

2021

Ethno-bamboo Approaches to the Pala'wan in the Mangrove Area of Palawan Island, the Philippines

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Abstract

Bamboo is an important resource in Southeast Asia, which is a hotspot of bamboo species diversity globally, and has historically contributed to livelihoods in various environments. Subsistence livelihoods are still widely found in Southeast Asia, especially in isolated villages, and various kinds of plant resources, including bamboo, support local livelihoods. Understanding the relationship between human society and plants is important to understand the historical process of expansion and adaptation of human society in Southeast Asia; however, despite its importance, information on bamboo utilization remains limited. A field survey was conducted in a village located in the mangrove area of Palawan Island, the Philippines. The residents were the Pala'wan. Data was obtained through participatory observation and interview survey to at least 30 villagers. In the village, 10 bamboo species, both wild and cultivated, were utilized for various purposes, with a large and specific demand for bamboo of cultivated species. These species are medium to large in size, and some are distributed widely both in mainland and insular Southeast Asia. These bamboo species are considered to have been brought by Southeast Asian people along with other useful plants and have adapted to the new environment. To understand the long-term relationship between Asian people and plants, it is necessary to consider bamboo, and multi-disciplinary integration of knowledge, which can be called as the "ethno-bamboo approach," can uncover new aspects of this relationship.

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Keywords: Ethnobotany, *Bambusa blumeana*, Insular Southeast Asia, material culture, bamboo utilization

Bamboo is an important plant resource in Asia. It has contributed to the livelihood of Asian people for thousands of years and is still widely used in many countries. The plant diversity of bamboo is also quite high, with 590 species in Asia (Dransfield & Widjaja, 1995). As a hotspot of bamboo diversity, there are 270 in Southeast Asia (Dransfield & Widjaja, 1995), and people in this region use bamboo in their daily lives for various purposes. In Southeast Asia, bamboo is not a climax species, and it grows in disturbed environments under natural conditions. Bamboo also thrives in the environment under artificial disturbances and is compatible with agricultural ecosystems. The compatibility between agricultural ecosystems and bamboo is an important characteristic of the region when considering relationships between humans and plants.

Many rural livelihoods in Southeast Asia are self-sustaining, and local people obtain almost all resources, including food and materials. Bamboo is a versatile plant and has contributed to almost all aspects of their daily lives, especially in isolated villages. There are two types of isolated villages in Southeast Asia: inland mountain villages and villages on islands. For example, bamboo was reported to significantly contribute to the food supply and subsistence of rural people in the mountain villages of Lao PDR (Izikowitz, 2001). In monsoon Asia, rice is a staple food in most villages. Rice is harvested by the end of the rainy season under rainfed conditions in both rainfed lowland paddies and highland swidden or *kaingin* fields. In the rice cultivation cycle, the pre-harvest season is considered the most difficult season for obtaining food. However, according to an interview by Izikowitz (2001), rural people did not struggle at that time because there were many forest products typically represented by bamboo after the start of the rainy season; instead, the most difficult time occurred just before the rainy season. This suggests that forest products, including bamboo, have contributed to alleviating food shortages. Bamboo has been the most important plant resource in disturbed environments created by agricultural activities in mountainous areas, such as swidden agriculture. In isolated villages on islands, such as Palawan Island of the Philippines, bamboo is considered to play an important role in rural livelihoods. Although bamboo is most diverse in mainland Southeast Asia, its diversity in insular Southeast Asia is also high. These diverse bamboo species similarly contribute to isolated societies in these areas.

The biological traits of bamboo are also crucial in its relationships with local societies. Bamboo belongs to the Gramineae family (which includes rice), and its rhizome system can be divided into two types: sympodial and monopodial. The monopodial type is a single-stemmed long rhizome located above ground, and its huge biomass lies underground. The terminal buds of rhizomes elongate continuously, and bamboo shoots grow from nodes of rhizomes. Monopodial

bamboo is mainly found in temperate regions. In contrast, sympodial bamboo is a clump-forming bamboo mainly found in tropical and subtropical regions. Climbing bamboo is also found in this group. The rhizome system is not remarkable, and its apical buds do not elongate continuously. Lateral buds grow soon after the apical bud growth. Consequently, this bamboo type does not occupy a large area and forms a clump shape. The monopodial type can propagate vegetatively on a local scale. While the sympodial type is propagated by seeds after flowering under natural conditions. The frequency of bamboo flowering is generally low (Janzen, 1976), and humans need to transport the bamboo to expand its distribution successfully. When the rhizome is covered by soil to some extent, it can quickly regenerate in a new land without any special management techniques. The high potential for regeneration should have greatly aided human survival, especially in isolated environments.

In addition to the ability of bamboo to regenerate and adapt to the new land, fast vegetative growth is also considered necessary. Bamboo grows from the buds of rhizomes and reaches full height within several months. For example, bamboo shoots of Moso bamboo (*Phyllostachys pubescens*) grow approximately 1.5 m in 1 day (Ueda, 1960), and bamboo shoots of other species also grow fast. Furthermore, medium- to large-sized bamboo can exceed the height of many different plant species in a short period. This quick increase in biomass suggests that bamboo can easily become a dominant species in agricultural ecosystems, such as fallow forests in swidden systems. In the case of the surrounding environments of residential areas, local people can effectively obtain food and materials for various tools. This kind of close relationship among bamboos, disturbed and surrounding environments close to areas of human livelihoods, and villages have been observed in many regions in Southeast Asia. However, this relationship has not been fully studied. Specifically in insular Southeast Asia, other plant species such as palms (including rattan), bananas (*Musa* spp., including abaca), Dipterocarpaceous tree species (for example, *Dipterocarpus* spp. and *Shorea* spp.), Frabaceous species, tuber plants (taro, yam, etc.), and other useful plants are the main focus (e.g. Lacuna-Richman, 2006), while bamboo is less prominent.

One reason for less attention is the difficulty in identifying bamboo. Generally, identification of Gramineae is difficult because leaves, culms, or other vegetative organs look similar compared to other plant species. Although Gramineae is mainly identified by flower morphology, bamboo rarely flowers, and it is often identified by its vegetative organs. Vegetative organs are often sensitive to environmental conditions. Sometimes different species become unified after observing flowers and long-term observation of vegetative parts. Such confusion is still common, and the taxonomy of bamboo remains a

necessity for arranging species. Thus, carefully observing and identifying bamboo is vital to precisely understand the relationship between human society in isolated areas and bamboo.

To understand subsistence livelihoods in isolated villages in insular Southeast Asia and the model of the relationship between plants and human society in the livelihood system of islands, studies on bamboo as an important plant resource are indispensable. This study focuses on bamboo utilization and describes the role of bamboo in the village of Pala'wan on Palawan Island. We chose a village near a mangrove forest and recorded its utilization by the local people. In addition, we discuss the relationship between bamboo and its contribution to local people in the island village society.

Materials and Methods

Research Site

The research site is a coastal village on southern Palawan Island located approximately 225 km south of Puerto Princesa, the capital of Palawan Province (Figure 1). The ethnic group in the research site consisted of the Pala'wan, who are animists who worship their deity called Ämpu?; the Molbog and Panimusan, who are indigenous Muslims; the Jama Mapun and Tausug, who are Muslims; the Illongo and Bicolano, who are Christians; and the Cuyonon, who are indigenous Christians. The main groups at the site are the Pala'wan and Molbog. Except for Christians, the local people consider sharks and crocodiles their ancestors (Tsuji, 2021). Historically and linguistically, these groups are very close (Revel-Macdonald, 1979) and have been initially one group. Inter marriages are often practiced among ethnic groups (Tsuji, 2020), and ethnic boundaries are sometimes unclear. Their social structure is bilateral, similar to other ethnic groups in the Philippines. The main subsistence activities at the site are swidden agriculture, fishing, reef, and mangrove forest gleaning, hunting, copra collection in coconut plantations, paddy field cultivation, and livestock husbandry (Tsuji, 2005, 2011, 2013, 2019). It is not easy to sustain their subsistence through indigenous shifting cultivation due to soil degradation. Recently, younger generations graduating from college tend to work for mining companies and banana plantations in the region. In the past decade, the spread of motorcycles instead of motorized boats has facilitated people's economic lives in public markets and shops. Barter trading in periodic local markets is decreasing. People work for oil palm plantations that were radically converted from coconut plantations at the beginning of the 2000s. Society has been rapidly exposed to the market economy due to modernization in the area for mining companies' profit.

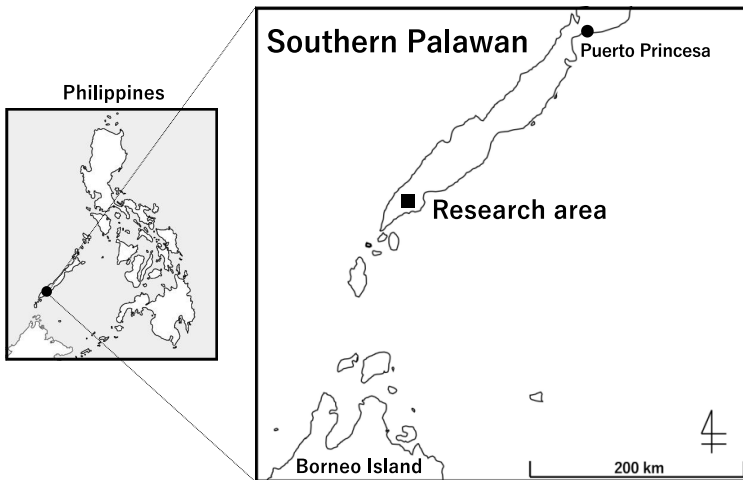


Figure 1. Location of research site

Data Collection

Ethnobotanical studies on bamboo were conducted to: (1) record the utilization and material culture, (2) identify bamboo species and the ecological habitat, and (3) analyze the rural livelihoods and subsistence activities as background information. The main fieldwork for this research was conducted from August 10 to 17, 2017, in a coastal village in the southern part of Palawan Island. Research methods include participatory observation and interviews with local Pala'wan people. Data were collected from at least 30 people in the community through the activity. Identification of bamboo species was conducted by Hirota and Dr. Widjaja, E. A., a bamboo taxonomist of the Indonesian Institute of Sciences (LIPI, Indonesia). General information about bamboo from local people was also obtained in addition to the research done on basic vegetation, agriculture, and fishing in the area. Tsuji interviewed local people about recent socio-cultural and ecological changes to investigate the condition of subsistence activities and biological resource utilization in the area. Hirota led the fieldwork, and Tsuji assisted his work in the field. The chieftain and his relatives in the area accompanied the researchers during fieldwork, and research permission was obtained from the chieftain of the community. The research languages were Tagalog and English.

Results and Discussion

Outline of Botanical studies and plant utilization in the Philippines

There are several botanical studies in the Philippines and Palawan Island focusing on plant names, medicinal and economic uses, and ethnobotany. Dickerson described the flora of the Philippines in relation to the Celebes, Formosa, and Australia. He also noted the similarities between Palawan and Borneo (Dickerson, 1928). Flora and fauna on Palawan Island are somewhat similar to those of Borneo, not those of the Philippines, by the Merrill-Dickerson Line (Widmann, 1998). Blanco identified 1,131 species of Philippine plants with indigenous information during the Spanish colonial period (Madulid, 2017). Merrill stated about 5,000 plant names used by natives of the Philippines during the American colonial period (Merrill, 1903), and Madulid covered 43,338 vernacular and common names as spoken in 97 languages and dialects in the country (Madulid, 2001a, 2001b). Other taxonomic studies have been conducted on flowering plants (Castro, 2006), medicinal plants (de Padua et al., 1978), ornamental plants (Madulid, 2006), and mangroves (Primavera et al., 2004; Primavera & Sadaba, 2012). Tavera and Quisumbing noted plants used for medicinal purposes (Tavera, 1901; Quisumbing, 1978), and Brown greatly contributed to describing in detail the forest products for economic purposes in the Philippines (Brown, 1920, 1921). Notably, Brown (1920, 1921) discussed a considerable number of Philippine bamboos.

Cultural studies of plant materials are reported in basketry (Lane 1986), rattans (PCARRD, 1985), textiles (Reyes, 1992), and mat weaving (Nocheseda, 2015) in the Philippines. Ethnobotanical studies have also been conducted regionally among the Hanunóo in Mindoro by Conklin (1955, 1957, 1958), the Itawes in Cagayan (Rocero, 1982), the Bontoc in Mountain Province (Reid & Madulid, 1972), and the Pinatubo Negritos in Zambales (Fox, 1952). Systematic studies on sago (Paluga, 2016) and swidden agriculture in Itbayat (Yamada, 2016) are also among the ethnobotanical studies of the Philippines. Ethnomusicological research on bamboo music instruments by Maceda (1998) can be considered as an ethnobotanical study in terms of examining the cultural aspects of the plant material.

Several botanical studies have been conducted on Palawan Island. Madulid recorded noteworthy plants on the island (Madulid, 2002). Gutierrez et al. (1983) listed useful plants among the Tau't Batu, a subgroup of the Pala'wan. Conelly conducted an economic botanical study on copal and rattan among the Tagbanua and reported a decrease in forest products due to agricultural expansion and logging (Conelly, 1985). Fox focused on rice wine

among Tagbanua from the viewpoint of anthropology (Fox, 1972). Novellino investigated the emergency role of palm starch among the Pala'wan and mentioned medicinal plants used for illness and healing practices (Novellino, 1999a, 1999b). Revel recorded plant utilization and plant material culture, including the folk taxonomy of bamboos among the Pala'wan in detail from the viewpoint of linguistics (Revel, 1990a, 1990b). Although Revel (1990a, 1990b) mentioned some bamboo folk taxonomy and material cultural aspects, ethnobotanical studies of bamboo have not yet been conducted on Palawan Island.

Bamboo utilization in a village near a mangrove forest

Many plant resources that support livelihoods at the research site were obtained from the mangrove forest near the residential area. In particular, building material, which has the largest biomass demand, is obtained from mangrove forests, and *Bakhaw* (*Rhizophora* spp.) is the most commonly used building material. This genus is typical and is a dominant species in mangrove forests. The cambium layer of *bakhaw* easily desquamates, and its bark can be easily removed. After removal, it becomes a beautiful white timber. The trunk of the *bakhaw* is also straight and is very useful for local people. *Bangkal* is also common among building materials. This species of *Nauclea orientalis* is a dominant species of the secondary forest located in the backland of the mangrove forest in this village. *Bangkal* has a straight and hard trunk and is used as flooring for houses. *Saramponay* (also called *mangkono* in Tagalog, *Xanthostemon verdugonianus*) is also used for floors of houses and canoes, and it is also distributed in the backland of mangrove forests. Another important building material is the *nipa* (nipa palm, *Nypa fruticans*), which is a common species in mangrove forests, not only in Palawan Island, but also in insular Southeast Asia. The *nipa* leaf is tied by rattan locally called *yantok* (mainly *Calamus* spp.) and is used for roofing. Mangrove forests and the surrounding environment support a large demand for plant resources in the village.

In addition to the utilization of these mangrove plants, bamboo is also commonly used. Bamboo is edible and is an important material for tools used in everyday life because of its easy processing. Ten bamboo species were recorded at the study site (Table 1). Among these, nine were used, except for *gunsing* (*Crytchloa* sp.). According to the villagers, *kawayan* (*Bambusa blumeana*) is the most "useful" bamboo species, as it is used as a building material; in rafts, boats (single and double outrigger), and dugout canoes; and as food. It is a large bamboo species of approximately 10 m in height. According to the villagers, there are other large bamboo species, such as *bayog* (*Bambusa* cf. *merrilliana*)

and *taring* (*Bambusa vulgaris*); however, *kawayan* is easier to cultivate because its rhizome can establish roots even in drier land. Villagers can collect ample bamboo shoots from this species during the rainy season, which villagers recognize as from June to December. Even if the bamboo shoot grows tall, villagers can collect it because soft and edible parts are found just above each node, where cell division is active even in tall shoots. Despite its plentiful spine and difficulty in collection, villagers have historically used this species. Like *kawayan*, *patongsog* (*Gigantochloa levis*) and *taring* were similarly utilized, and these species act to supplement *kawayan*.

Table 1. Bamboo species found at the research site.

Scientific Name	Local name	Tagalog	Cultivated or Wild	Use
<i>Bambusa blumeana</i>	<i>kawayan</i>	<i>kawayan</i> , * <i>kawayan tinik</i>	<i>Cultivated</i>	Food, floor, wall, baskets, traps for wild animals and fish, agricultural tools, outrigger of boat
<i>Bambusa textilis</i>	<i>rabok</i>	<i>boho</i>	<i>Wild</i> (* <i>remnant</i>)	Food, roof axis, baskets, traps for wild animals and fish, agricultural tools
<i>Bambusa vulgaris</i>	<i>taring</i>	<i>tereng</i> , * <i>taywanak</i> , * <i>tayu-anak</i> , * <i>tewanak</i>	<i>Cultivated</i>	Food, floor, wall, basket, trap for wild animals and fish, agricultural tools, outrigger of boat
<i>Bambusa cf. merrilliana</i>	<i>bayog</i>	<i>boho</i> , * <i>bayog</i>	<i>Cultivated</i>	Food, baskets, traps for wild animals and fish, agricultural tools, main shaft to connect outrigger(s) and main body of boat

<i>Crytochloa</i> <i>sp.</i>	<i>gunsing</i>	-	Wild	-
<i>Gigan-</i> <i>tochloa levis</i>	<i>patongsog</i>	<i>boho,</i> * <i>kawayan</i> <i>puti,</i> * <i>kawayan</i> <i>tsina</i>	Cultivated	Food, floor, wall, baskets, traps for wild animals and fish, agricultural tools, outrigger of boat
<i>Schizos-</i> <i>tachyum</i> <i>brachyclad-</i> <i>um</i>	<i>bongbong</i>	<i>boho,</i> * <i>buhong</i> <i>dilaw</i>	Cultivated	Baskets, traps for wild animals and fish, agricultural tools
<i>Schizos-</i> <i>tachyum</i> <i>lima</i>	<i>sumbling</i>	<i>boho,</i> * <i>buhong</i> <i>dilaw</i>	Wild	Baskets, traps for wild animals and fish, agricultural tools
<i>Schizos-</i> <i>tachyum</i> <i>lumanpao</i>	<i>bagto,</i> <i>bolikao</i>	-, * <i>bakawi,</i> * <i>boho,</i> * <i>bokawi,</i> * <i>bolo,</i> * <i>lumampaw</i>	Wild	Less biomass and rare, supplemental use of other bamboo species
<i>Schizos-</i> <i>tachyum sp.</i>	<i>napnap</i>	<i>boho</i>	Wild	Baskets, traps for wild animals and fish, agricultural tools

* Indicates information from Madulid (2001a, 2001b). **Original distribution of *Bambusa textilis* is southern China. This species is considered to be remnant.

In addition to the total size of the culm, species with thick culm walls are also useful. Villagers weave baskets, mats, walls, traps for fish and wild animals, and other tools using numerous thin strips of bamboo. When the bamboo culm wall is thick, the villagers can acquire more strips by skiving concentrically after splitting the bamboo culm radially. The villagers' recognized species by thick culm walls at the research site were *rabok* (*Bambusa textilis*) and *bongbong* (*Schizostachyum brachycladum*). The genus *Schizostachyum* generally has

a thin culm wall, and the culm wall of *bongbong* is not especially thick. However, this species is a medium-sized bamboo with long internodes and straight culms. Compared with other medium-sized bamboo species, such as *napnap* (*Schizostachyum* sp.) or *gusing*, the *bongbong* has a thicker culm wall and is considered more useful. According to interviews, the *rabok* is wild and originated from Southern China. It is considered to have been introduced in the past and to be a remnant species in the village.

Weaving bamboo can be mainly divided into two types: large- and small-sized weaving. In large-sized weaving, such as walls, floor mats, or doors, villagers use *kawayan* (floor mat, door), *patongsog* (floor mat, door), *taring* (floor mat, door), *napnap* (wall), *sumbiling*, or *Schizostachyum lima* (wall), which can be used for several decades. In small-sized weaving, such as baskets, mats, and traps for fish and wild animals, villagers use *bongbong* and all other bamboo species. Small-sized weaving tools are observed in every aspect of livelihood activities. While bamboo species used for small weaving mainly consisted of *bongbong*, *napnap*, or *sumbiling*, other bamboo species such as *kawayan*, *patongsog*, or *taring* are also commonly used, and the needs for small weaving are not as selective as those for large weaving. Strong selectivity has been reported in other regions of Southeast Asia (Hirota, 2019). Many wild animal traps have complicated structures, and specific bamboo species are used in the mechanism in many cases (Tsuji, 2019). However, this kind of selectivity was observed only in the utilization of large-sized bamboo and not that of small-sized bamboo at the research site.

Among other bamboo uses, the materials for boats are especially remarkable. Boats are indispensable for livelihood activities near the sea and mangroves, and four bamboo species in the research site were used to construct boats. *Kawayan*, *patongsog*, and *taring* are used as outriggers. These are medium- to large-sized bamboo species that are recognized to be suitable by villagers. Baoyog is used as the main shaft to connect the outrigger with the main body of the boat, and it plays an important role in the boat structure. The bayog culm is strong and heavy, and the villagers choose only this species for the shaft. *Bagto* (*Schizostachyum lumanpao*) was also observed at the study site; however, this species is rare in the village, and was scarcely used except for supplemental purposes.

Contribution of bamboo and its role in a widespread area of Southeast Asia

At the research site, bamboo contributes to various aspects of livelihoods in addition to mangrove plant species. Bamboo utilization is quite common in

Southeast Asia as well as in this research site. However, selectivity for bamboo utilization by villagers was also observed. While villagers used wild bamboo species mainly for smaller tools, such as baskets, traps for wild animals and fish, and agricultural tools, they chose cultivated species for more diverse purposes, including larger and specific demands. These cultivated bamboo species are medium to large in size and are considered to be introduced due to local people's needs.

The Pala'wan were originally known to be swidden farmers on Palawan Island, and the Pala'wan people at the research site are considered to have migrated to coastal areas from mountainous regions at some point. In this case study, bamboo species used for making boats, for example, are all cultivated species. Villagers prefer to use these species instead of wild species for important livelihood activities in coastal and mangrove areas. When people on islands intend to migrate to new environments, as shown in this case study, they bring a set of useful plants. These plants are considered to successfully expand their distribution along with the expansion of human society.

In insular Southeast Asia, tuber crops (taro, yam, etc.), palms (sago, coconut, etc.), *Musa* spp. (banana, plantain, Abacá, etc.), and breadfruits have historically played important roles in the expansion and survival of humans as both food and materials of daily life (Reid, 1988). They are mainly expanded by vegetative propagation by humans. In the process of human expansion to various kinds of environments on islands, it is considered that people could not expect useful plants to be widely distributed in new environments and thus brought reliable, useful plants during migration.

Some cultivated species found at the research site are widely distributed in Southeast Asia. For example, *B. blumeana* is one of the most widespread species in Southeast Asia (Hirota, 2021; Widjaja, 2019) and can be found on islands in the Pacific Ocean and in remote mountain villages of mainland Southeast Asia. *B. textilis*, *B. vulgaris*, and *S. brachycladum* are also widespread species in Southeast Asia, and this case study also showed their important roles in coastal and mangrove areas.

In ethnobotany, bamboo has not been a focus of research despite its importance compared to the other species mentioned above. Historically, many bamboo species have contributed to local livelihoods; therefore, focusing on bamboo, especially medium-to-large-sized bamboo species is necessary. Findings from ethno-bamboo approaches can contribute to other new aspects of the history of human expansion and adaptation to various environments in insular Southeast Asia. Asian people have long utilized bamboo species, and bamboo has contributed significantly to material culture in Asia. Examining the contribution of bamboo to Asian culture by considering ethnological and

biological knowledge is necessary, and the multi-disciplinary integration, which can be called the “ethno-bamboo approach,” will provide new perspectives to the long-term relationship between Asian people and plants.

Conclusion

In Asia, the relationship between bamboo and people has been maintained for a long time, playing a key role in sustaining human livelihood, especially in isolated environments, such as islands. This study described such relationships in a village specifically, in a mangrove area of Palawan, highlighting the significant roles of bamboo. Moreover, a trace of human influence has also been described for bamboo expansion, especially for medium to large bamboo species, some of which are distributed widely both in Mainland and Insular Southeast Asia. These bamboo species are considered to have been brought by Southeast Asian people along with other useful plants and have adapted to the new environment. It is necessary to study the interaction with bamboo to understand the long-term relationship between Asian people and plants. Multi-disciplinary integration of knowledge, referred to as the “ethno-bamboo approach,” could uncover new aspects of this relationship.

Acknowledgements

During our fieldwork on Southern Palawan Island, many Pala’wan people, especially the chieftain and his family, supported our research and generously shared their knowledge about bamboos and their respective habitats. This research was funded by the Japan Milk Alliance (J-Milk), Sakura Foundation of the Society of Biosophia Studies, Institute for Animal Science, Ajinomoto Foundation for Dietary Culture. We would like to express our gratitude to the people and foundations mentioned above.

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