

A synopsis of Bambusoideae (Poaceae) in Lombok, Indonesia

I PUTU GEDE P. DAMAYANTO^{1,2,*}, HIMMAH RUSTIAMI², MIFTAHUDIN³, TATIK CHIKMAWATI^{3,**}

¹Plant Biology Graduate Program, Department of Biology, Institut Pertanian Bogor. Jl. Raya Dramaga, Kampus IPB Dramaga, Bogor 16680, West Java, Indonesia. Tel.: +62-251-8622642, *email: parlida.damayanto.tab@gmail.com

²Herbarium Bogoriense, Botany Division, Research Center for Biology, Indonesian Institute of Sciences. Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor 16911, West Java, Indonesia

³Department of Biology, Institut Pertanian Bogor. Jl. Raya Dramaga, Kampus IPB Dramaga, Bogor 16680, West Java, Indonesia. Tel.: +62-251-8622642. **email: tchikmawati@gmail.com

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Abstract. Damayanto IGP, Rustiami H, Miftahudin, Chikmawati T. 2020. A Synopsis of Bambusoideae (Poaceae) in Lombok, Indonesia. *Biodiversitas* 21: 4489-4500. There is little documentation of bamboo on Lombok. Non-native Indonesian bamboos have been reported occurring in Lombok. As such, suspicious bamboo specimens and information in those reports need to be examined and possibly re-determined. This study aimed to provide updated taxonomical information of bamboo species in Lombok and to investigate the accuracy of previous studies regarding the existence of several non-native Indonesian bamboo species on the island (i.e. they do not have original distribution in Indonesia). Data from fieldwork were combined with specimens in Herbarium Bogoriense to create a synopsis of bamboo in Lombok and to develop an identification key to the species. Eleven species of bamboos in Lombok were reported from this study, namely *Bambusa glaucophylla*, *B. maculata*, *B. multiplex*, *B. spinosa*, *B. vulgaris*, *Dendrocalamus asper*, *Gigantochloa apus*, *G. atter*, *Schizostachyum brachycladum*, *S. lima*, and *Thyrsostachys siamensis*. Several doubtful species (*B. albustriata*, *B. ventricosa*, *Guadua angustifolia*, *S. jaculans*, *Pseudosasa japonica*) were presented to clarify the existence of a non-native Indonesian bamboo in Lombok. Moreover, there is not enough evidence to state *Dinorchloa* sp. occurred in Lombok. The results of this study can be used by stakeholders for bamboo identification and as the baseline taxonomic account for future studies and conservation of bamboo species in Lombok.

Keywords: Bamboo, diversity, identification key, Indonesia, Lombok

Abbreviations: BM: The Natural History Museum, BO: Herbarium Bogoriense, GOET: Herbarium of Universität Göttingen, K: Kew Herbarium, L: Naturalis Biodiversity Center, Nationaal Herbarium Nederland, M: Herbarium of Botanische Staatssammlung München, P: Muséum National d'Histoire Naturelle, US: United States National Herbarium

INTRODUCTION

Lombok is an island in the Lesser Sunda archipelago, flanked by the islands of Bali and Sumbawa. The island is administratively located in West Nusa Tenggara Province, Indonesia. Many parts of the island have mountainous terrain with the highest point is Mt. Rinjani with an altitude of 3726 meters above sea level (m asl.) (BPSPNTB 2018). From the ecoregion perspective, Lombok is categorized as seasonally dry tropics. The ecology of Lombok's seasonal and mountainous landscapes lacks investigation (Brearley et al. 2019). Likewise, the flora is not widely studied, reflected by little documentation of the island's bamboo diversity.

Botanical exploration in Lombok began in 1845. Steenis-Kruseman (1950) reported that many researchers had explored Lombok, such as MacGillivray in 1845, Zollinger in 1846, Wallace in 1856, Kesslitz in 1886, Koorders in 1894, Vorderman in 1894, Everett in 1896, Bosse in 1899, Fairchild in 1900, Ernst in 1906, Elbert in 1909, Kawakami in 1911, Toxopeus in 1921, Tengwall in 1925, Rensch-Maier in 1927, Straelen in 1929, Voogd in 1933-1936, Veen in 1936, Bloembergen in 1939 and

Botma in 1947. Despite these explorations, bamboo diversity in Lombok has not been well documented (Voogd 1941; Tobe et al. 2010).

Bamboos belong to the family Poaceae and subfamily Bambusoideae. Bamboo has two types of stems namely rhizomes which are located underground and culms which are located aboveground (Wong 2004), in which both stem types have nodes. The culms of bamboo generally grow erect, but some others climb or scramble (Judziewicz et al. 1999). The culms are generally cylindrical and hollow, but some are rectangular and solid or narrowly hollow (Widjaja 2001a). The branches generally grow above or to the right at the nodes of the culm (Widjaja 2001b), some also grow under the nodes (Wong and Dransfield 2016). Bamboo culm-sheath consists of blades, auricles, and ligules which vary in shape and size. The inflorescence is very rarely found and some bamboo flower once every 150 years (Janzen 1976). The base unit of a bamboo inflorescence is known as a pseudospikelet, consisting of one to several single flowers. Each flower consists of lemma, palea, stamens, and pistils (Judziewicz et al. 1999), and some species have one to three lodicules (Wong 2004).

Table 1. Bamboo diversity studies in certain area of Lombok, West Nusa Tenggara Province, Indonesia

Location	Numbers of species found	References
Central Lombok	14	Peneng et al. (2005)
Tiu Pupus riverbank, North Lombok	9	Huzaemah et al. (2016)
Meninting riverbank, West Lombok	8	Putri et al. (2016)
Senaru forest, North Lombok	5	Rini et al. (2017)
Kedome riverbank, East Lombok	5	Mentari et al. (2018)
Senggigi, West Lombok	5	Rizkillah (2018)
Peak of Mt. Pujut, Mandalika, Central Lombok	1	Susan et al. (2018)
Semoya riverbank, West Lombok	7	Munawarah et al. (2019)
Keremit riverbank, East Lombok	7	Santi et al. (2019)

Bamboo fruit can be a caryopsis or bacoid (Judziewicz et al. 1999). Bamboo naturally occurs in all continents except Europe and Antarctica (Clark et al. 2015). There are 1670 species and 125 genera of bamboo in the world (Soreng et al. 2017). Among these, 176 species of 24 genera are found in Indonesia (Widjaja 2019). The first report of bamboo diversity in Lombok was by Prawiroatmodjo and Padmono in 1976. Several years later, Widjaja (2001a) published a guidebook of bamboos in the Lesser Sunda Islands. Widjaja (2001a) reported six species of bamboos in Lombok. Based on a checklist of Lombok flora (Rustiami and Sulistyaningsih 2020), there is only one

bamboo species (*Bambusa vulgaris*) that occurred in Lombok. Several bamboo studies have been carried out locally in Lombok (Table 1).

This study aimed to provide updated taxonomical information of bamboo species in Lombok and to investigate the accuracy of previous studies regarding the existence of several non-native Indonesian bamboo species in the island (i.e. they do not have original distribution in Indonesia). This investigation is important as some studies mentioned bamboo species that have never been officially reported occurring in Lombok or even in Indonesia, for example, *Bambusa ventricosa* (Peneng et al. 2005), *Guadua angustifolia*, *Schizostachyum jaculans* (Putri et al. 2016; Huzaemah et al. 2016; Santi et al. 2019) and *Pseudosasa japonica* (Rizkillah 2018). Therefore, those specimens need to be examined and possibly re-determined. The results of this study can be used by stakeholders for bamboo identification and as the baseline taxonomic account for future studies and conservation of bamboo species in Lombok.

MATERIALS AND METHODS

Study period and area

Fieldwork was conducted in March 2018 and November 2019 in Lombok Island, West Nusa Tenggara Province, Indonesia. Geographically, Lombok Island was located at 8°13'34.8" S to 8°56'47.7" S and 115°49'40.6" E to 116°43'12.1" E with an altitude of 0-3726 m. Several areas with chances of finding bamboos were visited (Table 2 and Figure 1).

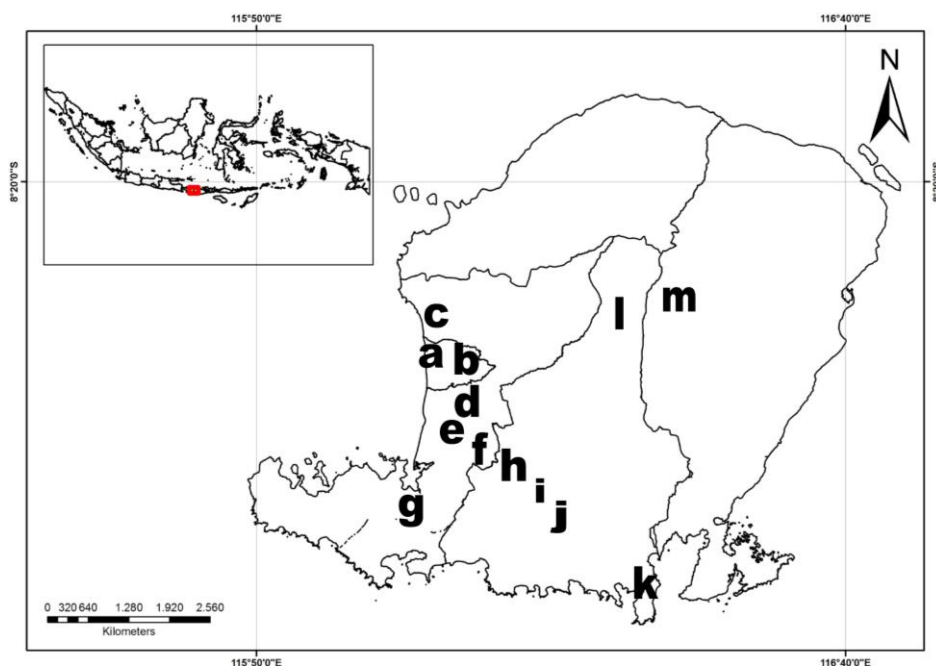


Figure 1. The locations (villages) of the fieldwork in Lombok Island, West Nusa Tenggara, Indonesia. A. Dayan Peken, B. Cakranegara, C. Meninting, D. Bagik Polak, E. Beleke, F. Kuripan, G. Marije, H. Sukarana, I. Tanak Awu, J. Batubolong, K. Mertak, L. Wajagesang, M. Kembang Kuning

Table 2. The locations of the fieldwork in Lombok Island, West Nusa Tenggara, Indonesia

Location			Coordinate	Altitude (m asl.)	Major surrounding landscape
District	Sub-district	Village			
Central Lombok	Jongat	Sukarana	8°41'57.9" S, 116°12'09.2" E	80-100	Paddy field and settlement
Central Lombok	Pujut	Mertak	8°53'38.0" S, 116°21'59.0" E	15-100	Secondary forest
Central Lombok	Pujut	Tanak Awu	8°45'52.4" S, 116°15'46.7" E	90-100	Paddy field and settlement
Central Lombok	Southwest Praya	Batubolong	8°42'41.4" S, 116°12'50.0" E	80-90	Paddy field and settlement
Central Lombok	Kompang	Wajagesang	8°36'00.5" S, 116°22'11.5" E	380-500	Bamboo garden
East Lombok	Sikur	Kembang Kuning	8°31'57.9" S, 116°25'30.6" E	670-700	Bamboo garden
Mataram	Ampenan	Dayan Peken	8°34'22.3" S, 116°04'41.8" E	10-15	Settlement
Mataram	Mataram	Cakranegara	8°35'04.8" S, 116°07'30.8" E	25-35	Settlement
West Lombok	Labu Api	Bagik Polak	8°38'08.7" S, 116°07'34.6" E	20-30	Bamboo garden
West Lombok	Kuripan	Kuripan	8°40'21.1" S, 116°10'16.9" E	30-40	Paddy field and settlement
West Lombok	Gerung	Beleke	8°39'35.5" S, 116°07'50.6" E	20-25	Paddy field and settlement
West Lombok	Batu Layar	Meninting	8°33'16.0" S, 116°04'32.0" E	5-10	River
West Lombok	Lembar	Marije	8°47'28.0" S, 116°03'11.0" E	200-250	Shrubs and dry field

Procedures

The method of collection of bamboo prescribed by McClure (1945) and Rugayah et al. (2004) and collection of herbarium specimens by Djarwaningsih et al. (2002) was followed. Since bamboos are rarely flowering (Janzen 1976), the sterile material was also collected. Supporting data was recorded and photographs of the fresh specimens were taken. All specimens were stored in the Herbarium Bogoriense (BO), Research Center for Biology, Indonesian Institute of Sciences (LIPI).

The specimens were then identified by matching with BO specimens and using literature on the bamboo of the Lesser Sunda Islands (i.e. Soenarko 1977; Dransfield 1996; Dransfield and Widjaja 1995; Wong 1995; Widjaja 1987, 1997, 2001a, b; Widjaja et al. 2004, 2005; Damayanto and Widjaja 2016). Observations of BO specimens were also carried out from other locations (if needed).

Data analysis

Morphological characters were analyzed and described descriptively. From these sources, a synopsis of bamboo in Lombok was created and arranged alphabetically. An identification key to the species was developed. Herbarium abbreviation followed Holmgren et al. (1981) and Girmansyah et al. (2006, 2018) or website sweetgum.nybg.org. The accepted status of every species names was determined by following Vorontsova et al. (2016) or websites such as ipni.org, powo.science.kew.org, tropicos.org, etc. Distribution map of the bamboo in Lombok was also produced from this study.

RESULTS AND DISCUSSION

Results

In this study, we recorded 11 species of bamboo found in Lombok Island: *Bambusa glaucophylla*, *B. maculata*, *B. multiplex*, *B. spinosa*, *B. vulgaris*, *Dendrocalamus asper*, *Gigantochloa apus*, *G. atter*, *Schizostachyum brachycladum*, *S. lima*, and *Thyrsostachys siamensis*.

Identification key to the bamboo species of Lombok

- 1 a. Branch complements with several sub-equal slender branches 2
- b. Branch complements with a dominant primary branch and several smaller branches 3
- 2 a. Culm internodes more than 50 cm long, green; culm-sheaths blade narrowly lanceolate and deflexed, auricles not prominent (<1 mm)..... *Schizostachyum lima*
- b. Culm internodes less than 50 cm long, bluish-green or golden-yellow with narrow green stripes; culm-sheaths blade broadly triangular and erect, auricles prominent (1 cm)... *Schizostachyum brachycladum*
- 3 a. Culm-sheaths covered with white hairs *Thyrsostachys siamensis*
- b. Culm-sheaths glabrous or covered with light brown to black hairs 4
- 4 a. Branches bearing spines..... *Bambusa spinosa*
- b. Branches without spines..... 5
- 5 a. Culms slightly zigzag..... 6
- b. Culms relatively straight/erect 9
- 6 a. Culm-sheaths glabrous; leaves usually at the end of a branch *Bambusa multiplex*
- b. Culm-sheaths covered with light brown to black hairs; leaves spreading over the branch 7
- 7 a. Culms up to 5 m high, 1.5-2.5 cm in diameter; leaves green with white stripes along the main nerve *Bambusa glaucophylla*
- b. Culms 15-20 m high, 4-9 cm in diameter; leaves green without white stripes 8
- 8 a. Young shoots green with yellow stripes on the sheath; culms green with yellow stripes when young, becoming green with brown spots when mature..... *Bambusa maculata*
- b. Young shoots green or yellow; culms green with or without inflated internodes in the lower part or yellow with green stripes..... *Bambusa vulgaris*
- 9 a. Culms covered with wax when young; aerial root appears from the base to the upper part of the culm *Dendrocalamus asper*
- b. Culms without covered with wax when young; aerial root appears only in the base part of the culm 10

- 10 a. Young shoots green; auricles of culm-sheaths rim-like, 1-3 mm high *Gigantochloa apus*
 b. Young shoots purplish green; auricles of culm-sheaths rounded or rounded with curved outward, 3.5-7 mm high *Gigantochloa atter*

Synopsis of bamboo in Lombok

***Bambusa glaucophylla* Widjaja**, Reinwardtia 11(2): 59 (1997). Type: Indonesia. Kedung Halang, Bogor, Java, E.A. Widjaja s.n. (holotype: BO!; Isotype K, L). Figure 2.A.

Description. Young shoots green. Culms up to 5 m high with erect tips, slightly zigzagged, green, glabrous when mature, internodes 20-25 cm long, 1.5-2.5 cm diameter. Branches grow near the ground with a dominant primary branch and several smaller branches, without spines. Culm-sheaths deciduous, covered with brown to black hairs; auricles rounded and slightly curved outward, about 2 mm high, bristles 2-3 mm long; ligule entire, glabrous or slightly hairy; blade triangular and erect. Leaves 5-12 × 1-1.5 cm, green with white stripes along the main nerve, glabrous; auricles rounded and curved outward, glabrous; ligule entire and glabrous.

Habitat and ecology. Cultivated in the home yard at an altitude of 15–90 m. Also found in wet or dry areas (Widjaja 2001a) in gardens, a city park (Widjaja 1997), and a riverbank (Huzaemah et al. 2016).

Distribution in Lombok. Southwest Praya, Central Lombok; Mataram (Widjaja 2001a); Gangga, North Lombok (Huzaemah et al. 2016) (Figure 3).

Vernacular names. *Bambu putih* (Indonesia) (Widjaja 2001a), *santong hias* (Sasak Bayan) (Huzaemah et al. 2016), *bambu hias* (Central Lombok).

Uses. This bamboo is used for hedges or as an ornamental plant.

Specimen examined. Indonesia: Lombok, Central Lombok District, Jongat Sub-distrik, Sukarana Village, 8°41'57.9" S, 116°12'09.2" E, 30 November 2019, I.P.G.P. Damayanto 1047 (BO).

***Bambusa maculata* Widjaja**, Reinwardtia 11(2): 63 (1997). Type: Indonesia. Moluccas, Tongde Village, South Ternate, E.A. Widjaja 4881 (holotype: BO!; Isotype K, L, US). Figure 2.B.

Description. Young shoots green with yellow stripes. Culms up to 15 m high, slightly zigzagged, green with yellow stripes when young becoming green with brown spots when mature, internodes 30-35 cm long, 4-7 cm in diameter. Branches with a dominant primary branch and several smaller branches, without spines. Culm-sheaths persistent to deciduous, glabrous or covered with dark hairs; auricles rounded and curved outward, up to 5.5 mm high, bristles up to 15 mm long; ligule entire, glabrous; blade triangular, erect to spreading. Leaves-blades 22.5-37.5 × 1-4.5 cm, green, glabrous; auricles inconspicuous, glabrous; ligule denticulate, up to 1 mm high, glabrous.

Habitat and ecology. Cultivated in dry areas in lowlands (Widjaja 1997, 2001a, b) and around riverbanks (Putri et al.

2016; Munawarah et al. 2019) at an altitude of 20-340 m (Huzaemah et al. 2016; Mentari et al. 2018).

Distribution in Lombok. Mataram (Widjaja 2001a); Batukliang, Central Lombok (Peneng et al. 2005); Gangga, North Lombok (Huzaemah et al. 2016); Keruak, East Lombok (Mentari et al. 2018); Batu Layar (Putri et al. 2016) and Gunung Sari (Munawarah et al. 2019), West Lombok (Figure 3).

Vernacular names. *Bambu tutul* (Sasak Bayan) (Huzaemah et al. 2016) or *treng borek* (Batukliang) (Peneng et al. 2005).

Specimen examined. There was no specimen available, however, the evidence of the existence of this bamboo in Lombok can be seen in Huzaemah et al. (2016), Mentari et al. (2018) and Munawarah et al. (2019).

***Bambusa multiplex* (Lour.) Raeusch. ex Schult.f.**, Syst. Veg. 7(2): 1350 (1830). Type: Vietnam. Anon. s.n. (holotype P). Figure 2.C.

Description. Young shoots green and glabrous. Culms up to 7 m high with arching tips, slightly zigzagged, green or yellow, internodes 30-50 cm long, 1-2.5 cm in diameter. Branches grow near the ground with sub-equal several branches and a dominant primary branch hardly prominent, without spines. Culm-sheaths deciduous and glabrous; auricles rim-like or inconspicuous with bristles up to 3 mm long; ligule irregularly toothed and glabrous; blade triangular and erect. Leaves-blades 5-12 × 0.5-1.5 cm, usually at the end of a branch, green, slightly hairy on the lower surface; auricles small, bristles up to 5 mm long; ligule irregularly toothed.

Habitat and ecology. Grows along the riverbank (Huzaemah et al. 2016; Putri et al. 2016), near roads and cultivated in cities at an altitude of 15–335 m.

Distribution in Lombok. Mataram City; Kuta and Praya, Central Lombok (Peneng et al. 2005); Gangga, North Lombok (Huzaemah et al. 2016); Batu Layar, West Lombok (Putri et al. 2016) (Figure 3).

Vernacular names. *Treng cina* (Peneng et al. 2005), *santong hias cina* (Sasak Bayan) (Huzaemah et al. 2016), *bambu cina* (Indonesia) (Widjaja 2001a, b), or *bambu hias* (Mataram).

Specimens examined. Indonesia: Lombok, along the road from Kuta to Mataram, 8°51'22.5" S, 116°11'05.5" E, 20 February 2005, H. Tobe & N. Utami Tobe 1251 (BO); Lombok, Mataram City, Ampenan Sub-distrik, Dayan Peken, Near Ampenan River, 8°34'22.3" S, 116°04'41.8" E, 30 November 2019, I.P.G.P. Damayanto 1053 (BO).

***Bambusa spinosa* Roxb.**, Hort. Bengal.: 25 (1814). Type: India (probably). *Roxburgh s.n.* (BM). Figure 2.D.

Description. Young shoots yellowish-green, covered with scattered black hairs, sometimes green with yellow stripes in the culm-sheath. Culms up to 25 m high, slightly zigzagged, green, internodes 25-30 cm long, 5-10 cm in diameter. Branches grow near the ground with a dominant primary branch and several smaller branches, bearing stout straight or curved spines. Culm-sheaths deciduous; auricles on either side of the base of the blade, up to 5 mm high, bristles up to 25 mm long; ligule up to 3 mm high with

bristles in the outer parts; blade narrowly lanceolate, erect in basal and apical sheaths, spreading to deflexed in middle sheaths. Leaves-blades $15\text{--}20 \times 1.5\text{--}2$ cm, green; auricles small with few bristles about 3 mm long; ligule truncates with short bristles.

Habitat and ecology. Grows in wet and dry areas (Widjaja 2001a) and in a Mt. Tunak Nature Tourism Park at an altitude of 15–20 m.

Distribution in Lombok. The western part of Lombok (Widjaja 2001a); Pujut, Central Lombok. This species was also seen in Lembar around Marije Village, West Lombok (Figure 3).

Vernacular names. *Treng greng* (Pujut) (Peneng et al. 2005) or *bambu duri* (West Lombok).

Specimen examined. Indonesia: Central Lombok, Pujut Sub-distrik, Mt. Tunak Nature Tourism Park, 8 March 2018, H. Rustiami 2220 (BO).



Figure 2. Culms (*left*), culm-sheaths (*right*) and young shoots (*inset*) of *Bambusa glaucophylla* (A), *B. maculata* (B), *B. multiplex* (C), *B. spinosa* (D), *B. vulgaris* var. *vulgaris* (E) and *B. vulgaris* var. *striata* (F)

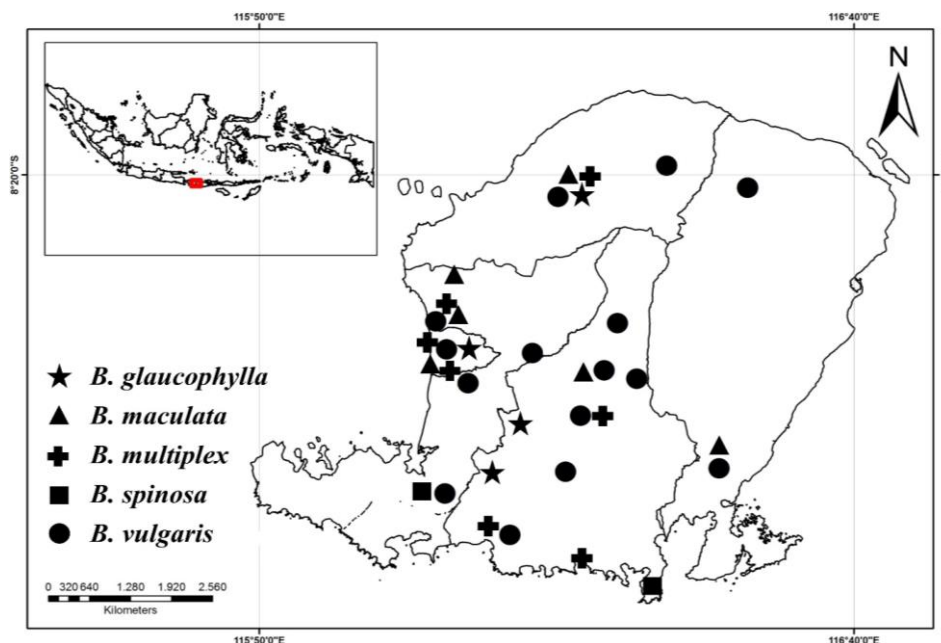


Figure 3. Distribution of *Bambusa glaucophylla*, *B. maculata*, *B. multiplex*, *B. spinosa* and *B. vulgaris* in Lombok, West Nusa Tenggara, Indonesia

***Bambusa vulgaris* Schrad. ex Wendl.**, Coll. Pl. 2: 26 (1808). Type: India. "*Bambusa vulgaris* Wendl.", ex herb. Wendl. Nos. 13986-13989 (GOET!). Figure 2.E-F.

Description. Young shoots green or yellow, covered with brown to black hairs. Culms up to 20 m high, slightly zigzagged, green with or without inflated internodes in the lower part or yellow with green stripes, internodes 20-30 cm long, 6-9 cm in diameter. Branches with a dominant primary branch and several smaller branches, without spines. Culm-sheaths deciduous, covered with dark brown to black hairs; auricles rounded and curved outward, up to 10 mm high, bristles up to 7 mm long; ligule toothed, up to 3 mm high with short bristles; blade broadly triangular and erect. Leaves-blades 8-32 × 1-4 cm, green; auricles small with few bristles about 2 mm long; ligule entire or sub-entire.

Habitat and ecology. This bamboo grows in the forest (Rini et al. 2017), along the riverbank (Putri et al. 2016; Mentari et al. 2018), the roadside and cultivated in villages at an altitude of 15-1100 m.

Distribution in Lombok. Bayan (Rini et al. 2017) and Gangga (Huzaemah et al. 2016), North Lombok; Batu Laya (Putri et al. 2016) and Narmada (Peneng et al. 2005), West Lombok; Keruak (Mentari et al. 2018) and Sembalun, East Lombok; Praya, North Batukliang (Peneng et al. 2005), Kopang and Pujut, Central Lombok (Figure 3).

Vernacular names. *Aur* (Sasak Bayan) or *aur kuning* (Sasak Bayan) (Huzaemah et al. 2016), *treng aur gading* (North Batukliang) or *treng aur hijau* (North Batukliang) (Peneng et al. 2005), *bambu kuning* or *bambu ampel* (Bayan) (Rini et al. 2017), *aur ketu* (East Lombok), *tereng tali*, *tereng aur* and *tereng galah* (Central Lombok).

Specimens examined. Indonesia: Lombok, Kopang, 14 June 1964, *Sun Hong-Fan* 9092 (BO); East Lombok,

Sembalun Sub-distrik, Sembalun Village, 8°21'7.27" S, 116°31'5.07" E, 22 August 2000, *R. Mulyati, Rugayah, Pratiwi, & Hamzah* 606 (BO); Lombok, Kuta, along the the road from Kuta to Mataram, 8°51'22.5" S, 116°11'05.5" E, 20 February 2005, *H. Tobe & N. Utami Tobe* 1250 (BO); Central Lombok, Pujut Sub-distrik, Mertak Village, "*tereng tali*", 13 March 2018, *H. Rustiami s.n.* (BO); Central Lombok, Pujut Sub-distrik, Mertak Village, "*tereng aur*", 13 March 2018, *H. Rustiami s.n.* (BO); Central Lombok, Pujut Sub-distrik, Mertak Village, "*tereng galah*", 13 March 2018, *H. Rustiami s.n.* (BO); Central Lombok, Pujut Sub-distrik, Tanak Awu Village, 8°45'52.4" S, 116°15'46.7" E, 30 November 2019, *I.P.G.P. Damayanto* 1044 (BO); West Lombok, Labu Api Sub-distrik, Bagik Polak Village, 8°38'08.7" S, 116°07'34.6" E, 30 November 2019, *I.P.G.P. Damayanto* 1051 (BO).

Notes. There are two varieties of this bamboo in Lombok, *B. vulgaris* var. *vulgaris* (Figure 2.E) and var. *striata* (= *vitata*) (Figure 2.F). In Indonesia, there are three varieties of *B. vulgaris*, var. *vulgaris* (green culm), var. *striata* (yellow culm with green stripes) and var. *wamin* (green culm with inflated internodes) (Widjaja 2001b).

***Dendrocalamus asper* (Schult.f.) Backer ex Heyne**, Nutt. Pl. Ned.-Ind. 2(1): 301 (1927). Type: Unknown [Based on Syst. Veg. 7(2): (1830) (as *Bambusa aspera* Schult.f.) was noted "*In Amboina et Huamchela ad montium pedes*"). Figure 4.A.

Description. Young shoots purplish-black, covered with velvety brown to black hairs. Culms up to 30 m high, erect, green, dark green, purplish-green or greyish-green, when young covered with velvety golden-brown appressed hairs, later glabrous, internodes 35-50 cm long, 12-15 cm in

diameter, aerial root appears from the base to the upper part of the culm. Branches grow about 1.5-3 m from the ground with a dominant primary branch and several smaller branches, without spines. Culm-sheaths deciduous and covered with velvety dark brown to black hairs; auricles prominent and sometimes crimped, up to 8 mm high, bristles up to 4 mm long; ligule irregularly toothed, up to 9 mm high with short bristles; blade lanceolate, erect first and later deflexed. Leaves-blades 20-30 × 2-4 cm, green; auricles small or absent and glabrous; ligule entire and very short.

Habitat and ecology. Grows in the garden, along with the riverbank (Putri et al. 2016; Munawarah et al. 2019) and the forest (Rini et al. 2017; Rini 2018) at an altitude of 212-1100 m.

Distribution in Lombok. Gangga (Huzaemah et al. 2016) and Bayan (Rini et al. 2017; Rini 2018), North Lombok; Batukliang, Central Lombok (Peneng et al. 2005); Batu Layar (Putri et al. 2016) and Gunung Sari (Munawarah et al. 2019), West Lombok; Sembalun and Sikur, East Lombok (Figure 5).

Vernacular names. *Treng petung* (Sikur) (Rini et al. 2017), *pring galah* (East Lombok) or *petung* (East Lombok).

Specimens examined. Indonesia: East Lombok, Sembalun Sub-distrik, Sembalun Village, 8°21'7.27" S, 116°31'5.07" E, 22 August 2000, R. Mulyati, Rugayah, Pratiwi, & Hamzah 605 (BO); East Lombok, Sikur Sub-distrik, Kembang Kuning Village, 8°31'57.9" S, 116°25'30.6" E, 2 December 2019, I.P.G.P. Damayanto 1057 (BO).

***Gigantochloa apus* (Schult.f.) Kurz**, Nat. Tijdschr. Ned. Ind. 27: 226 (1864). Type: Indonesia. Java, G. Salak, *Blume s.n.* (holotype M; isotype L). Figure 4.B.

Description. Young shoots green, covered with brown and black hairs. Culms up to 30 m high, erect, greyish-green to bright or yellowish-green, covered with white wax when young, shiny, glabrous, internodes 30-70 cm long, 6-14 cm in diameter, aerial root appears only in the base part of the culm. Branches usually grow upper half from the ground with a dominant primary branch and several smaller branches, without spines. Culm-sheaths not easily fall, green and covered with dark brown to black hairs when young, turning yellow-brown and glabrous when mature; auricles rim-like, up to 3 mm high, bristles 6-7 mm long; ligule toothed, up to 4 mm high, glabrous; blade ovate-triangular, spreading to deflexed. Leaves-blades 15-40 × 2-9 cm, green; auricles small, rounded and glabrous; ligule up to 4 mm high, entire and glabrous.

Habitat and ecology. Grows in the forest (Rini et al. 2017) and along the riverbank (Huzaemah et al. 2016; Putri et al. 2016; Mentari et al. 2018; Munawarah et al. 2019) at an altitude of 15-1100 m.

Distribution in Lombok. Bayan (Rini et al. 2017) and Gangga (Huzaemah et al. 2016), North Lombok; Mantang (Peneng et al. 2005) and Kuripan, Central Lombok; Batu Layar (Putri et al. 2016) and Gunung Sari (Munawarah et al. 2019), West Lombok; Keruak (Mentari et al. 2018) and Sembalun, East Lombok (Figure 5).

Vernacular names. *Treng tali* (Kuripan), *bambu tali* (Bayan) (Rini et al. 2017), or *pring tali* (Sembalun).

Specimens examined. Indonesia: East Lombok, Sembalun Sub-distrik, Sembalun Village, 8°21'7.27" S, 116°31'5.07" E, 22 August 2000, R. Mulyati, Rugayah, Pratiwi, & Hamzah 607 (BO); West Lombok, Kuripan Sub-distrik, Kuripan Village, 8°40'21.1" S, 116°10'16.9" E, 30 November 2019, I.P.G.P. Damayanto 1049 (BO).

***Gigantochloa atter* (Hassk.) Kurz**, Nat. Tijdschr. Ned. Ind. 27: 226 (1864). Type: Indonesia. Java, *Kurz s.n.* (neotype K!). Figure 4.C.

Description. Young shoots green or purplish-green, covered with black hairs. Culms up to 25 m high, erect, bluish-green to dark green with distinct pale rings on the nodes, covered with scattered black hairs when young, becoming glabrous when mature, internodes 30-50 cm long, 6-11 cm in diameter, aerial root appears only in the base part of the culm. Branches with a dominant primary branch and several smaller branches, without spines. Culm-sheaths deciduous, covered with black hairs; auricles rounded or rounded with curved outward, up to 6 mm high, bristles 6-7 mm long; ligule toothed, up to 6 mm high and glabrous; blade lanceolate, deciduous and deflexed. Leaves-blades 15-40 × 3-6 cm, green; auricles small, up to 1 mm high and glabrous; ligule entire, up to 1 mm high and glabrous.

Habitat and ecology. Grows in the forest (Rini et al. 2017), along riverbanks (Huzaemah et al. 2016; Putri et al. 2016; Mentari et al. 2018; Munawarah et al. 2019), roadsides (Mentari et al. 2018) and cultivated in villages at an altitude of 15-756 m.

Distribution in Lombok. Gangga, North Lombok (Huzaemah et al. 2016); Keruak, (Mentari et al. 2018) and Masbagik, East Lombok; Batu Layar (Putri et al. 2016) and Gunung Sari (Munawarah et al. 2019), West Lombok; North Batukliang (Peneng et al. 2005), Kuta, Jongat, and Southwest Praya, Central Lombok (Figure 5).

Vernacular names. *Santong biasa* (Sasak Bayan) (Huzaemah et al. 2016), *bambu santong* (Rini et al. 2017), *treng galah* (North Batukliang) (Peneng et al. 2005; Munawarah et al. 2019) and *tereng gerang* (Lombok Tengah).

Specimens examined. Indonesia: Central Lombok, Kuta, along the road from Kuta to Mataram, 8°51'22.5" S, 116°11'05.5" E, 20 February 2005, H. Tobe & N. Utami Tobe 1249 (BO); Central Lombok, Pujut Sub-distrik, Mertak Village, "tereng gerang", 13 March 2018, H. Rustiami s.n. (BO); Central Lombok, Southwest Praya Sub-distrik, Batubolong Village, 8°42'41.4" S, 116°12'50.0" E, 30 November 2019, I.P.G.P. Damayanto 1045 (BO); Central Lombok, Jongat Sub-distrik, Sukarana Village, 8°41'57.9" S, 116°12'09.2" E, 30 November 2019, I.P.G.P. Damayanto 1047 (BO); East Lombok, Masbagik Sub-distrik, Paokmontong Village, Dasan Malang Sub-Village, 28 November 2019, S. Sunarti & M. Rahayau 833 (BO).

***Schizostachyum brachycladum* (Kurz ex Munro)** Kurz, J. Asiat. Soc. Bengal. Pt. 2, Nat. Hist. 39: 89 (1870).

Type: Indonesia. Buitenzorg (now Bogor), Java, *Anon. s.n.* (Syntype K!). Figure 4.D.

Description. Young shoots yellowish-green or yellow, covered with brown hairs. Culms up to 12 m high, erect, green or yellow with green stripes, internodes 30-50 cm long, 5-10 cm in diameter. Branches with several sub-equal slender branches, without spines. Culm-sheaths 17-18 × 17-18 cm, covered with light brown to brown hairs; auricles small up to 1 cm high, bristles up to 5 mm long; ligule entire, up to 2 mm high and glabrous; blade 4-5 × 4-5.5 cm, broadly triangular, erect. Leaves-blades 20-35 × 4-6 cm wide, green; auricles small, less than 1 mm high, bristles up to 8 mm long; ligule entire, up to 1 mm high and glabrous.

Habitat and ecology. Cultivated in the city and found in riverbanks at an altitude of 15-316 m (Munawarah et al. 2019).

Distribution in Lombok. West Lombok (Peneng et al. 2005; Munawarah et al. 2019), Central Lombok, and Mataram (Figure 5). This bamboo is widespread in Lombok.

Vernacular names. *Treng gading*, *tereng kuning* (green culm) or *tereng aur* (yellow culm) (Sasak) (Munawarah et al. 2019), *bambu leman* (green culm) and *bambu gading* (yellow culm).

Specimen examined. Indonesia: Central Lombok, Southwest Praya Sub-distrik, Batubolong Village, 8°42'41.4" S, 116°12'50.0" E, 30 November 2019, *I.P.G.P. Damayanto 1046* (BO).

Notes. Widjaja et al. (2005) mentioned that *S. brachycladum* has two "varieties", with either a green culm or yellow culm with green stripes. The latter is found in Lombok as ornamental plant and is cultivated in cities.

***Schizostachyum lima* (Blanco) Merr.**, Amer. J. Bot. 3: 62 (1916). Type: Unknown (probably Philippines). Figure 4.E.

Description. Young shoots green, covered with brown hair. Culms up to 10 m high, erect, green internodes 50-120 cm long, 3-4 cm in diameter. Branches with several sub-equal slender branches, without spines. Culm-sheaths 17-18 × 7-8 cm, covered with brown to dark brown hairs; auricles not prominent, bristles up to 7 mm long; ligule short with bristles; blade 10-23 × 5-10 cm, narrowly lanceolate, deflexed. Leaves-blades 20-30 × 4-7 cm wide, green; auricles small, less than 1 mm high, bristles up to 8 mm long; ligule irregularly toothed, up to 1 mm high.

Habitat and ecology. Cultivated in villages up to 500 m asl. This bamboo is rare and only found in cultivation.

Distribution in Lombok. Kompong, Central Lombok (Figure 5).

Vernacular names. *Treng buluh* (Kompong).

Specimen examined. Indonesia: Central Lombok, Kompong Sub-distrik, Wajagesang Village, Dasan Baru Sub-Village, 8°36'00.5" S, 116°22'11.5" E, 3 December 2019, *I.P.G.P. Damayanto 1060* (BO).

***Thyrsostachys siamensis* Gamble**, Ann. Roy. Bot. Gard. (Calcutta) 7: 59 (1896). Type: Thailand. *Kurz s.n.* (lectotype K!). Figure 4.F.

Description. Young shoots pale green to purplish-green, glabrous. Culms up to 10 m high, erect, pale green to greyish green, covered with persistent old culm-sheaths, internodes 10-30 cm long, 2-7 cm in diameter. Branches grow from mid-culm nodes upwards with a dominant primary branch and several smaller branches, without spines. Culm-sheaths persistent, covered with white hairs; auricles inconspicuous or very small; ligule entire and glabrous; blade narrowly triangular and erect. Leaves-blades 7-14 cm × 5-8 mm, pale green; auricles very small or not seen and glabrous; ligule entire and glabrous.

Habitat and ecology. Grows along the riverbank at an altitude of 14-167 m (Mentari et al. 2018; Munawarah et al. 2019) and cultivated in cities.

Distribution in Lombok. Gangga, North Lombok (Huzaemah et al. 2016); Keruak, East Lombok (Mentari et al. 2018); Batu Layar (Putri et al. 2016) and Gunung Sari (Munawarah et al. 2019), West Lombok; Mataram City (Figure 5). This bamboo is widespread across Lombok.

Vernacular names. *Santong hias cina* (Sasak Bayan) (Huzaemah et al. 2016) or *tereng cina* (Sasak Batu Penyu) (Munawarah et al. 2019) or *treng jakarta*.

Specimens examined. Indonesia: West Lombok, Gerung Sub-distrik, Beleke Village, 8°39'35.5" S, 116°07'50.6" E, 30 November 2019, *I.P.G.P. Damayanto 1050* (BO); West Lombok, Gerung Sub-distrik, Beleke Village, 8°39'35.5" S, 116°07'50.6" E, 30 November 2019, *I.P.G.P. Damayanto 1050* (BO); Mataram City, Cakranegara Sub-distrik, West Cakranegara, Lingkungan Jeruk Manis, 8°35'04.8" S, 116°07'30.8" E, 30 November 2019, *I.P.G.P. Damayanto 1052* (BO).

Doubtful species

Bambusa albustiata and *Bambusa ventricosa* McClure

Bambusa albustiata mentioned by Peneng et al. (2005) was never reported as a species name of bamboo (*see* Vorontsova et al. 2016; ipni.org). Peneng et al. (2005) also suggested *B. ventricosa* was found in Lombok Tengah. This bamboo was reported from China to Vietnam (Vorontsova et al. 2016) and it has never been reported from Indonesia (Widjaja 2019). There were no descriptions available, no specimens, and no photographs of these bamboos. These bamboos are therefore not included in this paper.

Dinochloa sp.

Santi et al. (2019) reported *Dinochloa* sp. found in Lombok. Unfortunately, they did not provide a description of the species. *Dinochloa* has never been reported previously in Lombok. There was not enough evidence to include this bamboo in this paper.

Guadua angustifolia Kunth

Putri et al. (2016) reported *Guadua angustifolia* found in Meninting River, West Lombok. *Guadua angustifolia* originated from South America (Judziewicz et al. 1999). Londono (2001) mentioned this bamboo had been introduced to Indonesia and cultivated in Java and Bali (Widjaja 2019). The description of '*Gd. angustifolia*' in Putri et al. (2016), however, was incomplete. The important

morphological characters to identify this bamboo in the photograph of Putri et al. (2016) was also not clear and there was no specimen mentioned. We also did not found this bamboo during our fieldwork around Meninting River, West Lombok.

Although we do not include the *Gd. angustifolia* in this paper, we found information that plantlets of *Gd. angustifolia* from tissue culture have been traded in Indonesian online stores (see TBNV 2018). *Guadua*

angustifolia has been listed on a list of bamboo species sold by a bamboo tissue culture company, PT. Bambu Nusa Verde, located in Yogyakarta, Java (see BNV 2019). Based on personal communication with the staff of PT. Bambu Nusa Verde (Mrs Hana), *Gd. angustifolia* has been exported to other countries and only occasionally purchased locally, including in Bali and Lombok. This increases the chances that *Gd. angustifolia* is found on Lombok-this however needs confirmation.

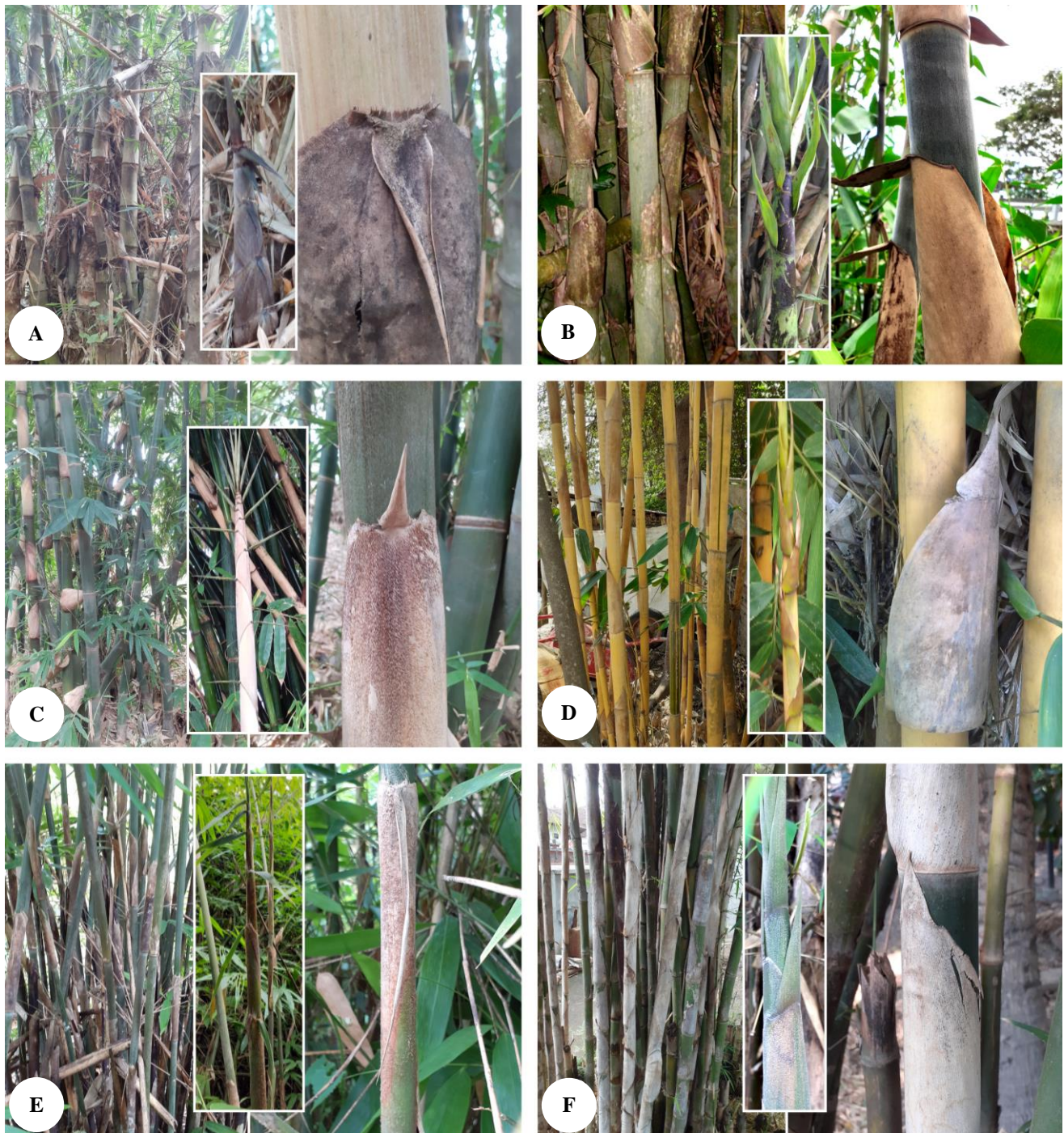


Figure 4. Culms (left), culm-sheaths (right) and young shoots (inset) of *Dendrocalamus asper* (A), *Gigantochloa apus* (B), *G. atter* (C), *Schizostachyum brachycladum* (D), *S. lima* (E) and *Thyrsostachys siamensis* (F)

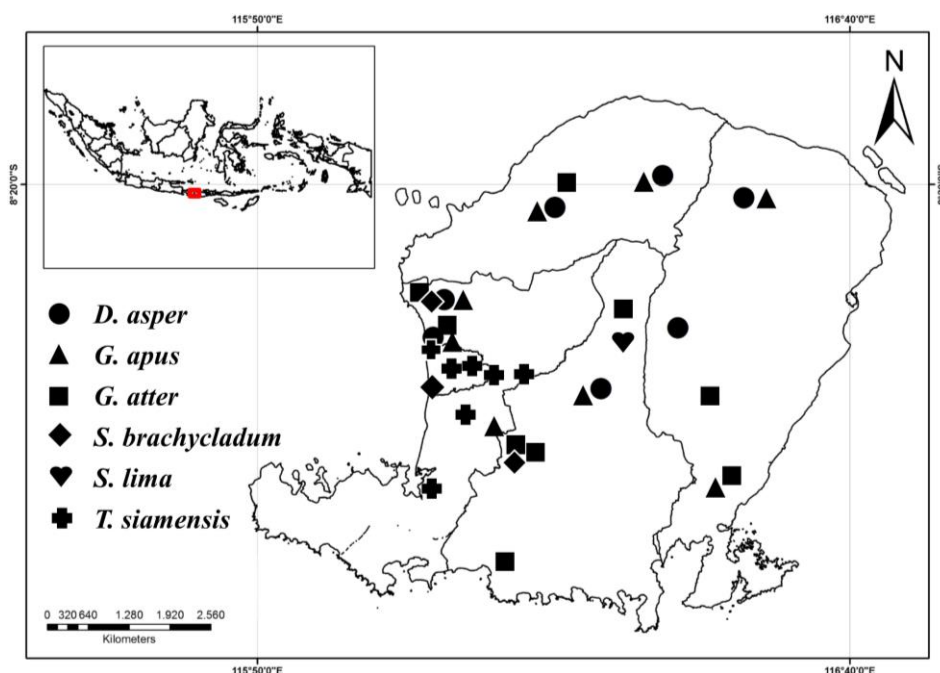


Figure 5. Distribution of *Dendrocalamus asper*, *Gigantochloa apus*, *G. atter*, *Schizostachyum brachycladum*, *S. lima* and *Thyrsostachys siamensis* in Lombok, West Nusa Tenggara, Indonesia

Schizostachyum jaculans Holttum

Schizostachyum jaculans was reported from Lombok by Huzaemah et al. (2016), Putri et al. (2016) and Santi et al. (2019). This bamboo, however, is from Peninsular Malaysia (Dransfield 1995). Holttum (1953) reported that *S. jaculans* has a culm with 3.5 cm in diameter, culm-sheath auricles absent and replaced by long bristles and ligule of leaf-sheath small and glabrous. This is different from '*S. jaculans*' described by Huzaemah et al. (2016), Putri et al. (2016), and Santi et al. (2019). Based on the photographs of this bamboo in Lombok, it is very similar to *S. lima* or *S. silicatum* Widjaja. We did not find *S. jaculans* during our fieldwork. Therefore, this bamboo is not included in this paper.

Pseudosasa japonica (Siebold & Zucc. ex Steud.) Makino ex Nakai

Rizkillah (2018) reported that *P. japonica* occurred in Senggigi, West Lombok. This bamboo is common in Korea and Japan (Vorontsova et al. 2016) and has never been reported from Lombok previously. Vorontsova et al. (2016) and Ariati et al. (2019) reported that *P. japonica* was introduced in Java, although Widjaja (2001b, 2019) never mentioned this species in Java. Only *P. amabilis* (McClure) Keng f. has been introduced to Cibodas Botanic Garden, Java (Widjaja 2001b; Widyatmoko et al. 2010) and also Bali 'Eka Karya' Botanic Garden, Bali (Widjaja 2019). A photograph and a description of *P. japonica* from Rizkillah (2018) clearly showed that it is *Thyrsostachys siamensis*.

Discussion

There are 176 species and 24 genera of bamboo in Indonesia (Widjaja 2019). Of those, only about 6% (11) of

species and 21% (5) of genera were found in Lombok based on the results of this study. The diversity of bamboo in Lombok is still relatively low compared with some regions in Indonesia (Figure 6). Bamboos in Lombok reach 58% (11) of the total bamboo species in Lesser Sunda Islands (LSI) (19 species). There are no endemic bamboo species in Lombok. This may be because Lombok is not as large as the other Indonesian islands (Figure 6).

Bamboo diversity in Lombok is higher (11 species) than other Indonesian small islands (eight to nine species) (Figure 7). For example, Peleng Island in Central Sulawesi which covers almost half the area of Lombok (*see* Hasanah 2017; BPSPNTB 2018) is reported to have eight species and six genera of bamboos (Damayanto and Rahmawati 2020), even Bengkalis Island in Riau with an area of only 8.5% of Lombok (*see* BPSKB 2018; BPSPNTB 2018) is reported to have nine species and five genera of bamboos (Rijaya and Fitmawati 2019).

Lowland regions with warmer temperatures and high rainfall usually have high species richness (Sinauer 2010). Bamboo diversity in several islands in Indonesia does not appear to be limited by rainfall (Figure 7). For instance, Lombok has a higher number of bamboo species than Selayar Islands, South Sulawesi, although annual rainfall in Lombok is about 33% lower than Selayar (BPS 2017; Liana et al. 2017). This is likely because bamboo is found in a wide range of habitats from dry to humid areas, swamps, marginal land, dry or regularly flooded riverbanks (Dransfield and Widjaja 1995), and from lowlands up to highlands up to 4300 m asl (Clark 2006). Rainfall is therefore unlikely to limit Bamboo species richness.

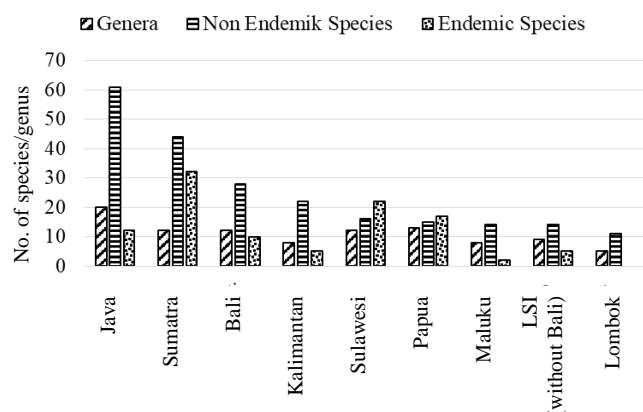


Figure 6. Comparison of bamboo diversity in several areas in Indonesia [processed from Widjaja (2019) and research data]

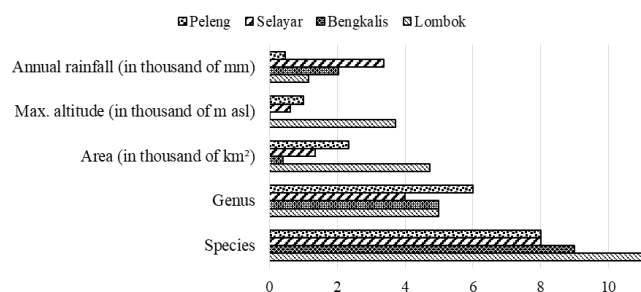


Figure 7. Comparison of bamboo diversity and ecological conditions in some small islands in Indonesia [processed from BPS (2017), Hasanah (2017), Liana et al. (2017), BPSKB (2018), BPSKKS (2018), BPSPNTB (2018), Rijaya and Fitmawati (2019), Damayanto and Rahmawati (2020) and research data]

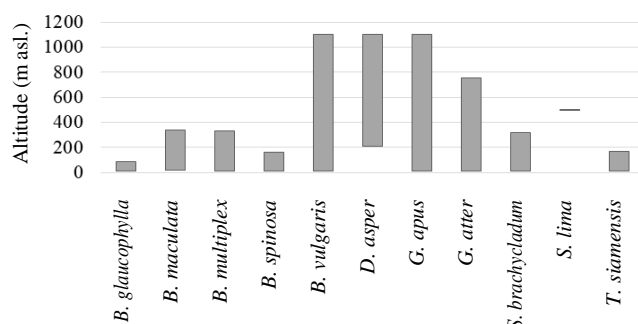


Figure 8. Elevation range of bamboo species in Lombok, West Nusa Tenggara, Indonesia

Some species of bamboos in Lombok were found growing in a fairly wide range of altitudes (Figure 8), such as *B. vulgaris*, *D. asper*, *G. apus*, and *G. atter*. These bamboos are also widespread in Lombok (see Figures 3 and 5). They were commonly found in lowland and highland and were reported from almost all regions of Indonesia (Widjaja 2019). Meanwhile, *S. lima* was only

found at an altitude of about 500 m (Figure 8). Based on the interviews with residents in Lombok, *S. lima* was rarely found and it was rarely collected in our exploration. There is no information about *S. lima* reported before in Lombok, except a report of Rini et al. (2017) who mentioned that *S. lima* (locally known as *bambu bilis*) can be found in Senaru Forest, North Lombok. They, unfortunately, did not provide a complete description and the photos presented were also not very clear.

Other species, such as *B. glaucophylla*, *B. multiplex*, *S. brachycladum* and *T. siamensis* are ornamental bamboo (Widjaja 2001b), so distributions are mostly in urban areas which are usually located in the lowlands of Lombok. On the other hand, *B. spinosa* is found in the dry areas of southern Lombok which is coastal lowland.

It can be concluded that there are 11 species of bamboos (*Bambusa glaucophylla*, *B. maculata*, *B. multiplex*, *B. spinosa*, *B. vulgaris*, *Dendrocalamus asper*, *Gigantochloa apus*, *G. atter*, *Schizostachyum brachycladum*, *S. lima*, and *Thyrsostachys siamensis*) in Lombok, Indonesia. *Bambusa vulgaris* is the most widespread bamboo, while *S. lima* is rare.

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