RESEARCH ARTICLE

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DIVERSITY AND UTILIZATION OF BAMBOO (*BAMBUSOIDEAE*) IN FIVE ISLANDS AROUND RIAU PROVINCE, INDONESIA

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SUMMARY

The existence of peatlands and their vegetation is one of the keys to the stability of hydrological systems in nature. However, the main problem in peatlands is that clean water is difficult to obtain. Based on the indigenous knowledge, bamboo is a soil-retaining plant and a clean-water filter, even in peatlands. This study aimed to explore the diversity of bamboo, which can grow and develop in peatlands, and determine the types of bamboo that function in the filtration of clean water in five islands in Riau Province. Five genera, 17 species, and three varieties were identified. According to the relationship analysis, there were two groups of bamboo. The closest species among groups in terms of the relationship analysis were *Bambusa vulgaris* Schard. Ex Wendl. var. *striata* and *B. vulgaris* Schard. Ex Wendl. var. *vulgaris* with a similarity level of 78.5%, whereas the furthest species was *Gigantochloa kuring Widjaja* and *Gigantochloa atter* (Kurz) with a similarity level of 25%. There were 21 types of bamboo utilization in Riau province. *B*. *vulgaris* Schard. Ex Wendl. var. *vulgaris* is a multipurpose bamboo and adaptable to all types of habitats. This species has the potential to be developed in peatland areas.

Keywords: Bamboo, *B*. *vulgaris* Schard. Ex Wendl. var. *vulgaris*, diversity, Peatland, Riau Province

Key findings: According to indigenous knowledge, bamboo is generally used as a soil-retaining plant and a clean-water filter. The diversity of bamboo in the five islands in Riau Province was considerably high. The most common type of bamboo species in this region was *B*. *vulgaris* Schard. Ex Wendl. var. *vulgaris*.

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INTRODUCTION

Mainland Riau and its surrounding islands have different geological histories that account for the formation of characteristics and uniqueness of each island in the form of undulating land. The eastern side is lowland wetlands covered by peat soils (MacArthur and Wilson, 2001). Riau Province is the region with the largest peatlands in Sumatra. The area of peatlands in this area is approximately 4.044 million hectares (~45.0% of the total land area in Riau Province or ~56.1% of the area of peatlands in Indonesia) (Wahyunto *et al*., 2005; Wahyunto *et al*., 2013).

Peatlands have a very important role in the community and other organisms in a region, including Riau Province. Peatlands function as a water reservoir and maintains the stability of the hydrological cycle in nature. This role can influence the regulation of water discharge in the rainy and dry seasons (Runtunuwu *et al*., 2011; Ramadhan *et al*., 2018). This will provide benefits for people who live around peatlands.

However, the well-known role of peatlands comes with many problems arising today, which are related to the damage caused by human activities, such as land fires and land conversion into plantation and agricultural areas without considering apparent ecological impacts (Nurhayati *et al*., 2010; Wahyunto *et al*., 2013; Darmawan *et al*., 2016). This may cause research on peatlands to focus only on the alleviation of the current problems. The problem that has not been much discussed is the availability of clean water that is used by communities around peatlands to meet their daily needs.

Peat water is the surface water that is mostly found in swamps and lowlands with certain acidic characteristics (pH 3.7–5.3); it is dominated by organic substances in the form of nonbiodegradable humid compounds (Zouboulis, 2004; Susilawati, 2008). This causes water in peat areas, especially in Riau, to fail to meet the standard of clean water quality and become unsuitable for consumption (Hasmalina *et al*., 2013). Research, especially with some environmentally and friendly techniques, on improving the water quality on this type of land must be done.

Some plants, including bamboo, can act as a medium that provides clean water in a particular area. Bamboo is one of the existing solutions to the low availability of clean water. Ecologically, bamboo has a vital role in the hydrological system, which is to filter clean water and absorb up to 90% of rainwater (Yuliantoro *et al*., 2016; Muliatiningsih *et al*., 2018). This correlates with current problems occurring in peatlands today, leading to the lack of clean water availability in this area. However, not all types of bamboo can adapt to peatland habitats. Thus, research on bamboo diversity needs to be conducted to discover the superior types of bamboo species in peatlands. This study can also be a major fundamental interest in the development and cultivation of bamboo in accordance with its location and function in meeting the needs of the community, especially as flora function as the filter and provider of

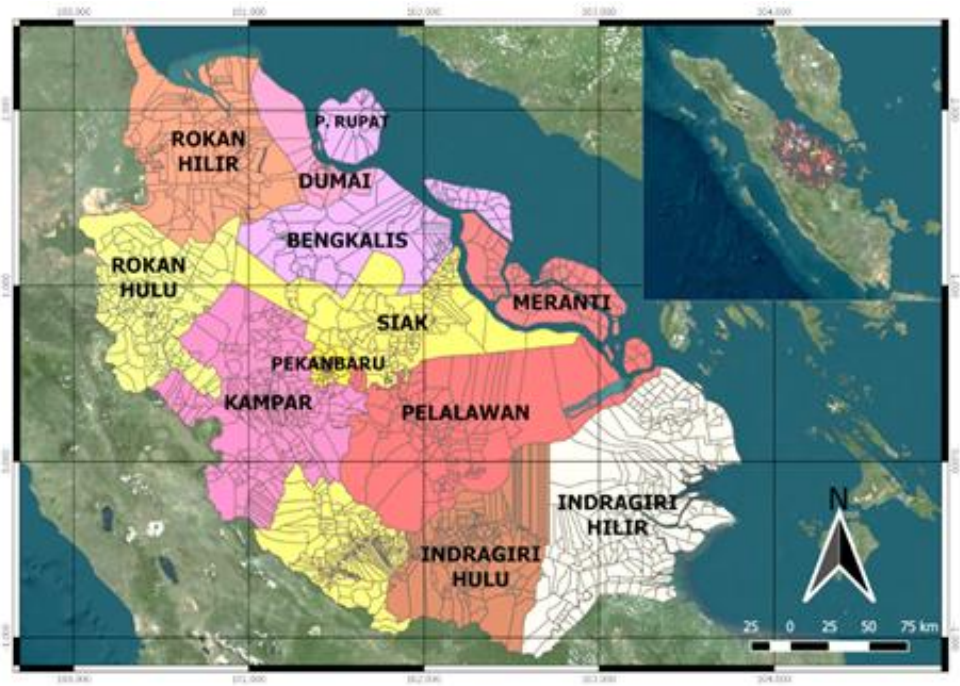

Figure 1. Research locations in five islands: Bengkalis Island, Rupat Island, Tebing Tinggi Island, Rangsang Island, and Merbau Island. Source: Esri Satellite 2019, Quantum GIS Application (source of map: Bakusurtanal, 2017).

clean water on peatlands. This study aimed to explore the diversity of bamboo that can grow and develop in peatlands and determine the types of bamboo that function in the filtration of clean water.

MATERIALS AND METHODS

Time and location

This research was conducted in December 2018 until September 2019. The research sites were in five islands with two different regencies. Bengkalis Island and Rupat Island are within the Bengkalis Regency, and Rangsang Islands, Merbau Islands, and Tebing Tinggi Island are within the Regency of the Meranti Archipelago (Figure 1).

Tools and material

Some tools and materials used were Global Positioning System for determining coordinates, Canon Camera Mirrorless for acquiring pictures, 70% alcohol for making herbariums, and bamboo samples.

Data recording

This research used exploratory survey methods, wherein the research samples were bamboo growing wild in the forest and those cultivated in plantations. Morphological observations were carried out descriptively. Furthermore, morphological characteristics were observed directly on the living plants in the field and in the laboratory. The morphological variability of bamboo accessions was characterized by using 56 vegetative characters, including young shoots, culm sheath, leaf sheath, clump growth, branching, and leaves. The description and characterization for morphological identification were performed in reference to the guidance of Widjaja (1997), Widjaja (2001a), Widjaja (2001b), Widjaja *et al.*, (2005), and Rijaya & Fitmawati (2019). The preparation of herbarium specimens followed the standard procedures reported by Bean (2013) and Wondafrash (2008). The samples that have been identified were then stored in the Bogoriense Herbarium, Biology Research Center, Cibinong, West Java.

Data analysis

Data obtained were analyzed by using cluster analysis, a numeric taxonomical method. This analysis was combined with the unweighted pair-group method of arithmetic averages (UPGMA) and the principal component analysis (PCA) in NTSYSPC version 2.02 and Minitab 16.0.

RESULTS

Bamboo diversity

Bamboo is one of the unique plants that can grow and adapt in various types of habitats while showing several patterns of variation over a habitat adaptation in certain species. This study, which was conducted in two regencies consisting of five islands, identified as many as five genera, 17 species, and three bamboo varieties. The numbers of species that have been identified were quite high if these were compared with the existing data on bamboo species in Indonesia; previous studies identified a total of 161 bamboo species in Indonesia (Widjaja *et al*., 2014; Widjaja, 2015). Based on these findings, the percentage of total bamboo species in the five islands in Riau Province was approximately 11.0% of the total bamboo species found in Indonesia. The number of genera, species, and varieties in each island can be seen in Table 1.

Composition and distribution of species

The types and numbers of species obtained in this study differed from island to island. The differences in genera and species were influenced by the area of each island and the soil structure that makes up the island. Most of the islands around Riau Province showed different characteristics and ways of formation: through volcanic events or volcanic eruptions and mud and organic

Table 1. Results of bamboo identification at five study sites.

District	Island	Total bamboo obtained			Remarks
		Genera	Species	Varieties	
Bengkalis	Bengkalis*	4	9 (4*)	2	5 Genera, 13 species,
	Rupat	4	9 (2*)	2	2 varieties
Meranti	Merbau	2	3 (0*)	2	5 Genera, 12 species,
Archipelago	Rangsang	5	7 (3*)	2	3 varieties
	Tebing Tinggi	4	7 (1*)	3	

(*) unique species

material (peat) accumulation. This situation significantly affected the numbers of genera and species, as well as variations in the morphological characters of bamboo growing in the area. Each genus, species, and variety discovered in each research location is displayed in Table 2.

Cluster analysis of bamboo from five islands in Riau Province

Cluster analysis was conducted on 19 accessions of bamboo species, and its results are displayed in the form of a dendrogram (Figure 2). The analysis was carried out on the basis of 56 representative vegetative characters, such as young shoot (type, color, color of hair, number of hair, auricle, and position of sheath), culms (type, height, diameter, thickness, nodes, nodes of basic, color, young culms, length of internodes, surface, and density), branching (type, distance, and number of branches), culm sheath (easily or does not easily decay, length, width, color, hair present or absent, color of hair, auricle, length of auricle, blade present or absent, length of blade, ligule, length of ligule, presence or absence of blades, length of blade, type of sheath, base of culm sheath, position, length, and width), leaves (length, width, abaxial, adaxial, color of petiole, auricle, bristles present or absent, height of leaf sheath auricle, blade present or absent, length of blade, type of ligule, length of ligule, blade present or absent, and length of blade). Cluster analysis was carried out via the UPGMA method and produced two main clusters. These results were further confirmed through the PCA method (Figure 3) to determine the role of each characteristic in clustering.

Utilization of bamboo in Riau

Interviews with local people revealed that they use bamboo in their lives in accordance with their individual needs and the availability of bamboo species around their homes. Bamboo utilization in Riau Province is shown in Table 3. Some types of bamboo are usually used as medicinal materials (Kim *et al.,* 2014) and as building materials and furniture (Kaminski *et al.,* 2016). Bamboo is also known to be used as part of musical instruments, craft materials, and household appliances (Akmal *et al.,* 2011; Kang *et al.,* 2017, Maulana *et al.,* 2017).

DISCUSSION

The Bengkalis Regency consists of two islands, Bengkalis Island and Rupat Island, whereas the Meranti Archipelago Regency consists of Merbau Island, Rangsang Island, and Tebing Tinggi Island. As many as five genera, 13 species, and two varieties were identified in Bengkalis Regency. In the Meranti Archipelago Regency, five genera, 12 species, and three varieties were identified: *Bambusa vulgaris* Schrad. Ex Wendl. var. *vulgaris, B. vulgaris* Schrad. Ex Wendl. var. *striata, B. vulgaris* Schrad. Ex Wendl. var. *wamini, Bambusa glaucophylla* Widjaja, *Bambusa heterostachya* (Munro) Holttum, *Bambusa multiplex* (Lour.) Raeusch. ex Schult., *Bambusa* sp., *Dendrocalamus asper* (Schult.) Backer, *Gigantochloa apus* (Schult.) Kurz, *Gigantochloa atter* (Hassk.) Kurz, *Gigantochloa cf. velutina* Widjaja, *Gigantochloa hasskarliana* (Kurz) Backer, *Gigantochloa kuring*

Table 2. Species composition, species distribution, and bamboo clump number.

No.	Genera	Species	Varieties	Spread	Total clumps	Note
1	*Bambusa*	*B. vulgaris* Schard. Ex Wendl.	*vulgaris* *	1, 2, 3, 4, 5	16	P/W
			striata *	1, 2, 3, 4, 5	11	P/W
			wamini	3	1	P
		Bambusa heterostachya (Munro) Holttum		1, 3	2	W
		Bambusa multiplex (Lour.) Raeusch. ex Schult.*		1, 2, 3	5	P/W
		Bambusa glaucophylla Widjaja*		2, 3, 4, 5	6	P/W
		Bambusa sp.		4	1	W
2	*Dendrocalamus*	*Dendrocalamus asper* (Schult.) Backer *		2, 3, 4, 5	8	W
3	*Gigantochloa*	*Gigantochloa* sp.		1	1	W
		Gigantochloa apus (Schult.) Kurz *		2	1	W
		Gigantochloa kuring Widjaja*		2	1	W
		Gigantochloa cf. velutina Widjaja		1	1	W
		Gigantochloa hasskarliana (Kurz) Backer		1, 3	4	P/W
		Gigantochloa levis (Blanco) Merr.		2	1	W
		Gigantochloa pruriens Widjaja		4	1	P/W
		Gigantochloa atter (Hassk.) Kurz		4	2	W
4	*Shyzostachyum*	*Schyzostachyum brachycladum* (Kurz) Kurz *		1, 2, 3, 4	4	P/W
		Schyzostachyum silicatum Widjaja *		2	1	W
5	*Thyrsostachys*	*Thyrsostachys siamensis* Gamble*		1, 2, 4	7	P

Information: 1. Rupat Island; 2. Bengkalis Island; 3. Tebing Tinggi Island; 4. Rangsang Island; 5. Merbau Island; P = Planted (Cultivation); W = Wild (Wild); *Rijaya and Fitmawati (2019).

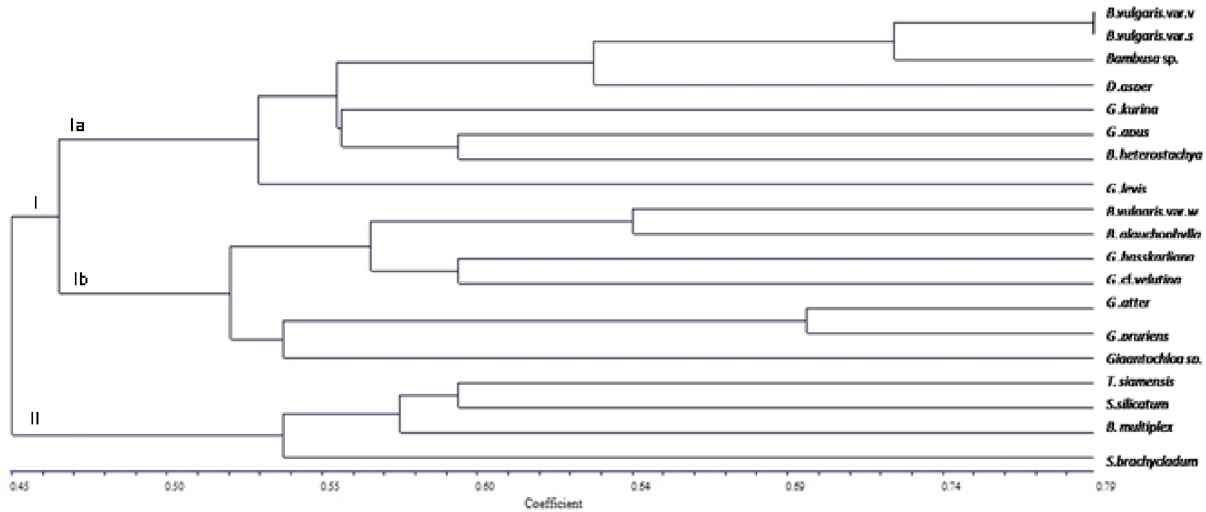

Figure 2. Dendrogram of 19 accessions of bamboo in five islands based on morphological characters.

Note: *Bambusa vulgaris* Schrad. Ex Wendl*.* var*. vulgaris; Bambusa vulgaris* Schrad. Ex Wendl*.* var*. striata; Bambusa* sp.; *Dendrocalamus asper* (Schult.) Backer; *Gigantochloa kuring* Widjaja; *Gigantochloa apus* (Schult.) Kurz; *Bambusa heterostachya* (Munro) Holttum; *Gigantochloa levis* (Blanco) Merr.; *Bambusa vulgaris* Schrad. Ex Wendl*.* var*. wamini; Bambusa glaucophylla* Widjaja; *Gigantochloa hasskarliana* (Kurz) Backer; *Gigantochloa* cf. *velutina* Widjaja*; Gigantochloa atter* (Hassk.) Kurz*; Gigantochloa pruriens* Widjaja; *Gigantochloa* sp.; *Thysostachys siamensis* Gamble; *Schyzotachyum silicatum* Widjaja*; Bambusa multiplex* (Lour.) Raeusch. ex Schult*; Schyzotachyum brachycladum* (Kurz) Kurz

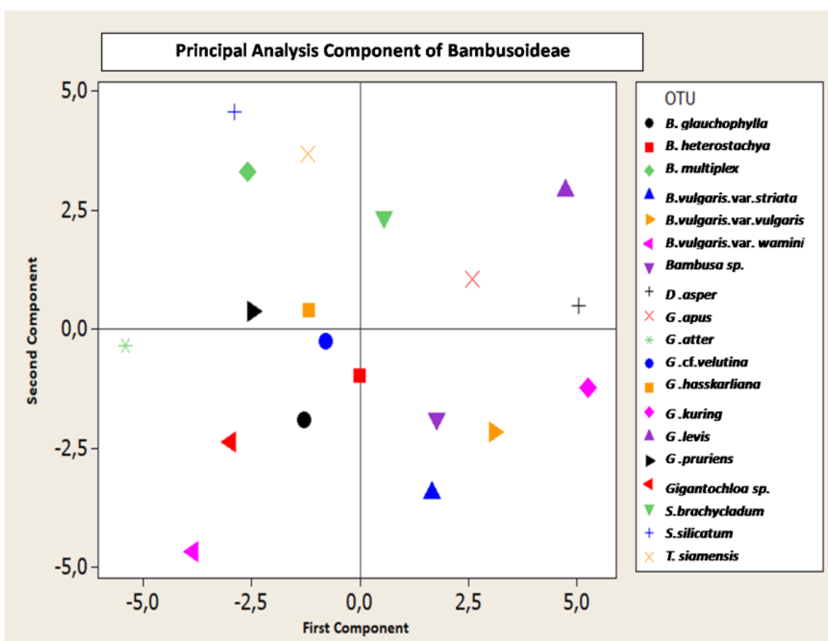

Figure 3. Scatter diagram showing the patterns of species distribution in determining a bamboo grouping on the basis of morphological characteristics by using PCA in the Minitab program.

Table 3. Utilization of bamboo by the community.

No.	Species & Varieties	Utilization																					Total
		a	b	c	D	e	f	g	h	i	j	k	l	m	n	o	p	q	r	t	u	v	
1.	*Bambusa glaucophylla* Widjaja	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
2.	*Bambusa heterostachya* (Munro) Holttum	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	4
3.	*Bambusa multiplex* (Lour.) Raeusch. ex Schult.	0	0	1	0	1	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	1	7
4.	*Bambusa* sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
5.	B. vulgaris Schrad. Ex Wendl var. *striata*	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	4
6.	B. vulgaris Schrad. Ex Wendl var. *vulgaris*	1	0	1	1	1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	15
7.	B. vulgaris Schrad. Ex Wendl var. *wamini*	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	4
8.	*Dendrocalamus asper* (Schult.) Backer	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
9.	*Gigantochloa apus* (Schult.) Kurz	1	1	1	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	7
10.	*Gigantochloa atter* (Hassk.) Kurz	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	8
11.	*Gigantochloa* cf. *velutina* Widjaja	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
12.	Gigantochloa hasskarliana (Kurz) Backer	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	3
13.	*Gigantochloa kuring* Widjaja	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	3
14.	Gigantochloa levis (Blanco) Merr.	1	1	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	7
15.	*Gigantochloa pruriens Widjaja*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
16.	*Gigantochloa* sp.	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
17.	*Schyzotachyum brachycladum* (Kurz) Kurz	1	0	1	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	7
18.	*Schyzotachyum silicatum* Widjaja	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
19.	*Thysostachys siamensis* Gamble	1	0	1	1	1	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	9
Total		10	7	11	7	4	6	4	2	4	6	3	1	7	1	1	1	2	1	1	1	19	

Information: a. Building material; b. Musical instruments; c. Craft; d. Vegetables; e. Paper pulp; f. Mabel; g. Cooking utensils; h. Windbreak; i. Drug; j. Decorative plants; k. Household appliances; l. Boat material; m. Decoration material; n. Rope; o. Pipe; p. Erosion barrier; q. Bamboo incense; r. Fence; s. Chopsticks; t. Toothpick; u. Traditional ceremonies; v. Water filter.

Widjaja*, Gigantochloa levis* (Blanco) Merr*., Gigantochloa pruriens* Widjaja*, Gigantochloa* sp*., Schyzostachyum brachycladum* (Kurz) Kurz, *Schyzostachyum silicatum* Widjaja, and *Thyrsostachys siamensis* Gamble. These types of bamboo species grow naturally at the study sites and also already cultivated by the local community (Table 2). Dransfield and Widjaja (1995) stated that most of bamboos are planted on the banks of rivers, ravines, fields, and land boundaries, although some grow wild in natural forests.

Table 1 shows that the highest variation in bamboo genera was recorded in Rangsang Island, with five genera. The numbers of genera in the Rangsang island were higher than those in previous studies; Talang Pauh Village, Bengkulu Tengah had only four genera despite having a high number of species (10 species) (Yani, 2014). Research conducted in the Hulu Banyu Village of Laksado Regency, the District of Hulu Sungai Selatan, revealed only five species of bamboo from three selected genera (Peran, 2008).

The highest number of bamboo species was obtained on Rupat Island and Bengkalis Island, which each had nine species. Rupat Island is the largest island (BPS Riau, 2017). This island has various mineral soil types and peat organic soils (Sudiharjo, 1988). Thus, it is possible to obtain distinctive species compared with other islands. Bengkalis Island is the closest island to Rupat Island, but there were different types of bamboo on the two islands. Research on these two islands revealed a high variation in bamboo species despite having not as many as the number of species found in Sumba Island, which has 10 species of bamboo (Widjaja and Karsono, 2005). According to Andoko (2003), bamboo preferably grows in soil with pH values between 5.0 to 6.5 and altitudes of 0–2000 m below sea level. Bamboo can grow well in fertile soils. The desired temperature and minimum humidity required for proper bamboo growth are approximately 8.8 °C–36 °C and 80%, respectively.

Table 2 shows that the bamboo species commonly found in the explored areas was *B. vulgaris* Schard. Ex Wendl. var. *vulgaris* and *D. asper* (Schult.) Backer. Both species are known to grow and have a stable tolerance level under various soil conditions. Genus *Bambus* has three varieties, namely *vulgaris*, *striata*, and *wamini* with whole distribution in each island. *B. vulgaris* Schard. Ex Wendl. was encountered in 27 clumps in all explored islands. This total clump consists of *B. vulgaris* Schard. Ex Wendl. var. *vulgaris* (16 clumps) and *B. vulgaris* Schrad. Ex Wendl. var*. striata* (11 clumps). This bamboo species was the most numerous species discovered in all research locations. Widjaja (2001a) stated that *B. vulgaris* Schard. Ex Wendl. var. *vulgaris* has a wide tolerance range and is thus able to grow and adapt in dry or humid areas and can grow in areas that are flooded. The high adaptability and tolerance level shown by *B. vulgaris* Schard. Ex Wendl. var. *vulgaris* are the main factors for the high abundance of this species in the five islands.

A large number of clumps are generally established from the species of *D. asper* (Schult.) Backer, with the total of eight clumps that are entirely spread almost all over the islands, except Rupat Island. This species is considered to be extinct because it can no longer be found in Rupat Island, possibly due to the consumption of young shoots by local people. This is also supported by Yani (2014), who confirmed that the population of this species in Tabalagan Village, Central Bengkulu has been decreasing over time due to the utilization of young shoots by local people. Moreover, this bamboo is always harvested for vegetable materials.

Bamboo exploration in the five islands in Riau Province identified 19 accessions of bamboo groups consisting of five genera, 17 species, and three varieties. Cluster analysis showed that the bamboo species in the five islands within two regencies in Riau Province have similarity values with a coefficient range of 0.45–0.725 (45%–72.5%). Cahyarini *et al.,* (2004) explained that if the coefficient value is less than 0.60 (60%), then the similarity distance of a species is statistically considered to be far. This indicated that the diversity of bamboo species in the five islands in Riau is high.

A dendrogram was constructed on the basis of the results of the morphological characterization of bamboo accessions by using 56 vegetative characteristics in accordance with Widjaja *et al.*, (2005) (Figure 2). In general, the dendrogram formed two main clusters, namely Cluster I (Genus *Bambusa*) and Cluster II (Genus *Schyzostachyum*). These two clusters were separated on the basis of leaf sheath characteristics. The leaf sheath is a modified leaf that is attached to each segment (Widjaja, 2001a). This section becomes an important organ for the identification and classification of bamboo species (Wong, 1995). Accessions in Cluster I have the type of leaf sheaths that are easy to decay, whereas in those in Cluster II have young shoots that do not easily decay. The easily decayed leaf sheaths are discovered and have been considered as the main characteristic that can help distinguish the genus *Dinochloa* (Widjaja, 2001a).

Cluster I (*Bambusa*) has a coefficient value of 0.465 (46.5%) and has formed two subgroups consisting of *Bambusa*, *Dendrocalamus*, and *Gigantochloa*. This result showed that these three genera share many similar characteristics that caused them to cluster in one group. Song *et al.* (2012) stated that *Gigantochloa* is morphologically and identically similar to *Bambusa* and *Dendrocalamus*. These three genera are distinguishable only on the basis of several vegetative characteristics possessed by each genus. Furthermore, these three genera are normally very difficult to separate if grouping is done without using generative characteristics (flowers). *B*. *vulgaris* Schard. Ex Wendl. var*. vulgaris* and *B*. *vulgaris* Schard. Ex Wendl. var*. striata* formed a subcluster with the closest similarity coefficient value of 0.785 (78.5%). This result indicated that both species belonged to the same species based on the vegetative characteristics used. Meanwhile*, B*. *vulgaris* Schard. Ex Wendl. var. *wamini* was separated from the other two varieties yet remained grouped in the same cluster because some of its diagnostic characteristics are available only in the type group of *B*. *vulgaris* Schard. Ex Wendl. var*. vulgaris*.

Cluster II (*Schyzostachyum*) has a coefficient value of 0.54 (54%) and consisted of *S*. *brachycladum* (Kurz) Kurz, *S*. *silicatum* Widjaja*, T*. *siamensis* Gamble, and *Bambusa multiplex* (Lour.) Raeusch. ex Schult*..* The inclusion of the genus *Bambusa* in this cluster was due to the similarity of the characteristics of the remaining leaf sheaths and some furs on the leaf sheath. These two characteristics separated *B*. *multiplex* (Lour.) Raeusch. ex Schult. from the other genus *Bambusa*. The results showed that not all species were clustered in the same genus. In fact, species, even those from different genera, with the same characters will group into one cluster. This also exerted the close relationship between the *B*. *multiplex* (Lour.) Raeusch. ex Schult. and the genus *Schyzostachyum*. These two genera were separated on the basis of the long internodes of the genus *Schyzostachyum*, whereas those of the genus *Bambusa* were known to have short internodes (Widjaja, 2001a).

PCA was used to classify accessions on the basis of morphological characteristics. The results of PCA showed the separation of two large groups; group I contained Genus *Schyzostachyum* and group II included Genus *Bambusa, Dendrocalamus*, and *Gigantochloa* (Figure 2). The characteristics that played a role in separating the two groups were those identified on the basis of leaf sheaths. These characteristics included the characteristics of the leaf sheath, the height of the auricle, and the number of ranches. In group II, *B*. *vulgaris* Schard. Ex Wendl. var. *vulgaris* was far apart due to the width character of the leave and length of leaf sheath. Widjaja (2001a) stated that the auricle of the leaf sheath can help to separate even genus types in the bamboo group. For example, the genus *Bambusa* has a large auricle of the leaf sheath, whereas the genus *Gigantochloa* and *Dendrocalamus* have smaller auricles.

Bamboo has its own role in the lives of local people. The utilization of bamboo cannot be separated and is very integrated with the life of the people in an area, especially in rural areas (Sastrapradja *et al*., 1977). The necessity and utility of bamboo in the local community in Bali start from when humans are born until humans die (Arinasa, 2014). The Balinese use bamboo specifically in their traditional ceremonies (Ekayanti, 2016).

Table 3 shows that the identified bamboo accessions provide 21 benefits to people's lives. The bamboo groups encountered at the study sites are widely used as handicraft materials (11 species and varieties) and as building materials (10 species and varieties). Some bamboo species have many advantages in people's survives. *B*. *vulgaris* Schrad. Ex Wendl var. *vulgaris* is the most widely used species with a total of 14 benefits in daily life. The next species is *T*. *siamensis Gamble* with a total of eight advantages (Table 3).

Several previous studies have provided information regarding the benefits and utilities of bamboo in people's lives. Bamboo can increase groundwater discharge (Raka *et al.,* 2011). Besides, bamboo is one of species that plays a role in preventing soil erosion (Wong, 2004). The capability of bamboo to resist erosion and landslides around rivers and maintain the hydrological cycle is attributed to its root system (Bystriakova *et al.,* 2003). The root system, in the form of dense root fibers with clumps that are specific to bamboo groups, enables bamboos to act in water filtration. In addition, research has proven that litters from bamboo leaves can be used as a filter medium and purify dirty water. Based on this research, this plant group has potential to be developed and cultivated in areas that experience water shortages, such as peat areas, especially in the five islands of research sites. The utilization of bamboo in various needs and trades is expected to handle and resolve the problem of clean water and improve the economy of local communities.

CONCLUSION

Seventeen species, five genera, and three varieties in the five islands and two regencies of Riau Province were recorded. All types of bamboo were capable of clean water filtration, and the most common type found was *B*. *vulgaris* Schard. Ex Wendl. var. *vulgaris* and *B*. *vulgaris* Schard. Ex Wendl. var. *striata*, each with 16 and 11 clumps. *B*. *vulgaris* Schard. Ex Wendl. var. *vulgaris* is multipurpose bamboo and adaptable to all types of habitat. This species has potential to be developed in peatlands area.

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