus-T / 250-Cyperus iria-T ThA / 250-Cyperus leptocarpus-T / 250-Cyperus malaccensis-T / 250-Cyperus mindorensis-T ThA 15 21 / 250-Cyperus nutans-T / 250-Cyperus pedunculatus-T / 250-Cyperus pilosus-T ThA / 250-Cyperus polystachyos-T 13 / 250-Cyperus rotundus-T Es ThA / 250-Cyperus sanguinolentus-T / 188-Cyrtophyllum fragrans-T 13 19 / 219-Dahlia pinnata-T C 7 / 115-Dalbergia candenatensis-T 10 / 195-Decalobanthus mammosus-T / 219-Decaneuropsis cumingiana -T 17 19 20 / 50-Deeringia amaranthoides-T R / 248-Dendrobium crumenatum-T C 17 35 / 248-Dendrobium plicatile-T / 115-Dendrolobium triangulare-T Nh 13 17 20 / 115-Dendrolobium umbellatum-T / 180-Dendrophthora opuntioides-T 41 / 115-Derris elliptica-T / 115-Derris scandens-T / 115-Derris trifoliata-T 7 13 19 / 115-Desmodium sequax-T 10 / 2-Desmos chinensis-T 13 / 2-Desmos dumosus-T / 219-Dichrocephala integrifolia-T R 15 / 54-Dillenia indica-G T Ed 8 19 47 / 138-Dimocarpus longan-T Ed 2 35 38 44 46 / 234-Dioscorea hispida-T 17 / 89-Diospyros maritima-G T / 22-Diploclisia glaucescens-T 9 12 17 20 / 190-Dischidia major-T 17 / 190-Dischidia nummularia-T / 138-Dodonaea viscosa-T 38 / 247-Donax canniformis-T 8 / 229-Dracaena angustifolia-T C 12 13 / 117-Drosera indica-T / 219-Duhaldea cappa -T 2 20 30 41 42 47 / 115-Dunbaria podocarpa-T 8 / 96-Durio zibethinus-T Ed 26 / 219-Eclipta prostrata-T 13 26 46 / 260-Elaeis guineensis-T / 93-Elaeocarpus angustifolius-T / 93-Elaeocarpus floribundus-G T / 93-Elaeocarpus grandiflorus-T Ed 14 17 / 93-Elaeocarpus stipularis-T / 250-Eleocharis dulcis-T ThA 13 / 250-Eleocharis tetraquetra-T / 219-Elephantopus mollis-T 35 / 219-Elephantopus scaber-T 7 13 15 17 26 30 33 / 161-Eleutherococcus trifoliatus-T 2 18 20 32 35 41 46 / 116-Ellipanthus tomentosus-T / 212-Elsholtzia blanda-T Ed 5 19 / 91-Embelia parviflora-T 37 41 46 / 91-Embelia ribes-T / 219-Emilia prenanthoidea-T R 39 / 219-Emilia sonchifolia-T R 5 13 17 39 46 / 40-Engelhardia roxburghiana -G T / 40-Engelhardia spicata -T / 113-Entada phaseoloides-T 20 23 41 47 / 219-Enydra fluctuans -T R ThA / 219-Erigeron sumatrensis-T / 111-Eriobotrya japonica-T Ed 10 40 / 252-Eriocaulon truncatum-T / 115-Eriosema chinense-T 13 / 100-Erismanthus sinensis-G T / 115-Erythrina fusca-T C / 115-Erythrina subumbrans-T C 19 / 115-Erythrina variegata-G T C 1 13 22 46 / 175-Erythropalum scandens-T R 26 30 46 / 219-Eschenbachia leucantha -T / 126-Eucalyptus globulus-G T 5 10 20 21 38 40 / 126-Eucalyptus robusta-T 19 29 30 38 39 46 / 248-Eulophia nuda-T C 17 / 193-Eumachia montana-T / 166-Euonymus indicus -T 1 / 100-Euphorbia atoto-T / 59-Eurya nitida-T / 133-Eurycoma longifolia-T 13 / 195-Evolvulus alsinoides-T 10 13 17 40 / 193-Exallage auricularia -T 13 17 35 46 / 27-Exbucklandia populnea-T / 100-Excoecaria agallocha-G T Nh 17 / 188-Fagraea ceilanica-T 12 / 113-Falcataria falcata-G T 17 / 22-Fibraurea tinctoria-T R 13 19 46 / 32-Ficus altissima-T C 8 / 32-Ficus benghalensis-T C 12 13 20 21 / 32-Ficus benjamina-T C / 32-Ficus drupacea-T 33 / 32-Ficus elastica-T C 15 33 35 / 32-Ficus fulva-T Ed ThA 20 23 / 32-Ficus heterophylla-T 2 20 / 32-Ficus microcarpa-T C 13 19 41 46 49 / 32-Ficus racemosa-T R / 32-Ficus rumphii-T Ed 10 17 / 32-Ficus sagittata-T / 32-Ficus simplicissima-T 2 20 41 / 32-Ficus sumatrana-T C / 32-Ficus vasculosa-T / 32-Ficus virens-G T R / 250-Fimbristylis dichotoma-T ThA / 250-Fimbristylis dipsacea-T / 250-Fimbristylis dura-T / 250-Fimbristylis fusca-T / 250-Fimbristylis quinquangularis subsp. quinquangularis-T ThA / 250-Fimbristylis tetragona-T / 250-Fimbristylis umbellaris -T / 65-Flacourtia rukam-T Ed 6 13 / 115-Flemingia macrophylla-T 20 / 115-Flemingia stricta-T / 115-Flemingia strobilifera-T 20 / 250-Fuirena umbellata-T ThA / 250-Gahnia tristis-T / 62-Garcinia merguensis-G T Ed / 83-Gaultheria leucocarpa-T / 187-Gelsemium elegans-T 23 41 50 / 219-Gerbera jamesonii-T C / 43-Glinus oppositifolius-T R / 245-Globba pendula-T C 8 20 / 100-Glochidion littorale-T / 100-Glochidion lutescens-T 17 / 100-Glochidion obscurum-T / 100-Glochidion rubrum-G T / 100-Glochidion zeylanicum var. zeylanicum-T / 134-Glycosmis parviflora-T Ed 41 / 134-Glycosmis pentaphylla-T Ed 35 / 211-Gmelina elliptica-T 7 / 211-Gmelina philippensis-T / 219-Gnaphalium polycaulon-T R 2 10 13 20 / 190-Gongronemopsis tenacissima -T S / 34-Gonostegia pentandra-T R / 248-Goodyera procera-T 10 20 / 248-Goodyera schlechtendaliana-T C 17 / 168-Gouania leptostachya-T 38 / 168-Gouania obtusifolia-T 38 / 219-Grangea maderaspatana-T R 23 / 209-Graptophyllum pictum-T C T / 94-Grewia eriocarpa -T / 94-Grewia hirsuta-T 35 / 115-Grona heterocarpos -T ThA 13 17 28 29 35 41 43 / 115-Grona heterophylla-T ThA 14 15 35 / 114-Guilandina bonduc-T / 138-Guioa diplopetala-T Ed 12 / 190-Gymnema inodorum-T Nh 20 43 / 190-Gymnema sylvestre -T / 73-Gynostemma pentaphyllum-T / 219-Gynura divaricata-T 6 7 20 38 40 41 49 / 219-Gynura procumbens-T R 2 6 12 42 / 138-Harpullia cupanioides-T / 193-Hedyotis philippensis-T / 115-Hegnera obcordata-T C 35 / 219-Helianthus annuus-T C 7 13 19 22 38 40 44 45 49 / 183-Helicia robusta-T / 95-Helicteres angustifolia-T 13 17 19 23 28 44 46 50 / 95-Helicteres hirsuta-T 5 13 17 19 44 / 95-Helicteres lanceolata-T 13 44 / 95-Helicteres viscida-T 13 17 23 / 198-Heliotropium arboreum-T 17 / 198-Heliotropium indicum-T 13 20 39 / 179-Helixanthera cylindrica-T / 179-Helixanthera parasitica-T / 161-Heptapleurum ellipticum-T 20 / 161-Heptapleurum heptaphyllum-T R 5 8 15 20 32 38 47 / 248-Herminium lanceum-T / 161-Heteropanax fragrans-T 17 20 38 45 / 135-Heynea trijuga-T 20 / 146-Hiptage

benghalensis-T 10 20 / 100-Homonoia riparia-T / 3-Horsfieldia irya-T / 9-Houttuynia cordata-T R 7 13 15 17 30 42 44 46 47 / 190-Hoya carnosa-T 20 29 39 40 41 / 190-Hoya diversifolia-T 20 / 190-Hoya multiflora-T 15 20 / 190-Hoya obovata-T 19 / 142-Hugonia griffithiana -T 19 45 / 189-Hunteria zeylanica-T 22 / 193-Hydnophytum formicarum-T 20 / 106-Hydrangea aspera-T 19 / 222-Hydrocharis dubia-T / 162-Hydrocotyle javanica-T R 13 41 / 197-Hydrolea zeylanica-T R / 209-Hygrophila ringens subsp. ringens-T 13 41 49 / 115-Hylodesmum laxum-T 17 26 / 100-Hymenocardia punctata-T / 63-Hypericum japonicum-T 17 26 33 41 44 46 / 193-Hypobathrum racemosum-T / 230-Hypoxis aurea-T / 212-Hyptis brevipes-T 17 / 212-Hyptis capitata -T / 189-Ichnocarpus frutescens-T / 163-Ilex viridis-T / 115-Indigofera dosua-T ThA / 115-Indigofera galegoides-T / 115-Indigofera hirsuta-T / 115-Indigofera linifolia-T / 115-Indigofera spicata-T ThA / 115-Indigofera suffruticosa-T / 115-Indigofera trifoliata-T / 115-Indigofera tsiangiana -T / 115-Indigofera zollingeriana-T ThA / 114-Intsia bijuga-G T / 164-Iodes cirrhosa-T / 144-Irvingia malayana-T Ed 19 / 193-Ixora chinensis-T C Ed 45 / 193-Ixora coccinea-T C 13 15 20 35 40 42 / 193-Ixora nigricans-T C 2 17 / 171-Jasminum multiflorum-T 13 17 20 37 41 46 / 171-Jasminum simplicifolium subsp. funale-T / 18-Kadsura heteroclita-T 13 20 41 46 / 245-Kaempferia angustifolia-T / 245-Kaempferia galanga-T Es 7 19 20 49 / 245-Kaempferia rotunda-T C 16 / 95-Kleinhovia hospita -G T / 219-Kleinia petraea -T C 6 / 3-Knema globularia-T / 219-Lactuca indica-T R 22 50 / 120-Lagerstroemia speciosa-T C / 132-Lannea coromandelica-T 7 / 261-Lasia spinosa-T R 23 47 / 170-Leea indica-T 20 44 / 170-Leea manillensis-T 20 / 170-Leea rubra -T 20 / 212-Leonurus japonicus-T 30 35 47 / 138-Lepisanthes rubiginosa-T C Ed 49 / 193-Leptopetalum biflorum-T 17 20 / 115-Lespedeza juncea-T ThA 13 19 25 40 / 212-Leucas aspera-T 49 / 261-Leucocasia gigantea-T R 17 / 171-Ligustrum sinense var. sinense-T C 17 / 201-Limnophila chinensis-T R 8 17 35 43 49 / 201-Limnophila repens-T R 8 17 / 201-Limnophila rugosa-T R 12 28 35 / 248-Liparis bootanensis-T 35 / 248-Liparis viridiflora-T 8 / 219-Lipoblepharis urticifolia subsp. urticifolia-T 41 / 8-Litsea lancifolia-T / 260-Livistona saribus -T C 2 / 215-Lobelia nicotianifolia-T / 259-Lophatherum gracile-T 8 15 / 248-Ludisia discolor-T C 17 / 128-Ludwigia adscendens-T R 17 44 / 125-Lumnitzera littorea-T R / 125-Lumnitzera racemosa-T Nh 17 / 134-Luvunga sarmentosa-T 7 / 134-Luvunga scandens-T 33 41 / 92-Lysimachia decurrens-T 41 / 92-Lysimachia lobelioides-T / 100-Macaranga denticulata-G T S / 100-Macaranga tanarius-T / 100-Macaranga triloba-T / 8-Machilus odoratissimus-G T / 32-Maclura cochinchinensis-T Ed 17 20 35 41 / 161-Macropanax dispermus-T / 179-Macrosolen bibracteolatus-T / 1-Magnolia × alba-T C Es 2 17 35 40 45 49 / 1-Magnolia champaca-G T / 1-Magnolia coco-T C 20 / 1-Magnolia figo -T / 100-Mallotus barbatus-T / 100-Mallotus floribundus-T / 100-Mallotus macrostachyus-T 17 / 100-Mallotus nudiflorus-G T Ed / 100-Mallotus paniculatus-T / 100-Mallotus repandus-T / 132-Mangifera foetida-T Ed 7 / 132-Mangifera indica-T Ed 13 40 / 190-Marsdenia tinctoria-T / 219-Matricaria chamomilla-T Es 23 / 115-Mecopus nidulans-T / 259-Megathyrsus maximus-T ThA / 126-Melaleuca leucadendra-T Es 5 13 20 35 38 46 / 127-Melastoma sanguineum-T 7 35 45 / 141-Meliosma simplicifolia-G T / 212-Melissa axillaris-T / 95-Melochia corchorifolia-T 26 35 / 127-Memecylon edule-T 2 12 17 / 212-Mesosphaerum suaveolens -T / 62-Mesua ferrea-T C 13 17 20 / 94-Microcos paniculata-T Ed 26 45 / 219-Microglossa pyrifolia-T 13 20 35 / 212-Microtoena insuavis-T 1 13 46 / 219-Mikania cordata-T 20 / 202-Millingtonia hortensis-T C / 259-Miscanthus sinensis-T / 138-Mischocarpus sundaicus-T Ed / 193-Mitragyna diversifolia-T / 193-Mitragyna speciosa-T / 187-Mitrasacme pygmaea-T / 73-Momordica subangulata-T / 77-Moringa oleifera-T R / 212-Mosla dianthera-T R 35 / 114-Moullava digyna-T Nh 21 50 / 115-Mucuna gigantea-T 20 / 115-Mucuna pruriens-T ThA 6 17 / 252-Murdannia edulis-T / 252-Murdannia nudiflora-T ThA / 190-Myriopteron extensum-T / 3-Myristica fragrans-T / 193-Myrmecodia tuberosa-T / 229-Narcissus tazetta-T C 35 / 169-Nekemias cantoniensis-T / 193-Neolamarckia cadamba-T 17 19 / 8-Neolitsea cassia -T Es / 118-Nepenthes mirabilis-T 18 21 22 26 49 / 138-Nephelium lappaceum-T Ed 13 / 189-Nerium oleander-T C / 248-Nervilia concolor-T C 41 50 / 115-Neustanthus phaseoloides-T ThA 19 35 / 219-Nidorella aegyptiaca -T / 260-Nypa fruticans-T 17 35 / 248-Oberonia ensiformis-T 37 41 / 189-Ochrosia oppositifolia-T / 212-Ocimum americanum-T 5 20 / 212-Ocimum basilicum-T 6 17 20 28 42 45 46 / 212-Ocimum gratissimum-T Es 20 / 212-Ocimum tenuiflorum-T Es 5 45 / 162-Oenanthe javanica-T R 2 22 37 41 / 115-Ohwia caudata -T 13 20 26 / 172-Olax scandens -T C / 193-Ophiorrhiza mungos-T 17 / 202-Oroxylum indicum-T Ed Nh 13 17 26 28 40 49 / 212-Orthosiphon 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4. Conclusion

The paper assessed the diversity of medicinal species, genera, families and classes of the Magnoliophyta distributed in both Vietnam and Indonesia. Establishment of comprehensive and reasonable combined model for developing 922 medicinal plant species in both Vietnam and Indonesia. The results provide a lot of valuable information, contributing to the development of cooperation of Vietnam and Indonesia on plant diversity research and orientation for application of medicinal plants.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors have no conflict of interests to declare.

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