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**Inventory and conservation of bamboos with medicinal properties in  
Buleleng district in Bali Indonesia**

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**研究資料**

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**Inventory and conservation of bamboos with medicinal properties in Buleleng district in Bali Indonesia**

Wawan SUJARWO, I.B.K. ARINASA and I.N. PENENG

*“Eka Karya” Bali Botanic Garden - Indonesian Institute of Sciences (LIPI)**Candikuning, Baturiti, Tabanan, Bali, Indonesia 82191**e-mail: w\_sujarwo@yahoo.co.id; wawan.sujarwo@lipi.go.id***Abstract**

Buleleng is a district in the north part of Bali Island where has indigenous knowledge on bamboos for using as medicine traditionally. Exploration and interview were enforced in order to determine bamboo species that can be used as medicine. The result of this research revealed that, there were five bamboo species with medicinal properties, namely *Gigantochloa apus* (J.A. & J.H. Schult.) Kurz locally called to tali bamboo, *Bambusa vulgaris* Schrad. ex Wendl. var. *stricta* called ampel gading bamboo, *Schizostachyum brachycladum* Kurz called tamblang gading bamboo, *Gigantochloa nigrociliata* (Buse) Kurz called tabah bamboo, and *Schizostachyum lima* (Blanco) Merr. called buluh lengis bamboo locally. Morphology of those bamboos, kinds of disease as well as part which are used, chemical compounds and conservation efforts were discussed in this paper.

**Keywords:** Bamboo, GC-MS, Medicine, Buleleng Bali, Indonesia**1. Introduction**

The use of modern medicines and pharmaceuticals has occasionally spoiled humans, so that the knowledge of ancestral traditional medicines has been slighted (Arinasa 2007). An Indonesian government program of “back to nature” has reminded us of under-utilized natural resources that the country has.

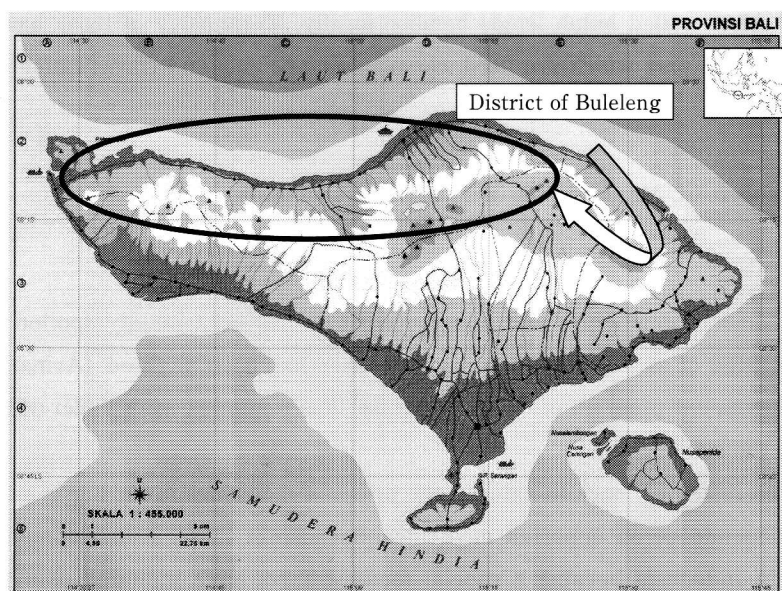
People are interested in “back to nature,” the prices of medicines in Indonesia are increasing, and there is dependence on imported medicines. Because of those, a development plan from 2010 to 2014 in Indonesia became a special focus. Efforts have included using introduced medicinal plants and wild species that have been traditionally cultivated. One potential alternative medicine material is bamboo (Sujarwo, 2010).

Bamboo is well known, as it grows from lowland to highland. Its uses in construction, for handicrafts and household utensils, and its conservation of water and soil are well known by many people, but its utilization as medicine is less known. The Hindu society in Bali utilized bamboo for cutting the navel cord, for household handicrafts, agriculture tools, building material, and in the death ceremony called as Ngaben (Dransfield and Widjaja 1995). However, although Balinese ancestors used bamboos, the use for medicine has not been widely known. Some indigenous knowledge of bamboo was found in "Lontar Usada". Lontar usada is a manuscript about healing system, the medicinal ingredients and the method in Bali traditional healing (Tengah et al. 1995). In previous days the shoots of yellow bamboo (*Bambusa vulgaris*) were used to heal liver problems (Dransfield and Widjaja 1995). Balinese ancestors used the water in *Dinochloa scandens* (cangkoreh in Indonesian) as a medicinal eyewash and for tuberculosis (Sastrapradja et al. 1997). *Gigantochloa apus* (tali) was used to heal wounds and for rheumatism and impotency (Suwidja 1989).

## 2. Methods

### 2.1. Research area

Buleleng district is located in the north part of Bali island which is the widest district among nine districts in Bali and is almost a third of Bali Island ( $\pm 1365.88$  hectares). The climate in Buleleng is tropic with average rainfall by 1,365 mm/year. Rainy season is between October to April whereas dry season is between April to October. Buleleng district consists of nine subdistricts, namely Tejakula, Kubutambahan, Sawan, Buleleng, Sukasada, Banjar, Busungbiu, Seririt, and Gerokgak (Anonymous 2007).



Map 1. The Location of Research (circle)  
(Bale, 2006)

## 2.2. Method

This research activity consists of exploration and interview. The method of interview is used to know bamboo species with medicinal properties and practice of usage. Interview was conducted with *balian usada*. *Balian usada* is an indigenous medical practitioner who is knowledgeable on plant uses. On the other hand, the collection of bamboo species was carried out with exploration. In addition, making specimen of herbarium is also needed to identify the botanical name of bamboo species. The chemical compounds of bamboo species were analyzed by GC-MS (*gas chromatography mass spectrometry*).

## 3. Results and discussions

### 3.1. The morphology of bambos with medicinal properties

There are 20 bamboo species in Buleleng District, Bali (Arinasa *et al.* 2004; Widjaja *et al.* 2005), and many of them are planted at pebble land or riverside that have function as conservation of water and soil. Based on interview activity, total twelve respondents have been obtained, who all were *balian usada*, while *Balian usada* is an indigenous medical practitioner who is knowledgeable on plant uses. The result of this research revealed that there were five of bamboo species, those were roots and culms of *Gigantochloa apus* used to cure diabetes and for skin rejuvenation; shoots of *Bambusa vulgaris* var. *stricta* used to cure liver problems; roots of *Schizostachyum brachycladum* used to smooth mother's milk; shoots of *Gigantochloa nigrociliata* used to relax muscle and for heartburn; shoots of *Schizostachyum lima*, used to increase memory. The bamboos that were found during the exploration are completely described as below:

#### **Tali Bamboo** (*Gigantochloa apus* (J.A. & J.H. Schult.) Kurz)

Description :

Clump is dense; sympodially branched rhizome, as shown at Picture 1. Culm is erect  $\pm$  15 m in tall, 7.1-8.7 cm in diameter, greyish-green to bright, shiny, covered by brown hairy but caducous when maturity, internode is 30-35 cm, wall is  $\pm$  15 mm in thick and its top is curve. Young shoots is slender, with appressed blackish brown hairs, light green to grey-green. Branch arising is  $\pm$  1 m up ward, usually consist of 6-9, one dominant branch is bigger than others. Culm sheath is narrowly trapezoid, 7-35 cm x 8-26 cm covered with dark brown or black hairs, persistent auricles frame is like 1-3 mm in long with bristle until 7 mm in long, ligule is 2-4 mm and glabrous. Blade is spreading to deflexed, triangular with narrow basal tinged yellowish. Leaf blade is 13-49 cm x 2-9 cm, slightly hairy beneath when young. Auricle is small and rounded, 1-2 mm in long and glabrous. Ligule is flat, 2-4 mm in long and glabrous.



Picture 1. Clump of Tali bamboo

**Ampel Gading Bamboo** (*Bambusa vulgaris* Schrad. ex Wendl. var. *stricta*)

Description :

Sympodial bamboo and is not closely dense, as shown at Picture 2. Culm is  $\pm 10$  m in tall, erect or rather sinuous, 5.5-10 cm in diameter, internode is 24-28 cm in long and wall can reach 7-15 mm in thick. Young culm is yellow with green stripes. Young shoots are yellow-green, covered with black hairs. Branch arising is  $\pm 1.5$  m up ward, consist of 2-5 dominant branch. Culm sheat is more and less triangular caducous, appressed by black to dark brown hairs, auricles is rounded with edges curve out 1-1.5 cm in long and bristles reach 7 mm in long. Ligule is slightly serrated, 2-3 mm in long with short bristles. Blade is erect, triangular with widely on the base. Leaf blade is 9-30 cm x 1-4 cm and glabrous. Auricle is small, 1 mm in tall with short bristles. Ligule is flat, 1-2 mm in long.



Picture 2. Clump of Ampel Gading bamboo

**Tamblang Gading Bamboo** (*Schizostachyum brachycladum* Kurz)

Description :



Picture 3. Clump of Tamblang Gading bamboo

Sympodial bamboo, clump is dense, as shown at Picture 3. Culm is erect with pendulous tip  $\pm 12$  m in tall, 5.5-6.7 cm in diameter, internode is 52-56 cm, wall is thin  $\pm 4$  mm in thick. Young culm is covered by white hairs but caducous when maturity and smooth. The culm is yellowish with green stripes. Branch arising is from nodes  $\pm 1.5$  m up ward consist of 8-12 slender sub-equal branches. Culm sheat is 12-27 cm x 18-35 cm, persistent, covered by brown hairs, auricle frame is like 2.5-6 mm in long with bristle 4-8 mm in tall. Ligule is flat, 2 mm in tall. Blade is erect, triangular wide basal with stiff acuminate apex is 4-18 cm x 4 x 10 cm. Young shoot is yellow with rigid culm sheat and hard broad blades, covered by brown-blackist hairs. Leaf blade is 26-40 cm x 4-7 cm, hairy below but after maturity glabrous. Auricle is small, 1 mm in tall, bristle is 7 mm. Ligule is flat, 1 mm in tall and glabrous.

**Tabah Bamboo** (*Gigantochloa nigrociliata* (Buse) Kurz)

Description :

Sympodial bamboo with dense clump, as showan at Picture 4. Culm is erect  $\pm 10$  m in tall, slightly curve tip, covered by black or brown hairs, glabrous when maturity. Internode is 30-32 cm in long, 3.5-6 cm in diameter, wall reach up to 6 mm in thick. Branch arising is 2-3 m up ward consist of 5-10 branches, one of the lateral branches is bigger than others. Culm sheat is triangular but with truncate apex, slightly persistent covered by black or brown hairs, auricle is rounded with



Picture 4. Clump of Tabah bamboo

edges curve inside 2-4 mm in tall and glabrous. Ligule is serrate, 2-3 mm in tall. Leaf is erect black, triangular with wide basal. Young shoot is grey-green, bearing appressed dark brown and white hairs. Leaf blade is 19.5-35 cm x 2.5-4.5 cm, hairy beneath and glabrous above. Auricle frame is like 1 mm in tall and glabrous. Ligule is serrate 1-2 mm in tall with short bristle is 2 mm in tall.

**Buluh Lengis Bamboo** (*Schizostachyum lima* (Blanco) Merr.)



Picture 5. Clump of Buluh Lengis bamboo

**Description :**

Sympodial bamboo with dense clump, as shown at Picture 5. Culm is erect with drooping tip  $\pm 10$  m in tall, 3.5-3.7 cm in diameter, internode is 37-100 cm, wall is thin 3-4 mm in thick. Young shoot is green with pale brown hairs, covered by white waxy powder. Many branches arising are at each node, subequal is  $\pm 1.5$  m up ward. Culm sheath is 18-30 cm x 8 cm, green when young, persistent, covered by pale brown hairs, auricle is short, bristles reach 12 mm. Ligule is flat, 1 mm in tall, covered by bristle is 10 mm in long. Blade is erect first than deflected. Leaf blade is 25-40 cm x 3-7 cm and glabrous above, hairy beneath, small auricles, 2 mm in tall and bristle is 4-13 mm in

long. Ligule is flat, 1 mm in tall and glabrous.

**3.2. Chemical compounds of bamboo species with medicinal properties**

The objective of GC-MS's test is to know chemical compounds on the parts of bamboo. In addition, GC-MS could be used to answer a hypothesis about the utilization of bamboo as medicine. According to Balinese indigenous knowledge, many people believe that *Bambusa vulgaris* var. *stricta* could be used to heal liver problem.

The result of this research, found informations about kinds of disease. In fact, some diseases are curable with parts of specific bamboo species. Ogunjinmi *et al.* (2009) mentioned that many nutritious and active minerals, such as vitamins, amino acids, flavine, phenolic acid, polysaccharide, trace elements and steroid can be extracted from bamboo culm, shoot and leaf. All are having anti-oxidation, anti-aging, anti bacterial and anti-viral functions. The results of chemical compound test using GCMS as shown at Table 1.

One of bamboos as liver medicine is *Bambusa vulgaris* var. *stricta*, many references mentioned that shoots of *Bambusa vulgaris* var. *stricta* contain saponin and flavanoid that have an active function as liver medicine (Winarto 2007). The result of GC-MS used hexane solvent, found fatty acids such as saturated fatty acid (e.g palmitic, myristic, stearic, lauric, behenic, arachidic) and unsaturated fatty acid (linolenic) also the other compound (curcumene). Aromatic compound was also detected, such as naphthalene. Tengah (2009) described that active compounds have a function as liver medicine, such as curcumene and unsaturated fatty acid (linolenic acid), due to curcumene can catch free radical which is one of liver cause.

The result of GC-MS revealed that almost bamboo species with medicinal properties contain

Table 1. The results of chemical compound test using GC-MS

No.	Name of chemical compounds	Percent of normalization					
		<i>G. apus</i>		<i>B. vulgaris</i>	<i>S. brachycladum</i>	<i>G. nigrociliata</i>	<i>S. lima</i>
		Roots	Culms	Shoots	Roots	Shoots	Shoots
1.	Toluene	6.02	-	-	-	-	4.02
2.	Isoamil acetate	30.32	-	-	-	-	19.45
3.	Hexane, 4-ethyl-2-methyl	3.55	-	-	-	-	-
4.	Limonene	5.53	-	-	-	-	4.06
5.	1,3,5 trimethyl benzene	1.39	-	-	-	-	-
6.	Octana, 4 ethyl	0.73	-	-	-	-	-
7.	Endobornyl acetate	0.72	-	-	-	-	-
8.	Curcumene	6.39	6.67	0.39	-	-	5.68
9.	Alpha cedrene	3.93	4.12	0.24	-	-	4.25
10.	Myristic acid	0.56	1.86	1.10	1.43	1.06	-
11.	Palmitic acid	16.15	49.99	48.15	46.75	53.78	11.94
12.	Stearic acid	2.97	3.07	-	-	0.10	-
13.	Oleic acid	3.24	6.66	-	10.59	-	4.30
14.	9,12 octadecadienal	5.21	14.12	-	-	-	-
15.	Stearolic acid	0.60	-	-	-	-	-
16.	Naphtalene	-	2.04	0.42	1.13	0.37	-
17.	Pentadecylic acid	-	1.03	1.01	0.84	0.58	-
18.	Margaric acid	-	1.91	0.28	0.50	0.51	-
19.	Oleoamide	-	2.49	0.21	0.85	-	-
20.	Lauric acid	-	-	0.65	1.11	0.37	-
21.	Linolenic acid	-	-	3.15	2.96	3.23	1.25
22.	Arachidic acid	-	-	0.25	-	0.40	-
23.	Behenic acid	-	-	0.19	-	0.88	-
24.	Unknown	-	-	-	33.86	0.49	-
25.	2-methyl-3-ethyl heptane	-	-	-	-	-	1.97
26.	2,3-dimethyloctane	-	-	-	-	-	7.14
27.	5-methyl-2-undecene	-	-	-	-	-	2.64
28.	2,4,6-trimethyloctane	-	-	-	-	-	4.70
29.	1,2,3-trimethylbenzene	-	-	-	-	-	1.75
30.	2,5-dimethyldecane	-	-	-	-	-	1.23
31.	2,6,8-trimethyldecane	-	-	-	-	-	1.62
32.	3-methyldecane	-	-	-	-	-	1.24
33.	Endobornyle acetate	-	-	-	-	-	1.17
34.	5-octadecane	-	-	-	-	-	1.11
35.	5-eicosene	-	-	-	-	-	0.93
36.	2-heptadecane	-	-	-	-	0.13	-
37.	Ambrettolide	-	-	-	-	9.38	-
38.	Heneicosanic acid	-	-	-	-	0.44	-

high palmitic acid, it indicates that the content of saturated fatty acid is high. The influence of saturated fatty acid is opposite with utilizing bamboo as medicine, too much saturated fatty acid can cause hypertension. Considering that palmitic acid is saturated fatty acid but Benoit *et al.* (2009) mentioned that palmitic acid is very useful to stimulate insulin, which plays a role to heal diabetes. For instance, utilizing saturated fatty acid on VCO (virgin coconut oil), which could heal many kinds of disease. The result of GC-MS could be used to conclude that utilizing bamboo as medicine is possible, because bamboo contains high antioxidant and has been discovered some chemical compounds such as palmitic acid, linolenic acid, curcumene and naphthalene. High antioxidant could be used to catch free radical which is one of disease cause



(Tengah 2009).

Utilizing hexane solvent has influent to the result of GC-MS's test, it could be seen on many fatty acid compounds that have been identified, when correlated with its use as medicine, it is still so far. It is possible that its active compounds as medicine can not be identified by using non polar solvent. There is possibility that these compounds could be identified with semi polar or polar solvent. In addition, further testing might be needed to determine active compounds, because chemical compounds such as toluene and naphthalene that play a role as medicine is their derivate compounds.

### 3.3. The conservation efforts of bamboo species

The research of bamboo with medicinal properties in Buleleng District Bali has found five of bamboo species, those were Tali Bamboo (*Gigantochloa apus* (J.A. & J.H. Schult.) Kurz), Ampel Gading Bamboo (*Bambusa vulgaris* Schrad. ex Wendl. var. *stricta*), Tamblang Gading Bamboo (*Schizostachyum brachycladum* Kurz), Tabah Bamboo (*Gigantochloa nigrociliata* (Buse) Kurz) and Buluh Lengis Bamboo (*Schizostachyum lima* (Blanco) Merr.). Furthermore, those bamboos have been planted in Taman Usada (medicinal plant collection) of Bali Botanic Garden.

The result of exploration in the field, totally got 26 seedlings of bamboo with medicinal properties. Furthermore, bamboo seedlings were acclimated in nursery of Bali Botanic Garden for 3-4 months. KOMPENIT (kompos penambat nitrogen) fertilizer was used as media of acclimatization and then planted on the polybag.

In the process of bamboo cultivation was conducted by watering at least twice a day. Basically, the propagation of bamboo is quite difficult for specific bamboo, this was due to occur in root decay. Total 26 seedlings can survive on as many as 21 seedlings on the process of acclimatization. In other word, mortality occurred 5 seedlings with the highest mortality in *Bambusa vulgaris* var. *stricta*, because the seedlings obtained were fairly low quality and was also influenced by long dry season, so that the seedlings before acclimatized in the nursery have so much withered. *Bambusa vulgaris* var. *stricta* is susceptible to the disease; this could be seen from the culm of fungi susceptible.

According to the total of 21 survived bamboo seedlings during the acclimatization process showed a fine growth, it is indicated by many leaves grow and arising branch in their internodes. In each bamboo species revealed an average growth. Furthermore, 21 bamboo seedlings were planted in "Taman Usada" (medicinal plant collection) of Bali Botanic Garden.

## 4. Conclusions

1. There are five bamboo species with medicinal potency, those are roots and culms of *Gigantochloa apus* used to cure diabetes and for skin rejuvenation; shoots of *Bambusa vulgaris* var. *stricta* used to cure liver problems; roots of *Schizostachyum brachycladum* used to smooth mother's milk; shoots of *Gigantochloa nigrociliata* used to relax muscle and for heartburn; shoots of *Schizostachyum lima*, used to increase memory.

2. The result of GC-MS (*gas chromatography mass spectrometry*) used hexane solvent revealed that found fatty acids such as saturated fatty acid (e.g palmitic, myristic, stearic, lauric, behenic, arachidic) and unsaturated fatty acid (linolenic) also the other compound (curcumene). Aromatic compound was also detected, such as naphthalene.
3. There are 21 bamboo seedlings have been planted in "Taman Usada" (medicinal plant collection) of Bali Botanic Garden.
4. As the suggestion, further research might be needed to determine active compounds in bamboo for producing the medicine from bamboo raw material.

## 5. Acknowledgement

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