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Bamboo Diversity in the Maluku Islands, Indonesia

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Abstract. *There is little documentation of bamboo species diversity and distribution in the Maluku Islands of Indonesia. This study aimed to provide information on the diversity and distribution of Maluku's bamboo species. The research was conducted in March–April 2021 at the Herbarium Bogoriense (BO), National Research and Innovation Agency. Herbarium specimens of bamboo in BO collected from the Maluku Islands (Provinces of Maluku and North Maluku) were studied alongside online scanned images of herbarium specimens. Bamboo species were re-identified and validated. A literature study was conducted to enrich the data. A distribution map of bamboo species in the Maluku Islands was compiled. Data were analyzed and presented descriptively. We built an identification key for the bamboo species in the Maluku Islands. There are 16 species and eight genera of bamboo in the Maluku Islands: Bambusa glaucophylla, B. maculata, B. multiplex, B. spinosa, B. tuldoides, B. vulgaris, Dendrocalamus asper, Gigantochloa atter, G. robusta, Neololeba amahussana, N. atra, Phyllostachys aurea, Racemobambos ceramica, Schizostachyum brachycladum, S. lima, and Thyrsostachys siamensis. These bamboo species were found across Maluku Province (Buru, Ambon, Seram, Kei Kecil, Kei Besar, Yamdena, and Tanimbar) and North Maluku Province (Ternate, Tidore, Halmahera, Obi, and Sula) at an altitude of 1–1100 m above sea level in primary and secondary forests, limestone, peatland edges, city parks, and gardens.*

Keywords: *bamboo, checklist, distribution, Moluccas, Poaceae*

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INTRODUCTION

Maluku is a group of islands located in eastern Indonesia, situated between Sulawesi in the west and Papua in the east. In the north it is bordered by the Philippines and the Pacific Ocean. Timor and Australia are located to the south. Administratively, the Maluku Islands cover two provinces of Indonesia, Maluku Province with an area of 46,914.03 km^2 (Badan Pusat Statistik Provinsi Maluku, 2021) and North Maluku Province with an area of 31,982.50 km^2 (Badan Pusat Statistik Provinsi Maluku Utara, 2021). Maluku Province has c. 1,286 islands and North Maluku Province c. 856 islands (Badan Pusat Statistik, 2021). Maluku's main islands are Halmahera, Taliabu, Manggole, Sulabesi, Obi, Bacan, Morotai, Seram, Buru, Wetar dan Yamdena. Smaller islands include Ternate, Tidore, Kayoa, Kafiroto, Mandioli, Tapat, Abilatu, Tobalai, Jorongan, Kelang, Manipa, Saparua, Haruku, Ambon, Kei Besar, Kei Kecil, Kobroor, Trangan, Woko, Maru, Waliaru,

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Selu, Seira, Selaru, Masela, Babar, Sermata, Luang, Lakor, Moa, Leti, Roman, Kisar, and Liran (Atmadilaga, 2007).

Mangroves, swamps, coastal forests, and dipterocarp forests are all found in Maluku (Widjaja et al., 2014). As of 2017, as many as 4,442 species of plants and fungi had been reported from the islands (Retnowati & Rugayah, 2019), including many bamboo species. Bamboo belongs to Poaceae (grass family), sub-family Bambusoideae. Bamboo, in general, has rhizomes and culms (hollow cylindrical stems) with nodes, and at each node, branches that support the leaves. Young shoots grow from the rhizome nodes and become mature bamboo. Young shoots and culms of bamboo are usually covered by the sheaths.

Bamboo is a commodity in the Maluku Islands, this is mainly woven bamboo (Badan Pusat Statistik Provinsi Maluku, 2021; Badan Pusat Statistik Provinsi Maluku Utara, 2021). In addition, it has been used as fish traps known as *rumpon* (Simbolon et al., 2011), chairs, traditional toys, housing, household utensils, *yanger bitada* (a traditional musical instrument), and ceremonially during the *baramasuen* dance (Baguna et al., 2015). Bamboo uses in daily life has encouraged various studies related to bamboos in the Maluku Islands, such as studies of chemical and anatomical components (Loiwatu & Manuhuwa, 2008), mechanical properties (Loiwatu, 2013), commercial improvement (Baguna et al., 2015), ethnoecological (Sinyo et al., 2017), fertilizer usage from bamboo shoots (Samad et al., 2020), and cultural studies of *baramasuen* (Soamole et al., 2018).

Information on the diversity and distribution of bamboo species in the Maluku Islands, however, is still rarely found. Widjaja et al. (2014) reported that 14 species of bamboo were found in the Maluku Islands. Another two species were later reported (Widjaja, 2019). Currently, we lack data on the distribution of bamboo species and do not have an identification key to the species. Here, we address this knowledge gap. This study can be used in the conservation and management of bamboo species in the Maluku Islands. In addition, this study will aid the completion of data collation for all Indonesian bamboo species.

MATERIALS AND METHODS

This study was conducted in March–April 2021 at Herbarium Bogoriense (BO), National Research and Innovation Agency. Data collection (species name, location, altitude, habitat, vernacular names, collector's name, and collection number) was carried out by studying all bamboo herbarium specimens stored in BO collected in the Maluku Islands. The boundaries of the Maluku Islands in this study are all areas included in the administration of Maluku and North Maluku Provinces of Indonesia (Figure 1), this differs from the phytogeographic area outlined by Steenis-Kruseman (1950) which categorized several islands in Maluku Province located around Nusa Tenggara Timur as belonging to the Lesser Sunda Islands group.

Online scanned images of herbarium specimens collected from the Maluku Islands were also examined on several online database portals, such as BioPortal: Dutch Natural History Collections (https://bioportal.naturalis.nl), GBIF: Global Biodiversity Information Facility (https://www.gbif.org), HerbWeb: Kew Herbarium Catalogue (https://apps.kew.org/herbcat/gotoHomePage.do), iDigBio: National Resource for Advancing Digitization of Biodiversity Collections (https://www.idigbio.org/portal/search), JSTOR: JSTOR's Global Plants (https://plants.jstor.org), POWO: Plants of the World Online, Royal

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Botanic Gardens, Kew (http://powo.science.kew.org), and Tropicos: Missouri Botanical Garden (http://legacy.tropicos.org/ImageSearch.aspx).

All specimens were re-identified following several references (Damayanto & Widjaja, 2016; Dransfield, 1980; Dransfield & Widjaja, 1995b; Ervianti et al., 2019a, Ervianti et al., 2019b; Widjaja, 1987; Widjaja, 1997; Widjaja, 2001b; Widjaja, 2001a; Widjaja, 2020; Widjaja et al., 2005). Accepted names of bamboo were validated according to Vorontsova et al. (2016) and online database portals (Damayanto et al., 2020a). The distribution map was compiled using the online application (http://simplemappr.net). Literature was consulted for additional data. Data were analyzed and presented descriptively. An identification key to the bamboo species in the Maluku Islands was presented.

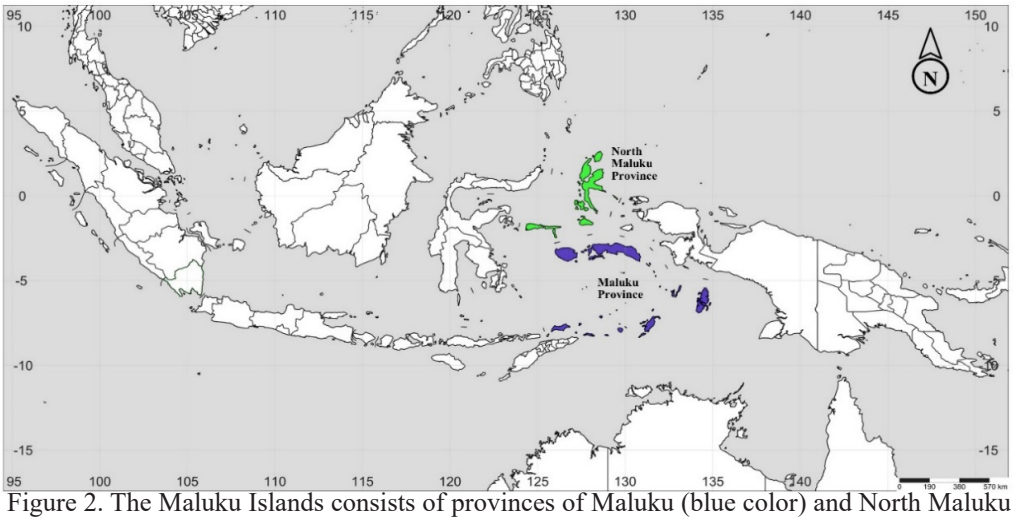

Figure 2. The Maluku Islands consists of provinces of Maluku (blue color) and North Maluku (green color)

RESULTS AND DISCUSSION

One hundred collections from the Maluku Islands were examined. There were 12 species from six genera recorded: *Bambusa maculata* Widjaja, *B. multiplex* (Lour.) Raeusch. ex Schult.f., *B. spinosa* Roxb., *B. vulgaris* Schrad. ex J.C.Wendl., *Dendrocalamus asper* (Schult.f.) Backer, *Gigantochloa atter* (Hassk.) Kurz ex Munro, *G. robusta* Kurz, *Neololeba amahussana* (Lindl.) Widjaja, *N. atra* (Lindl.) Widjaja, *Racemobambos ceramica* S.Dransf., *Schizostachyum brachycladum* (Kurz ex Munro) Kurz, and *S. lima* (Blanco) Merr. The most collected bamboo species was *N. atra* (35 collection numbers) and the least collected were *B. spinosa, G. robusta,* and *R. ceramica* (one collection).

The results from the herbarium specimens above differed from the number of bamboo species reported by Widjaja (2019). Widjaja (2019) reported *B. glaucophylla* Widjaja, *B. tuldoides* Munro, *G. apus* (Schult.f.) Kurz, *G. atroviolacea* Widjaja, *Phyllostachys aurea* (André) Rivière & C.Rivière, and *Thyrsostachys siamensis* Gamble in the Maluku Islands. Bamboo species such as *B. glaucophylla*, *B. tuldoides*, *P. aurea*, and *T. siamensis* were often used as ornamental plants (Widjaja, 2001a) in urban areas so they are rarely collected as herbarium specimens. Similarly, Ervianti et al. (2019) mentioned that *B. glaucophylla*, *B. tuldoides*, *P. aurea*, and *T. siamensis* were distributed in Sulawesi, however,

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there were no herbarium specimens cited.

Widjaja (2019) mentioned (see table of a bamboo species list on page 173) that *G. apus* (written as *G. apus* "Black") was found in the Maluku Islands, however, this bamboo was not mapped (see distribution map on page 78). In contrast, Widjaja (2019) reported that *G. atroviolacea* (written as *G. atroviolaceae*) did not occur in the Maluku Islands (see table of a bamboo species list on page 173), however, this bamboo was recorded around Ambon, Maluku based on the distribution map on page 82. The herbarium specimens of *G. apus* and *G. atroviolacea* collected from the Maluku Islands, unfortunately, were not available at BO or online. *Gigantochloa apus* has been introduced to Central Sulawesi by transmigrants from Java and Bali in 1970 (Widjaja, 1987), so it is suspected that *G. apus* could also have been brought to the Maluku Islands for its usefulness. The lack of bamboo collection in the Maluku Islands is probably the reason for no herbarium specimens of *G. apus*. Similarly, *G. apus* had never been found in Lombok (Widjaja, 1987; Widjaja, 2001b), until recent collecting trips (see Damayanto et al., 2020b; Huzaemah et al., 2016; Mentari et al., 2018; Munawarah et al., 2019; Peneng et al., 2005; Putri et al., 2016). We did not include *G. apus* and *G. atroviolacea* in this study.

Widjaja (2019) reported that *G. robusta* did not occur in the Maluku Islands (see table of a bamboo species list on page 174), however, based on the distribution map on page 96, these species were recorded in the islands of Sula (North Maluku) and Tanimbar (Maluku). We found one specimen of *G. robusta* in BO which was collected from the Tanimbar Islands. In the Malesia phytogeographic region, the Tanimbar Islands were included in the Lesser Sunda Islands (LSI), the islands from Bali to Timor (Steenis-Kruseman, 1950) although the Tanimbar Islands belong to Maluku Province administratively. We therefore include the occurrence of *G. robusta* from Tanimbar as being part of the Maluku Islands.

Sinyo et al. (2017) reported that *Bambusa atra* (vernacular name: *pipe*) and *Bambusa glaucescens* (vernacular name: *cendani*) were found in Tidore, North Maluku. *Bambusa atra,* however, is a synonym for *N. atra* (Vorontsova et al., 2016; Widjaja, 1997), while *B. glaucescens* is a synonym for *B. multiplex* (Dransfield & Widjaja, 1995a; Vorontsova et al., 2016). Thus, based on observations of BO herbarium specimens, online specimens, and literature studies, there are a total of 16 species and eight genera of bamboo found in the Maluku Islands (Table 1).

Table 1. Bamboo diversity in the Maluku Islands

Species	Distribution	Altitudes (m asl)	Vernacular names	Status	References
Bambusa glaucophylla	Maluku Islands	-	-	Cultivated/ ornamental	Widjaja (2019)
Bambusa maculata	North Maluku (Ternate; Tidore; Halmahera)	3–300	*Buluh kuni; tabadiku cino; tabadiku cina*	Cultivated	BO; Baguna et al. (2015); Sinyo et al. (2017); Widjaja (2019)
Bambusa multiplex	Maluku (Ambon; Seram)	530	*Bambu cina*	Cultivated/ ornamental	BO; Widjaja (2019)

Species	Distribution	Altitudes (m asl)	Vernacular names	Status	References
Bambusa spinosa	North Maluku (Ternate; Halmahera, Sula); Maluku (Buru; Seram)	450	*Tabadiku gulau*	Cultivated/ wild	BO; Widjaja (2019)
Bambusa tuldoides	Maluku Islands	-	-	Cultivated	Widjaja (2019)
Bambusa vulgaris	North Maluku (Sula; Ternate; Halmahera); Maluku (Buru; Kei Kecil)	1–450	*Audiga; datapu; gal; galau; tabadiku ake; tabadiku ate; tabadiku bahadi; tabadiku nani; tabadiku sagoe; tabadiku cina*	Cultivated	BO; Widjaja (2019)
Dendrocalamus asper	North Maluku (Ternate; Halmahera; Sula); Maluku (Seram; Yamdena)	6–300	*Tabadiku; tabadiku jawa; tenine*	Cultivated	BO; Loiwatu (2013); Loiwatu & Manuhuwa (2008); Widjaja (2019)
Gigantochloa atter	North Maluku (Ternate; Halmahera); Maluku (Buru; Seram)	50–1100	*Aulato; bambu pagar; buluh pagar; o tongajawa; tabadiku tui*	Cultivated	BO; Widjaja (2019)
Gigantochloa robusta	North Maluku (Sula); Maluku (Tanimbar)	-	-	Cultivated	BO; Widjaja (2019)
Neololeba amahussana	North Maluku (Halmahera); Maluku (Buru; Seram)	100–470	*Wala bua*	Wild	BO; Widjaja (2019)
Neololeba atra	North Maluku (Obi; Ternate; Tidore; Halmahera; Obi); Maluku (Ambon; Buru; Kei Besar; Seram)	2–700	*Bambu loleba; loleba; loleba hitam; loleba putih; lo-leba; ma'man; o todoku ma dorou; tirak walawe; todoku, ute popa; wala'bua; wala'we; we'mo koki iha; we'mo ma dorooe loha; wonomo*	Cultivated/ wild	BO; Sinyo et al. (2017); Widjaja (2019)
Phyllostachys aurea	Maluku Islands	-	-	Cultivated/ ornamental	Widjaja (2019)
Racemobambos ceramica	North Maluku (Seram)	1000–1100	-	Wild	BO; Widjaja (2019)

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Species	Distribution	Altitudes (m asl)	Vernacular names	Status	References
Schizostachyum brachycladum	North Maluku (Ternate; Halmahera; Obi); Maluku (Ambon; Buru; Seram)	50–470	*Acana; amu; bulu; buluh air; buluh nasi jahat; lobahadi; ole*	Cultivated/ ornamental	BO; Loiwatu (2013); Loiwatu & Manuhuwa (2008); Widjaja (2019)
Schizostachyum lima	North Maluku (Ternate; Halmahera); Maluku (Seram)	5–650	*Buluh toi; lo bahadi, lo upa; o tuwiki; sasa; tapile; toei*	Cultivated/ wild	BO; Loiwatu (2013); Loiwatu & Manuhuwa (2008); Widjaja (2019)
Thyrsostachys siamensis	Maluku Islands	-	-	Cultivated/ ornamental	Widjaja (2019)

Remarks: BO = Herbarium Bogoriense; m asl = meters above sea level

Bamboo species were distributed in the Maluku province islands of Buru, Ambon, Seram, Kei Kecil, Kei Besar, Yamdena, and Tanimbar, as well as, in the North Maluku province islands of Ternate, Tidore, Halmahera, Obi, and Sula (Figure 2). There were no distribution points for *B. glaucophylla, B. tuldoides, P. aurea*, and *T. siamensis* in Figure 2 due to no herbarium specimens available at BO or online. The presence of these species in the Maluku Islands is based on Widjaja (2019) that had no specific location information. We expect *B. glaucophylla, B. tuldoides, P. aurea*, and *T. siamensis* to be widely distributed in urban areas in the Maluku Islands since these bamboos are often used as ornamental plants.

The widest distribution of bamboo species in the Maluku Islands is *N. atra* (Figure 2i). In addition, *N. atra* also has a lot of vernacular names which suggests that *N. atra* is well known and used by the local communities. This species (reported as *Bambusa atra*) was reported native to Papua New Guinea, Maluku, and the Sangihe Islands (Widjaja, 1995). *Neololeba atra* has also been planted in Sumatra, Java, and Bali (Widjaja, 2019), and in the botanical gardens of Bogor, Purwodadi, and Bali (Damayanto & Fefirenta, 2021). In contrast to *N. atra*, bamboo *R. ceramica* is endemic to the Maluku Islands (Figure 2j). The only known herbarium specimen of *R. ceramica* (holotype specimen) in BO is a Rutten collection (collection number 2234) from Seram on 18 May 1919 (*see* Dransfield, 1980). In Indonesia, all of these genus members are single island endemic species (Damayanto & Fefirenta, 2021). There are no reports of *R. ceramica* being conserved in botanical gardens in Indonesia (*see* Ariati et al., 2019; Arinasa et al., 2017; Lestarini et al., 2012; Manajemen Koleksi Kebun Raya Indonesia, 2021; Sujarwo et al., 2019).

Neololeba amahussana is also endemic to the Maluku Islands (Widjaja, 2019). This species was initially only found on the islands of Ambon and Seram (Widjaja, 1997), however, based on the BO herbarium specimens *N. amahussana* of G. A. L. de Haan (number 186) which was collected on September 30, 1937, this species was also found in Jailolo District, West Halmahera Regency, North Maluku (Figure 2h). Widjaja (1997) stated that *N. amahussana* had been planted in Bogor Botanical Gardens, West Java in plot XI L 6 (see specimen examined of *N. amahussana*), however this is not reflected in current species lists (*see* Ariati et al., 2019; Manajemen Koleksi Kebun Raya Indonesia, 2021).

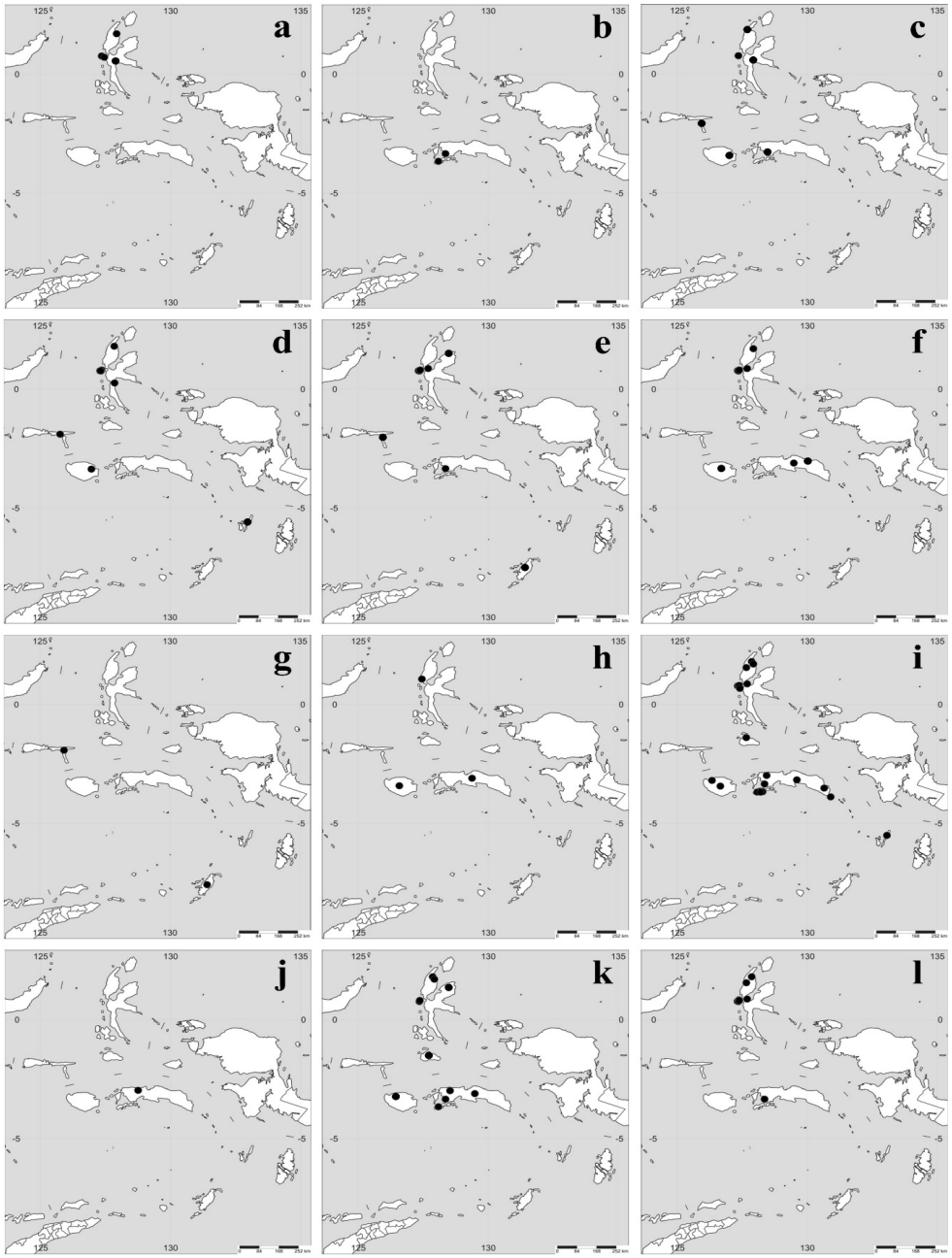

Figure 2. Bamboo species distribution in the Maluku Islands: *Bambusa maculata* (a); *Bambusa multiplex* (b); *Bambusa spinosa* (c); *Bambusa vulgaris* (d); *Dendrocalamus asper* (e); *Gigantochloa atter* (f); *Gigantochloa robusta* (g); *Neololeba amahussana* (h); *Neololeba atra* (i); *Racemobambos ceramica* (j); *Schizostachyum brachycladum* (k); *Schizostachyum lima* (l)

An identification key to the bamboo species in the Maluku Islands can be found below. A brief morphological description habitat, and global distribution of bamboo species in the Maluku Islands are presented in Table 2.

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1a.	Monopodial bamboos; branch complements with only two branches ...	***Phyllostachys aurea***
1b.	Sympodial bamboos; branch complements with several sub-equal branches or one dominant branch and one–several smaller branches	**2**
2a.	Branch complements with several sub-equal branches	**3**
2b.	Branch complements with one dominant branch and one–several smaller branches.....	**4**
3a.	Culms green or yellow with green stripes; culm-sheath blades broadly triangular and erect; culm-sheath auricles small with bristles; culm-sheath ligules entire.....	***Schizostachyum brachycladum***
3b.	Culms green; culm-sheath blades linear to lanceolate and erect first then deflexed; culm-sheath auricles inconspicuous with bristles; culm-sheath ligules short with bristles	***Schizostachyum lima***
4a.	Branch complements pointing up parallel to the culms	**5**
4b.	Branch complements spreading up	**6**
5a.	Culm-sheaths covered with pale hairs; culm-sheath blades narrow; leaf-blades auricles inconspicuous with bristles, ligules denticulate with bristles	***Neololeba amahussana***
5b.	Culm-sheaths covered with white, brown, or black hairs and persistent; culm-sheath blades triangular; leaf-blades auricles small with bristles, ligules entire with bristles	***Neololeba atra***
6a.	Culms scrambling	***Racemobambos ceramica***
6b.	Culms erect	**7**
7a.	Clumps very densely tufted; culms very thick and solid in lower part, greyish-green and usually covered with persistent old culm-sheaths; culm-sheaths covered with white hairs.....	***Thyrsostachys siamensis***
7b.	Clumps closely to densely tufted; culms moderately thick to thick and rarely solid in lower part, green, green with brown spots, green with yellow striped, yellow with green striped, or black and rarely covered with persistent old culm-sheaths; culm-sheaths usually covered with brown to black hairs and rarely white	**8**
8a.	Culms relatively straight; internodes relatively long in the middle part of culm; branch complements usually found above the middle of the culm; culm-sheath blades erect, spreading to deflexed in the middle part of the culm	**9**
8b.	Culms slightly zigzag; internodes relatively short in the middle part of culm; branch complements found just above the ground or above the middle of the culm; culm-sheath blades erect to spreading in the middle part of culm	**11**
9a.	Nodes with aerial roots in the lower to the upper part of culm; young culms covered with velvety golden-brown appressed hairs, later glabrous	***Dendrocalamus asper***
9b.	Nodes with aerial roots only in the lower part of the culm; young culms covered with brown to black hairs, later persistent or glabrous	**10**

10a.	Young culms green, covered with black hairs and later glabrous; culm-sheaths narrowly triangular with truncate apex, covered with black hairs, deciduous but usually lower ones rather persistent; culm-sheath blades lanceolate, deflexed, and deciduous; culm-sheath auricles rounded to slightly curved outward with bristles; leaf-blades glabrous	***Gigantochloa atter***
10b.	Young culms green with yellow stripes in the lower part, covered with brown hairs and later persistent; culm-sheaths deltoid with truncate apex, covered with dark brown hairs, deciduous with age but often long persistent on the lower part of the culm; culm-sheath blades triangular, reflexed; culm-sheath auricles rounded, crisped and joined to the base of the blades with bristles; leaf-blades hairy on the lower surface	***Gigantochloa robusta***
11a.	Culms and branches bearing spines.....	***Bambusa spinosa***
11b.	Culms and branches without spines	**12**
12a.	Leaf-blades green with white stripes	***Bambusa glaucophylla***
12b.	Leaf-blades green without white stripes	**13**
13a.	Culm-sheath auricles rim-like; leaf-blades whitish-green	***Bambusa multiplex***
13b.	Culm-sheath auricles rounded; leaf-blades green	**14**
14a.	Culm-sheaths glabrous, apex asymmetrically arched	***Bambusa tuldoides***
14b.	Culm-sheaths hairy, apex symmetrical arched	**15**
15a.	Young shoots green with yellow stripes; young culms green with yellow stripes; mature culms with green brown spots.....	***Bambusa maculata***
15b.	Young shoots green or yellow, covered with brown to black hairs; young culms green or yellow with green stripes; mature culms green or yellow with green stripes	***Bambusa vulgaris***

Table 2. Morphological description, habitat, and global distribution of bamboo species in the Maluku Islands

Species	Morphological description	Habitat & global distribution
Bambusa glaucophylla	Sympodial, young shoots green. Culms green, slightly zigzag, glabrous when mature. Branching without spines, grow near the ground with one dominant primary branch and several smaller branches. Culm-sheaths deciduous, covered with brown to black hairs; auricles rounded and slightly curved outward with bristles; ligule entire, glabrous or slightly hairy; blades triangular and erect. Leaf-blades green with white stripes, glabrous; auricles rounded and curved outward, glabrous; ligule entire and glabrous.	Cultivated in city parks, gardens, and along the road in dry or humid tropical areas. Distributed in Indonesia [Sumatra, Java, Bali, Kalimantan, Sulawesi, Maluku, Papua, and Lesser Sunda Islands (Widjaja, 2019)], the Malay Peninsula, Borneo (Global Biodiversity Information Facility, 2022), and Singapore (Widjaja, 1997).

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Species	Morphological description	Habitat & global distribution
Bambusa maculata	Sympodial, young shoots green with yellow stripes. Culms green with yellow stripes when young becoming green with brown spots when mature, slightly zigzag. Branching without spines, grow near the ground with one dominant primary branch and several smaller branches. Culm-sheaths persistent to deciduous, glabrous or covered with dark hairs; auricles rounded and curved outward with bristles; ligule entire and glabrous; blades triangular and erect to spreading. Leaf-blades green, glabrous; auricles inconspicuous, glabrous; ligule denticulate, glabrous.	Found in dry areas with nutrient-poor soils. Only found in Indonesia; Sumatra, Java, Sulawesi, Maluku (Widjaja, 2019), Bali (Arinasa & Peneng, 2013; Widjaja et al., 2005), Lombok (Damayanto, Rustiami, et al., 2020), Sumbawa, and Sumba (Widjaja, 2001b).
Bambusa multiplex	Sympodial, young shoots green and glabrous. Culms green or yellow, slightly zigzag. Branching without spines, grow near the ground with one dominant primary branch hardly prominent and sub-equal several branches. Culm-sheaths deciduous and glabrous; auricles rim-like or inconspicuous with bristles; ligule irregularly toothed and glabrous; blades triangular and erect. Leaf-blades green, usually at the end of a branch, slightly hairy on the lower surface; auricles small with bristles; ligule irregularly toothed.	Found in the sub-tropics and tropics in dry or humid areas. Distributed in Indonesia [Sumatra, Java, Kalimantan, Sulawesi, Maluku, Papua, Bali (Widjaja, 2019): Lombok (Damayanto, Rustiami, et al., 2020), Sumbawa, Flores, and Timor (Widjaja, 2001b)], China to Indo-China, Himalaya, Hainan, Myanmar, Nepal, Taiwan, Bangladesh, Bismarck, South America, Cuba, Dominican Republic, Florida, Haiti, Iraq, Jamaica, Japan, Madagascar, Mauritius, Mexico, New Zealand, Pakistan, Puerto Rico, Seychelles, Sri Lanka, Trinidad-Tobago, and Windward (Plants of the World Online, 2022a).
Bambusa spinosa	Sympodial, young shoots yellowish green, covered with scattered black hairs, sometimes green with yellow stripes in the culm-sheath. Culms green, slightly zigzag. Branches bearing stout straight or curved spines, grow near the ground with one dominant primary branch and several smaller branches. Culm-sheaths deciduous; auricles small on either side of the base of the blade, bearing bristles; ligule with bristles in the outer parts; blades narrowly lanceolate, erect in basal and apical sheaths, spreading to deflexed in middle sheaths. Leaf-blades green; auricles small with few bristles; ligule truncates with short bristles.	Found in dry or humid areas, riverbanks, and on acidic soils. Distributed in Indonesia [Sumatra, Java, Kalimantan, Sulawesi, Maluku, Papua, Bali, and Lesser Sunda Islands (Widjaja, 2019)], Bangladesh, China, Indo-China, Nansei-shoto, Puerto Rico, Taiwan, Thailand, Malay Peninsula (Plants of the World Online, 2022b), and Philippines (Roxas, 1995).
Bambusa tuldoides	Sympodial, young shoots green, glabrous or covered with brown to black hairs. Culms green, slightly zigzag, internodes inflated when in the dry areas. Branching without spines, grow near the ground with one dominant and several smaller branches. Culm-sheaths deciduous, glabrous, apex asymmetrically arched; auricles prominent with bristles; ligule densely fringed, glabrous; blades triangular and erect. Leaf-blades green; auricles small or inconspicuous with bristles; ligule entire and glabrous.	Cultivated in lowland, highland, and dry areas. Distributed in Indonesia [Sumatra, Kalimantan, Java, Sulawesi, Maluku, Papua, Bali, and Lesser Sunda Islands (Widjaja, 2019)], China, Laos, Malay Peninsula, Myanmar, Vietnam, Bangladesh, South America, Cuba, El Salvador, Mexico, Nansei-shoto, Puerto Rico, and Trinidad-Tobago (Plants of the World Online, 2022c).

Species	Morphological description	Habitat & global distribution
Bambusa vulgaris	Sympodial, young shoots green or yellow, covered with brown to black hairs. Culms green with or without inflated internodes in the lower part or yellow with green stripes, slightly zigzag. Branching without spines, grow near the ground with one dominant primary branch and several smaller branches. Culm-sheaths deciduous, covered with dark brown to black hairs; auricles rounded and curved outward with bristles; ligule toothed with short bristles; blades broadly triangular and erect. Leaf-blades green; auricles small with few bristles; ligule entire or sub-entire.	Cultivated in dry and humid areas, riverbanks, and gardens. Distributed in Indonesia [Sumatra, Kalimantan, Java, Sulawesi, Maluku, Papua, Bali, and Lesser Sunda Islands (Widjaja, 2019)], China to Indo-China, Myanmar, Thailand, Malaysia, Aldabra, Andaman, Ascension, Assam, Bangladesh, Benin, Bismarck, South America, Burkina, Cameroon, Caroline, Cayman, Chagos, Comoros, Cook, Costa Rica, Cuba, Dominican Republic, Himalaya, El Salvador, Florida, Ghana, Guatemala, Haiti, Hawaii, Honduras, India, Ivory Coast, Jamaica, Leeward, Libya, Madagascar, Maldives, Mali, Mauritius, Mexico, Nansei-shoto, New Guinea, Nicaragua, Nicobar, Nigeria, Ogasawara-shoto, Panamá, Puerto Rico, Rodrigues, Rwanda, Réunion, Seychelles, Sierra Leone, South Carolina, Sri Lanka, Togo, Tonga, Trinidad-Tobago, Wallis-Futuna, Windward, and Zaïre (Plants of the World Online, 2022d).
Dendrocalamus asper	Sympodial, young shoots purplish black, covered with velvety brown to black hairs. Culms green, dark green, purplish green or greyish green, when young covered with velvety golden-brown appressed hairs, later glabrous, aerial root appears from the base to the upper part of the culm. Branching without spines with a dominant primary branch and several smaller branches. Culm-sheaths deciduous and covered with velvety dark brown to black hairs; auricles prominent and sometimes crimped with bristles; ligule irregularly toothed with bristles; blades lanceolate, erect first and later deflexed. Leaf-blades green; auricles small or absent and glabrous; ligule entire.	Cultivated in dry and humid areas in lowland and highland. Distributed in Indonesia [Sumatra, Kalimantan, Java, Sulawesi, Maluku, Papua, Bali, and Lesser Sunda Islands (Widjaja, 2019)], Andaman, Bangladesh, China, Laos, Malay Peninsula, Myanmar, New Guinea, Philippines, Taiwan, Thailand, Vietnam, Bismarck, Brazil, Colombia, Ecuador, Puerto Rico, and Sri Lanka (Plants of the World Online, 2022d).
Gigantochloa atter	Sympodial, young shoots green or purplish-green, covered with black hairs. Culms bluish green to dark green with distinct pale rings on the nodes, covered with scattered black hairs when young, becoming glabrous when mature, aerial root appears only in the base part of the culm. Branching without spines, with one dominant primary branch and several smaller branches. Culm-sheaths deciduous, covered with black hairs; auricles rounded or rounded with curved outward with bristles; ligule toothed and glabrous; blades lanceolate, deciduous and deflexed. Leaf-blades green; auricles small and glabrous; ligule entire and glabrous.	Found in open valley forest on limestone, in dry and humid areas in lowland or highland areas. Distributed in Indonesia [Sumatra, Kalimantan, Java, Sulawesi, Maluku, Papua, Bali, and Lesser Sunda Islands (Widjaja, 2019)], Laos, New Guinea, Philippines, and Vietnam (Plants of the World Online, 2022e).

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Species	Morphological description	Habitat & global distribution
Gigantochloa robusta	Sympodial, young shoots brownish green covered with brown to black hairs. Culms light green to yellowish with yellow stripes in the lower part, aerial root appears only in the base part of the culm. Branching without spines, with one dominant primary branch and several smaller branches. Culm-sheaths deciduous with age, covered with black hairs; auricles rounded and usually crisped with bristles; ligule toothed with bristles; blades triangular and deflexed. Leaf-blades green; auricles rim-like with bristles; ligule toothed with bristles.	Found in tropical dry and humid areas in secondary forest and cultivated in the gardens. Only known from Indonesia: Sumatra, Java, Kalimantan, Bali, and Maluku (Widjaja, 2019).
Neololeba amahussana	Sympodial, culms erect at the base and then scrambling. Branching without spines, with one dominant primary branch elongated and one to several smaller sub-equal branches, branching in the upper part of culm. Culm-sheaths covered with pale hairs; auricles rounded with easily broken bristles; ligule with easily broken bristles; blades narrow and erect. Leaf-blades green, glabrous; auricles inconspicuous with bristles; ligule toothed with bristles.	Occurred in lowland areas. Endemic to Indonesia, Maluku (Widjaja, 2019). However, this species was reportedly introduced and cultivated in the botanical gardens of Java and India [based on specimen examined by Widjaja (1997)], as well as, introduced to the Andaman Islands (Plants of the World Online, 2022f) and Vietnam (Vorontsova et al., 2016).
Neololeba atra	Sympodial, young shoots green to purplish green covered with white to brown hairs. Culms erect, straight, and green; young culms with white to brown hairs and glabrous with age. Branching without spines, with one dominant branch and one to two smaller branches, branching only in the upper part of culm. Culm-sheaths persistent, covered with white or brown hairs; auricles rounded with long bristles; ligule irregular toothed with bristles; blades triangular with cordate base and erect. Leaf-blades green; auricles rounded with long bristles; ligule laciniate with bristles.	Found on riverbanks, cultivated in gardens and in wet tropical areas. Distributed in Indonesia [Sumatra, Java, Bali, Sulawesi, Maluku, and Papua (Widjaja, 2019)], Bismarck, New Guinea, Philippines, Queensland (Vorontsova et al., 2016), Andaman, Assam, Myanmar (Plants of the World Online, 2022g), and several botanical gardens in India (Widjaja, 1997).
Phyllostachys aurea	Monopodial, young shoots green with spotted. Culms erect, straight, and green when young, golden-yellow when older, bellow the nodes white powdery waxy. Branching without spines, with two unequal branches. Culm-sheaths easily deciduous, covered with white hairs and brown spots; auricles inconspicuous; ligule with bristles; blades lanceolate to narrowly lanceolate and erect or spreading. Leaf-blades green; auricles inconspicuous with bristles; ligule glabrous.	Found in highland areas. Distributed in Indonesia [Sumatra, Kalimantan, Java, Bali, Sulawesi, Maluku, Papua, and Lesser Sunda Islands (Widjaja, 2019)], China to Vietnam, Spain, Cameroon, Transcaucasus, Nansei-shoto, Himalaya, New South Wales, Queensland, South Australia, Kermadec, New Zealand North, North America, Mexico, and Brazil (Vorontsova et al., 2016).
Racemobambos ceramica	Sympodial, scrambling. The upper part of culms smooth, hollow with thin wall. Branching glabrous without spines, with one dominant lateral branch and several smaller branches. Culm-sheaths not available. Leaf-blades green and glabrous; auricles short with bristles; ligule short.	Occurred in highland forests at an altitude of 1000–1100 m asl. Endemic to Maluku, Indonesia (Widjaja, 2019).

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Species	Morphological description	Habitat & global distribution
Schizostachyum brachycladum	Sympodial, young shoots yellowish-green or yellow, covered with brown hairs. Culms erect, straight, green or yellow with green stripes. Branching without spines, with several sub-equal slender branches. Culm-sheaths persistent or sometime deciduous, covered with light brown to brown hairs; auricles small with bristles; ligule entire and glabrous; blades broadly triangular and erect. Leaf-blades green or sometimes green with yellow strips; auricles small with long bristles; ligule short and glabrous.	Cultivated in the city, gardens in humid and dry areas in lowlands and highlands. Distributed in Indonesia [Sumatra, Kalimantan, Java, Bali, Sulawesi, Maluku, Papua, Lesser Sunda Islands (Widjaja, 2019)], Indo-China, Malaysia, and Philippines (Vorontsova et al., 2016).
Schizostachyum lima	Sympodial, young shoots green, covered with brown hairs. Culms erect and green. Branching without spines, with several sub-equal slender branches. Culm-sheaths persistent, covered with brown to dark brown hairs; auricles not prominent with bristles; ligule short with bristles; blades narrowly lanceolate, deflexed. Leaf-blades green; auricles inconspicuous with bristles; ligule irregularly toothed.	Found in secondary forests, gardens, and agricultural areas. Distributed in Indonesia [Sulawesi, Maluku, Papua, Lesser Sunda Islands (Widjaja, 2019)], Philippines, New Guinea, Solomon, and Bismarck (Vorontsova et al., 2016).
Thyrsostachys siamensis	Sympodial, young shoots pale green to purplish green, glabrous. Culms erect, pale green to greyish green, covered with persistent old culm-sheaths. Branching without spines, grow from mid-culm nodes upwards with a dominant primary branch and several smaller branches. Culm-sheaths persistent, covered with wax; auricles inconspicuous or very small and glabrous; ligule entire and glabrous; blades narrowly triangular, deciduous, and erect. Leaf-blades linear, pale green; auricles inconspicuous and glabrous; ligule entire and glabrous.	Cultivated in gardens, along the road, city parks, in lowland to highland areas. Distributed in Indonesia [Sumatra, Kalimantan, Java, Sulawesi, Maluku, Papua, Bali, Lesser Sunda Islands (Widjaja, 2019)], China to Indo-China, Bangladesh, Sri Lanka, Myanmar, Thailand, and Malaysia (Vorontsova et al., 2016).

Bamboo species of the Maluku Islands grow at an altitude of 1–1100 m above sea level (asl). *Gigantochloa atter* species has the widest range of elevations (50–1100) m asl, followed by *N. atra* (2–700 m asl) and *S. lima* (5–650 m asl). Meanwhile, *B. multiplex* and *B. spinosa* were only known to grow at an altitude of 530 and 450 m asl, respectively. *Racemobambos ceramica* grows at an altitude of 1000–1100 m asl. These bamboos were found in primary and secondary forests, limestone, peatland edges, city parks, and cultivated in gardens.

CONCLUSION

There are 16 species and eight genera of bamboo in the Maluku Islands: *Bambusa glaucophylla, B. maculata, B. multiplex, B. spinosa, B. tuldoides, B. vulgaris, Dendrocalamus asper*, *Gigantochloa atter, G. robusta, Neololeba amahussana, N. atra, Phyllostachys aurea, Racemobambos ceramica, Schizostachyum brachycladum, S. lima*, and *Thyrsostachys siamensis*. These bamboo were found in Maluku Province (Buru, Ambon, Seram, Kei Kecil, Kei Besar, Yamdena, and Tanimbar) and North Maluku Province (Ternate, Tidore, Halmahera, Obi, and Sula) at an altitude of 1–1100 m asl in primary and secondary forest, limestone, peatland edges, city parks, and gardens.

AUTHOR CONTRIBUTION

I.P.G.P.D. designed research, validated the specimens, analyzed the data and wrote the manuscript. Y.R. and D.R. collected the

data, compiled the references, and wrote the manuscript.

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CONFLICT OF INTEREST

We declare that there is no conflict of interest regarding the publication of this paper.

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