REINWARDTIA
Vol. 23. No. 2. pp: 85–103
DOI: 10.55981/reinwardtia.2024.4821

FLORA OF ANCIENT JAVA: IDENTIFICATION OF SPECIES, LANDSCAPE DISTRIBUTION, AND CULTURAL ASSOCIATION OF PLANTS MENTIONED IN OLD JAVANESE RAMAYANA

Received July 15, 2024; accepted August 30, 2024

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ABSTRACT
MULYANTO, D., ISKANDAR, B. S., ISKANDAR, J. & WIYANTI, D. T. 2024. Flora of ancient Java: identification of species, landscape distribution, and cultural association of plants mentioned in Old Javanese Ramayana. *Reinwardtia* 23(2): 85–103. — We searched the Old Javanese Ramayana as historical ethnobotanical resource and identified all references to plants and their biological references. Our analysis of plant names, landscape distributions, uses, and cultural associations in Java more than 1,000 years ago, includes trees and shrubs that appear in descriptions of landscapes, urban environments, forest hermitages, and uninhabited forested mountains. Of the 2,802 stanzas, only 198 stanzas (7.06%) mention plant names, with a total of 466 plant citations. Of all plant citations, we found 232 Old Javanese plant names, of which 230 had botanical references identified. These identified plant names refer to 204 species belonging to 76 plant families. The plant families with the most described species are Fabaceae (20 species), Poaceae (11 species), and Moraceae (11 species). Of the 204 species identified, 114 are native to Java Island, 90 are non-native plants. Of the 232 Old Javanese plant names, 190 (81.89%) are of Javanese origin or have Proto-Austronesian or Proto-Malayo-Polynesian roots and show lexical similarity to the plant names in modern languages closely related to the Javanese. The plant species with the highest SDR value related to landscape description are the non-native plants *Saraca asoca* and *Mangifera indica.* The author of Old Javanese Ramayana not only knows the names of many plants and their uses, but also the characteristics of plants such as size, colour, taste, and habitat. The discovery confirms previous scholar's speculation that while the place names in the Old Javanese epics are Indian, the botanic elements of these places is primarily Javanese.

Key words: Epic poetry, historical ethnobotany, Old Javanese, plant name.

ABSTRAK
MULYANTO, D., ISKANDAR, B. S., ISKANDAR, J. & WIYANTI, D. T. 2024. Flora Jawa Kuno: identifikasi jenis, sebaran lanskap, dan asosiasi budaya tumbuhan yang disebutkan dalam Ramayana Jawa Kuno. *Reinwardtia* 23(2): 85–103. — Kami menelusuri Ramayana Jawa Kuno sebagai sumber etnobotani historis dan mengidentifikasi semua referensi mengenai tumbuhan dan referensi biologisnya. Analisis kami mengarah pada nama-nama tumbuhan, sebaran lanskap, kegunaan, dan asosiasi budaya di Jawa lebih dari 1.000 tahun yang lalu mencakup pepohonan dan semak yang muncul dalam deskripsi lanskap, lingkungan perkotaan, hutan pertapaan, dan pegunungan berhutan tak berpenghuni. Dari 2.802 bait, hanya 198 bait (7,06%) yang menyebutkan nama tumbuhan, dengan jumlah sitasi tumbuhan sebanyak 466 bait. Dari seluruh kutipan tumbuhan, kami menemukan 232 nama tumbuhan Jawa Kuno, 230 diantaranya teridentifikasi referensi botaninya. Nama tumbuhan yang teridentifikasi ini merujuk pada 204 jenis yang termasuk dalam 76 suku tumbuhan. Suku tumbuhan yang jenisnya paling banyak disebut adalah Fabaceae (20 jenis), Poaceae (11 jenis), dan Moraceae (11 jenis). Dari 204 jenis yang teridentifikasi, 114 jenis merupakan jenis asli Pulau Jawa, 90 merupakan tumbuhan asing. Dari 232 nama tumbuhan Jawa Kuna, 189 (81,89%) berasal dari bahasa Jawa

atau mempunyai akar bahasa Proto-Austronesia atau Proto-Melayu-Polinesia dan menunjukkan kemiripan leksikal dengan nama tumbuhan dalam bahasa-bahasa modern yang berkerabat dekat dengan bahasa Jawa. Jenis tumbuhan yang memiliki nilai SDR tertinggi terkait deskripsi lanskap ialah tumbuhan eksotik *Saraca asoca* dan *Mangifera indica*. Pengarang Ramayana Jawa Kuno tidak hanya mengetahui nama-nama tumbuhan dan kegunaan mereka pada masyarakat saat itu, tetapi juga mengenal cukup baik ciri-ciri tumbuhan seperti ukuran, warna, rasa, dan habitatnya. Penemuan ini memperkuat spekulasi para ahli sebelumnya bahwa meski nama-nama tempat dalam epos Jawa Kuno adalah nama-nama India, unsur botani tempat-tempat tersebut sebagian besar bersifat Jawa.

Kata kunci: Etnobotani historis, Jawa Kuno, nama tumbuhan, puisi epik.

INTRODUCTION

The presence of biological entities over a certain period in a civilization is a topic of great interest for ethnobiologists (Edelman *et al.*, 2022; Kalle & Soukand, 2023). Historical ethnobiology focuses on the relationship between man and biota that persists across time and space, using past evidence contained in historical documents, and discusses the composition of ethnobotanical information based on considerations from document analysis (Medeiros, 2020). These documents are elements that reveal traces of social memory, and it is this conceptual model of document analysis in which memory functions, that allows the construction of ethnobiological information. Information discovered or obtained through the analysis of historical documents provides a chronological perspective that conveys the relationship of human culture to its biota, that is, it reveals some things that concern different aspects of human life through decisions made in the past that contribute to the current reality of humanity (Kalle & Soukand, 2023; Medeiros & Alves, 2018; Medeiros, 2020; Silva *et al.,* 2014).

Historically, Java's natural environment, including its biological components, has long provided a wealth of allegories and metaphors for Javanese court poets (Creese, 2001; Kieven, 2022; Worsley, 2022). Scholars argue that the stories, the names of the protagonists, and the names of the landscapes and places that authors portray in their literary works are of Indian origin, but that the men and women who inhabited the time and space of the story's world were Javanese. They are essentially social creatures living in a local environment familiar to the poem's author and readers (Acri, 2010; Creese, 2001; Zoetmulder, 1974). In other words, ancient Javanese poets were not describing Indian cities, seas and mountains, but singing about a uniquely Javanese world with its seasons, topography, flora and fauna, social life, *etc*. However, scientific evidence for this view has not yet been provided comprehensively.

In fact, several studies have been done on the landscape of Java depicted in the Old Javanese epics, including biological elements (Jákl, 2015; 2016; 2017; Mulyanto *et al.,* 2023b; Suprapta. 2021; Worsley, 2012). According to scholars, the depiction of landscapes and natural elements in these epic poems serves several purposes (Jákl, 2019; 2020; 2022; Worsley, 2012; 2022). One of them is that the inscription of the place name of Indian mountains, rivers and cities of India on the Javanese landscape actually helped to link the Javanese landscape with the characteristics of the heroes who once lived there, the heroes who inhabited that space. In some epics, poets allegorically portray animals, birds, and certain plants to satirize religious and political figures of certain parts of contemporary Java (Acri, 2010; 2011; 2014), or intimately link the natural environment with the beauty of women (Creese, 2001; 2015).

The oldest and longest Old Javanese epic is the Ramayana (Robson, 2018). Its encyclopedic nature and description of contemporary natural landscapes made the poem a useful source for introducing the Javanese ethnobotany of the past. Unfortunately, except for the names of popular plants whose names are still used today in Java with clear botanical references, the botanical references of most plant names are still not identified, making it difficult for modern readers to visualize the shape and color of the plants represented. As Zoetmulder (1974) points out, without knowledge of the biotic components of Java, it is difficult to understand the depictions in the Old Javanese epics. Some studies have actually noted the presence of plants in the Old Javanese Ramayana and commented on the presence of certain plants or their products, identifying their botanical references as well (Hoogervorst & Jákl, 2020; Jákl, 2015; 2016; 2017; Mulyanto *et al.,* 2023b). However, the number of identified plants is very limited; not all plant species mentioned in this epic have been identified and analyzed from an ethnobotanical perspective. Therefore, this article aims to collect and analyze the plant name, landscape distribution, utilization, and symbolic associations of plants mentioned in the Old Javanese Ramayana in order to contribute to a better understanding of the perception and use of plants in Java in the late 9th and early 10th centuries.

MATERIALS AND METHODS

Material

The data are from the Old Javanese Ramayana (also known as Ramayana Kakawin, abbreviated as RK in academic publications), a version of a famous Indian epic poem called *kakawin*, written in verse form based on traditional Sanskrit poetry (*kāvya*) and believed to be the first of its kind. Its exact date of production is unknown, but is generally believed to be in the late 9th or early 10th century. The author's name is unknown. A large number of extant manuscripts attest to its popularity and adaptations (Robson, 2018). The latest version of the Old Javanese Ramayana, romanized by Kern & Van der Molen (2015) and translated into English by Robson (2015), was used in this study. The text consists of 26 *sargas* or chapters, each of which consists of a different number of stanzas, each of which consists of four lines with (almost) the same number of syllables, and which are structured according to the same metrical pattern, except for chapter 22 and 26. The text consists of a total of 2,802 stanzas. In this article, references to text use a system of two arabic numbers separated by a dot. For example, if the authors refer to the 27th stanza of the 16th *sarga*, then the reference is written as 16.27.

Data Collection and plant identification

Every stanza and line of the Old Javanese Ramayana was examined and the poetic fragments in which the name of the plant appeared were recorded along with their context. Using this information, a database was created and populated with the following fields: 1) plant name, 2) description of the plants cited in the text related to the name, 3) usage cited in the text related to the plant, 4) symbolic associations of the plant, and 5) number of citations of each divided plant.

Ethnobotanical studies have shown that the most common plant names correspond to plant taxa in the modern scientific sense (Van Andel *et al.,* 2019; Heenan *et al.,* 2020). However, when dealing with plant names in extinct or ancient languages, it must be borne in mind that at the time the texts were written, there was no unified system of plant names (Mulyanto *et al.*, 2023a; Mulyanto *et al.*, 2023b). The most important way to clarify the meaning and botanical references of an ancient plant name is to analyze the context in which it appears. The more frequently a particular plant name appears and the more diverse the contexts are, the more information we can obtained about the plant mentioned in the text (Sorokin, 2019).

Assuming that the Old Javanese plant names cited in the text have been adopted into the botanical vocabulary of modern languages spoken in Java and the surrounding areas, the first way to identify them is to look for information on similar names used in these languages, which is a useful source of botanical references. Languages linguistically and historically related to Old Javanese include Modern Javanese, Balinese, Malay, Sundanese, Sasak, and Madurese. As these languages have plant words that share similarities with Old Javanese phytonyms, this study allows us to propose several hypotheses. Therefore, the study of the plants of the Malesia, including the list of colloquial names in these languages, is important as a source of information. In this study, botanical works on Malesia plants by European or Dutch botanist from 19th to early 20th century were relevant source of information (Blume, 1825; Van den Burg, 1885; Burkill, 1935; de Clercq, 1909; Daner, 1926; Hasskarl, 1844; Heyne, 1917; Miquel, 1856; Teijsmann, 1866). These works not only described plant taxa in the Linnaean style, but also recorded information on vernacular names and their use by the local population (Pols, 2009).

Lexically, Indian languages, especially Sanskrit, had a major influence on Old Javanese. Some plant names cited in the Old Javanese Ramayana have lexical roots in Sanskrit and other Indian languages (Mulyanto *et al.,* 2023b). To identify the botanical references of these names, we searched scholarly works on Sanskrit texts containing native plant names and their botanical references (Dash & Kashyap, 1980; Kartikar *et al.,* 1918; Meulenbeld, 1974; 1999; 2000; Quattrocchi, 2012).

Since it is scientifically biased to rely solely on the vernacular names of plant species, other criteria are used in the identification process, specifically comparing the botanical references of the vernacular names with the morphological characteristics of the plants mentioned in the text. In the Old Javanese Ramayana, fortunately, the poet not only mentions the names of many plants, but also the morphological characteristics of certain plants such as its dimension, roots, color of flowers, or habitat, and these informations reinforce information that has been obtained from the identification of vernacular names (Table 1).

Finally, to determine species origin and biogeographical zones used to determine whether a species is native or exotic/non-native related to Java, Plants of the World Online (https://powo.science.kew.org/) was consulted. In this study, native plants are defined as plants that arrived in Java naturally (*i.e.* without human intervention) since the end of the last glacial period or plants that were already present there (*i.e.* plants that arrived and survived into the Holocene), and exotic/non-native plants are defined as plants that were introduced intentionally or accidentally to Java by human from their original or native regions.

Table 1. List of plant whose morphological characteristics mentioned in the text.

No	Plant species identified by its vernacular name	Morphological characteristic of the plant mentioned in the text	Number of stanza
1	*Alocasia macrorrhizos*	"The *wyah* [leaf] could be compared to a shield, as it is so wide"	25.100
2	*Amorphophallus variabilis*	"The pointed *acung-acung* plants are [like] the spears or daggers"	25.100
3	*Arenga pinnata*	"With dislike for the *lilang* fruit because of its itch"	25.69
4	*Baccaurea racemosa*	"The *kapuṇḍung* were felled, laden with fruit, their fruit grew close"	9.54
5	*Barleria prionitis*	"The thick *landĕp* flower are yellow and charming"	25.88
6	*Bauhinia tomentosa*	"The [color of] *trikañcu* are like mixed of gold and silver"	25.89
7	*Butea monosperma*	"The *palāśa* flowers fell, as red as a rain of fire"	8.215
8	*Butea monosperma*	"To what could their red colour be compared?"	25.82
9	*Camellia lanceolata*	"The *kulurak* has thick buds"	25.75
10	*Celosia argentea*	"The many *kuraṇṭa* flowers that were growing thickly"	17.123
11	*Chrysopogon zizanioides*	"The withered *kuśa* grass in flower is the pennants"	25.101
12	*Cinnamomum iners*	"The *kayu teja* leaves were like washed copper"	16.38
13	*Clerodendrum nutans*	"Their flower pure and so white that they seemed to be smiling"	16.39
14	*Clitoria ternatea*	"The flower of *tĕlĕng* is dark"	25.89
15	*Cochlospermum religiosum*	"The golden *kanigara* are thick"	25.77
16	*Corchorus trilocularis*	"See how the golden *nĕp* seemed to be talking like the missile of fig"	24.105
17	*Crinum asiaticum*	"Their tusks, being white, were picked like *bakung*"	19.122
18	*Curcuma purpurascens*	"And the *tĕmu* shudders like a muṭu arrow erect"	25.100
19	*Dioscorea hispida*	"The lovely *gaqung* vine is at its most fragrant, climbing up"	16.33
20	*Diospyros sundaica*	"The *kayu harĕng* is slender as a bow"	25.100
21	*Durio zibethinus*	"The *ḍūryan* had an extraordinary smell"	24.98
22	*Ficus benjamina*	"It is the *waringin* that is inviting, with its cool, thick foliage"	25.71
23	*Graptophyllum pictum*	"There is the *puring* tree on the bank, with its ruddy flowers"	25.75
24	*Hippophae rhamnoides*	"Beside the golden *kalpataru*"	8.54
25	*Mangifera odorata*	"Anyone who saw the *kaweni* [in the forest] suspected it was a fire"	16.24
26	*Melastoma malabathricum*	"The tender *luruk-luruk* bore thick flowers, side by side, red and other white, as if they had been laundered"	16.37
27	*Nelumbo nucifera*	"The blooms of the *saroja* in the pool while in flower, are pretty and fragrant, some red in colour and others white"	5.70
28	*Nymphaea lotus*	"He saw that the *padma* were white, without exception"	6.115
29	*Nymphaea nouchali*	"Some wove lovely blue *nīlotpala*"	17.119
30	*Pandanus amaryllifolius*	"They [flower] are completely white"	25.83
31	*Pandanus tectorius*	"Look, there are the petals of the *puqak* lying around and resembling the broken tusks"	25.103
32	*Punica granatum*	"Likewise the *dālima*, amazingly sweet, in red garlands"	17.118
33	*Saraca asoca*	"He saw some *aśoka* trees with red flowers of a brilliant hue"	8.85
34	*Sterculia foetida*	"The tangled roots of the *kĕpuh* are like a thousand faces"	25.72
35	*Uraria crinita*	"The *ikurasu* is like the standards"	25.102
36	*Wollastonia biflora*	"The *saruni* were abundant, divinely yellow"	17.118

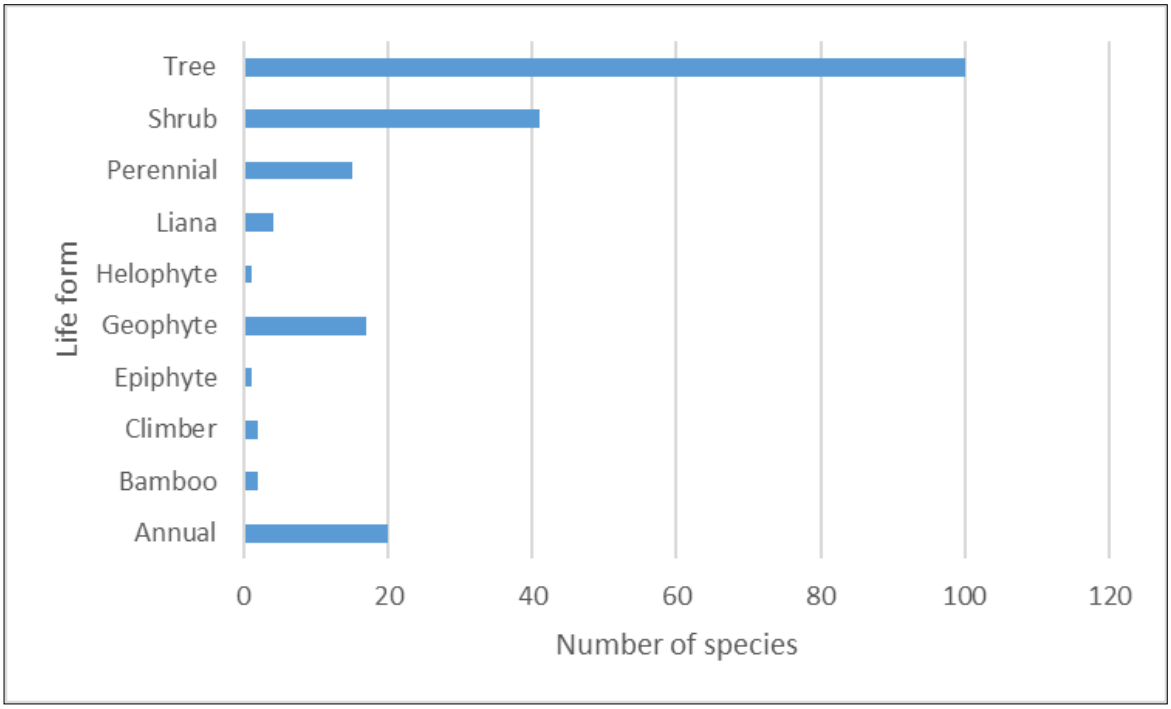

Fig. 1. Distribution of habit of plants mentioned in the text.

Data Analysis

After the botanical identity of all plant names was established, a table was compiled containing an alphabetical list of plant species based on currently accepted scientific names, Old Javanese plant names, biogeographical status related to Java Island, and number of citations. The citations were organized into three categories: 1) direct mention of the plant name in the description of the landscape, 2) uses of the plant, and 3) figurative citations.

To identify the dominant plants used by the authors of Old Javanese Ramayana to describe the botanical elements of landscapes, the modified summed dominance ratio (SDR), which is calculated from the relative density and relative frequency of plants present in the landscapes. The formula is:

$$SDR = \frac{(RD + RF)}{2} x\ 100$$

Where RD = sum of individuals of a plant/sum of all individuals of all plants, and RF = sum of landscapes in which a plant occurred/sum of counts of all plants occurences in all landscapes.

RESULTS

Diversity of plant species

Of the 2,802 stanzas, only 198 stanzas (7.06%) mention the names of plants, with a total of 466 plant citations. From all plant citations, 232 Old Javanese plant names were found, of which 230 had botanical references identified (Table 2). These identified plant names refer to 204 species belonging to 76 plant families. The plant families with the highest number of species mentioned are Fabaceae (20 species) and Poaceae (11 species). Based on data from Plants of the World Online (2024), of the 204 species identified, 114 are native to Java Island and 90 are non-native plants (Table 2), and the life form of plants with the highest mentioned are categorized as tree (100 species) and shrub (41) (Fig. 1).

Some species are called by several names, for example *Aegle marmelos* is called *maja* (Javanese) and *wila* (Javanization of Sanskrit *vilva*); *Artocarpus heterophyllus* is called *nangka* (Javanese) and *panasa* (Sanskrit); and *Mimusops elengi* is named *tanjung* (Javanese) and *bakula* (Javanization of Sanskrit *vakula*). Of the 232 Old Javanese plant names, 190 (81.89%) glosses are of Javanese origin or have Austronesian or Proto-Malayo-Polynesian roots and show lexical similarity to the names of vernacular names in modern languages closely related to Old Javanese such as Sundanese, Malay, Balinese, Madurese, or Sasak. For example, the name of *Mangifera indica*, *poh*, is used not only in Modern Javanese (*pelem poh*), but also attested in Balinese, Madurese, and Malay. The name's root go back to the Proto-Malayo-Polynesian gloss **pahu*(*q*) for *Mangifera* (Blench, 2008).

There are 42 (18.10%) plant names that are either Sanskrit names or Javanese version of Indo-Aryan names that entered Javanese via Sanskrit, for example the name *dālima* for pomegranate (*Punica granatum*) is a Persian name.

Table 2. List of plant species mentioned in Old Javanese Ramayana.

No	Scientific name	Old Javanese name (s)	Habit	Ethnobotanical use mentioned in the text	Biogeographical status related to Java	Summed dominance ratio value
1	*Abrus precatorius* L.	*Gurun*	Shrub	Medicine	Non-native	-
2	*Acalypha hispida* Burm.f.	*Kaṇḍuyuhan*, *wungatali*	Shrub	Ornamental	Non-native	0.90
3	*Aegle marmelos* (L.) Corrêa	*Maja*, *wila*	Tree	Food	Non-native	0.77
4	*Aglaia odoratissima* Blume	*Tangluh*	Tree	Ornamental	Native	-
5	*Ailanthus excelsa* Roxb.	*Warul*	Tree	No information	Non-native	0.26
6	*Albizia procera* (Roxb.) Benth.	*Wru-wruh*	Tree	No information	Native	0.26
7	*Alocasia macrorrhizos* (L.) G.Don	*Wyah*	Shrub	No information	Non-native	-
8	*Alpinia galanga* (L.) Willd.	*Laja*	Geophyte	Spice	Native	0.26
9	*Alpinia gigantea* Blume	*Ilu*	Geophyte	Spice	Non-native	0.26
10	*Alstonia scholaris* (L.) R.Br.	*Pule*	Tree	No information	Native	-
11	*Amaranthus spinosus* L.	*Cikru*	Annual	Fodder	Non-native	0.26
12	*Amomum maximum* Roxb.	*Rangga*	Geophyte	No information	Native	0.51
13	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	*Acung-acung*	Geophyte	No information	Native	0.26
14	*Amorphophallus variabilis* Blume	*Hilus*	Geophyte	Food	Native	0.38
15	*Antidesma bunius* (L.) Spreng.	*Wuni*	Tree	Food	Native	0.26
16	*Aphanamixis polystachya* (Wall.) R.N.Parker	*Gugula*	Tree	Incense	Native	-
17	*Aquilaria malaccensis* Lam.	*Agaru*	Tree	Incense	Native	-
18	*Areca catechu* L.	*Wwah*	Tree	Offering	Non-native	0.26
19	*Arenga pinnata* (Wurmb) Merr.	*Hano*, *lilang*	Tree	No information	Non-native	0.51
20	*Artocarpus odoratissimus* Blanco	*Kukap*	Tree	Food	Native	0.64
21	*Artocarpus heterophyllus* Lam.	*Nangka*, *panasa*	Tree	Food	Non-native	0.90
22	*Artocarpus integer* (Thunb.) Merr.	*Barkakan*	Tree	Food	Native	0.26
23	*Baccaurea racemosa* (Reinw.) Müll.Arg.	*Kapuṇḍung*	Tree	Food	Native	0.64
24	*Bambusa spinosa* Roxb.	*Horwi*	Bamboo	No information	Native	0.26
25	*Bambusa vulgaris* Schrad. ex J.C.Wendl.	*Ho gading*	Bamboo	No information	Non-native	0.26

No	Scientific name	Old Javanese name (s)	Habit	Ethnobotanical use mentioned in the text	Biogeographical status related to Java	Summed dominance ratio value
26	*Barleria cristata* L.	*Kurawaka*	Shrub	Ornamental	Native	0.26
27	*Barleria prionitis* L.	*Landĕp*	Shrub	No information	Native	0.26
28	*Barringtonia acutangula* (L.) Gaertn.	*Putat*	Tree	Medicine	Native	0.51
29	*Basella alba* L.	*Lambayung*	Shrub	No information	Native	-
30	*Bauhinia tomentosa* L.	*Trikañcu*	Tree	Ornamental	Non-native	0.26
31	*Biophytum sensitivum* DC.	*Kurangrang*	Annual	Religious	Native	0.26
32	*Bischofia javanica* Blume	*Gintungan*	Tree	Food	Native	0.77
33	*Blumea balsamifera* DC.	*Sĕmbung*	Shrub	No information	Native	0.26
34	*Borassus flabellifer* L.	*Tal*	Tree	No information	Native	0.89
35	*Boswellia serrata* Roxb.	*Surabhi*	Tree	Fragrance	Non-native	0.90
36	*Brassica juncea* (L.) Czern	*Sasawi*	Annual	No information	Non-native	-
37	*Brucea javanica* (L.) Merr.	*Kawalot*	Shrub	No information	Native	0.26
38	*Buddleja asiatica* Lour.	*Huris*	Shrub	Ornamental	Native	0.26
39	*Butea monosperma* (Lam.) Taub.	*Bajrojwala*, *palāśa*	Tree	Ornamental	Non-native	1.15
40	*Caesalpinia pulcherrima* Sw.	*Komala*	Shrub	No information	Non-native	0.26
41	*Calophyllum inophyllum* L.	*Mandāra*, *punnāga*	Tree	Ornamental	Native	1.28
42	*Camellia lanceolata* (Blume) Seem.	*Kulurak*	Shrub	No information	Non-native	0.26
43	*Caryota rumphiana* Mart.	*Haṇḍuru*	Tree	No information	Non-native	0.26
44	*Castanopsis argentea* (Blume) A.DC.	*Warangan*	Tree	Food	Native	0.26
45	*Casuarina equisetifolia* L.	*Cāmara*	Tree	No information	Native	0.26
46	*Cedrus deodara* (Roxb.) G.Don	*Dewadāru*	Tree	No information	Non-native	0.38
47	*Ceiba pentandra* (L.) Gaertn.	*Raṇḍö*, *kapuk*	Tree	No information	Non-native	0.51
48	*Celosia argentea* L.	*Kuraṇṭa*	Annual	Ornamental	Non-native	0.51
49	*Centella asiatica* (L.) Urb.	*Panggaga*	Perennial	Religious	Native	0.26
50	*Chrysopogon zizanioides* (L.) Roberty	*Kalakā*, *kuśa*, *usör*	Perennial	Religious	Non-native	0.51
51	*Cinnamomum iners* (Reinw. ex Nees & T.Nees) Blume	*Kayu teja*	Tree	No information	Native	0.51
52	*Cinnamomum macrocarpum* Hook.f.	*Tamāla*	Tree	No information	Non-native	0.26

No	Scientific name	Old Javanese name (s)	Habit	Ethnobotanical use mentioned in the text	Biogeographical status related to Java	Summed dominance ratio value
53	*Cinnamomum verum* J.Presl	*Utkaṭa*	Tree	Religious	Non-native	-
54	*Citrus maxima* (Burm.) Merr.	*Lungga*	Tree	Food	Non-native	0.26
55	*Citrus medica* L.	*Limo*	Tree	Food	Non-native	0.38
56	*Clerodendrum chinense* Mabb.	*Měṇḍur*	Shrub	Ornamental	Native	0.90
57	*Clerodendrum nutans* Wall. ex Jack	*Payanggu*	Shrub	No information	Non-native	0.38
58	*Clerodendrum paniculatum* L.	*Panggil*	Shrub	No information	Native	0.38
59	*Clinacanthus nutans* Lindau	*Tajěm*	Shrub	No information	Native	0.26
60	*Clitoria ternatea* L.	*Tělěng*	Perennial	Adornment	Non-native	0.51
61	*Cochlospermum religiosum* (L.) Alston	*Kanigara*	Tree	Adornment	Non-native	0.26
62	*Cocos nucifera* L.	*Nyū*	Tree	Food	Non-native	0.77
63	*Coix lacryma-jobi* L.	*Jahěli*, *jahli*	Annual	Food	Native	0.38
64	*Coleus scutellarioides* (L.) Benth.	*Dilěm*	Shrub	No information	Native	0.26
65	*Colocasia esculenta* (L.) Schott.	*Talěs*	Geophyte	Food	Non-native	0.38
66	*Corchorus trilocularis* L.	*Něp*	Annual	No information	Non-native	0.51
67	*Crinum asiaticum* L.	*Bakung*, *manguněng*	Geophyte	No information	Native	0.51
68	*Crocus sativus* L	*Kumkuma*	Geophyte	Medicine	Non-native	-
69	*Curcuma longa* L.	*Kuñit*	Geophyte	Spice	Non-native	0.51
70	*Curcuma purpurascens* Blume	*Těmu*	Geophyte	No information	Native	-
71	*Cyanthillium cinereum* (L.) H.Rob.	*Cāmpagi*	Annual	No information	Native	0.26
72	*Cynometra cauliflora* L.	*Kurañjya*	Tree	No information	Native	0.26
73	*Dentella repens* (L.) J.R.Forst. & G.Forst.	*Karangbali*	Shrub	Adornment	Native	0.26
74	*Desmostachya bipinnata* (L.) Stapf.	*Kurawa*	Perennial	Ornamental	Native	0.26
75	*Dialium indum* L.	*Kurañji*	Tree	No information	Native	0.26
76	*Dioscorea alata* L.	*Huwi*	Geophyte	Food	Native	0.26
77	*Dioscorea hispida* Dennst.	*Gaḍung*	Geophyte	Ornament	Native	0.77
78	*Diospyros sundaica* Bakh.	*Kayu harěng*	Tree	No information	Native	-
79	*Diplazium esculentum* (Retz.) Sw.	*Paku*	Perennial	Religious	Native	0.26
80	*Donella lanceolata* (Blume) Aubrév.	*Calakět*	Tree	Food	Native	0.26
81	*Dracontomelon dao* (Blanco) Merr. & Rolfe	*Rahu*	Tree	Food	Native	0.26

No	Scientific name	Old Javanese name (s)	Habit	Ethnobotanical use mentioned in the text	Biogeographical status related to Java	Summed dominance ratio value
82	*Dryobalanops aromatica* Gaertn.f.	*Kapūr*	Tree	Incense	Non-native	0.26
83	*Durio zibethinus* L.	*Dūryan*	Tree	Food	Non-native	0.77
84	*Elaeocarpus floribundus* Blume	*Kaměsa*	Tree	Food	Native	0.26
85	*Elaeocarpus grandiflorus* Sm.	*Handul*	Tree	No information	Native	0.26
86	*Erythrina subumbrans* (Hassk.) Merr.	*Daḍap*	Tree	No information	Native	0.26
87	*Ficus annulata* Blume	*Kuwang*	Tree	No information	Native	0.26
88	*Ficus benjamina* L.	*Waringin*	Tree	No information	Native	0.77
89	*Ficus drupacea* Thunb.	*Hambulu*	Tree	No information	Native	0.51
90	*Ficus glandulifera* (Wall. ex Miq.) King	*Alělěs*	Tree	No information	Native	-
91	*Ficus palmata* Forssk.	*Duray*	Tree	Dye	Non-native	-
92	*Ficus racemosa* L.	*Lwa*	Tree	Food	Native	0.64
93	*Ficus religiosa* L.	*Bodhi*	Tree	Religious	Non-native	0.26
94	*Ficus virens* Aiton	*Kaywāra*	Tree	No information	Native	0.38
95	*Flacourtia jangomas* (Lour.) Raeusch.	*Limus*	Tree	Food	Non-native	0.26
96	*Flacourtia rukam* Zoll. & Moritzi	*Rukěm*	Tree	Religious	Native	0.51
97	*Garcinia mangostana* L.	*Manggis*, *manggusṭa*	Tree	Food	Non-native	0.51
98	*Garuga pinnata* Roxb.	*Wyu*	Tree	Food	Non-native	0.26
99	*Gnetum edule* (Willd.) Blume	*Tilil*	Climber	No information	Non-native	0.51
100	*Graptophyllum pictum* Griff.	*Puring*	Shrub	No information	Non-native	0.26
101	*Grewia asiatica* L.	*Palisa*	Shrub	Religious	Non-native	0.26
102	*Guizotia abyssinica* (L.f.) Cass.	*Walěs*	Annual	Religious	Non-native	0.26
103	*Gymnema sylvestre* R.Br.	*Kuriñjěm*	Liana	No information	Non-native	0.26
104	*Heptapleurum farinosum* (Blume) Lowry & G.M.Plunkett	*Panggang*	Tree	No information	Native	0.26
105	*Hippophae rhamnoides* L.	*Kalpataru*	Shrub	Religious	Non-native	0.26
106	*Holarrhena pubescens* Wall. ex G.Don	*Kuṭaja*	Shrub	No information	Non-native	0.26
107	*Hordeum vulgare* L.	*Gandākṣata*	Annual	Cleaner	Non-native	-
108	*Imperata cylindrica* (L.) P.Beauv.	*Halalang*	Perennial	Wrap	Non-native	0.51
109	*Indigofera tinctoria* L.	*Nīla*	Shrub	Dye	Non-native	-
110	*Ipomoea pes-caprae* (L.) R.Br.	*Katang-katang*	Geophyte	No information	Native	0.26

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111	*Kleinhovia hospita* L.	*Katimang*	Tree	No information	Non-native	0.38
112	*Lablab purpureus* (L.) Sweet.	*Kara-kara*	Annual	Religious	Non-native	0.26
113	*Lagenaria siceraria* (Molina) Standl.	*Walū*	Annual	Container	Non-native	0.51
114	*Lagerstroemia speciosa* (L.) Pers.	*Katangga*, *wungu*	Tree	Ornament	Native	0.77
115	*Lansium domesticum* Corrêa	*Langsĕb*	Tree	Food	Native	0.38
116	*Lawsonia inermis* L.	*Pacar*	Shrub	Adornment	Non-native	0.51
117	*Lepidium sativum* L.	*Salimā*	Annual	No information	Non-native	0.26
118	*Lepisanthes rubiginosa* (Roxb.) Leenh.	*Kalayu*	Shrub	Food	Native	0.26
119	*Limonia acidissima* L.	*Kawista*	Tree	Food	Non-native	0.26
120	*Ludwigia octovalvis* (Jacq.) P.H.Raven	*Samalĕm*, *taruṇa samalĕm*	Shrub	No information	Native	0.51
121	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	*Madhuka*	Tree	No information	Non-native	0.26
122	*Magnolia champaca* (L.) Baill. ex Pierre	*Cāmpaka*	Tree	Ornament	Native	0.38
123	*Mallotus philippensis* (Lam.) Müll.Arg.	*Keśara*	Shrub	No information	Native	0.26
124	*Mangifera foetida* Lour.	*Ambawang*	Tree	Food	Non-native	0.38
125	*Mangifera indica* L.	*Poh*, *sūkara*	Tree	Food	Non-native	2.19
126	*Mangifera odorata* Griff.	*Kaweni*	Tree	Food	Non-native	0.90
127	*Medinilla alpestris* (Jack) Blume	*Parijāta*	Epiphyte	No information	Native	1.93
128	*Melastoma malabathricum* L.	*Luruk-luruk*	Shrub	Ornament	Native	0.51
129	*Melicope glabra* (Blume) T.G.Hartley	*Sampang*	Tree	No information	Native	0.26
130	*Mesua ferrea* L.	*Nāgapuṣpa*	Tree	No information	Native	0.64
131	*Mimusops elengi* L.	*Bakula*, *tañjung*	Tree	Food	Native	1.41
132	*Mirabilis jalapa* L.	*Anuja*	Perennial	Ornament	Non-native	0.51
133	*Musa x paradisiaca* L.	*Pisang*	Tree	Food	Non-native	0.26
134	*Nelumbo nucifera* Gaertn.	*Saroja*, *saroruha*, *pangkaja*	Geophyte	Ornament	Native	0.77
135	*Neolamarckia cadamba* (Roxb.) Bosser	*Kadamba*	Tree	No information	Native	0.26
136	*Neonauclea celebica* (Havil.) Merr.	*Kalampyayan*	Tree	No information	Non-native	0.26
137	*Neonauclea lanceolata* (Blume) Merr.	*Kalĕpu*	Tree	Food	Native	0.26

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138	*Nephelium lappaceum* L.	*Wunglwan*	Tree	Food	Non-native	0.51
139	*Nerium oleander* L.	*Kañiri*	Shrub	Adornment	Non-native	0.51
140	*Nyctanthes arbor-tristis* L.	*Śrigaḍing*	Shrub	Ornament	Native	0.77
141	*Nymphaea lotus* L.	*Padma*, *tuñjung*	Geophyte	Ornament	Non-native	1.80
142	*Nymphaea nouchali* Burm.f.	*Nīlotpala*, *kumuda*, *utpala*	Geophyte	Ornament	Non-native	1.02
143	*Ocimum basilicum* L.	*Sulasih*	Annual	Religious	Native	0.38
144	*Ocimum tenuiflorum* L.	*Lampĕs*	Perennial	Religious	Native	0.26
145	*Oryza sativa* L.	*Pari*	Annual	Food	Non-native	0.26
146	*Oroxylum indicum* (L.) Benth. Ex Kurz	*Wungli*	Tree	Religious	Native	0.26
147	*Pandanus amaryllifolius* Roxb.	*Paṇḍan*	Shrub	No information	Non-native	0.26
148	*Pandanus tectorius* Parkinson ex Du Roi	*Puḍak*	Tree	Ornament	Native	1.41
149	*Pangium edule* Reinw.	*Pangi*	Tree	Spice	Native	0.26
150	*Peltophorum pterocarpum* (DC.) Backer ex K.Heyne	*Suka*	Tree	Adornment	Native	0.26
151	*Pericampylus glaucus* (Lam.) Merr.	*Duḍutan*	Liana	Fodder	Native	0.26
152	*Persicaria chinensis* (L.) H.Gross	*Rumbu*, *ḍangḍangan*	Perennial	Medicine	Native	0.38
153	*Phyllanthus emblica* L.	*Kamalaka*	Tree	Food	Native	0.26
154	*Pilea crenulata* (Sw.) Urb.	*Rumbi*	Herbs	No information	Non-native	0.26
155	*Piper betle* L.	*Sĕrĕh*	Shrub	Betel chew	Non-native	0.26
156	*Pistia stratiotes* L.	*Ambang-ambang*	Helophyte	No information	Native	0.26
157	*Plumbago indica* L.	*Suntagi*	Shrub	No information	Native	0.26
158	*Podocarpus neriifolius* D.Don	*Wulwan*	Tree	No information	Native	0.26
159	*Pometia pinnata* J.R.Forst. & G.Forst.	*Sĕntul*	Tree	Food	Native	0.26
160	*Porana volubilis* Burm.f.	*Widyasari*	Liana	Religious	Native	0.26
161	*Protium javanicum Burm.*	*Tanggulun*	Tree	Food	Native	0.26
162	*Pterocarpus indicus* Willd.	*Asana*	Tree	Ornament	Native	1.18
163	*Pterospermum acerifolium* (L.) Willd.	*Karṇikāra*	Tree	No information	Non-native	0.51
164	*Punica granatum* L.	*Dālima*	Tree	Ornament	Non-native	1.28
165	*Radermachera gigantea* (Blume) Miq.	*Paḍali*, *paḍāntĕn*	Tree	Adornment	Native	1.02

No	Scientific name	Old Javanese name (s)	Habit	Ethnobotanical use mentioned in the text	Biogeographical status related to Java	Summed dominance ratio value
166	*Rotheca serrata* (L.) Steane & Mabb.	*Singgugu*	Shrub	No information	Native	0.26
167	*Saccharum officinarum* L.	*Tĕbu*, *wĕlas-arĕp*	Perennial	Food	Non-native	0.51
168	*Saccharum spontaneum* L.	*Galagah*	Perennial	No information	Native	0.26
169	*Salacca zalacca* (Gaertn.) Voss	*Salak*	Perennial	Food	Native	0.26
170	*Sandoricum koetjape* (Burm.f.) Merr.	*Kacapi*	Tree	Food	Native	0.38
171	*Santalum album* L.	*Candana*	Tree	Incense	Native	0.64
172	*Saraca asoca* (Roxb.) W.J.de Wilde	*Aśoka*	Tree	Ornament	Non-native	2.31
173	*Senna occidentalis* Link	*Sĕnting*	Shrub	Ornament	Non-native	0.26
174	*Senna surattensis* (Burm.f.) H.S.Irwin & Barneby	*Wunga kuning*	Shrub	Ornament	Non-native	0.26
175	*Sesamum indicum* L.	*Tīla*	Annual	Food	Non-native	-
176	*Setaria italica* (L.) P.Beauv.	*Jawa*, *sĕkul*	Annual	Food	Non-native	0.51
177	*Sida rhombifolia* L.	*Śilāñjana*	Perennial	Dye	Native	-
178	*Sindora sumatrana* Miq.	*Sindūra*	Tree	Dye	Non-native	-
179	*Solanum melongena* L.	*Pūryan*	Shrub	Food	Native	0.26
180	*Solanum nigrum* L.	*Ranti*	Annual	Food	Non-native	0.38
181	*Sphenoclea zeylanica* Gaertn.	*Guṇḍa*	Annual	No information	Native	0.26
182	*Sterculia foetida* L.	*Kĕpuh*	Tree	No information	Non-native	0.26
183	*Strophanthus caudatus* (L.) Skeels.	*Janggit*	Liana	No information	Native	0.26
184	*Syzygium acuminatissimum* (Blume) DC.	*Kulampwak*	Tree	No information	Native	0.26
185	*Syzygium aqueum* (Burm.f.) Alston	*Jambu*	Tree	Food	Native	1.03
186	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	*Lawangga*	Tree	No information	Non-native	0.26
187	*Syzygium cumini* (L.) Skeels.	*Duhĕt*	Tree	Food	Native	0.89
188	*Syzygium polycephalum* (Miq.) Merr. & Perry	*Kalihasĕm*	Tree	Food	Native	0.26
189	*Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult.	*Wungawari*	Shrub	Ornament	Non-native	0.51
190	*Tabernaemontana pandacaqui* Lam.	*Paṇḍakaki*	Shrub	Ornament	Native	0.51
191	*Tamarindus indica* L.	*Kamalagi*	Tree	Medicine, food	Non-native	0.26
192	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	*Arjuna*	Tree	Ornament	Non-native	0.26

No	Scientific name	Old Javanese name (s)	Habit	Ethnobotanical use mentioned in the text	Biogeographical status related to Java	Summed dominance ratio value
193	*Terminalia bellirica* (Gaertn.) Roxb.	*Kalpawṛkṣa*	Tree	Religious	Native	0.51
194	*Terminalia catappa* L.	*Katapang*	Tree	No information	Native	0.26
195	*Trema tomentosum* (Roxb.) H.Hara	*Tamyang*	Shrub	No information	Native	0.26
196	*Trichosanthes bracteata* (Lam.) Voigt	*Kalayar*	Climber	No information	Native	0.26
197	*Trichosanthes cucumerina* L.	*Bolu*	Annual	Ornament	Native	-
198	*Uraria crinita* (L.) Desv. ex DC.	*Ikurasu*	Perennial	No information	Native	0.26
199	*Vigna radiata* (L.) R.Wilczek	*Atak*	Annual	Food	Non-native	0.26
200	*Vitex altissima* L.f.	*Tilaka*	Tree	Ornament	Native	0.26
201	*Wollastonia biflora* (L.) DC.	*Saruṇi*	Shrub	Adornment	Native	1.06
202	*Wurfbainia compacta* Škormičk. & A.D.Poulsen	*Karkolakā*	Geophyte	No information	Native	0.26
203	*Zingiber officinale* Roscoe	*Jahe*	Perennial	Religious	Non-native	0.26
204	*Ziziphus jujuba* Mill.	*Wadara*	Shrub	Food	Non-native	0.51
205	Unidentified	*Alĕr*	?	No information	?	?
206	Unidentified	*Hā*	?	No information	?	?

Notes: Plant species with no SDR value is plant that not mentioned in the description of landscapes.

Plants in the description of landscapes

An important feature of Old Javanese epics is their narrative nature. The author's goal is essentially to lead us through the plot from beginning to end. In the Old Javanese Ramayana, the poem's story takes place in four different landscapes: 1) forest hermitage, 2) uninhabited forested mountains with rivers, lakes, and canyons, 3) countryside and rural landscape, 4) palaces, royal gardens, and urban surrounds. The last two represent two aspects of ancient Javanese society, while the first two show a world beyond these human societies, but connected to them.

In total, there are 388 (83.26%) plant citations related to description of landscapes. Landscape that most often mentions the presence of plants is uninhabited forested mountain with a total of 144 plants citation in which 107 species are mentioned. Meanwhile, countryside is landscape with the fewest plants mentioned with only 21 species (Table 3). Several plants are mentioned in more than one landscapes.

Symbolic association of plants

The presence of certain plants in the stories is not only makes the depiction of different landscapes more vivid, but also serves as metaphors: for example, the Palmyra palm (*Borassus flabellifer*) is often used as an allegory for the height of a person or the length of a weapon, and its falling fruit serves as a metaphor for the speed of an arrow. Another example, the seeds of the *Brassica juncea*, are used as a metaphor for the smallness of things or insignificancy related to size (Table 4).

Other plants are planted in the forest hermitages because they have been assigned specific meanings or symbolize something that reminds the ascetic or hermit of the purpose of being there. When describing a forest hermitage in chapter 25, spiritual reasons for the presence of certain plants in also mentioned (Table 5). Unfortunately, in the text, no information is given as to why these plants are given special symbolic meanings.

Table 3. Number of plant citations and species mentioned in the description of landscapes.

Category of landscape	Number of plant citations	Number of species mentioned
Uninhabited forested mountain	144	107
Forest hermitage	118	96
Palace, royal garden, and urban surround	102	53
Countryside and rural landscape	25	21

Table 4. List of plant species used as parable or metaphor.

Plant species mentioned	Refferent	Metaphor for	Mentioned in stanza
Alocasia macrorrhizos	Leaf	Soldier's sheild	25.100
Amorphophallus paeoniifolius	Flower	Soldier's sword	25.100
Basella alba	Plant	Fragileness	17.8
Borassus flabellifer	Tree	Giant stature	2.67
Borassus flabellifer	Tree	Giant's bow	19.82
Borassus flabellifer	Fruit	Arrow speed	16.21
Borassus flabellifer	Fruit	Giant's arrow	19.82
Boswellia serrata	Flower	Renown person	26.52
Brassica juncea	Seed	Insignificancy	15.63
Butea monosperma	Flower	Burning passion	25.82
Ceiba pentandra	Tree	Giant's foot	4.7, 8.76
Colocasia esculenta	Plant	Fragileness	17.8
Crinum asiaticum	Flower	Elephant tusks	19.122
Ficus religiosa	Tree	World shelter	26.48
Imperata cylindrica	Plant	Insatiability	17.86
Nymphaea nouchali	Flower	Beauty	12.1
Ocimum basilicum	Plant	Felling of love	16.35
Santalum album	Bark	Purity	21.94
Saraca asoca	Tree	Un-sad	17.138
Sterculia foetida	Roots	Thousand faces	25.72

Utilization of plant

Of the 204 species identified, 75 (36.76%) were mentioned without any reference to ethnobotanical uses. These species are generally mentioned related to landscape depictions and/or their symbolic associations, while 129 (63.23%) were mentioned with their uses, mainly as food (including fruit), ornamental plants planted in royal gardens, and for religious purposes (Fig. 2).

In the Old Javanese Ramayana, the presence of rice (*Oryza sativa*) as a crop is mentioned only in the description of the countryside and rural landscape. In the forest hermitage, ancient cereals such as Job's tears (*Coix lacryma-jobi*) and foxtail millet (*Setaria italica*) are specified as staple food crops instead of rice. It is said that tubers such as winged yam (*Dioscorea alata*), taro (*Colocasia esculenta*), and voodoo lily (*Amorphophallus variabilis*), fruit trees such as mango (*Mangifera indica*), horse mango (*Mangifera foetida*), banana (*Musa x paradisiaca*), pomegranate (*Punica granatum*), and jujube (*Ziziphus jujuba*) were culti-

Table 5. List of plant species planted in forest hermitage for spiritual reasons and its symbolic association.

Plant species	Symbolic association	Mentioned in stanza
Alpinia galanga	"Replacement for ears of corn gleaned in fear"	25.45
Alpinia gigantea	"Image of him who is disinterested ad equanimous"	25.49
Amorphophallus variabilis	"Image of him who is disinterested ad equanimous"	25.49
Artocarpus heterophyllus	"Image of him who is disinterested ad equanimous"	25.49
Barringtonia acutangula	"Repels depression"	25.43
Biophytum sensitivum	"To prevent them being melancholy"	25.44
Buddleja asiatica	"For a calm and composed life"	25.45
Centella asiatica	"A means if grouping for goodness"	25.42
Coix lacryma-jobi	"Replacement for ears of corn gleaned in fear"	25.45
Colocasia esculenta	"Will put an end to amourous intercourse"	25.46
Dioscorea alata	"Finished in its heart and does not desire enjoyment"	25.45
Diplazium esculentum	"As a bathing-place for meditation"	25.47
Ficus racemosa	"Cause one to be comfortable in broad fields of study"	25.43
Flocourtia rukam	"Eradicates the impurity of passion"	25.43
Grewia asiatica	"Useful for making evil turn away in aversion"	25.44
Guizotia abyssinica	"For repaying the good deeds of others"	25.42
Lablab purpureus	"Compassion is protected by it"	25.47
Musa x paradisiaca	"Be conscious of fear"	25.46
Neonauclea lanceolata	"The hope of liberation"	25.47
Ocimum tenuiflorum	"Results in tranquility"	25.42
Oroxylum indicum	"A means if grouping for goodness"	25.42
Pangium edule	"What they use to be their minds when they eat it"	25.44
Persicaria chinensis	"Has great purifying powers"	25.90
Porana volubilis	"For obtaining knowledge"	25.42
Setaria italica	"Afraid of committing an offence, so speaks honestly"	25.45
Solanum nigrum	"As food for the gods"	25.44
Syzygium cumini	"To keep evil at bay"	25.43
Zingiber officinale	"Replacement for ears of corn gleaned in fear"	25.45

vated in hermitage surrounds, as well as vegetables such as black nightshade (*Solanum nigrum*), and aromatic and spice plants such as common basil (*Ocimum basilicum*), ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and galangal (*Alpinia galanga*). Sugarcane (*Saccharum officinarum*) is said also to be the food of those performing severe penances, along with bananas.

Discussion

The author of Old Javanese Ramayana appear clearly to have taken as their model not the condition of the remote past and places as he imagined them, but the real world in which they lived. This does not mean that the imagination does not play an important part in the poem as a whole, but stripped of its poetical embellishments, we can discern in this study, some features of author's botanical environment. Information gathered from floristic distribution and lexical root of plant names mentioned in the Old Javanese Ramayana supports previous scholar's speculation that although the place names in this epics are Indian, the biotic elements of these places is mainly Javanese

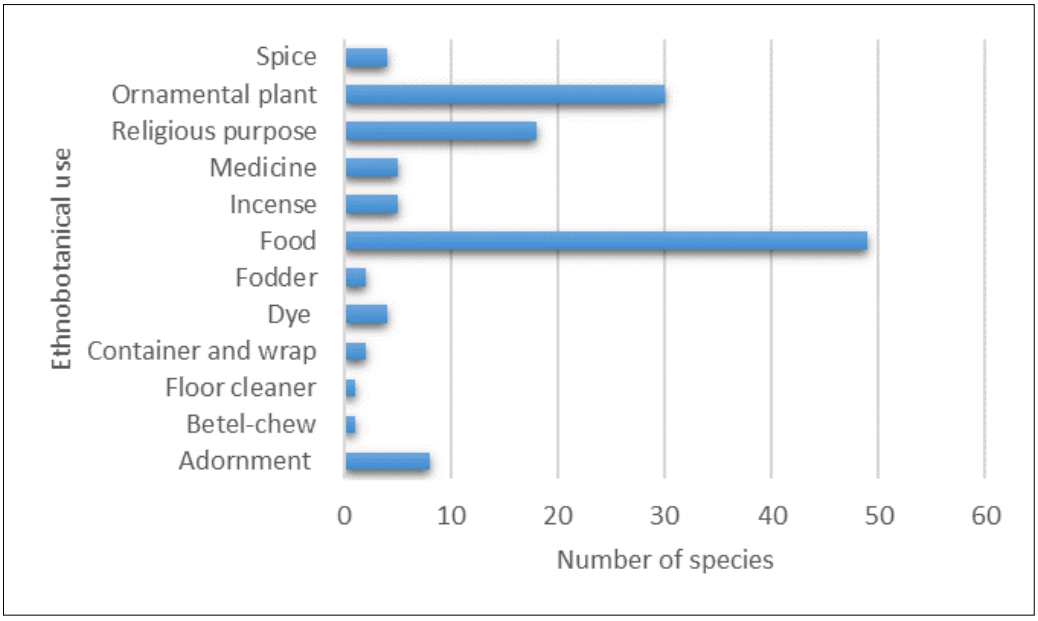

Fig. 2. Distribution of ethnobotanical uses of plants mentioned in the text.

(Zoetmulder, 1974; Creese, 2001, 2015; Jákl, 2016; 2017; Hoogervorst, 2020). However, when considering the most dominant plant species in depictions of landscapes, based on their SDR values, the plant species with the highest values are *Saraca asoca* and *Mangifera indica* which are non-native plants. Not only are these two species present in all four landscape representations, but their names are also frequently cited. The frequent mention of these two species in depictions of all types of landscapes may be related to their sacred position in Indian culture and religion. *Saraca asoca* is a legume tree, a medium-sized evergreen deciduous tree with fragrant orange or red flowers and bare brances that grow in a spreading, arching pattern. It is widely distributed in India (Urumarudappa *et al.,* 2023). It is one of the oldest medicinal plants identifiable in the India and South Asian countries for thousands of years. The tree is found widely in traditions and legends and is almost always depicted as sacred and extremely benevolent. But for a girl whose lover is not at home, it is just another torment tormenting her lovesick heart (Dwivedi, 2017). In the Old Javanese Ramayana, the trees surrounding Sita during her imprisonment are said to ward off sorrows, but they are also fitting trees to mourn Sita in her fiery grief. Mango also is considered a sacred fruit, and the tree itself is revered as the tree of life in Hinduism. Legend tells the story of Kamadeva, the god of love, who used a bow made from mango wood to inflame his desire. It is said that Lord Shiva meditated in the shade of a mango tree, and the goddess Laksmi emerged from its lush branches. In Hindu ceremonies and rituals, mango leaves and fruits play a central role as decorative elements. Offering mangoes to gods is a common act of devotion and worship. Mangoes are also synonymous with love and romance and are often exchanged between lovers as a token of affection. Mangoes are also considered a symbol of abundance and fertility and are often incorporated into rituals aimed at promoting fertility (Chauhan & Chauhan, 2019). Modern Javanese gloss for mango, *pelem*, probably derived from the fruit's epithet in Indian culture, *mahaphalam*, means 'the great fruit' (Blench, 2008; Mulyanto *et al.*, 2023b).

Other plants with high SDR values are native to Java Island such as *Calophyllum inophyllum*, *Medinilla alpestris*, *Mimusops elengi*, *Pandanus tectorius*, *Pterocarpus indicus*, *Rademachera gigantea*, *Syzygium aqueum*, and *Wollastonia biflora*. However, some non-native plants such as *Butea monosperma*, *Nymphaea lotus*, *Nymphaea nouchali*, and *Punica granatum* are also have high SDR values. Except for *Butea monosperma* which is mentioned only in connection with depictions of uninhabited forested mountain and/or forest hermitage landscapes, these non-native plants are only mentioned in depictions of palaces, royal gardens, and urban surrounds. From this information, it can be said that cultural centers like royal palaces or hermitages are the initial locations where plants were first introduced to an area.

The number of non-native plants mentioned in the Old Javanese Ramayana is quite large, but most of them probably belong to the category of archaeophytes, plant species that are not native to a particular geographical area but were introduced in ancient times (Preston *et al.*, 2004). For example, the Old Javanese names of non-native plants such as *wyah*, *wwah*, *nyū*, *tĕbu*, *pari*, *talĕs*,

and *pandan* for *Alocasia macrorrhizos*, *Areca catechu*, *Cocos nucifera*, *Saccharum officinarum*, *Oryza sativa*, *Colocasia esculenta*, and *Pandanus amaryllifolius* respectively, are names that have their roots in Proto-Austronesian, with the roots **bíRaq*, **buwaq*, **niyuR*, **tebus*, **págey*, **tales*, and **paŋuDan* respectively (Wolff, 1994; 2018; Zorc, 1994).

Lastly, when studying plant names from ancient texts, identifying those plants is the most important step. Botanical identification of plant names, that is, the search for the correspondence of plant names with biological taxa in the modern sense, turned out to be a difficult task. When formulating hypotheses about the botanical affiiation of an ancient plant name, the role of contextual analysis depends on the frequency of occurrence of this plant name, as well as the degree of diversity and realism of its contexts. The more frequently this plant name appears, the more diverse its contexts are, and the closer they are to historical narratives or utilitarian and practical texts, the more information we can get about the botanical reality hidden behind the plant name (Sorokin, 2019). However, many plant names are mentioned only once without any description of morphological features. Therefore, if an ancient text is examined, relying solely on the informations from that text is not enough. A prerequisite for successful identification is to study as many relatively contemporary texts or documents as possible.

ACKNOWLEDGEMENTS

This study was funded by a Literature-Based Research Grant (RDPD) from the Universitas Padjadjaran. We would like to thank the Rector of the Universitas Padjadjaran for the support provided. The main data source for this study was kindly provided by the Research Institute for Languages and Cultures of Asia and Africa, Tokyo University of Foreign Studies. The authors would like to thank the Institute.

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