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Cahyaningsih, Ria; Magos Brehm, Joana; Maxted, Nigel

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Setting the priority medicinal plants for conservation in Indonesia

Ria Cahyaningsih · Joana Magos Brehm · Nigel Maxted

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Abstract Setting priority species for conservation planning in a large and biodiverse country such as Indonesia is crucial. At least 80% of the medicinal plant species in South East Asia can be found in Indonesia, whether they are native or introduced. However, their conservation is currently ineffective due to limited human and financial resources. By examining factors such as species' occurrence status, rarity and part of the plant harvested, the various Indonesian medicinal plant species can be prioritised for conservation planning. In this study, various threatened plant species have been included in the priority list as well as those listed in related legislation. Some 233 species within 161 genera and 71 families are recommended for prioritisation. An inventory of these priority species was produced presenting compiled data including vernacular names, plant habit, harvested plant part, uses, distribution, whether it is conserved *ex situ*, and their DNA barcoding. Significantly 41.20% of priority species have no information on their current conservation status in either *in situ* or *ex situ* national or international genebanks.

Keywords Prioritisation · Priority · Conservation · Medicinal plants · Indonesia

Introduction

For centuries, the diversity and wealth of Indonesian medicinal plants have been recognised worldwide. This was first noted by the French botanist Bontius (1658) in the list of Java medicinal plants compilation (de Padua et al. 1999) and the Portuguese botanist Georgius Everhardus Rumphius (1627–1702) in his work entitled *Het Amboinsche kruidboek* (Herbarium Amboinense) (Rumphius, 1741–1755; Veldkamp 2011). Medicinal plants are still widely used in Indonesian traditional medicine (Jamu), a tradition that is similar to Ayurveda in India and Traditional Chinese Medicine (TCM) in China (WHO 2009). These traditional Indonesian remedies remain widely used today, in urban as well as rural areas and among all social classes. About two-fifths of the national population use traditional medicine, and most traditional healers in Indonesia use Indonesian indigenous medicine (WHO 2009).

As a country rich in medicinal plants, it is difficult to quantify the exact number of plants in Indonesia, but it is estimated that 2,000 (Erdelen et al. 1999; WHO 2009) to 7,500 medicinal plants (Hamid and Sitepu 1990) are regularly used out of a total of around

R. Cahyaningsih (✉) · J. Magos Brehm · N. Maxted
School of Biosciences, University of Birmingham,
Edgbaston, Birmingham B15 2TT, UK
e-mail: ria.cahyaningsih@lipi.go.id

R. Cahyaningsih
Bogor Botanic Gardens, Indonesian Institute of Sciences,
Kota Bogor, Indonesia

30,000–40,000 plant species within the country (Ministry of National Development Planning 2016). There are high levels of endemism and expected medicinal plant uniqueness in Indonesia is estimated to be at about 40%–50% of the total flora of each island, except Sumatera which has only 23% (Ministry of National Development Planning 2016).

Medicinal plants are valuable species not only for personal health care (de Padua et al. 1999) but also for their economic value as they are traded by local communities (Hawkins 2007). Indonesia's medicinal plants' economic value equates to as much as US\$14.6 billion annually (Ministry of Environment The Republic of Indonesia 2013). Globally, the trade of medicinal plants in 2005 was more than US\$3 billion (Jenkins et al. 2018) and this is estimated to grow to be worth US\$5 trillion by 2050 (WHO 2009).

Indonesia is a vast country, with a land area of 1,919,440 km² spread over thousands of islands (Ministry of Environment and Forestry of Indonesia 2014). Conservation of Indonesian species is thus challenging and costly. Human population growth, land conversion, deforestation and climate change all contribute to medicinal plant loss, as well as overharvesting for medicinal trade (Voek 2004; Hawkins 2007; Ma et al. 2010). Hamilton (2004) argues that the loss of local knowledge regarding medicinal plants and their use is a global concern.

The economic value of medicinal plants in Indonesia, coupled with other threats and a lack of resources for their conservation, makes it urgent that active conservation programmes are put in place. An obvious initial step would be for some form of prioritisation of species and an assessment of the criteria which might be used. This has not been previously attempted in Indonesia, however a number of studies have been conducted elsewhere. Dhar et al. (2000) did undertake such an exercise in the Indian Himalayas prioritising consumers (using medicinal plants) and biologists (concerned about their conservation). The outcome was to prioritise conservation for species that are harvested in a destructive manner, that have restricted distribution and for which there are limited propagation techniques. van Andel et al. (2015) prioritised the medicinal plants in West Africa based on commercial demand, whether they are wild-harvested, and their occurrence in undisturbed vegetation types. Dery et al. (1999) conducted prioritisation in the Shinyanga Region of Tanzania involving local people with the

necessary knowledge and scored their appraisal. Allen et al. (2014) prioritised European medicinal plants by selecting only native species.

Producing checklists that consist of the name of the species, the author details, inventories and additional information is essential to formulating the conservation strategies (Magos Brehm et al. 2017) and these form the groundwork for further action. Establishing priorities for conservation can be based on current conservation status, the threat of genetic conservation, and legislation (Maxted et al. 1997). Inventory is also needed to describe a country's species richness: an essential tool in conservation management (Magos Brehm et al. 2008). Considering these arguments, the economic value of medicinal plants in Indonesia and the need to prioritise conservation efforts, this project aims to analyse available data concerning Indonesian medicinal plants for active in situ and ex situ conservation and to provide a priority list of species.

Methods

The checklist of medicinal plants of Indonesia was compiled in Excel from relevant literature. The literature used was as follows:

1. Plant Resources of South-East Asia (PROSEA) book series, specifically: Medicinal and Poisonous Plants 1 (de Padua et al. 1999), Medicinal and Poisonous Plants 2 (van Valkenburg and Bunyaphatsara 2002), Medicinal and Poisonous Plants 3 (Lemmens and Bunyaphatsara 2003), and Spices (de Guzman and Siemonsma 1999). Only species distributed in Indonesia were selected. Poisonous plants were included but in lower number and only if they had a medicinal function (de Padua et al. 1999). Spice plant species were included as well because traditional people use them in medication (de Guzman and Siemonsma 1999).
2. Indonesian Medicinal Plant Indexes (Eisai 1986; 1995).
3. Atlas of Indonesian Medicinal Plants series 1–6 (Dalimartha 1999, 2000, 2003, 2006, 2008, 2009). *Ganoderma lucidum* (Curtis) P.Karst. (Ganodermataceae) was excluded from the list as it is fungi.

4. The Useful Plants of Indonesia (Heyne 1987). Only species with records of medicinal use was selected.
5. Rare Indonesian Medicinal Plants stated in IBSAP (Indonesia Biodiversity Strategy and Action Plan) based on Rifai et al. (1992) and Zuhud et al. (2001) (The National Development Planning Agency 2003). *Usnea misaminensis* (Vain.) Motyka, the Parmeliaceae family, was excluded as it belongs to the fungi kingdom rather than the plant kingdom.

The taxonomic names were checked against the online taxonomic name resolution service tool by checking “Constrain by higher taxonomy” under “Best match settings”, which is effective for spelling errors and for merging all the synonyms into a single accepted name (Boyle et al. 2013). The steps are described in Fig. 1.

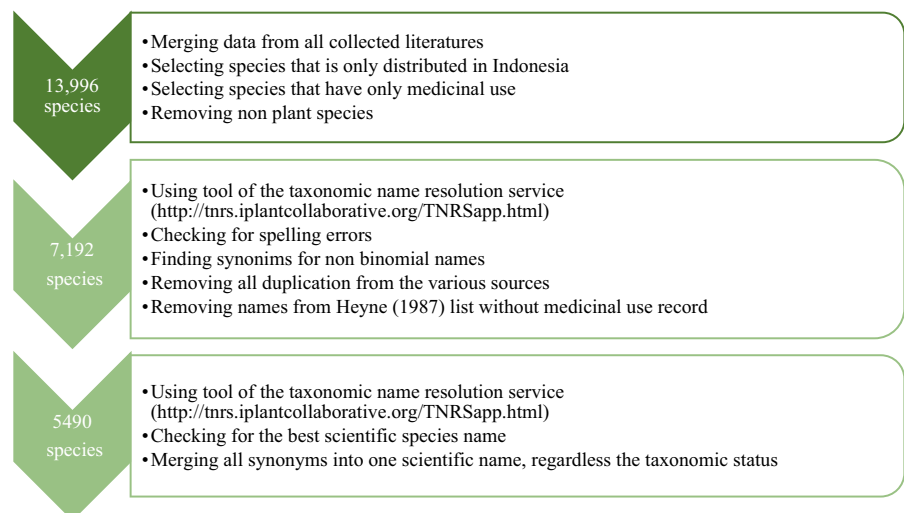
After the literature review, prioritising the checklist was done serially with the collected information, namely, (a) occurrence status, (b) rarity, (c) part of the plant harvested, (d) threat status, and (e) legislation (Fig. 2).

- a. Native status. Similarly to Allen et al. (2014), only species native to Indonesia were prioritised.
- b. Rarity. This criterion is based on the distribution of the species in Indonesia. Only medicinal plant species that are endemic, distributed on seven major areas in Indonesia (i.e. the main islands of Sumatera, Java, Kalimantan, Sulawesi, and Papua, and the area of the Lesser Sunda Islands and

Maluku) regardless of their global distribution, and that have never been introduced elsewhere (with data obtained from literature and online through <http://powo.science.kew.org/>; POWO 2019) are listed as a priority. Plants never introduced elsewhere could describe their slow natural distribution and unavailability of propagation technique.

- c. Part of the plant harvested. The species for which the root or non-aerial parts such as tuber and rhizomes, complete bark, or whole plants are harvested were prioritised (as suggested by Dhar et al. 2000) as this is detrimental to the persistence of the species in the wild.
- d. Threat status. Since Indonesia does not have a national red list, the threat status at the global level for each species was retrieved from the IUCN Red List (<https://www.iucnredlist.org/>). The medicinal plant species that have been assessed as Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) are considered a priority.
- e. Legislation. This criterion refers to the prioritisation of those species included in national or global legislation. This is very important because it depicts that the listed species need conservation and the government should be responsible to them (Magos Brehm et al. 2010). At a global level, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was used. Thus, the species threatened with extinction (listed in Appendix I) and the species which may

Fig. 1 Flowchart of setting checklist of medicinal plants of Indonesia



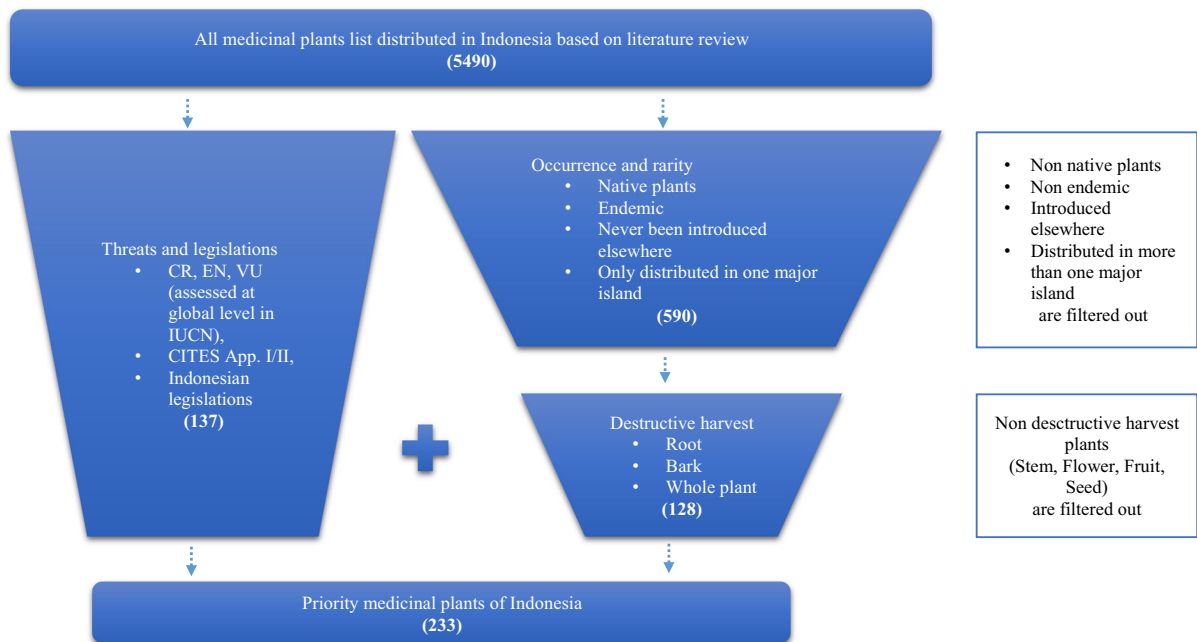


Fig. 2 Flowchart of setting prioritisation of medicinal plants of Indonesia

be threatened with extinction if their trade is not closely monitored (listed in Appendix II of CITES (UNEP-WCMC (Comps.) 2014)) were prioritised. At the national level, the legislation related to medicinal plant conservation included the following:

1. Indonesian Government Regulation Act. 7 of 1999 regarding Natural Genetic Resources and Its Ecosystem.
2. Decree of Forestry Ministry No 57/MENHUT-II/2008 regarding Strategy Direction of National Species Conservation 2008–2018.
3. Decree of Environmental and Forestry Ministry No. P.20/MENLHK/SETJEN/KUM.1/6/2018 regarding the Protected Flora and Fauna Species.
4. Decree of Environmental and Forestry Ministry P.106/MENLHK/SETJEN/KUM.1/12/2018 revised decree of Environmental and Forestry Ministry P.92/MENLHK/SETJEN/KUM.1/8/2018 (replaced the Decree of Environmental and Forestry Ministry No. P.20/MENLHK/SETJEN/KUM.1/6/2018) regarding the Protected Flora and Fauna Species.

5. IBSAP (Indonesia Biodiversity Strategy and Action Plan) based on Rifai et al. (1992) and Zuhud et al. (2001) in The National Development Planning Agency (2003).

The listed plant species protected by Indonesian laws are classified as requiring protection due to their limited or small population, decreasing number of individuals and endemism. The medicinal plants that were included in the CITES appendices I or II or any native medicinal plants that are listed in any national legislation were included in the priority list.

Due to the primary data for prioritisation, the checklist that consists of a scientific name and author are obtained online from POWO (2019). An inventory of priority medicinal plant species was compiled with their vernacular names, plant habit, used plant parts, uses, and DNA barcoding data (<http://www.boldsystems.org/>; Ratnasingham and Hebert 2007). Group plants that were selected based on criteria of limited distribution, destructive harvest, CITES, IUCN, and National legislation were showcased with a Venn diagram generated by Bioinformatics and Evolutionary Genomics (http://bioinformatics.psb.ugent.be/cgi-bin/liste/Venn/calculate_venn.html).

Table 1 Level of endemism of priority medicinal plant species within Indonesia

Distribution	Endemic to one major island	Endemic to ≥ 2 islands/areas	Total occurrence
Sumatera ^a	43	78	121
Java ^a	33	62	95
Kalimantan ^a	17	68	85
Papua ^c	13	35	48
LSI ^b	12	44	56
Maluku ^b	11	37	48
Sulawesi ^b	1	43	44

Biogeographical regions of Southeast Asia: ^aSundaland, ^bWallacea, ^cAustralia (according to Myers et al. 2000; Mittermeier et al. 2011)

Ex situ conservation status information on whether the species has been collected or not was obtained from Indonesian botanic gardens through direct communication with Bogor Botanic Gardens, and by mining data online from Purwodadi Botanic Garden (<http://www.krpurwodadi.lipi.go.id/koleksi/>) and Cibodas Botanic Garden; <http://sindata.krcibodas.lipi.go.id/Cibodas-Botanic-Gardens-Record/CBGR/>) as well as from Genesys (<https://www.genesys-pgr.org/>).

Results

Establishing the checklist of Indonesian medicinal plants

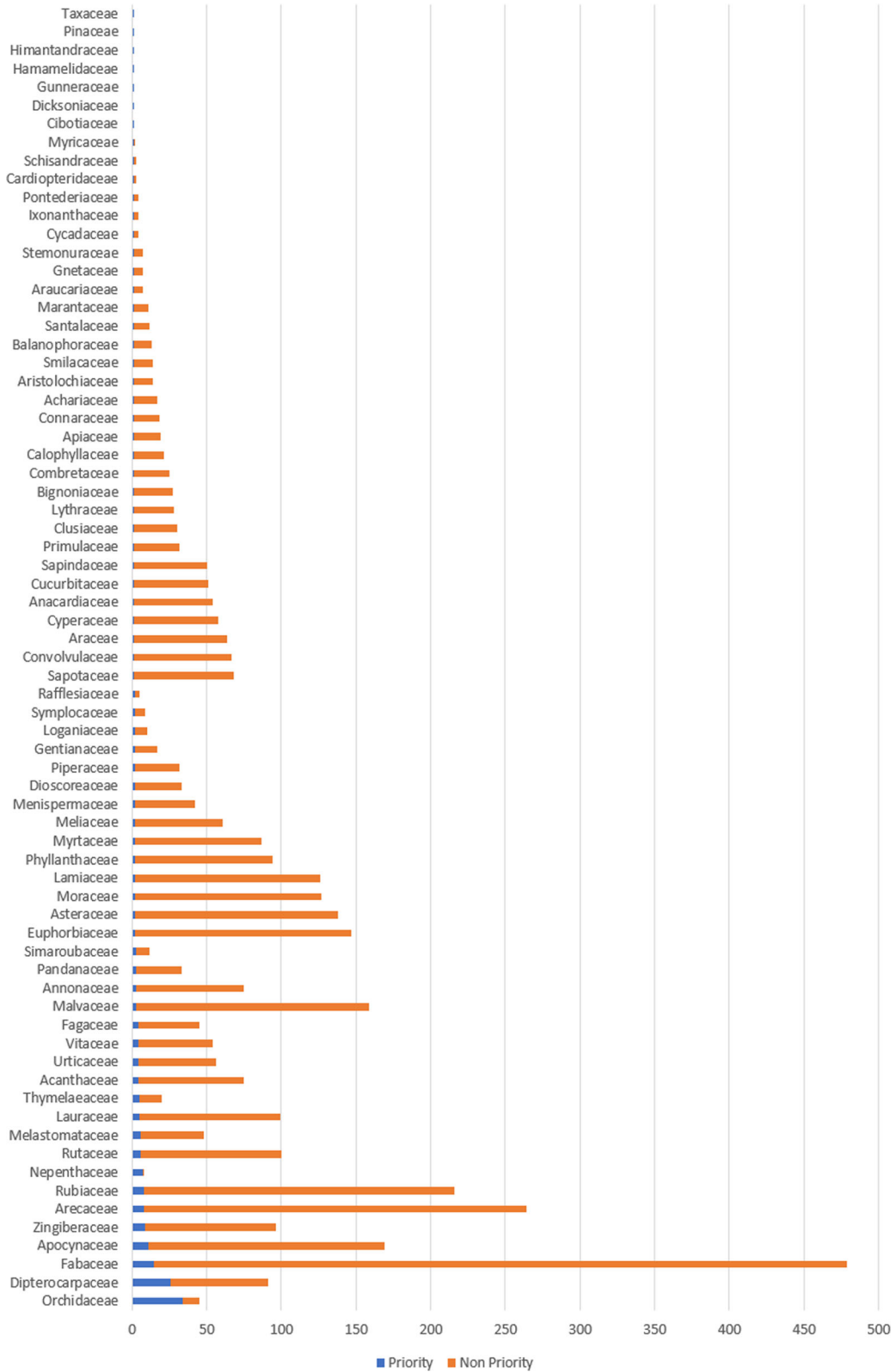
Indonesia has a total of 5490 medicinal plant taxa, of which 5408 are identified species, and 82 can only be identified at the genus level. No further information can be identified for the 82 genus-level species; hence it cannot be concluded that they are new species. The 5408 Indonesian medicinal plant species are within 245 families and 1809 genera; 3312 are native (61.24%), 1754 (32.43%) are introduced, and 342 species (6.32%) are of unknown status. Most medicinal plants (8.84%) belong to the Fabaceae family (Fig. 3) since it is one of the biggest families of medicinal plants in the world (Willis 2017). There is estimated to be a total of 27,734 medicinal plant species around the world (MPNS 2020), meaning that Indonesia's medicinal species make up around 20% of the global population.

Prioritising and inventorying Indonesian medicinal plants

A total of 233 species of Indonesian medicinal plants, within 161 genera and 71 families, were prioritised for conservation (Table Appendix 1) according to the criteria discussed above (Fig. 3). The higher priority medicinal plant families belong to the Orchidaceae (34 species or 14.59%) and Dipterocarpaceae (26 species or 11.16%). Most of these are included in Appendix II of CITES or have been assessed as threatened in the IUCN Red List (Table Appendix 2). Some 127 out of the 233 priority species are known as medicinal plants worldwide (MPNS 2020), whereas 106 species are used as commercial timber (Dipterocarpaceae), ornamental plants (Orchidaceae) and sources of fibre (Nepenthaceae).

Some 96 out of 233 (41.20%) major priority medicinal plants are distributed in one major area/island and harvested in a destructive manner. Some species are included in the priority list solely based on the IUCN threatened list (2), CITES Appendix II list (25), and in Indonesian legislation (11) (Fig. 4).

The rest of the species in the CITES Appendices may represent global demand, and da Silva and Conde (2019) have used it for their own prioritisation. Moreover, the CITES Appendices are managed based on trading data and are very important in Indonesia. Throughout Asia, as Ma et al. argue (2010), the illegal trade in medicinal plants like orchids cause losses in plant diversity. However, it is difficult to assess this adequately in Indonesia due to its size and large remote areas.



◀ **Fig. 3** The families represented in the Indonesian Medicinal Plant Species Checklist. The species with a higher priority for conservation can be identified

Most of the medicinal plants that can be classed as priority (77.25%) are harvested destructively either by removing the rooting parts (root, rhizome, or tuber), bark, or harvesting the entire plant. The remaining plants (14.59%) are harvested through other parts such as their leaves, sap, stems, fruits, or flowers. Some 8.15% of the priority species have no information regarding how they are harvested, as their harvesting methods were not necessarily designed solely for medicinal use. Harvesting non-aerial parts of the plant (root, rhizome and tuber, bark and rhizome) makes the plants highly susceptible to failure or can directly kill the plants. Other parts of the plant, such as leaves, flowers, and seeds, are excluded from the prioritisation criteria, although they can also affect the plant's vigour and fitness. Nevertheless, the harvesting of root and bark might affect mostly shrubs and trees, whereas the collection of seed affects mainly annuals and biannuals (Schippmann and Cunningham 2002).

In term of the habit types of priority medicinal species, the majority type consists of trees (32.62%), shrubs (27.03%), herbs (24.03%), lianas (6.44%), climbers (6.01%), tree like-palms (3.00%), and holoparasite (0.86%). Some 97 of the 233 priority species have been identified through DNA barcoding

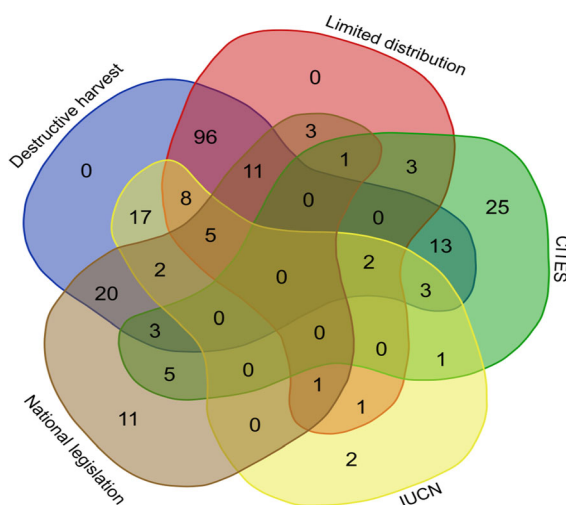


Fig. 4 Venn diagram of priority medicinal plant species grouped into prioritisation criteria

and provided online (<http://www.boldsystems.org/>; Ratnasingham and Hebert 2007). The taxonomic identification via DNA barcoding is of high importance for conservation. Since plant phenotypic characteristics are affected by physiology and environmental factors (Chen et al. 2010 and Techen et al. 2014) it may become difficult to identify certain species. Thus, for conservation purposes, consistent results of DNA barcoding can help to prevent deception and theft of protected and commercial species (Kress et al. 2014 and Mishra et al. 2016). Furthermore, it also protects the rights of consumers to use authentic plant species for their medicines, as the barcoding can be conducted on both fresh and dried plants (Dick and Webb 2012) as well as on market products (Eurlings et al. and Newmaster et al. 2013).

Regarding their distribution, 53 priority species are endemic to Indonesia (see Table 1), 179 species are distributed in both Asia and Australia, and one species (*Dodonaea viscosa* Jacq. subsp. *angustifolia* (L.f.) J.G.West) is distributed worldwide. Sundaland and Wallacea, with 93 and 24 endemic medicinal plant species respectively, are included in the hotspot areas identified by Myers et al. (2000) and Mittermeier et al. (2011) as having significant endemism and threats. The number of native medicinal plants in Indonesia showcases how rich Indonesia's biodiversity is, a point also noted by Vavilov (1935) who identified it as a centre of origin/diversity of cultivated plants.

Indonesian people in villages often intensively use a traditional medicinal plant that they collect from the wild and plant in their home gardens (Astutik et al. 2019). Nevertheless, we could not identify the priority species data regarding their collection and planting locally as medicinal plants. In addition, ex situ conservation institutions have been actively collecting priority medicinal plants. More than half of the 233 species have been planted in nurseries or botanical gardens either nationally or internationally. Some 137 priority species are cultivated in the Indonesian Botanic Garden–Indonesian Institutes of Sciences and one species [*Phyllodium elegans* (Lour.) Desv.] can be found at the International Livestock Research Institute (ILRI) (Ethiopia) with Forages as its common name. Despite being distributed in more than two islands/areas, 107 priority species that are threatened globally have been listed in national legislation. Likewise, *Borassus flabellifer* L. (Arecaceae) and *Dalbergia latifolia* Roxb. (Fabaceae) are threatened

but have been introduced to other parts of Indonesia as well as to other countries.

Discussion

Checklist of Indonesian medicinal plants

As Paton et al. (2016) have argued, plant species names serve as “a key to communicating and managing information about plants”. Creating a national checklist of Indonesian medicinal plant species, and annotating with additional data to allow for prioritisation, is essential groundwork for conservation. As the information is currently located in different sources and is arguably incomplete, there are many areas of literature and numerous journals that discuss medicinal plants that need to be collected and reviewed. The Medicinal Plant Names Services (MPNS 2020) can be useful to access the global information for medicinal plants and to build up understanding amongst both scientific and non-scientific users. Many journals report ethnobotanical studies of Indonesian people that are rich in ethnicity, but the MPNS to date has little information regarding Indonesia plants. For this project, the literature that is estimated to have a complete species list of Indonesian medicinal plants was selected for further study.

Using the TRNS tool (Taxonomic Name Resolution Service; Boyle et al. 2013) to help with the taxonomical check name was helpful for this research but some issues were unable to be resolved. Homonyms and ambiguous names needed to be checked manually. Some plant names are Rumphius-related names such as *Sampanea montana* Rumph. and *Arbor spiculorum aeruginea* Rumph. that are pre-binomial names, not binomial. This is because Rumphius works had not been recorded in Species Plantarum, the starting point of binomial names by Linnaeus (1753) (Raven and Margulis 2009) and was resolved by available synonyms in the available literature (Eisai 1986). The value of this “resolution” is also constrained by the quality of the underlying taxonomic resources available. To resolve the taxonomic status would allow for better tracking of the plant to the names employed in original publications, enabling them to be matched to modern comprehensive nomenclatural and taxonomic datasets.

Allkin (2014) and Rivera et al. (2014) describe the frequent use of ambiguous names and even misleading names that exist in the literature, scientific journals, and international legislation in terms of medicinal plant names. Some 3,445 names out of 9,178 Latin names from 308 scientific articles were incorrect, as identified by Rivera et al. (2014). This might happen because, in certain circumstances more than one name can refer to a plant, while on the other hand one name can refer to more than one plant, or the name can keep changing (Allkin 2014). Dauncey et al. (2016) suggested authors use the proper and unambiguous scientific plant(s) names of medicinal plants or their products before publishing their articles in order to maintain scientific integrity. The confusion concerning the identity of plants employed is made even more complex because of the widespread use in health legislation of common, trade, product and pharmaceutical names (the latter also written in Latin) which are inherently ambiguous (Allkin 2014). Labelling plant materials correctly and unambiguously is a key step in researching medicinal plant use (Allkin and Patmore 2018).

The checklist resulting from this study might not be perfect, and can only reduce the pitfall of medicinal scientific names, that is synonym names and homonyms (Allkin and Patmore 2018). However, it can also be a reasonable basis for future research and coordination in discussing whole species to conserve, considering many medicinal plants can be found in Indonesia. As the ethnobotanical knowledge, especially regarding new medicinal plants, is still increasing this study serves as a foundation for future work.

Priority of Indonesian medicinal plants, their current conservation and conservation planning.

Prioritisation has been done for some plant taxa in Indonesia, but this research was not specifically for medicinal plants. Studies include those by Moge (2001), Risna et al. (2010), and Hamidi et al. (2019). Moge et al. (2001) listed 200 rare plant species in Indonesia and 29 priority medicinal plants are included in his list, namely *Anaxagorea javanica* Blume (Annonaceae), *Pimpinella pruatjan* Molke. (Apiaceae), *Alstonia scholaris* (L.) R.Br., *Alyxia halmaheirae* Miq., *A. reinwardtii* Blume, *Rauvolfia serpentina* (L.) Benth. ex Kurz, *Urceola laevigata* (Juss.) D.J.Middleton & Livsh., *Voacanga grandifolia* (Miq.) Rolfe (Apocynaceae), *Caryota no* Becc., *Phoenix paludosa* Roxb. (Arecaceae), *Oroxylum*

indicum (L.) Kurz (Bignoniaceae), *Cibotium barometz* (L.) J.Sm. (Cibotiaceae), *Shorea palembanica* Miq. (Dipterocarpaceae), *Euchresta horsfieldii* (Lesch.) Benn., *Koompassia malaccensis* Maingay, *Parkia intermedia* Hassk., *P. timoriana* (DC.) Merr. (Fabaceae), *Scutellaria javanica* Jungh. (Lamiaceae), *Cinnamomum culilaban* (L.) J.Presl, *C. sintoc* Blume, *Cryptocarya massoy* (Oken) Kosterm. (Lauraceae), *Strychnos ignatii* Bergius, *S. lucida* R.Br. (Loganiaceae), *Vanda miniata* (Lindl.) L.M.Gardiner (Orchidaceae), *Kadsura scandens* (Blume) Blume (Schisandraceae), *Symplocos odoratissima* (Blume) Choisy ex Zoll (Symplocaceae), *Aquilaria hirta* Ridl. (Thymelaeaceae), *Amomum sumatranum* (Valeton) Skornick. & Hlavatá, and *Curcuma petiolata* Roxb. (Zingiberaceae). Risna et al. (2010) prioritised the family of Arecaceae, Cyatheaceae, Nepenthaceae, and Orchidaceae as a taxa unit considering the nature of each plant and the natural habitat, with the result of ex situ conservation recommendations on some taxa. Three priority medicinal plants are in line with other results and are *Nepenthes reinwardtiana* Miq., *Johannesteijsmannia altifrons* (Rchb.f. & Zoll.) H.E. Moore, and *Nepenthes ampullaria*. *Anisoptera costata* Korth. (Dipterocarpaceae), *Castanopsis argentea* (Blume) A.DC. (Fagaceae), and *Eusideroxylon zwageri* Teijsm. & Binn. (Lauraceae) are also included in priority plant taxa that need to be conserved in Indonesia (Hamidi et al. 2019). Moreover, the Ministry of Agriculture published Decree No. 511 Year 2006, which was first revised with Decree No. 141 Year 2019, and finally revised with Decree No. 104 Year 2020, which lists horticultural plants grown in Indonesia. This includes a number of medicinal plants that are produced and processed for market. Three priority species, *Curcuma aeruginosa* Roxb., *Lunasia amara* Blanco, and *Rauvolfia serpentina* (L.) Benth. ex Kurz, have already been included in horticulture plant priority lists since 2006. Thus, some priority Indonesian medicinal plants identified in this study have been confirmed as priority species by other studies. These depict the need for a priority conservation list for sustainable use.

This priority list can be used to help formulate in situ and ex situ conservation plans through the National Priority Program included in the Mid-Term National Development Plans of Indonesia, in line with the Convention on Biological Diversity regarding the conservation of biodiversity and its sustainable use

(CBD 2010). The priority list also helps to achieve the Global Strategy for Plant Conservation 2011–2020 objectives and its targets: objective I (“Plant diversity is well understood documented and recognised”), II (“Plant diversity is urgently and effectively conserved”), III (“Plant diversity is used in a sustainable and equitable manner”), IV (“Education and awareness about plant diversity, its role in sustainable livelihoods and importance for all life on earth is promoted”), and V (“The capacities and public engagement necessary to implement the strategy have been developed”).

The stakeholders involved in the conservation and use of medicinal plants, particularly in Indonesia, can use the priority list of medicinal plants developed here as a basis for coordinated and systematic active conservation work. It is clear that conservation efforts on Indonesian medicinal plants have already been made, but the information and network of stakeholders either does not currently exist or is difficult to access, hence the need to make it more widespread and strengthened. This network will find what has and what has not been done regarding conservation so that active conservation may utilise its limited resources on the conserving those Indonesian medicinal plants that most need it.

Conclusion

This study has identified a total of 5490 medicinal plant species of which 233 are a priority for conservation. Not all priority species are well-known as medicinal plants, such as those that belong to Dipterocarpaceae (mostly timber plants) and Orchidaceae (mostly ornamental plants). An inventory of priority medicinal species was developed, and it is hoped that this can be used to help the medicinal plant’s stakeholders, mainly comprising researchers and government officials working on the systematic conservation of priority Indonesian medicinal plants. This priority list can be used to help formulate in situ and ex situ conservation plans at regional and national levels. Furthermore, dissemination to a wider public will help in raising knowledge and awareness of medicinal plants, which is essential towards the conservation of these valuable resources.

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Author Contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by RC. The first draft of the manuscript was written by RC and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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Appendix

See Tables 2 and 3.

Table 2 Indonesian priority medicinal plant species

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part#	Uses	Ex situ	DNA Barc.	Ref.
1	<i>Avicennia marina</i> var. <i>rumphiana</i>	Sp. level: (Forsk.) Vierh.; Var. level: (Hallier f.) Bakh	Acanth.	Api-api (I)	K SI M P	Sh	Wo	Fever	A	P	6
2	<i>Baobab prionitis</i>	L.	Acanth.	Jarong kembang landep (I)	J LSI SI	Sh	Ro Le	NA	P (N)	A	6
3	<i>Hypoestes polythrysa</i>	Miq.	Acanth.	Trembuku (I)	LSI	He	St Ro Le	Earache, cuts	A	A	6, 7, 5, 3
4	<i>Pseuderanthemum graciliflorum</i>	(Nees) Ridl.	Acanth.	Kemaja hutan (M), Blue Twilight (En)	J	Sh	Ro	Diabetes, tonic	A	A	6, 7
5	<i>Pangium edule</i>	Reinw.	Achari.	Picung (I)	J LSI M P	Tr	WH	Cough, body odor issue	P (N)	P	6, 7 13, 5 2
6	<i>Koorderstodendron pimattam</i>	Merr.	Anacardi.	Tabu hitam (I)	P	Tr	Sa	Folk medicine	P (N)	A	6
7	<i>Anaxagorea javanica</i>	Blume	Annon.	Akar angin (I)	Sm J K SI	Sh	Ro Se Ba	Folk medicine	P (N)	A	7, 3
8	<i>Goniothalamus Hook.f. & Thomson</i>	Hook.f. & Thomson	Annon.	Penawar hitam (M)	Sm	Tr	Ba	Back-ache	A	A	2
9	<i>Goniothalamus tapis giganteus</i>	Miq.	Annon.	Unang-unang (I)	Sm	Sh	Ro Ba Le	Scorpion stings antidote	A	P	6, 7 2
10	<i>Pimpinella praujian</i>	Molk.	Api.	Purwaceng (I)	J	He	WH	Genital disease	P (N)	A	6, 7, 5 2
11	<i>Alstonia iwahigensis</i>	Elmer	Apocyn.	Pulai gunung (I)	K	Tr	Ro	Cholera, childbirth care	A	A	2
12	<i>Alstonia scholaris</i>	(L.) R.Br.	Apocyn.	Pulai (I)	Sm J K LSI SI M P	Tr	Fl Le St	Rheumatism, lumbago	P (N)	P	6, 7, 8, 5 2
13	<i>Alyxia halmaherae</i>	Miq.	Apocyn.	NA	SI M	Sh	WH	Childbirth care	A	A	2
14	<i>Alyxia reinwardtii</i>	Blume	Apocyn.	Pulasari (I)	Sm J K LSI	Cl	WH	NA	P (N)	P	6, 7 2
15	<i>Alyxia rostrata</i>	(Markgr.) Markgr.	Apocyn.	Komunang (I)	P	Cl	Ba	NA	A	A	2
16	<i>Hunteria zeylanica</i>	(Retz.) Gardner ex Thwaites	Apocyn.	Gitan obat (I)	Sm	Sh	Ba Ro	NA	P (N)	A	6, 5, 7
17	<i>Myriopterion extensum</i>	(Wight & Arn.) K. Schum.	Apocyn.	Wing-fruitvine (En)	J	Cl	Ro	Diarrhoea, sore eyes	A	A	6
18	<i>Rauvolfia serpentina</i>	(L.) Benth. ex Kurz	Apocyn.	Pule pandak (I)	J LSI	Sh	Ro St Le	Asthma, colics	P (N)	P	6, 7, 5, 8 1
19	<i>Urceola laevigata</i>	(Juss.) D.J.Middleton & Livsh.	Apocyn.	Gembor (I)	Sm J K LSI SI	Sh	WH	Aphrodisiac, cancer	P (N)	P	6, 7, 5 2
20	<i>Voacanga grandifolia</i>	(Miq.) Rolfe	Apocyn.	Kalak kamin (I)	J LSI SI M P	Sh	Le	Cancer	P (N)	P	2
21	<i>Willughbeia tenuiflora</i>	Dyer ex Hook.f.	Apocyn.	Jitah (I)	Sm	Li	Ba St	Rheumatism, stomach-ache	P (N)	A	5

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
22	<i>Alocasia cuprea</i>	K.Koch	Ar.	Taro (I)	K	He	St, Ro, Le	Folk medicine	P (N I)	P	6
23	<i>Agathis borneensis</i>	Warb.	Araucari.	Bembung (I)	Sm K	Tr	Wo	NA	P (N)	P	6
24	<i>Borassus flabellifer</i>	L.	Arec.	Lontar (I)	J LSI SI	TrP	WH	Aphrodisiac	P (N I)	P	6, 7, 5
25	<i>Caryota no</i>	Becc.	Arec.	Sarai raja (I), Giant fishtail palm (En)	K	TrP	Wo	Diuretic, tonic	P (N I)	P	6
26	<i>Eugeissona utilis</i>	Becc.	Arec.	Bertan (I), Bornean sago palm (En)	K	TrP	Se, Ro, St	Malarial	P (N)	P	6, 5
27	<i>Iguanura wallichiana</i>	(Mart.) Becc.	Arec.	Mapau kalui (I)	Sm	TrP	Ro, Le, Se	NA	P (N)	P	6, 5
28	<i>Johannesteijsmannia altifrons</i>	(Rehb.f. & Zoll.) H.E.Moore	Arec.	Belawan sang (I)	Sm K	Tr	Le	Anaemia, stomach ache	P (N)	A	6, 5
29	<i>Phoenix paludosa</i>	Roxb.	Arec.	Korma rawa (I), Mangrove date palm (En)	Sm	TrP	Le, Fr, St	Boils, sore eyes	P (N I)	P	6, 7
30	<i>Pigafetta filaris</i>	(Giseke) Becc.	Arec.	sagu laki-laki (I)	M P	Sh	Fr, Wo	Folk medicine	P (N)	P	6, 5
31	<i>Saribus woodfordii</i>	(Ridl.) Bacon & W.J.Baker	Arec.	Boda (PNG), Nggela Fountain Palm (En)	P	TrP	St, Wo	Stomach issues	A	P	6
32	<i>Thottea tomentosa</i>	(Blume) Ding Hou	Aristolochi.	Singa depa (I)	J	He	Le, Rh, St	Cough, intestinal worms	P (N)	P	2
33	<i>Blumea arfakiana</i>	Marelli	Aster.	Kwipo (PNG)	P	Sh	Le, Ro	NA	A	P	1
34	<i>Blumea arnakidophora</i>	Matf.	Aster.	kambali (PNG)	P	Sh	Le, Ro	NA	A	A	1
35	<i>Balanophora fungosa</i> subsp. <i>Indica</i>	Sp. level: J.R.Forst. & G.Forst.; Susp. level: (Arn.) B.Hansen	Balanophor.	Perud puspa (I), fungus root (En)	Sm	Tr	WH	NA	A	A	6
36	<i>Oroxylum indicum</i>	(L.) Kurz	Bignoni.	Pongporang (I)	Sm, J LSI SI	Tr	Ba, Le	NA	P (N I)	P	6, 7, 5, 2
37	<i>Mesua ferrea</i>	L.	Calophyll.	Penaga lili (I)	LSI	Tr	Wo	Snakebites, gonorrhoea	P (N)	P	6, 7, 5
38	<i>Gonocaryum gracile</i>	Miq.	Cardiopterid.	Tobung-tobung (I)	Sm	Sh	Fr, Le, Ro	Stop bleeding, rheumatic	A	P	3
39	<i>Cibotium barometz</i>	(L.) J.Sm.	Ciboti.	Paku simpai (I)	Sm, J P	Tr	Rh, Ba	Cholera	P (N)	P	7, 12
40	<i>Garcinia ambainensis</i>	Spreng.	Clusi.	Kayu asam besar (I)	M	Tr	Ro, Le	Diarrhoea, wounds	A	A	6, 7, 5
41	<i>Terminalia bellirica</i>	(Gaertn.) Roxb.	Combret.	Jaha kebo (I)	LSI	Tr	Fr	NA	P (N)	P	7, 5
42	<i>Rourea fulgens</i>	Planch.	Connar.	Semilat (M)	Sm	Sh	Le, Ro	Fever	A	A	6, 7

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
43	<i>Erycibe aenea</i>	Prain	Convolvul.	Langsat hutan (M)	Sm	Li	Ro	Sore muscles, headache, fever	A	A	3
44	<i>Trichosanthes ovigera</i>	Blume	Cucurbit.	Areyu tiwuk (I), Japanese Snake Gourd (En)	J	Cl	Fr Tu	Colic, asthma	A	P	6, 7, 5 1
45	<i>Cycas rumphii</i>	Miq.	Cycad.	Tandiang (I)	J K LSI SI M P	Tr P	Se Ba Le	Cough, tuberculosis	P (N) I	P	6, 7, 5
46	<i>Fimbristylis falcata</i>	(Vahl) Kunth	Cyper.	Malasibuias (P)	P	He	Rh	Insect bites, cancer	P (I)	A	3
47	<i>Dicksonia blumei</i>	(Kunze) Moore	Dicksoni.	paku kidang (I)	Sm J LSI SI	Sh	Le	A substitute for <i>Curcuma longa</i>	P (N)	P	7
48	<i>Dioscorea laurifolia</i>	Wall. ex Hook.f.	Dioscore.	Wild yam (En)	K	Cl	Tu	Fever, colic	A	A	6, 7
49	<i>Dioscorea orbiculata</i>	Hook.f.	Dioscore.	Wild Yam (En)	Sm	Cl	Tu	Sores, skin issues	A	A	6, 7
50	<i>Anisoptera costata</i>	Korth.	Dipterocarpaceae	Entenam (I)	Sm J K	Tr	Wo	Colds, burns	P (N)	P	6, 5
51	<i>Anisoptera marginata</i>	Korth.	Dipterocarpaceae	Entenam (I)	Sm K	Tr	Wo	Emmenagogue	P (N)	P	6, 5
52	<i>Anisoptera megistocarpa</i>	Slooten	Dipterocarpaceae	Beurmen (I)	Sm	Tr	Wo	Sores on the legs	A	A	6, 7
53	<i>Dipterocarpus baudii</i>	Korth.	Dipterocarpaceae	Keruwing (I)	Sm	Tr	Wo	NA	A	P	6, 5
54	<i>Dipterocarpus gracilis</i>	Blume	Dipterocarpaceae	Keruwing bulu (I)	Sm J K	Tr	Wo	Ulcerated wounds	P (N)	A	6, 5
55	<i>Dipterocarpus kunsleri</i>	King	Dipterocarpaceae	Keruwing bunga (I)	Sm K	Tr	Wo	Scabies, fever	A	A	6, 5
56	<i>Dipterocarpus retusus</i>	Blume	Dipterocarpaceae	Jawa Palahlar (I)	Sm J LSI	Tr	Wo	Boils and pimples, infected ears	P (N)	P	6, 5
57	<i>Hopea celebica</i>	Burck	Dipterocarpaceae	Damar laut (I)		Tr	Wo	NA	P (N)	A	6, 5
58	<i>Hopea mengarawan</i>	Miq.	Dipterocarpaceae	Damar mata kucing (I)	Sm K	Tr	Wo	Dropsy	P (N)	A	5
59	<i>Hopea sangal</i>	Korth.	Dipterocarpaceae	Kedemat (I)	Sm J K LSI	Tr	Wo	Infected nails	P (N)	P	6, 5
60	<i>Parashorea lucida</i>	Kurz	Dipterocarpaceae	Damar tyrik ayam (I)	Sm K	Tr	Wo	NA	P (N)	P	6, 5
61	<i>Shorea bracteolata</i>	Dyer	Dipterocarpaceae	Buryau (I)	Sm K	Tr	Wo	NA	P (N)	No information	5
62	<i>Shorea glauca</i>	King	Dipterocarpaceae	Simanto (I)	Sm	Tr	Wo	Fever, sores	A	A	6, 5
63	<i>Shorea laevis</i>	Ridl.	Dipterocarpaceae	Kumus (I)	Sm K	Tr	Wo	Stop bleeding	A	P	6, 5
64	<i>Shorea lepidota</i>	Blume	Dipterocarpaceae	Melebekan (I)	Sm	Tr	Wo	Swellings	P (N)	A	6, 5
65	<i>Shorea macrophylla</i>	(de Vriese) P.S.Ashton	Dipterocarpaceae	Tengkawang telor (I)	K	Tr	Wo Fr	NA	A	A	6, 5
66	<i>Shorea palembanica</i>	Miq.	Dipterocarpaceae	Tengkawang majau (I)	Sm K	Tr	Wo Fr	NA	P (N)	A	6
67	<i>Shorea selanica</i>	(Lam.) Blume	Dipterocarpaceae	Kayu bapa (I)	M	Tr	Wo	After childbirth care	P (N)	A	6, 5
68	<i>Shorea seminis</i>	Slooten	Dipterocarpaceae	Tengkawang ayer (I)	K	Tr	Fr	NA	P (N)	P	6
69	<i>Shorea singkawang</i>	Burck	Dipterocarpaceae	Kalimantan Sengkawang (I)	Sm	Tr	Wo	NA	P (N)	P	6, 5

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
70	<i>Shorea splendida</i>	(de Vriese) P.S.Ashton	Dipterocarpaceae	Tengkawang pinang (I)	K	Tr	Wo Fr	Childbirth	P (N)	A	6, 5
71	<i>Shorea stenoptera</i>	Burck	Dipterocarpaceae	Tengkawang hungkul (I)	K	Tr	Fr Wo	Flamence, galactagogue	P (N)	A	6, 5
72	<i>Shorea sumatrana</i>	(Stooten) Desch	Dipterocarpaceae	Kedawang (I)	Sm J	Tr	Wo Fr	Skin itchy	P (N)	A	6, 7, 5
73	<i>Shorea teysmanniana</i>	Dyer ex Brandis	Dipterocarpaceae	Sasak (I)	Sm	Tr	Wo	Childbirth	P (N)	A	6, 5
74	<i>Vatica pauciflora</i>	Blume	Dipterocarpaceae	Resak padang (I)	Sm	Tr	Wo Ba	NA	P (N)	A	6
75	<i>Vatica teysmanniana</i>	Burck	Dipterocarpaceae	Resak paya (I)	Sm	Tr	Wo	Tonic, aphrodisiac	A	A	5
76	<i>Homalanthus longistylus</i>	K.Schum. & Lauterb.	Euphorbiaceae	Merom (PNG)	P	Tr	Sa Ba	NA	A	A	3
77	<i>Macaranga griffithiana</i>	Müll.Arg.	Euphorbiaceae	Mahang bulan (I), Griffith's Mahang (En)	Sm	Tr	Ro	Febrifuge	A	P	3
78	<i>Cajanus goensis</i>	Dalzell	Fabaceae	NA	J	Sh	Le Ro	Wounds, high blood pressure	A	A	6
79	<i>Dalbergia ferruginea</i>	Harms	Fabaceae	Akar langsa (I)	K SI M P	Sh	Wo	Swellings	P (N)	A	3
80	<i>Dalbergia junghuhnii</i>	Benth.	Fabaceae	Akar urat-urat (M)	Sm J K SI M	Sh	Le	NA	P (N)	A	3
81	<i>Dalbergia latifolia</i>	Roxb.	Fabaceae	Sana kling (I), Bombay blackwood (En)	J K L SI SI	Tr	Wo	NA	P (N)	P (I)	6, 7, 5
82	<i>Dalbergia parviflora</i>	Roxb.	Fabaceae	Bulangan (I)	Sm K	Li	Wo	Leucorrhoea, aphrodisiac	P (N)	A	6, 7, 5
83	<i>Dalbergia pinnata</i>	(Lour.)Prain	Fabaceae	Areyu ki loma (I)	Sm J K L SI M	Sh	Le Sts	Dysentery and ringworm	A	A	6, 7, 5, 3
84	<i>Derris trifoliata</i>	Lour.	Fabaceae	Areyu ki tonggeret (I)	Sm J K L SI M P	Sh	Ro St Le	Fever, head lice	A	A	6 1
85	<i>Entada spiralis</i>	Ridl.	Fabaceae	Akar sintok (I)	Sm	Sh	Se Ba	NA	A	P	7
86	<i>Euchresta horsfieldii</i>	(Lesch.)Benn.	Fabaceae	palakiya (I)	Sm J L SI	Sh	Se	Dysentery	P (N)	P	6, 7, 5, 3
87	<i>Intsia palembanica</i>	Miq.	Fabaceae	Merbau (I)	Sm K L SI SI M P	Tr	Se Ba Le	NA	P (N)	A	6, 5
88	<i>Koopassia malaccensis</i>	Benth.	Fabaceae	Tualang ayam (I)	K	Tr	Wo	Childbirth, rheumatism	P (N)	P	6, 5
89	<i>Parkia intermedia</i>	Hassk.	Fabaceae	Petai (I)	Sm J K	Tr	Se	Similar use to those of G. macrophyllus	P (N)	A	6, 7, 5
90	<i>Parkia timoriana</i>	(DC.) Merr.	Fabaceae	Kedawang (I)	Sm J K L SI M P	Tr	Se Le Ba	Diarrhoea, mosquito repellent	P (N)	P (I)	6
91	<i>Phyllodium elegans</i>	(Lour.) Desv.	Fabaceae	NA	J	Sh	Ro Fl	Headache, bruises	P (I)	A	2
92	<i>Sindora javanica</i>	(Koord. & Valetton) Backer	Fabaceae	Uku aka, Saprantu (I)	J	Tr	Wo	NA	A	A	6, 5

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
93	<i>Castanopsis argentea</i>	(Blume) A.DC.	Fag.	Saminten (l)	Sm J K	Tr	Wo Ba Fr	Asthma	P (N)	A	6, 5
94	<i>Castanopsis inermis</i>	(Lindl.) Benth. & Hook.f.	Fag.	Berangan (l)	Sm	Tr	Se Ba	Dropsy, dysentery	A	A	6, 7, 5
95	<i>Lithocarpus indatus</i>	(Blume) Rehder	Fag.	Ataruwa (l)	J SI	Tr	Wo Ba	Snakebites, scorpions sting	P (N)	A	6, 5
96	<i>Lithocarpus playcarpus</i>	(Blume) Rehder	Fag.	Pasang (l)	J	Tr	NA	NA	A	A	6, 5
97	<i>Gentiana quadrifaria</i>	Blume	Gentian.	Jukut cengang (l)	J	He	Ro	Stimulant, tonic	A	A	6
98	<i>Utania racemosa</i>	(Jack) Sugumaran	Gentian.	Kopi hutan (l); False coffe tree (En)	Sm	Sh	Le Ba Ro Fl	NA	A	P	6, 7
99	<i>Gnetum tenuifolium</i>	Ridl.	Gnet.	Dagum (l)	Sm	Li	Se Ro	NA	A	A	6, 7
100	<i>Gunnera macrophylla</i>	Blume	Gunner.	Hariyang gede (l)	Sm J SI P	He	Ro	NA	P (l)	P	6, 7, 5, 3
101	<i>Exucklandia populnea</i>	(R.Br. ex Griff.) R.W.Br.	Hamamelid.	Hapas-hapas (l)	Sm	Tr	Wo Ba Le	Intestinal issues, tonics	A	A	6
102	<i>Gabulimima belgraveana</i>	(F.Muell.) Sprague	Himantandr.	White magnolia (En)	P	Tr	Ba Le	Sores	A	P	3
103	<i>Ixonanthes icosandra</i>	Jack	Ixonanth.	Kayu bulus (l)	Sm	Tr	Ba	Cholera, menstruation disorders	P (N)	A	6
104	<i>Scutellaria javanica</i>	Jungb.	Lami.	Kapunten (l)	Sm J LSI SI M P	He	NA	Dysentery, pneumonia	P (N)	A	1
105	<i>Vitex parviflora</i>	A.Juss.	Lami.	Kayu kula (l)	LSI SI M	Tr	Le Ba	To induce labour	P (l)	P	6, 7, 5
106	<i>Beilschmiedia madang</i>	Blume	Laur.	Huru (l)	Sm J K	Tr	Wo	NA	A	P	6, 3
107	<i>Cinnamomum culilaban</i>	(L.) J. Presl	Laur.	Kuhitlawang (l)	M	Tr	Ba	NA	P (N)	A	6 14
108	<i>Cinnamomum sintoc</i>	Blume	Laur.	Huru Sintok (l)	Sm J K LSI	Tr	Ba	NA	P (N)	A	6, 7
109	<i>Cryptocarya massoy</i>	(Oken) Kosterm.	Laur.	Ai kor (l)	P	Tr	Ba	Boils	P (N)	A	6, 7
110	<i>Eusideroxylon zwageri</i>	Teijsm. & Binn.	Laur.	Ulin (l)	Sm K	Tr	Fr	Intestinal worms	P (N)	P	6, 7
111	<i>Strychnos ignatii</i>	P.J. Bergius	Logani.	Pokru (l)	Sm J K	Li	Ro	Women contraceptive	P (N)	P	6, 4
112	<i>Strychnos lucida</i>	R.Br.	Logani.	Bidaralaut (l), Slangen hout (En)	J LSI	Sh	WH	Folk medicine	P (N)	P	6, 7, 5
113	<i>Woodfordia fruticosa</i>	(L.) Kurz	Lythr.	Sidawayah (l)	J LSI	Sh	Fl Fr Se	Folk medicine	P (l)	P	5 14
114	<i>Grewia salutaris</i>	Span.	Malv.	Nila (l)	LSI	Sh	Wo Ba	NA	A	A	6, 7, 5
115	<i>Helicteres isora</i>	L.	Malv.	Puteran (l)	M	Sh	Ba St Fr Le	Diarrhoea, gonorrhoea	P (N)	P	6, 7, 5 14

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
116	<i>Hibiscus celebicus</i>	Koord.	Malv.	Kelembauan in talun (I)	SI	Sh	Ba Le Ro	Diarrhoea, gonorrhoea	A	A	6, 5
117	<i>Halopegia blanei</i>	(Körm.) K.Schum.	Marant.	Daun biranut (I)	J	He	Tu Le	Dysentery, coughs	A	P	6, 5, 7
118	<i>Dissochaeta punctulata</i>	Hook.f. ex Triana	Melastomat.	Akar meroyan busuk (M)	Sm	Li	Ro	NA	A	A	3
119	<i>Medinilla crispata</i>	Blume	Melastomat.	Tali morea (I)	M	Sh	Ro	Folk medicine	A	A	6, 7, 5
120	<i>Medinilla radicans</i>	Blume	Melastomat.	Areyu manjel (I)	J	Sh	Ro	Wounds	P (N)	A	6, 7, 5, 3
121	<i>Oxyspora bullata</i>	J.F.Maxwell	Melastomat.	Greater Allomorphia (En)	Sm	Sh	Le Ro	Constipation	A	A	3
122	<i>Oxyspora exigua</i>	J.F.Maxwell	Melastomat.	Keduduk hutan (I)	Sm	Sh	Le Ro	NA	A	A	6, 7
123	<i>Phyllogathis rotundifolia</i>	(Jack) Blume	Melastomat.	Tapak gajah (M)	Sm	He	Ro Le	NA	P (N)	A	2
124	<i>Heynea trijuga</i>	Roxb. ex Sims	Meli.	Mamak (I)	K	Tr	Le Ba Le Ro	NA	P (N)	A	6, 3
125	<i>Toona sureni</i>	(Blume) Merr.	Meli.	Suren (I)	LSI P	Tr	Ba Le	Diarrhoea, rheumatism	P (N)	A	5
126	<i>Stephania japonica</i>	(Thunb.) Miers	Menisperm.	Areyu geureung (I)	LSI	He	Ro Le	Fever	P (N)	P (I)	1
127	<i>Tinospora glabra</i>	(Burm.f.) Merr.	Menisperm.	Pancasona (I)	LSI	Li	Le Ba	NA	P (N)	P	1
128	<i>Ficus chartacea</i>	(Wall. ex Kurz) Wall. ex King	Mor.	Speckle-leafed Fig (En)	K	Sh	Ba	Wounds	A	P	6
129	<i>Ficus deltoidea</i>	Jack	Mor.	Tabat barito (I)	Sm J K M	Sh	NA	Wounds	P (N)	A (I)	6, 7, 1
130	<i>Myrica javanica</i>	Blume	Myric.	Ki tete (I)	J	Sh	Ba Fr	Skin diseases	A	A	6, 7, 5
131	<i>Syzygium conglomeratum</i>	(Duthie) I.M.Turner	Myrt.	Jheling serai tatang (I)	Sm	Tr	Wo	NA	A	A	6, 5
132	<i>Syzygium rumphii</i>	(Merr.) Govaerts	Myrt.	Kayu merah (I)	M	Tr	Wo Ba	Cough	A	A	6, 5
133	<i>Nepenthes ampullacea</i>	Jack	Nepenth.	kantong teko (I)		Cl	St	Rheumatism	P (N)	A	6
134	<i>Nepenthes ampullaria</i>	Jack	Nepenth.	Ketakong (I)	Sm K M P	Cl	St Ro	Infected eyes, headache	P (N)	P	6, 7
135	<i>Nepenthes boschiana</i>	Korth.	Nepenth.	NA	K	Cl	NA	Diarrhoea, fevers	A	P	6, 7
136	<i>Nepenthes gracilis</i>	Korth.	Nepenth.	Periuk monyet (I)	Sm K SI	Cl	NA	Tuberculosis, cough	P (N)	P	6, 7
137	<i>Nepenthes mirabilis</i>	(Lour.) Druce	Nepenth.	Kantong semar rawa unum (I), common swamp pitcher-plant (En)	Sm J K LSI SI M P	Cl	NA	NA	P (N)	P	6
138	<i>Nepenthes rafflesiana</i>	Jack	Nepenth.	Katakong menjangan (I)	Sm K	Cl	St	Stomachache, eye inflammation	P (N)	A	6

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
139	<i>Nepenthes reinwardiana</i>	Miq.	Nepenth.	Ketakong babi (I)	Sm K	Cl	St	NA	P (N)	P	6, 7
140	<i>Acropsis liliifolia</i> var. <i>liliifolia</i>	Sp. level: (J.Koenig) Ormerod	Orchid.	Ki plengpeng (I)	Sm J K LSI SI M P	He	Ro Le	NA	P (N)	A	6, 7, 5, 3
141	<i>Apostasia nuda</i>	R.Br.	Orchid.	Si sarsar bulung (I)	Sm J K	He	Ro Fr	NA	P (N)	P	6, 7, 5, 3
142	<i>Arundina graminifolia</i>	(D.Dom) Hoehr.	Orchid.	Anggrek bambu (I)	Sm J K LSI SI M P	He	NA	NA	P (N)	P	6, 7
143	<i>Calanthe triplicata</i>	(Willeme) Ames	Orchid.	Anggrek natal (I)	Sm J K LSI SI M P	He	NA	Skin issues	P (N)	A	6
144	<i>Cleisostoma scortechinii</i>	(Hook.f.) Garay	Orchid.	Scortechin's Cleisostoma (En)	Sm J K LSI	He	NA	Childbirth, coughs	P (N)	A	6
145	<i>Corymborkis veratrifolia</i>	(Reinw.) Blume	Orchid.	White cinnamon orchid (En)	Sm J K LSI SI M P	He	Le Ro	Hepatitis, pneumonia	P (N)	P	3
146	<i>Cymbidium aloifolium</i>	(L.) Sw.	Orchid.	Cymbidium Daun Gaharu (I), The Aloe-Leaved Cymbidium (En)	Sm J	He	Le	Tonic	P (N)	P	3
147	<i>Dendrobium crumenatum</i>	Sw.	Orchid.	Anggrek merpati (I)	Sm J K LSI SI M P	He	Le Fr	Boils	P (N)	P	6, 7, 5, 2
148	<i>Dendrobium faciferum</i>	J.J.Sm.	Orchid.	Anggrek (I)	LSI SI M	He	St	Diuretic, rheumatism	P (N)	A	6, 5
149	<i>Dendrobium hymenanthum</i>	Rehb.f.	Orchid.	The Membranous Dendrobium (En)	K	He	NA	Snake bites, rheumatism	A	A	6
150	<i>Dendrobium purpureum</i>	Roxb.	Orchid.	Anggrek kesumba (I)	SI M P	He	Le	Skin issues	P (N)	A	5, 2
151	<i>Dendrobium salaccense</i>	(Blume) Lindl.	Orchid.	Sakat hartum (I)	Sm J K LSI	He	Le	Childbirth, sores	P (N)	P	6, 7, 5
152	<i>Dendrobium utile</i>	J.J.Sm.	Orchid.	Anggrek serat (I)	SI M	He	St	Fever, childbirth	P (N)	A	6, 5
153	<i>Erythrorchis altissima</i>	(Blume) Blume	Orchid.	Akar tulang (I)	Sm J K	He	NA	NA	P (N)	A	6
154	<i>Grammatophyllum scriptum</i>	(L.) Blume	Orchid.	Anggrek boki (I)	M P	He	Se	Poison antidote, cough	P (N)	A	6, 7, 5, 3
155	<i>Grammatophyllum speciosum</i>	Blume	Orchid.	Anggrek tebu (I), Tiger orchid (En)	Sm J K SI	He	St	Sedative	P (N)	P	6, 3
156	<i>Habenaria multipartita</i>	Blume ex Kraenzl.	Orchid.	Uwi-uwi (I)	J LSI	He	Tu	Antiseptic, disinfectant	A	A	6, 7, 5

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
157	<i>Habenaria rumphii</i>	(Brongn.) Lindl.	Orchid.	Stiff rein orchid (En)	Sm J K SI M P	He	Tu	NA	A	A	6, 5
158	<i>Hetaeria obliqua</i>	Blume	Orchid.	Pokok tambak hutan (M), The Oblique Hetaeria (En)	Sm K	He	Le	Liver issue, diabetes	P (N)	A	3
159	<i>Liparis conchylabulbon</i>	Rehb.f.	Orchid.	Tapered sphinx orchid (En)	Sm J K LSI SI M P	He	NA	Colic, scabies	P (N)	A	6, 7, 5, 3
160	<i>Liparis viridiflora</i>	(Blume) Lindl.	Orchid.	Green-Flowered Liparis (En)	Sm J K LSI SI M P	He	NA	After childbirth, headache	P (N)	A	6
161	<i>Nervilia concolor</i>	(Blume) Schltr.	Orchid.	Selembar sabulan (I), tall shield orchid (En)	Sm J K LSI SI M P	He	WH	NA	P (N)	P	3
162	<i>Nervilia plicata</i>	(Andrews) Schltr.	Orchid.	Selembar satahun (I), The Folded Nervilia (En)	Sm J K P	He	WH	Malaria, fever	P (N)	P	3
163	<i>Oberonia lycopodioides</i>	(J.Koenig) Ormerod	Orchid.	Sakat idlah buaya (M), The Lycopodium-Like Oberonia (En)	Sm J K SI M	He	Le	Tooth ache	P (N)	A	3
164	<i>Oberonia mucronata</i>	(D.Don) Ormerod & Seidenf.	Orchid.	The Mucronate Oberonia (En)	Sm J K SI P	He	NA	Liver issues	A	A	3
165	<i>Renanthera moluccana</i>	Blume	Orchid.	Anggrek merah (I)	SI M P	He	Le	NA	A	A	6, 7, 5, 4
166	<i>Robiquetia spathulata</i>	(Blume) J.J.Sm.	Orchid.	The Sheath-Covered Spathe Robiquetia (En)	Sm J K SI M	He	NA	Antiseptic, disinfectant	P (N)	P	6
167	<i>Spathoglottis affinis</i>	de Vriese	Orchid.	The Similar Spathoglottis (En)	J K	He	NA	NA	P (N)	A	6
168	<i>Spathoglottis plicata</i>	Blume	Orchid.	Philippine Ground Orchid (En)	Sm J K LSI SI M P	He	Le	Cramped, headache	P (N)	P	6, 5
169	<i>Strongylaria panna</i>	(Lindl.) Schuit., Y.P.Ng & H.A.Pedersen	Orchid.	Kura kubong (M), The Flag Eria (En)	Sm K	He	NA	Substitute for <i>Piper betle</i>	P (N)	A	3
170	<i>Tropidia curculigoides</i>	Lindl.	Orchid.	Serugat (I), The Curculigo-Like Tropidia (En)	Sm J K LSI SI P	He	WH	Boils	P (N)	A	3
171	<i>Vanda miniata</i>	(Lindl.) L.M.Gardiner	Orchid.	The Rust Red Ascocentrum (En)	Sm J	He	NA	Eyesore, fever	A	P	6
172	<i>Vanilla abundiflora</i>	J.J.Sm.	Orchid.	Vanilla (I), Indonesian vanilla (En)	K	He	Fr	Liver issue, toothache	P (N)	A	6, 7, 5, 4
173	<i>Vanilla griffithii</i>	Rehb.f.	Orchid.	Akar penubal (I), Griffith's Vanilla (En)	Sm K	He	Fr Fl Sa	Wounds, snakebite	P (N)	A	6, 7, 5
174	<i>Benstonea atrocarpa</i>	(Griff.) Callm. & Buerki	Pandan.	Pandan mengkuang (I)	Sm	Sh	Le St Ro	Childbirth cure, tonic	A	A	6, 5

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
175	<i>Pandanus lais</i>	Kurz	Pandan.	Pandan kowang (l)	Sm	Tr	Se, Le Ba	Skin issues, insects bites	A	A	6
176	<i>Pandanus robinsonii</i>	Merr.	Pandan.	Pandan pudak (l)	M	Sh	Le, St Ro Ba	After childbirth care	A	A	6, 5
177	<i>Breynia pubescens</i>	Merr.	Phyllanth.	Gagilamo (l)	M	Sh	Ba	Childbirth care, aphrodisiac	A	A	6, 7, 5
178	<i>Phyllanthus submolis</i>	K.Schum. & Lauterb.	Phyllanth.	Hin (PNG)	P	Tr	Ba	High blood pressure, back pain	A	A	3
179	<i>Pinus merkasii</i>	Jungb. & de Vriese	Pin.	Sala (l)	Sm	Tr	Wo, Ba	NA	P(N I)	P	6, 7, 5
180	<i>Piper attenuatum</i>	Buch.-Ham. ex Miq.	Piper.	Sirih dingin (l)	J	Cl	St, Ba Le	Wounds	A	P	6, 7, 5
181	<i>Piper caducibractaeum</i>	C.DC.	Piper.	Sirih kandat (l)	M	Sh	Le, Ba	NA	A	A	6, 7, 5
182	<i>Pontederia plantaginea</i>	Roxb.	Pontederi.	Eceng padi (l)	J	He	Ro, Se	Stomachache	A	A	6
183	<i>Ardisia odontophylla</i>	Wall. ex A.DC.	Primul.	Pasal (l)	J	Sh	Ro, Le	Antiseptic, aromatherapy	A	P	6, 7, 5, 3
184	<i>Rafflesia arnoldi</i>	R.Br.	Rafflesi.	Padma raksasa (l)	Sm, K	Pa	Fl	NA	P(N)	A	6
185	<i>Rafflesia horsfieldii</i>	R.Br.	Rafflesi.	Padma (l)	J	Pa	Fl	Stomachache	P(N)	A	6, 7, 5, 3
186	<i>Catunaregam spinosa</i>	(Retz.) Lam.	Rubi.	The mountain pomegranate (En)	J	Sh	Fr, Ba Ro	NA	P(N)	A	6
187	<i>Mussaenda glabra</i>	Vahl	Rubi.	Kingkilaban (l)	J	Sh	Sa, Le Ro, Fl	NA	A	A	6, 3
188	<i>Oldenlandia recurva</i>	(Korth.) Miq.	Rubi.	Akar kemenyan hantu (l)	K	He	Ro, St Le	NA	A	A	6, 5
189	<i>Pavetta subvelutina</i>	Miq.	Rubi.	Jarum-jarum (l), White pavetta (En)	J	Sh	Le, Ro St, Ba Fr	NA	A	A	6
190	<i>Prismatomeris tetrandra subsp. malayana</i>	Sp. level: (Roxb.) K.Schum.; Subsp. Level: (Ridl.) J.T.Johanss.	Rubi.	Mentulang (l)	K	Sh	Le, Ro St	NA	A	A	6, 7
191	<i>Psychotria sylvatica</i>	Blume	Rubi.	Halan (l)	J	Sh	Le, Ba St, Ro	NA	A	A	6
192	<i>Rennellia morindiformis</i>	(Korth.) Ridl.	Rubi.	Akar bumi (M)	Sm	Sh	Ba	NA	A	A	3
193	<i>Uncaria homomalla</i>	Miq.	Rubi.	NA	Sm	Li	St, Le Ba	NA	A	P	2

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
194	<i>Lunasia amara</i>	Blanco	Rut.	Kemaitan (I)	LSI	Sh	Ro Fr St Sa	NA	P (N)	P	6, 7, 2
195	<i>Melicope denhamii</i>	(Seem.) T.G.Hartley	Rut.	Kisampung (I)	P	Sh	Le Ba	NA	P (N)	A	6
196	<i>Micromelum minutum</i>	Wight & Arn.	Rut.	Sesi (I)	LSI	Tr	Ro Sh Le	NA	P (N)	P	6, 7, 2
197	<i>Murraya paniculata</i>	(L.) Jack	Rut.	Kemuning (I); Mock orang (En)	Sm LSI P	Sh	Le	NA	P (N)	P	6, 7, 8, 5 14
198	<i>Zanthoxylum avicennae</i>	(Lam.) DC.	Rut.	Adas kastela (I)	LSI	Sh	Le Fr Se St Ba	NA	A	A	6, 5
199	<i>Zanthoxylum nitidum</i>	(Roxb.) DC.	Rut.	Areuy beulit gede (I)	P	Sh	Ba Fr Le Ro	NA	A	A	6, 7, 5
200	<i>Santalum album</i>	L.	Santal.	Cendana (I), Sandalwood (En)	J LSI	Tr	HeW Fr Le	Diseases and skin issues	P (N)	P	6, 7, 5
201	<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>	Sp. level: Jacq.; Subsp. Level: (L.f.) J.G.West	Sapind.	Cantigi (I)	LSI	Sh	Le Ba Fr	Cholera, colic, cough	P (I)	A	6
202	<i>Palcaquium hispidum</i>	H.J.Lam	Sapot.	Mayang serikit (En)	Sm K	Tr	Wo	NA	A	A	6, 5
203	<i>Kadsura scandens</i>	(Blume) Blume	Schisandr.	Hunyor buut (I)	Sm J LSI	Li	Rh Le	Painful joints	P (N)	A	6, 7
204	<i>Eurycoma apiculata</i>	A.W.Benn.	Simaroub.	Pasak bumi (I)	Sm	Tr	Ro	Dysentery, stomachache	A	P	1
205	<i>Eurycoma longifolia</i>	Jack	Simaroub.	Pasak bumi (I)	Sm K	Sh	Ro Ba Le	Ague, bruises	P (N)	P	6, 7, 5, 1
206	<i>Soulamea amara</i>	Lam.	Simaroub.	Buwa hati (I)	P	Sh	Ro Fr Le	Aphrodisiac	P (N)	P	6, 7, 5, 2
207	<i>Smilax zeylanica</i>	L.	Smilac.	Kayu cina hutan (I)	J	Li	Ro	Fever, snake bites	P (N)	P	1
208	<i>Gomphandra quadrifida</i>	(Blume) Sleumer	Stemonur.	Kayu barik-barik(I)	Sm	Sh	Ro Le	Diarrhoea, gonorrhoea	A	P	3
209	<i>Symplocos cochinchinensis</i>	(Lour.) S. Moore	Symploc.	Kayu dyurang (I)	J LSI P	Sh	Le Ba	Aphrodisiac, diuretic	P (N)	A	6
210	<i>Symplocos odoratissima</i>	Choisy ex Zoll.	Symploc.	Ki seriatwan (I)	Sm J LSI	Sh	WH	NA	P (N)	P	6, 7, 5, 4
211	<i>Taxus wallichiana</i>	Zucc.	Tax.	Tampinur batu (I)	Sm SI	Tr	Se St Ba Le	NA	P (N)	P	3
212	<i>Aquilaria cuningiana</i>	(Decne.) Ridl.	Thymelae.	Giba kolano (I)	K M	Sh	Ba Ro	Diabetes, cough	A	A	3
213	<i>Aquilaria hirta</i>	Ridl.	Thymelae.	Karas (I)	Sm	Tr	Ba	Folk medicine	P (N)	A	7
214	<i>Aquilaria malaccensis</i>	Lam.	Thymelae.	Alim (I), Eagle wood tree (En)	Sm K	Tr	Ba	Cough, snakebite	P (N)	P	6, 5

Table 2 continued

No.	Scientific name	Author	Family	Auxiliary name	Dist.	Plant habit	Plant part*	Uses	Ex situ	DNA Barc.	Ref.
215	<i>Gonystylus bancanus</i>	(Miq.) Kurz	Thymelae.	Ramin (l)	Sm K	Tr	NA	Sore breasts of nursing mothers	P (N)	A	7, 5
216	<i>Gonystylus macrophyllus</i>	(Miq.) Airy Shaw	Thymelae.	Piang bai (l)	Sm J K SI M P	Tr	Wo	Tonic, diarrhoea	P (N)	A	6
217	<i>Maoutia diversifolia</i>	(Miq.) Wedd.	Urtic.	Beubeunteuran (l)	J	Sh	Ba	NA	A	A	85et41i, 7, 5
218	<i>Nothocnide repanda</i>	(Blume) Blume	Urtic.	Leuksa (l)	LSI	Li	Le St Ba	Diarrhoea, malaria	P (N)	P	7, 3
219	<i>Pipturus asper</i>	Wedd.	Urtic.	Dalnot (P)	M	Sh	Ba	Febrifuge, headache	A	P	2
220	<i>Poikilospermum ambainense</i>	Zipp. & Miq.	Urtic.	Tali ayer (M)	M	Li	Ro St Le Ba	Tonic, dysentery	A	A	6
221	<i>Ampelocissus arachnoidea</i>	(Hausskn.) Planch.	Vit.	Oyod air (l)	J	Li	Ro Fr	Tonic, fever	A	A	6, 7, 3
222	<i>Ampelocissus cinnamomea</i>	(Wall. ex M.A.Lawson) Planch.	Vit.	Bulang kerta (l)	Sm	Li	Le Ro	NA	A	A	6, 7
223	<i>Ampelocissus polythysa</i>	(Miq.) Gagnep.	Vit.	Akar lebar (l)	Sm	Li	Ro	NA	A	A	6
224	<i>Leea aequata</i>	L.	Vit.	Ginggyang (l)	LSI	Sh	Ro Tu St Sh	Fever, hair care	P (N)	A	6, 7, 5 14
225	<i>Anonum sumatranum</i>	(Valeton) Skornick. & Hlavatá	Zingiber.	Puwar tenangan (l)	Sm	He	Sa	NA	A	A	6, 7 10, 5 1
226	<i>Curcuma aeruginosa</i>	Roxb.	Zingiber.	Temu hitam (l)	J	He	Rh	NA	P (N)	P	5, 6, 7 1
227	<i>Curcuma aurantiaca</i>	Zip	Zingiber.	Koneng kalamasu (l)	J	He	Rh Fl	Jaundice, dropsy	A	P	6, 7, 5
228	<i>Curcuma colorata</i>	Valeton	Zingiber.	Temu hitam (l)	J	He	Le Rh	Diarrhoea, malaria	P (N)	P	6, 7, 5 1
229	<i>Curcuma euchroma</i>	Valeton	Zingiber.	Kunir kebo (l)	J	He	Rh	Skin diseases	A	A	6, 7, 5 1
230	<i>Curcuma petiolata</i>	Roxb.	Zingiber.	Temu badur (l)	J	He	Rh	Diuretic, rheumatism	A	P	6, 7, 5 1
231	<i>Kaempferia angustifolia</i>	Roscoe	Zingiber.	Kunci menir (l)	Sm	He	Rh Le	Stomachache	P (N)	P	6
232	<i>Kaempferia undulata</i>	Wender.	Zingiber.	Kunci kunot (l)	J	He	Ro Tu Rh	Tonic, snakebites	A	A	6
233	<i>Wurfbainia uliginosa</i>	(J.Koenig) Giseke	Zingiber.	Tepus merah (M)	Sm	He	Se Rh Fr	Toothache, anthelmintic	A	P	6, 7

Auxiliary name I: Indonesia, En: English, M: Malaysia, PNG: Papua New Guinea, NA: No Information; Distribution J: Java, K: Kalimantan, LSI: the Lesser Sunda Islands, Sm: Sumatera, SI: Sulawesi, M: Maluku, P: Papua; Plant habit Cl: climber, He: herb, Li: liana, Sh: shrub, Tr: tree, Pa: Parasite, TrP: tree like-palm; Used plant part*: all uses, medicinal uses and others; Ba: bark, Wo: wood, Rh: Rhizome, Tu: Tuber, Ro: root, Le: leaves, Sa: sap, St: stem, Fr: fruit, Fl: flower, Se: Seed, WH: Whole plants, NA: No Information; Ex situ conservation/DNA barcoding P: Present, A: Absent, N: National, I: International; References 1: de Padua et al. (1999) 2: van Valkenburg and Bunyapraphatsara (2002), 3: Lemmens and Bunyapraphatsara (2003), 4: de Guzman and Siemonsma (1999), 5: Heyne (1987), 6: Eissai (1986), 7: Eissai (1995), 8–13: Dalimartha (1999 2000 2003 2006 2008 2009) 14: IBSAP (Indonesia Biodiversity Strategy and Action Plan) based on Rifai et al. (1992) and Zuhud et al. (2001) in The National Development Planning Agency (2003)

Table 3 Indonesian medicinal plants with threat status (IUCN), whether they are listed in CITES Appendix II and national legislations

No.	Species	Author	Family	CITES App	IUCN	National legislations						References			
						L1	L2	L3	L4	L5	L6				
1	<i>Avicennia marina</i> var. <i>rumphiana</i>	Sp. level: (Forssk.) Vierh.; Var. level: (Hallier f.) Bakh.	Acanthaceae		VU							Duke et al. (2010)			
2	<i>Pangium edule</i>	Reinw.	Achariaceae									✓			
3	<i>Anaxagorea javanica</i>	Blume	Annonaceae									✓			
4	<i>Pimpinella prutajan</i>	Molk.	Apiaceae									✓			
5	<i>Alstonia scholaris</i>	(L.) R.Br.	Apocynaceae									✓	LC (World Conservation Monitoring Centre 1998a)		
6	<i>Alyxia halmaherae</i>	Miq.	Apocynaceae									✓			
7	<i>Alyxia reinwardtii</i>	Blume	Apocynaceae									✓			
8	<i>Rauvolfia serpentina</i>	(L.) Benth. ex Kurz	Apocynaceae	II								✓			
9	<i>Urceola laevigata</i>	(Juss.) D.J.Middleton & Livsh.	Apocynaceae									✓			
10	<i>Voacanga grandifolia</i>	(Miq.) Rolfe	Apocynaceae									✓			
11	<i>Agathis borneensis</i>	Warb.	Araucariaceae		EN		✓					✓	Farjon (2013a)		
12	<i>Borassus flabellifer</i>	L.	Arecaceae		EN								✓	Rakotoarinivo, Dransfield (2012)	
13	<i>Caryota no</i>	Becc.	Arecaceae				✓						✓	LC (Johnson 1998)	
14	<i>Euglossa utilis</i>	Becc.	Arecaceae				✓						✓		
15	<i>Johannesteijsmannia altifrons</i>	(Rehb.f. & Zoll.) H.E.Moore	Arecaceae				✓						✓		
16	<i>Phoenix paludosa</i>	Roxb.	Arecaceae				✓						✓	NT (Ellison et al. 2010)	
17	<i>Pigafetta filaris</i>	(Giseke) Becc.	Arecaceae				✓						✓		
18	<i>Saribus woodfordii</i>	(Ridl.) Bacon & W.J.Baker	Arecaceae		VU		✓						✓	World Conservation Monitoring Centre (1998e)	
19	<i>Oroxylum indicum</i>	(L.) Kurz	Bignoniaceae										✓		
20	<i>Mesua ferrea</i>	L.	Calophyllaceae										✓		
21	<i>Cibotium barometz</i>	(L.) J.Sm.	Cibotiaceae	II			✓						✓		
22	<i>Terminalia bellirica</i>	(Gaertn.) Roxb.	Combretaceae										✓		
23	<i>Cycas rumphii</i>	Miq.	Cycadaceae	II									✓	NT (Hill 2010)	
24	<i>Dicksonia blumei</i>	(Kunze) Moore	Dicksoniaceae							✓					
25	<i>Anisoptera costata</i>	Korth.	Dipterocarpaceae		EN									✓	Nguyen (2017)

Table 3 continued

No.	Species	Author	Family	CITES App	IUCN	National legislations						References
						L1	L2	L3	L4	L5	L6	
26	<i>Anisoptera marginata</i>	Korth.	Dipterocarpaceae		EN							Ashton (1998a)
27	<i>Anisoptera megistocarpa</i>	Slooten	Dipterocarpaceae		CR							Ashton (1998k)
28	<i>Dipterocarpus baudii</i>	Korth.	Dipterocarpaceae		VU							Ly et al. (2017c)
29	<i>Dipterocarpus gracilis</i>	Blume	Dipterocarpaceae		VU							Ly et al. (2017b)
30	<i>Dipterocarpus kunstleri</i>	King	Dipterocarpaceae		CR							Ashton (1998b)
31	<i>Dipterocarpus retusus</i>	Blume	Dipterocarpaceae		EN							Ly et al. (2017d)
32	<i>Hopea celebica</i>	Burck	Dipterocarpaceae		EN							Ashton (1998c)
33	<i>Hopea mengarawan</i>	Miq.	Dipterocarpaceae		CR							Ashton (2018)
34	<i>Hopea sangal</i>	Korth.	Dipterocarpaceae		VU							Pooma et al. (2017a)
35	<i>Parashorea lucida</i>	Kurz	Dipterocarpaceae		CR							Ashton (1998d)
36	<i>Shorea bracteolata</i>	Dyer	Dipterocarpaceae		EN							Newman, Pooma (2017)
37	<i>Shorea glauca</i>	King	Dipterocarpaceae		EN							Newman, Pooma (2017a)
38	<i>Shorea laevis</i>	Ridl.	Dipterocarpaceae		VU							Pooma et al. (2017b)
39	<i>Shorea lepidota</i>	Blume	Dipterocarpaceae		CR					✓		Ashton (1998e)
40	<i>Shorea macrophylla</i>	(de Vriese) P.S.Ashton	Dipterocarpaceae		CR					✓		LC (Randi et al. 2019a)
41	<i>Shorea palembanica</i>	Miq.	Dipterocarpaceae		CR					✓		Ashton (1998f)
42	<i>Shorea selanica</i>	(Lam.) Blume	Dipterocarpaceae		CR					✓		Ashton (1998g)
43	<i>Shorea seminis</i>	Slooten	Dipterocarpaceae		CR					✓		Ashton (1998h)
44	<i>Shorea singkawang</i>	Burck	Dipterocarpaceae		VU					✓		Pooma, Newman (2017a)
45	<i>Shorea splendida</i>	(de Vriese) P.S.Ashton	Dipterocarpaceae		EN					✓		Randi et al. (2019b)
46	<i>Shorea stenoptera</i>	Burck	Dipterocarpaceae		EN					✓		Randi et al. (2019c)
47	<i>Shorea sumatrana</i>	(Slooten) Desch	Dipterocarpaceae		EN					✓		Pooma, Newman (2017b)
48	<i>Shorea teysmanniana</i>	Dyer ex Brandis	Dipterocarpaceae		EN							Ashton (1998i)
49	<i>Vatica teysmanniana</i>	Burck	Dipterocarpaceae		CR							Ashton (1998j)
50	<i>Dalbergia ferruginea</i>	Roxb.	Fabaceae	II								
51	<i>Dalbergia junghuhnii</i>	Benth.	Fabaceae	II								

Table 3 continued

No.	Species	Author	Family	CITES App	IUCN	National legislations						References
						L1	L2	L3	L4	L5	L6	
52	<i>Dalbergia latifolia</i>	Roxb.	Fabaceae	II	VU							Asian Regional Workshop (Conservation & Sustainable Management of Trees, Viet Nam, August 1996) 1998a LC (Chadburn 2012)
53	<i>Dalbergia parviflora</i>	Roxb.	Fabaceae	II								
54	<i>Dalbergia pinnata</i>	(Lour.)Prain	Fabaceae	II								
55	<i>Derris trifoliata</i>	Lour.	Fabaceae	II								
56	<i>Euchresta horsfieldii</i>	(Lesch.)Benn.	Fabaceae			✓					✓	
57	<i>Intisia palembanica</i>	Miq.	Fabaceae			✓					✓	LC (Asian Regional Workshop (Conservation & Sustainable Management of Trees, Viet Nam, August 1996) 1998c)
58	<i>Koornpassia malaccensis</i>	Benth.	Fabaceae			✓					✓	LC (Harvey-Brown 2019) World Conservation Monitoring Centre (1998f)
59	<i>Parkia intermedia</i>	Hassk.	Fabaceae								✓	
60	<i>Parkia timoriana</i>	(DC.)Merr.	Fabaceae								✓	
61	<i>Sindora javanica</i>	(Koord. & Valetton)Backer	Fabaceae		VU							
62	<i>Castanopsis argentea</i>	(Blume) A.DC.	Fagaceae		EN	✓					✓	Barstow, Kartawinata (2018)
63	<i>Lithocarpus indutus</i>	(Blume) Rehder	Fagaceae		VU	✓					✓	World Conservation Monitoring Centre (1998c)
64	<i>Lithocarpus platycarpus</i>	(Blume) Rehder	Fagaceae		EN	✓					✓	World Conservation Monitoring Centre (1998d)
65	<i>Gunnera macrophylla</i>	Blume	Gunneraceae								✓	
66	<i>Scutellaria javanica</i>	Jungh.	Lamiaceae								✓	
67	<i>Vitex parviflora</i>	A.Juss.	Lamiaceae		VU						✓	World Conservation Monitoring Centre (1998g)
68	<i>Beilschmiedia madang</i>	Blume	Lauraceae			✓					✓	LC (de Kok 2019a)
69	<i>Cinnamomum culilaban</i>	(L.) J. Presl	Lauraceae								✓	
70	<i>Cinnamomum sintoc</i>	Blume	Lauraceae								✓	LC (de Kok 2019b)
71	<i>Eusideroxylon zwageri</i>	Teijsm. & Binn.	Lauraceae		VU	✓					✓	Asian Regional Workshop (Conservation & Sustainable Management of Trees, Viet Nam, August 1996) 1998b
72	<i>Strychnos ignatii</i>	P.J. Bergius	Loganiaceae								✓	
73	<i>Strychnos lucida</i>	R.Br.	Loganiaceae								✓	LC (BGCI, IUCN SSC Global Tree Specialist Group 2018)

Table 3 continued

No.	Species	Author	Family	CITES App	IUCN	National legislations						References	
						L1	L2	L3	L4	L5	L6		
74	<i>Woodfordia fruticosa</i>	(L.) Kurz	Lythraceae									✓	LC (CAMP Workshops on Medicinal Plants, India (January 1997) 1998)
75	<i>Helicteres isora</i>	L.	Malvaceae									✓	
76	<i>Ficus deltoidea</i>	Jack	Moraceae									✓	
77	<i>Syzygium conglomeratum</i>	(Duthie) I.M.Turner	Myrtaceae		VU								Kochummen (1998)
78	<i>Nepenthes ampullacea</i>	Jack	Nepenthaceae	II									
79	<i>Nepenthes ampullaria</i>	Jack	Nepenthaceae	II									LC (Clarke 2018a)
80	<i>Nepenthes boschiana</i>	Korth.	Nepenthaceae	II	EN	✓	✓	✓	✓	✓			Schnell et al. (2000)
81	<i>Nepenthes gracilis</i>	Korth.	Nepenthaceae	II									LC (Clarke 2018b)
82	<i>Nepenthes mirabilis</i>	(Lour.) Druce	Nepenthaceae	II									LC (Clarke 2014)
83	<i>Nepenthes rafflesiana</i>	Jack	Nepenthaceae	II									LC (Clarke 2018c)
84	<i>Nepenthes reinwardiana</i>	Miq.	Nepenthaceae	II									LC (Clarke 2018d)
85	<i>Acriopsis liliifolia</i> var. <i>liliifolia</i>	Sp. level: (J.Koenig) Ormerod	Orchidaceae	II									
86	<i>Apostasia nuda</i>	R.Br.	Orchidaceae	II									
87	<i>Arundina graminifolia</i>	(D.Don) Hochr.	Orchidaceae	II									
88	<i>Calanthe triplicata</i>	(Willemet) Ames	Orchidaceae	II									
89	<i>Cleisostoma scortechinii</i>	(Hook.f.) Garay	Orchidaceae	II									
90	<i>Corymborkis veratrifolia</i>	(Reinw.) Blume	Orchidaceae	II									
91	<i>Cymbidium aloifolium</i>	(L.) Sw.	Orchidaceae	II									
92	<i>Dendrobium crumenatum</i>	Sw.	Orchidaceae	II									
93	<i>Dendrobium faciferum</i>	J.J.Sm.	Orchidaceae	II									
94	<i>Dendrobium hymenanthum</i>	Rchb.f.	Orchidaceae	II									

Table 3 continued

No.	Species	Author	Family	CITES App	IUCN	National legislations						References	
						L1	L2	L3	L4	L5	L6		
95	<i>Dendrobium purpureum</i>	Roxb.	Orchidaceae	II								✓	
96	<i>Dendrobium salaccense</i>	(Blume) Lindl.	Orchidaceae	II									
97	<i>Dendrobium utile</i>	J.J.Sm.	Orchidaceae	II									
98	<i>Erythrorchis altissima</i>	(Blume) Blume	Orchidaceae	II									LC (Brummitt 2013)
99	<i>Grammatophyllum scriptum</i>	(L.) Blume	Orchidaceae	II									
100	<i>Grammatophyllum speciosum</i>	Blume	Orchidaceae	II			✓						
101	<i>Habenaria multipartita</i>	Blume ex Kraenzl.	Orchidaceae	II									
102	<i>Habenaria rumphii</i>	(Brongn.) Lindl.	Orchidaceae	II									
103	<i>Hetaeria obliqua</i>	Blume	Orchidaceae	II									
104	<i>Liparis condylobulbon</i>	Rchb.f.	Orchidaceae	II									
105	<i>Liparis viridiflora</i>	(Blume) Lindl.	Orchidaceae	II									
106	<i>Nervilia concolor</i>	(Blume) Schltr.	Orchidaceae	II									
107	<i>Nervilia plicata</i>	(Andrews) Schltr.	Orchidaceae	II									
108	<i>Oberonia lycopodioides</i>	(J.Koenig) Ormerod	Orchidaceae	II									
109	<i>Oberonia mucronata</i>	(D.Don) Ormerod & Seidentf.	Orchidaceae	II									
110	<i>Renanthera moluccana</i>	Blume	Orchidaceae	II									✓
111	<i>Robiquetia spathulata</i>	(Blume) J.J.Sm.	Orchidaceae	II									
112	<i>Spathoglottis affinis</i>	de Vriese	Orchidaceae	II									
113	<i>Spathoglottis plicata</i>	Blume	Orchidaceae	II									
114	<i>Strongyleria pannea</i>	(Lindl.) Schuit., Y.P.Ng & H.A.Pedersen	Orchidaceae	II									
115	<i>Tropidia curculgoides</i>	Lindl.	Orchidaceae	II									

Table 3 continued

No.	Species	Author	Family	CITES App	IUCN	National legislations						References
						L1	L2	L3	L4	L5	L6	
116	<i>Vanda miniata</i>	(Lindl.) Gardiner, Lauren Maria	Orchidaceae	II		✓						
117	<i>Vanilla abundiflora</i>	J.J.Sm.	Orchidaceae	II								
118	<i>Vanilla griffithii</i>	Rchb.f.	Orchidaceae	II								
119	<i>Pinus merkusii</i>	Jungh. & de Vriese	Pinaceae		VU		✓	✓	✓	✓		Fajton (2013b)
120	<i>Rafflesia arnoldi</i>	R.Br.	Rafflesiaceae			✓	✓	✓	✓	✓		
121	<i>Rafflesia horsfieldii</i>	R.Br.	Rafflesiaceae			✓	✓	✓	✓	✓		
122	<i>Lunasia amara</i>	Blanco	Rutaceae							✓		LC (BGCI, IUCN SSC Global Tree Specialist Group 2019)
123	<i>Murraya paniculata</i>	(L.) Jack	Rutaceae							✓		
124	<i>Santalum album</i>	L.	Santalaceae		VU							Arunkumar et al. (2019)
125	<i>Palaquium hispidum</i>	H.J.Lam	Sapotaceae		VU							Olander, Wilkie (2018)
126	<i>Kadsura scandens</i>	(Blume) Blume	Schisandraceae							✓		
127	<i>Eurycoma longifolia</i>	Jack	Simaroubaceae							✓		
128	<i>Symplocos odoratissima</i>	Choisy ex Zoll.	Symplocaceae							✓		
129	<i>Taxus wallichiana</i>	Zucc.	Taxaceae	II	EN							Thomas, Farjon (2011)
130	<i>Aquilaria cumingiana</i>	(Decne.) Ridl.	Thymelaeaceae	II	VU							Harvey-Brown (2018a)
131	<i>Aquilaria hirta</i>	Ridl.	Thymelaeaceae	II	VU							Harvey-Brown (2018b)
132	<i>Aquilaria malaccensis</i>	Lam.	Thymelaeaceae	II	CR							Harvey-Brown (2018c)
133	<i>Gonystylus bancanus</i>	(Miq.) Kurz	Thymelaeaceae	II	CR							Barstow (2018a)
134	<i>Gonystylus macrophyllus</i>	(Miq.) Airy Shaw	Thymelaeaceae	II								LC (Barstow 2018b)
135	<i>Amomum sumatranum</i>	(Valeton) Skornick. & Hlavatá	Zingiberaceae							✓		DD (Romand-Monnier 2013)
136	<i>Curcuma petiolata</i>	Roxb.	Zingiberaceae							✓		DD (Ardiyani 2019)
137	<i>Kaempferia angustifolia</i>	Roscoe	Zingiberaceae							✓		

L1: Government Regulation No. 71/1999; L2: Decree of Forestry Ministry No 57/MENHUT-II/2008; L3: Forestry Ministry No. P.20/MENLHK/SETJEN/KUM.1/6/2018; L4: P No 92/MENLHK/SETJEN/KUM/1/8/2018; L5: P No 106/MENLHK/SETJEN/KUM/1/12/2018; L6: IBSAP (Indonesia Biodiversity Strategy and Action Plan) based on Rifai et al. (1992) and Zuhud et al. (2001) in The National Development Planning Agency (2003); IUCN: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD)

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