BIODIVERSITAS
Volume 22, Number 4, April 2021
Pages: 2078-2087

ISSN: 1412-033X
E-ISSN: 2085-4722
DOI: 10.13057/biodiv/d220457

The ethnobotany of *Ngusaba* ceremonial plant utilization by Tenganan Pegringsingan community in Karangasem, Bali, Indonesia

DEWA AYU SRI RATNANI[1,♥], I KETUT JUNITHA[2], ENIEK KRISWIYANTI[2], I NYOMAN DHANA[3]

[1]Program of Biology Education, Faculty of Teacher Training and Education, Universitas Mahasaraswati Denpasar. Jl. Kamboja No. 11A, Denpasar 80233, Bali, Indonesia. Tel.: +62-361-227019, ♥email: sri.ratnani67@gmail.com

[2]Program of Biology, Faculty of Mathematics and Natural Sciences, Universitas Udayana. Jl. Raya Kampus Unud No. 9, Jimbaran, Badung 80361, Bali, Indonesia

[3]Program of Anthropology, Faculty of Humanities, Universitas Udayana. Jl. Nias No. 13, Sanglah, Denpasar 80114, Bali, Indonesia

Manuscript received: 22 March 2021. Revision accepted: 28 March 2021.

Abstract. *Ratnani DA, Junitha IK, Kriswiyanti E, Dhana IN. 2021. The ethnobotany of* Ngusaba *ceremonial plant utilization by Tenganan Pegringsingan community in Karangasem, Bali, Indonesia. Biodiversitas 22: 2078-2087.* Tenganan Pegringsingan is an ancient village in Bali, Indonesia, which often performs several ceremonies with high intensity. One of them is the *Ngusaba* ceremony, where many plants are utilized both in species and quantity. Hence, this study aimed to identify the species, family, local names, sources, and parts of plants, used for *Ngusaba* ceremonies by the Tenganan Pegringsingan community including the Index of Cultural Significance (ICS). Data analysis was qualitative and quantitative. Furthermore, the qualitative method was used to obtain data on the plants' local names, while snowball sampling was applied to select key informants through in-depth interviews and moderate participation. The results showed that the 130 species distributed in 56 families mostly belonging to the purchased source (34.61%). The Poaceae is the largest family, while the most widely used part of the plant is the leaf. Based on the ICS analysis results, a range of 2-114 values was obtained. The highest value is Base (*Piper betle* L.) and kangkung (*Ipomoea batatas* L.) as lowest.

Keywords: Ancient villagers, local knowledge, *Ngusaba* plant

INTRODUCTION

Bali is one of the tourism destinations in Indonesia has many attractions. Its distinctive feature is a unique blend of humans, nature, and culture, including customs and religious ceremonies where plants play an important role. Plants or their parts are the most important elements in material associated with the *Yadnya* ceremonies (Sujarwo 2020), including the *ngusaba* ceremony. The *Ngusaba* ceremony is a social activity to connect with the all mighty God (Ida Sang Hyang Widhi), which also includes banquets and *subak* village thanksgiving (Arwati 2007). It provides much information about the use of many plants or their parts, including leaves, flowers, fruits, seeds, and tubers (Adiputra 2011).

The utilization of *Ngusaba* by the Tenganan Pegringsingan community has some problems: which include (i) many of the ceremonial ingredients types and quantities needed exceed these plant's availability in nature; (ii) Only a few people are interested in traditional practices such as agriculture, because most of them rely on tenant farmers; (iii) The existence of plants, especially endemic species become increasingly hard to be found. Besides, plants are an important source of food, medicine, spice, construction materials, etc. in rural areas (Sujarwo et al. 2016; Sujarwo dan Caneva 2016; Sujarwo dan Keim 2017; Navia et al. 2020). They have many cultural sides, namely history, religion, language, art, politics, and social structure (Kakudidi 2004). They also have an important meaning, especially in various religious ceremonies (Helida et al. 2015; Ristanto et al. 2020). Several plants are part of various ritual purposes (Sharma and Pegu 2011; Iskandar and Iskandar 2017) and a source of livelihood for the local people (Suwardi et al. 2020) that believe ritual is one of the most important instruments for understanding local communities and offering, to conserve nature (Geng et al. 2017). The conservation of plant resources is very important to combine with the understanding and awareness of local communities' cultural practices (Sheybani et al. 2015; O'Neill et al. 2017).

However, information technology development and modern lifestyle have led to a decline in local communities' traditional knowledge (Putri et al. 2017) and this condition also affects the Tenganan Pegringsingan community. In addition, the knowledge of ritual plant utilization is diminishing because it is only passed across generations orally and has remained unwritten (Anderson et al. 2011; Surata et al. 2015; Nisyapuri et al. 2018). The loss of local knowledge implicates plant resources' existence, as well as triggers disease and professional changes (Gomez et al. 2010; Cuadra et al. 2012; Ju et al. 2013; Vásquez et al. 2016; Aswani et al. 2018). The knowledge is very useful to conserve biodiversity, hence it needs to be maintained (Yusro et al. 2014) and documented for good management to halt the menace of biodiversity depletion (Adom 2018). There has been much effort in biodiversity conservation, such as plant preservation and documentation of their utilization through ethnobotany which is the study of utilitarian relationships between humans and plants in natural ecosystems and other social components (Hakim

2014). Ethnobotany data cover botany, taxonomy, and regional botanical knowledge. It is also essential for biodiversity conservation (Pieroni et al. 2014; Tapundu and Anam 2015), fulfillment of needs such as food, health, and culture (Setiawan and Qiptiyah 2014; Tamalene et al. 2016; Mesfin et al. 2018), construction, decoration, and other living necessities (Bosworth et al. 2011). Today, ethnobotany has become a crucial study area, which covers management resource development, biodiversity conservation at the genetic, species and ecosystem level, and regional socio-economic development (Caneva et al. 2017). Therefore, this study aims to identify plants used for *Ngusaba* ceremonies by the Tenganan Pegringsingan community.

MATERIALS AND METHODS

Study area

This study was conducted in Tenganan Pegringsingan community of Tenganan Village, Manggis Subdistrict, Karangasem District, Bali, Indonesia, from February to August 2020. The location is at positions 8000º.00' to 8041º.37.8' S and 115035º .9.8’ to 115054º 8.9’ E, at an altitude of 70-400 m asl. The village's temperatures ranging from 28-31ºC.

General description of the study sites

Tenganan Pegringsingan is located in Manggis Subdistrict, Karangasem District, with a distance of ± 20 km from the District City, and ± 68 km from Denpasar. It is physiographically surrounded by three-quarters of a circle of hills forming borders in the north as Macang Village (*kaja* hill), east as Asak Village (*kangin* hill), and west as Ngis Village (*kauh* hill), but directly adjacent to Pesedahan Village in the south. According to usage the area includes paddy rice lands covering 255.85 ha, drylands covering 480.89 ha, and Adat forest lands covering 197.32 ha. (Monograph of Tenganan Village 2020). Tenganan Pegringsingan total population is 1022, with the family heads being 338, while the location map is shown in Figure 1.

Informant selection

Key informants were consulted with community leaders and selected using the snowball sampling technique, which was carried out in a chain by questioning those that have been interviewed or contacted previously (Hariyadi and Ticktin 2012). Furthermore, they had much information about the *Ngusaba* ceremony (Nurdiani 2014), including the offering expert, ceremony officials, and community leaders.

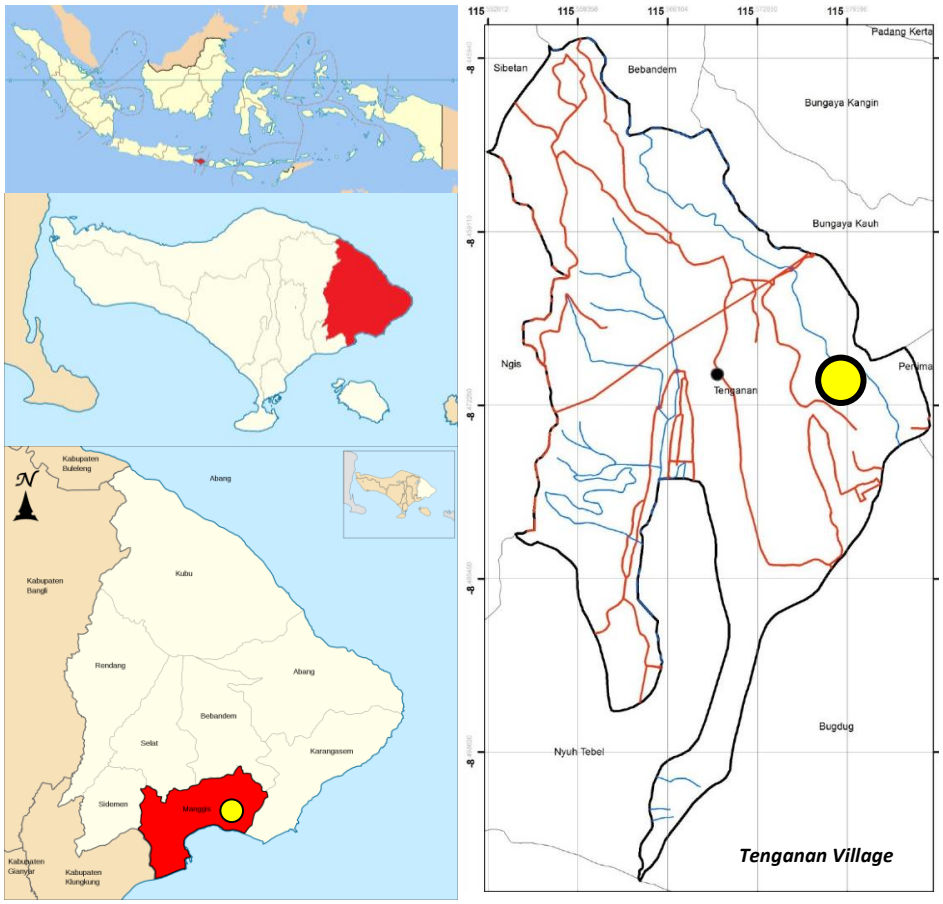

Figure 1. Map of the location of Tenganan Pegringsingan community (○) in Tenganan Village, Manggis Subdistrict, Karangasem District, Bali, Indonesia (Monograph of Tenganan Village 2020)

Data collection

Ethnobotany data were collected through semi-structured interviews and moderate participation in the form of species, family, local names, parts, sources, and the Index of Cultural Significance (ICS) of plants, which were analyzed qualitatively and quantitatively. A descriptive narrative was carried out for qualitative analysis through data reduction, display and analysis (Sugiyanto 2017). The quantitative analysis of the *Ngusaba* ceremonial plant was carried out through the ICS from Purwanto (2003). The ICS showed the importance values of each useful plant species based on the community's needs, and its calculation results showed each plant's importance level. The equation provided is to be employed to calculate ICS.

$$ICS = \sum_{i=1}^{n} (q \times i \times e)\, ni$$

Because each species of plant has several uses, the equation is as follows:

$$ICS = \sum_{i=1}^{n} (q1 \times i1 \times e1)\, n1 + (q2 \times i2 \times e2)\, n2 + \ldots + (qn \times in \times en)\, ni$$

Where:

ICS = the number of calculations the utilization of a plant species from 1 to n,

q : quality value calculated by giving a score or value on the quality value of a plant species: 3 = the main *Ngusaba* ceremony ingredient; 2 = additional *Ngusaba* ceremony materials + primary materials, 1 = other *Ngusaba* ceremony materials + secondary materials + primary materials

i : intensity value describes the intensity of utilization of useful plant species by giving values: value 3 = high intensity; 2 = moderate intensity; 1 = low intensity.

e : exclusivity value: value 2 = most important, is the first choice and is second to none;1 = possibility of being a choice of secondary materials (Turner 1998; Purwanto 2003; modification of researchers).

The plants were collected with the informants and then identified by matching with the herbarium specimen of the Bali Botanical Garden, the picture on the flora book, and images on plantNet. Their scientific names were verified using online sources (e.g. The Plantlist 2019).

RESULTS AND DISCUSSION

Types of plants utilized for *Ngusaba* ceremony

The results showed 11 types of *Ngusaba* ceremonies carried out by the Tenganan Pegringsingan community, including *Ngusaba Kasa, Karo, Ketiga, Kelima (sambah), Kenem, Kepitu, Kaulu, Kesanga, Kedasa, Desta,* and *Sada*. The ceremonies are held almost monthly every year, and each lasts for three days, except for sambah which lasts for one month. The *Ngusaba* plants in Tenganan Pegringsingan Village have a high diversity of 130 species belonging to 56 families among which the largest is Poaceae (16 species), followed by Fabaceae (9) and Musaceae (8). The percentage of the *ngusaba* plant families utilized by the community is shown in figure 2. The various species were collected from various habitats, mainly wild vegetation in the forest, roadsides, in front of the house, home gardens and drylands. The growth form indicated that the most widely used *ngusaba* are obtained from herbs (57 species or 43.84%), followed by trees (38 species or 29.23%), and shrubs (34 species or 26.15%) (Table 1).

This result is higher than 26 species representing 17 families found to be commonly used for performing the six main traditional rituals of the Karangwangi people (Erawan et al. 2018). The Baduy community uses 50 species representing 28 families for nine stages of their pure agricultural activity (Iskandar and Iskandar 2017), while the Aceh tribe in Peureulak uses 51 species consisting of 47 genera and 34 families (Sutrisno et al. 2020). Moreover, Bali Aga village uses 125 plant species for all the Panca yadnya ceremony (Sujarwo 2020) and based on these, cultural diversity shows biodiversity. The diversity of plants used for *Ngusaba* ceremonial offerings is an expression of the region's uniqueness which is a mountainous area surrounded by hills. A region's uniqueness determines biodiversity, including plants in a specific ecosystem. Each ethnic group grows according to regional uniqueness, culture, and natural resources' availability (Suryadarma 2017). Almost all the Poaceae family plants used for *Ngusaba* ceremonies are edible, staple foodstuffs, and the main agricultural product.

Plant parts utilized for *Ngusaba* ceremony by Tenganan Pegringsingan community

The plant parts used are in the form of leaf, stem, flower, fruit, seeds, tuber, and rhizome as presented in Figure 3. The most widely used are leaves, while the rhizome is the lowest.

The most utilized parts reported were leaves (45.52%), followed by fruits (38.80 %) and flowers (17.91%). Other studies such as Mesfin et al. (2013), Riadi et al. (2019), and Ristanto et al. (2020) also reported that leaves were the most commonly used. The high utilization of *Ngusaba* leaves appears to be associated with several advantages such as higher number or productivity of leaves that are easier to obtain than the other parts (Handayani 2015). *Piper betle* L. leaves are mostly utilized in all types of *Ngusaba* ceremonies. These are made in various forms that differentiate their names and are also irreplaceable (exclusive) and a must have in every offering. Furthermore, banana shoots are used almost equally as *Piper betle* L. and those having leaves that are useful to local people are included in a taste of sepia banana group, where the most widely used is *Musa acuminata* L. (*biyu keladi*).

Table 1. Species of *Ngusaba* plants utilization by Tenganan Pegringsingan community

Family/scientific name	Local name	Plants part	Habitus	ICS value	Category
Acanthaceae					
Asystasia gangetica L.	Loja	Leaf	Herb	6	Low
Graptophylum pictum L.	Temen	Leaf	Shrub	24	Moderate
Justicia adhatoda L.	Dausa	Leaf	Shrub	102	Very high
Thunbergia erecta Benth	Terom Pelung	Flower	Shrub	4	Very low
Achariaceae					
Pangium edule Reinw.	Pangi	Seed	Tree	20	Moderate
Agavaceae					
Dracaena marginata Lam.	Sumenek	Leaf	Tree	24	Moderate
Amaranthaceae					
Celocia cristata L.	Kenyiwaan	Flower	Herb	6	Low
Amaryllidaceae					
Allium sativum L	Kesuna	Tuber	Herb	42	Moderate
Allium cepa L.	Bawang	Tuber	Herb	30	Moderate
Anacardiaceae					
Mangifera caesia Jack.	Wani	Fruit	Tree	12	Low
Mangifera indica L	Poh Arum Manis	Fruit	Tree	12	Low
Mangifera indica L	Poh Madu	Fruit	Tree	12	Low
Mangifera odorata Griff.	Pakel	Leaf	Tree	6	Low
Annonaceae					
Cananga odorata Lamk.	Sandat	Flower	Tree	12	Low
Apocynaceae					
Plumeria alba L.	Jepun Bali	Flower	Tree	24	Moderate
Plumeria alba L.	Jepun Cenana	Flower	Tree	4	Very low
Plumeria acuminata L.	Jepun Merah	Flower	Tree	4	Very low
Allamanda cathartica L.	Kecubung Kuning	Flower	Shrub	4	Very low
Araceae					
Colocasia esculenta Schott.	Keladi	Leaf, tuber	Herb	12	Low
Araliaceae					
Schefflera elliptica (Blume) Harms.	Kayu Belang	Leaf	Shrub	20	Moderate
Arecaceae					
Arenga pinnata Merr	Jaka	Midrib, leaf, fruit	Tree	66	High
Areca catechu	Buah	Fruit, flower	Tree	66	High
Cocos nucifera L	Nyuh Gadang	Midrib, leaf, fruit	Tree	84	High
Cocos nucifera L	Nyuh Barak	Midrib, leaf, fruit	Tree	84	High
Salacca zalacca L	Salak	Fruit	Tree	12	Low
Asclepiadaceae					
Hoya australis R.Br.ex.Trail.	Tebel-tebel	Leaf	Herb	6	Low
Asteraceae					
Tagetes erecta L.	Gumitir	Flower	Herb	4	Very low
Tithonia aristrata Oerst.	Sungenge	Flower	Herb	6	Low
Athyriaceae					
Diplazium esculentum (Retz.) Sw.	Paku Sayur	Leaf	Herb	24	Moderate
Bromeliaceae					
Ananas comusus Mer.	Manas	Fruit	Herb	12	Low
Cactaceae					
Hylocereus polyrhizus Britton&Rose	Buah Naga	Fruit	Herb	26	Moderate
Clusiaceae					
Calophyllum inophyllum L	Camplung	Leaf	Tree	6	Low
Mesua ferrea L.	Nagasari	Leaf	Shrub	6	Low
Garcinia mangostana L.	Manggis	Fruit	Tree	12	Low
Combretaceae					
Lumnitzera littorea Jack.	Padi-padi	Leaf	Tree	6	Low
Convolvulaceae					
Ipomoea aquatica Forssk.	Kangkung	Stem, leaf	Herb	2	Very low
Cucurbitaceae					
Citrulus lanatus (Thunb.)	Semangka	Fruit	Herb	24	Moderate
Cucumis sativus L.	Ketimun	Fruit	Herb	30	Moderate
Dioscoreaceae					
Dioscorea bulbifera L.	Ubiaung buluh	Tuber	Herb	6	Low

Euphorbiaceae					
Aleurites moluccanus L.	Tingkih	Seed	Tree	18	Low
Codiaeum variegatum	Kayu Mas	Leaf	Shrub	24	Moderate
Phyllanthus boxifolius Muell.Arg.	Kayu Sisi	Leaf	Shrub	24	Moderate
Fabaceae					
Caesalpinia pulcherima (L) Sw.	Sumerak	Leaf, flower	Shrub	24	Moderate
Casia glauca Lamk.	Kembang Kuning	Leaf	Shrub	78	High
Clitoria ternatea L.	Teleng	Flower	Shrub	12	Low
Erythrina abyssinica Lam.	Dapdap	Leaf, stem	Tree	36	Moderate
Psophocarpus tetragonolobus L.	Kacang Botor	Seed	Herb	6	Low
Tamarindus indica Linn.	Cagi	Seed	Tree	6	Low
Indigofera tinctoria Mill.	Taum	Leaf	Shrub	6	Low
Vigna unguiculata L.	Kacang Barak	Seed	Herb	30	Moderate
Vigna radiata L	Kacang Ijo	Seed	Shrub	6	Low
Heliconiaceae					
Heliconia stricta Huber.	Pisang Ikik	Leaf, fruit	Herb	6	Low
Hydrangeaceae					
Hydrangea macrophylla L.	Bunga Biru	Flower	Shrub	4	Very low
Lamiaceae					
Ocimum gratissimum L.	Sulasih	Leaf	Shrub	6	Low
Leeaceae					
Leea aculeata Burm.f.	Girang	Leaf, stem	Shrub	4	Very low
Leea indica Burm.f	Kelawasan	Leaf	Shrub	24	Moderate
Leguminosae					
Bauhinia purpurea L.	Badya	Leaf	Tree	6	Low
Indigofera tinctoria Mill.	Kumaligi	Leaf	Herb	24	Moderate
Mucuna pruriens Wilmot.	Juleh	Seed	Herb	6	Low
Lablab purpureus L.	Komak selem	Seed	Herb	12	Low
Lygodiaceae					
Lygodium circinatum (Burm.f) Sw.	Ata	Stem+leaf	Herb	36	Moderate
Liliaceae					
Cordyline fruticosa L.	Andong	Leaf	Herb	30	Moderate
Limnocharitaceae					
Limnocharis flava L.	Biyah	Leaf	Herb	6	Low
Malvaceae					
Durio zibethinus L.	Duren	Fruit, leaf	Tree	12	Low
Hibiscus rosasinensis L.	Pucuk Bang	Flower	Shrub	84	High
Magnoliaceae					
Michelia champaca L.	Cempaka	Flower	Shrub	12t	Low
Marantaceae					
Maranta ramosissima Wall.	Kecandik	Leaf	Herb	6	Low
Meliaceae					
Aglaia odorata Lour.	Kiulan	Flower	Shrub	4	Very low
Azadirachta indica Juss	Apah	Leaf	Tree	30	Moderate
Lansium domesticum L.	Langsat	Fruit	Tree	4	Very low
Moraceae					
Ficus benyamina L.	Bingin	Leaf	Tree	24	Moderate
Ficus religiosa L.	Ancak	Leaf	Tree	8	Low
Musaceae					
Musa paradisiaca L.	Biyu Gedang Saba	Leaf, fruit	Herb	30	Moderate
Musa acuminata L.	Biyu Ketip Tulang	Leaf, fruit	Herb	30	Moderate
Musa acuminata L.	Biyu Kunti	Leaf, fruit	Herb	84	High
Musa acuminata L.	Biyu Kayu	Leaf, fruit	Herb	48	Moderate
Musa acuminata L.	Biyu Bunga	Leaf fruit	Herb	54	High
Musa acuminata L.	Biyu Keladi	Leaf, fruit	Herb	99	High
Musa acuminata L.	Biyu Dak Sangket	Leaf, fruit	Herb	84	High
Musa acuminata colla	Biyu Alas	Fruit	Herb	32	Moderate
Myrtaceae					
Psidium guajava L.	Nyambu Kristal	Fruit	Shrub	4	Very low
Syzygium polyanthum Walp.	Don Juwet	Leaf	Tree	4	Very low
Nyctaginaceae					
Bougenvillea spectabilis L.	Bunga Kertas	Flower	Shrub	4	Very low
Pisonia alba Span.	Dagdag See	Leaf	Shrub	6	Low
Oleaceae					
Nyctanthes arbotristis L.	Srigading	Flower	Shrub	102	Very high

Oxalidaceae					
Averrhoa carambola L.	Belimbing Sayur	Leaf, fruit	Tree	6	Low
Pandanaceae					
Pandanus amiryllicolius Roxb.	Pandan Arum	Leaf	Shrub	8	Low
Pandanus tectorius Parkinson ex Du Roi	Pandan Duri	Leaf	Shrub	12	Low
Pinaceae					
Pinus merkusii Jungh.& de Vriese	Cemara	Leaf	Tree	6	Low
Piperaceae					
Piper betle L. var.nigra	Base Bali	Leaf	Herb	24	Moderate
Piper betle L.	Base biasa	Leaf	Herb	114	Very high
Piper retrofractum Vahl.	Tabia Bun	Fruit	Herb	24	Moderate
Poaceae					
Brachiaria mutica (Forssk.) Stapf.	Padang Guwun	Stem+leaf	Herb	18	Low
Coix lacryma jobi L.	Jali-Jali	Fruit	Herb	6	Low
Cymbopogon citratus DC	See	Stem	Herb	4	Very low
Gigantochloa apus (Schult.) Kurz	Tiying Tali	Stem	Tree	8	Low
Hordeum scalinum Schreb.	Ikuh bojog	Flower	Herb	12	Low
Imperata cylindrica L.	Ambengan	Leaf	Herb	18	Low
Oryza sativa L	Beras	Seed	Herb	108	Very high
Oryza nivara L	Beras merah	Fruit, seed	Herb	39	Moderate
Oryza sativa L. var. glutinosa	Ketan Putih	Fruit, seed	Herb	70	High
Oryza sativa L. var. glutinosa	Ketan barak	Fruit, seed	Herb	75	High
Oryza sativa L. var. glutinosa	Injin	Fruit, seed	Herb	75	High
Oryza sativa L.	Padi Gaga	Fruit	Herb	12	Low
Oryza sativa L.	Padi Bali	Fruit, seed	Herb	18	Low
Saccharum officinarum L	Tebu Guwak	Stem	Herb	6	Low
Sorghum bicolor L.	Jagung Beleleng	Seed	Herb	6	Low
Zea mays L.	Jagung	Seed	Herb	6	Low
Pteridaceae					
Adiantum pedatum L.	Paku condong	Leaf	Herb	6	Low
Rubiaceae					
Gardenia jasminoides J.Ellis	Jempiring	Flower	Shrub	4	Very low
Ixora coccinea L.	Jaum-Jaum	Flower	Shrub	6	Low
Psychotria micrantha Kunth.	Wisnu	Leaf	Shrub	6	Low
Rosaceae					
Malus domestica Borkh.	Apel	Fruit	Tree	20	Moderate
Pyrus communis L.	Pir	Fruit	Tree	22	Moderate
Rutaceae					
Citrus amblycarpa Hassk	Limo	Fruit, leaf	Shrub	4	Very low
Citrus grandis L.	Jerungga	Fruit	Tree	12	Low
Citrus reticulata Blanco	Sumaga	Fruit	Shrub	24	Moderate
Citrus sinensis L.	Juuk	Fruit	Tree	24	Moderate
Murraya paniculate L.	Kemoning	Leaf	Shrub	24	Moderate
Santalaceae					
Santalum album L.	Cenana	Stem	Tree	6	Low
Sapindaceae					
Cardiospermum halicacabum Linn.	Kesuman Jai	Leaf	Herb	6	Low
Nephelium lappaceum L.	Buluan	Fruit	Tree	18	Low
Sapotaceae					
Manilkara zapota L.	Sabo	Fruit	Tree	4	Very low
Solanaceae					
Solanum melongena L.	Tuwung	Fruit	Shrub	6	Low
Urticaceae					
Laportea stimulans	Lateng Kebo	Leaf	Herb	6	Low
Vitaceae					
Vitis vinifera L.	Anggur	Fruit	Shrub	4	Very low
Zingiberaceae					
Alpinia galanga L.	Langkuas	Rhizome	Herb	57	High
Curcuma longa Linn.	Kunyit	Rhizome	Herb	18	Low
Zingiber officinale Rosc.	Jahe	Rhizome	Herb	30	Moderate

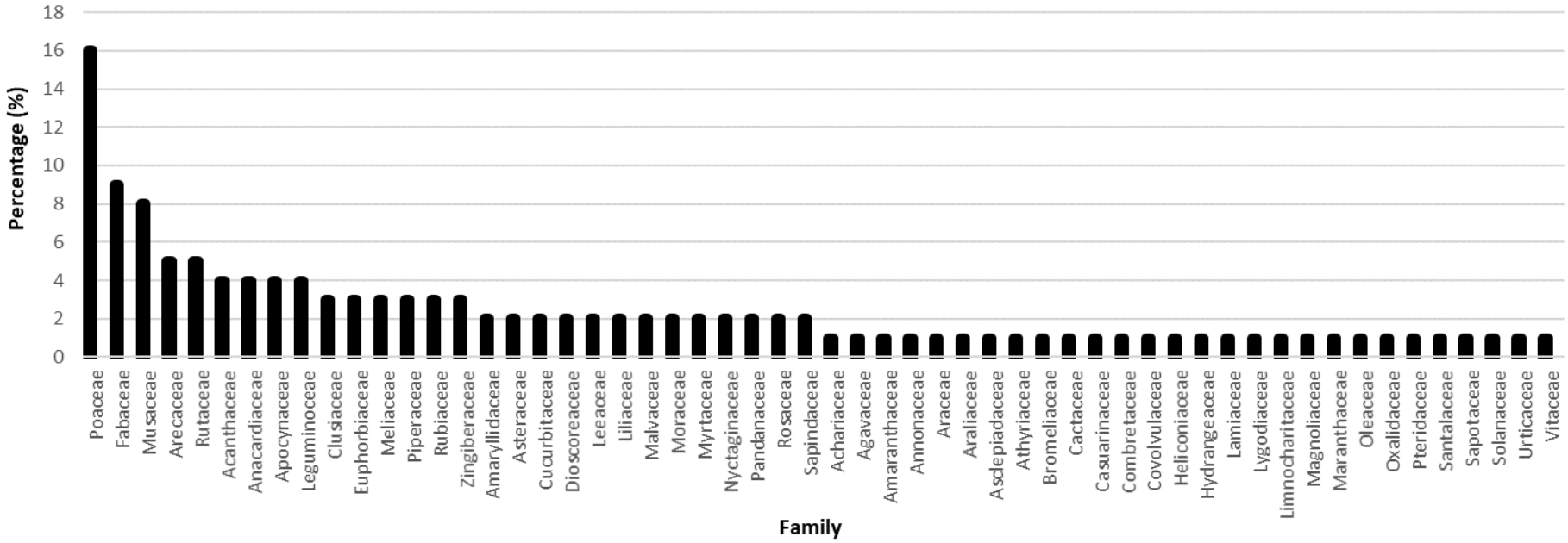

Figure 2. *Ngusaba* ceremony plant family used by Tenganan Pegringsingan community, Karangasem District, Bali, Indonesia

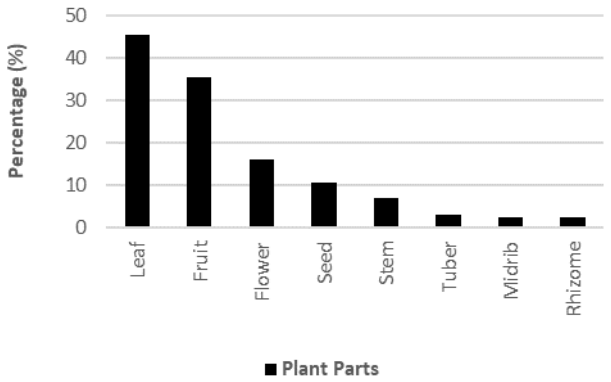

Figure 3. Parts of plant used for *Ngusaba* ceremony by Tenganan Pegringsingan community, Karangasem District, Bali, Indonesia

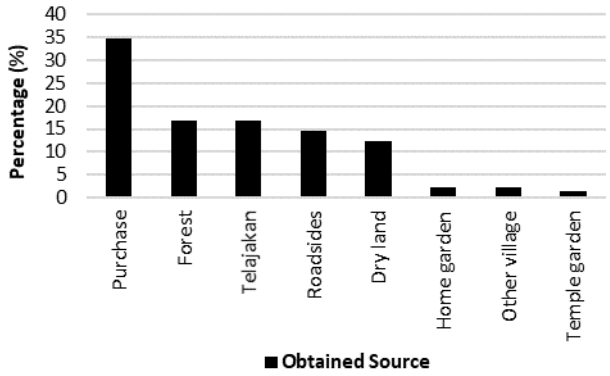

Figure 4. Sources of *Ngusaba* ceremonial plants by Tenganan Pegringsingan community, Karangasem District, Bali, Indonesia

Source of *Ngusaba* ceremonial plants

Ngusaba sources include the home gardens, in front of the house (*telajakan)*, drylands, forests, roadsides, temples, other villages, and from purchase (Figure 4).

Thus, the purchase is the highest source (34.61%), followed by forest (16.92%) and *telajakan* (16.92%), and most of them are wild. This is in line with Sujarwo (2020) stated that most of the *Panca Yadnya* ceremonial plants in *Bali Aga* Village come from Balinese wild ethnoflora (Constant et al. 2018), and they are mostly distributed in various habitats. Their availability varies from one place to another among species. The majority used were harvested from the wild (35.38%), followed by semi-wild (23.84%), and cultivated (7.69 %). The community's efforts by planting in the settlements' vicinity including *telajakan*, drylands, and home gardens. However, there are many types and quantities of ceremonial ingredients needed that exceed this plant's availability in nature. Some of them have not been found in the Tenganan Pegringsingan Village, such as *Musa acuminata* L.(*biyu kunti*), *Musa acuminata* L. (*biyu kayu*), *Oryza nivara*, *Oryza sativa* var. glutinosa (red and black), *Citrus grandis* L., and *Hordeum scalinum* Schreb.

Index of Cultural Significance of useful plants (ICS)

The ICS calculation results showed various values with a range of 2-114. *Piper betle* L. has the highest (114), while the lowest value is noted for *Ipomoea aquatica* Forssk, and the ICS value categories (Figure 5).

The highest ICS value is noted for the plant species widely used by the Tenganan Pegringsingan community, especially those with high exclusivity and intensity levels. In fact, the intensity value is high because it is used in all *Ngusaba* ceremonies as a staple ingredient and is irreplaceable. Plants with more benefits often have a higher ICS value, which means to be more valuable and more exclusive (Hager 2008). The people of Tenganan Pegringsingan placed *Base* (*Piper betle* L.) plants at the highest level and as the most useful and valuable.

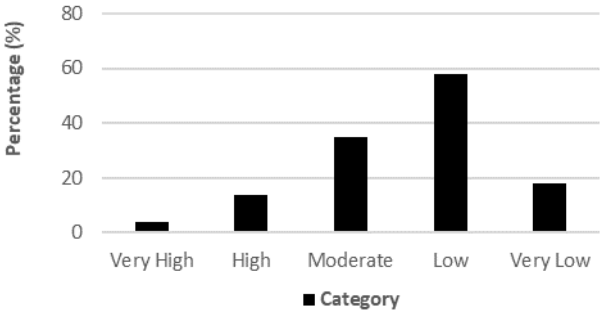

Figure 5. The percentage of the *Ngusaba* ceremony plants used by Tenganan Pegringsingan community, Karangasem District, Bali, Indonesia

This result showed that the Tenganan Pegringsingan community has the most interaction with the *Piper betle* L., meaning that this plant species will be used continuously in as much it is in line with the local community's cultural development. The variety of beneficial plants to a community group highly determines the conservation efforts made. The ICS results of Useful Plants as a quantitative ethnobotany analysis showed each useful plant species importance based on community needs (Munawaroh et al. 2011), hence determining the ones to be preserved (Supiandi 2019). The ICS plants' high index indicates a conservation stimulus, such as nature, benefits, and community willingness towards making efforts to develop it. The Tenganan Pegringsingan community tends to provide species that are often conserved as they are typical and cannot be replaced by other plants. In the beginning, local village communities made use of their natural resources and environment primarily based on local knowledge and/or beliefs embedded in their culture (Iskandar 2016). Therefore, human culture can be understood as the knowledge that contains several sets of models used effectively to interpret, understand, and guide behavior in adapting to the environment (Ahimsa-Putra 2012). This situation requires thoughts and efforts on plant

reintroduction, which the community continuously utilizes by creating a *Ngusaba* ceremonial plants' garden.

In conclusion, we indicated that Tenganan Pegringsingan people utilize a large number of plant species (130) named and explained for *Ngusaba* ceremonies. The plant's largest family (16) is Poaceae, while the most widely used part is the leaf, and the highest proportion was obtained by purchasing. Even though most of them are harvested from the wild vegetation, areas such as roadsides, forests, and dry lands are exposed to many threats. The Index of Cultural Significance of the *Ngusaba* in Tenganan Pegringsingan Village ranges from 2 to 114, and *Piper betle* L. has the highest value (114). There is an imbalance between their existence and the use of plants by the community. Many of them become increasingly hard to be found and some have not been found in Tenganan Pegringsingan, such as *Musa acuminata* L. (*biyu kunti*), *Musa acuminata* L.(*biyu kayu*), *Oryza nivara*, *Oryza sativa* var. glutinosa (red and black), *Citrus grandis* L., *Limnocharis flava* L., *Pinus merkusii* L., and *Hordeum scalinum* Schreb. Therefore, urgent efforts on plant reintroduction are needed to be continuously utilized by the community by creating a *Ngusaba* ceremonial plants' garden.

ACKNOWLEDGEMENTS

The authors are grateful to all people in the studied village for their kind hospitality, the share of knowledge on plants and provision of the opportunity and facilities needed in Tenganan Pegringsingan, Manggis Subdistrict, Karangasem Bali, Indonesia.

REFERENCES

Adiputra N. 2011. Medicinal plants, ceremonial plants and environmental conservation. Bumi Lestari J Environ 11 (2): 346-354. [Indonesian]

Adom D. 2018. Traditional cosmology and nature conservation at the Bomfobiri Wildlife Sanctuary of Ghana. Nat Conserv Res 3 (1): 35-57. DOI: 10.24189/ncr.2018.005

Ahimsa-Putra HS. 2012. Phenomenology approach to understanding religion. Walisongo 20 (2): 271-304. DOI: 10.21580/ws.20.2.200 [Indonesian]

Anderson MJ, Christ TO, Chase JM, Vellend M, Brian D, Inouye, Freestone AL, Sanders NJ, Cornell HV, Comita LS, Davies KF, Harrison SP, Kraft NJB, Stegen JC, Swenson NG. 2011. Navigating the multiple meanings of diversity: A roadmap for ecologists. Ecol Lett 14 (1): 19-28. DOI: 10.1111/j.1461-0248.2010.01552.x.

Arwati M. 2007. *Ngusaba* Ceremony. Office of Religion of Bali Province, Denpasar. [Indonesian]

Aswani S, Lemahieu A, Sauer WHH. 2018. Global trends of local ecological knowledge and future implications. PLoS ONE 13 (4): e0195440. DOI: 10.1371/journal.pone.0195440

Bosworth K, Lysbeth F, Diley HMA. 2011. School climate factors contributing to student and faculty perceptions of safety in select Arizona schools. J School Health 81 (4): 194-201. DOI: 10.1111/j.1746-1561.2010.00579.x

Caneva G, Traversetti L, Sujarwo W, Zuccarello V. 2017. Sharing ethnobotanical knowledge in traditional villages: Evidence of food and nutraceutical B core groups in Bali, Indonesia. J Econ Bot 71 (4): 303-313. DOI: 10.1007/s12231-017-9395-x.

Constant NL, Tshisikhawe MP. 2018. Hierarchies of knowledge: Ethnobotanical knowledge, practices and beliefs of the Vhavenda in South Africa for biodiversity conservation. J Ethnobiol Ethnomed 14 (56): 2-28. DOI: 10.1186/s13002-018-0255-2.

Cuadra VP, Cambi V, Ruda MA. 2012. Consequences of the loss of traditional knowledge: The risk of injurious and toxic plants growing in kindergartens. Ethnobot Res App 10: 77-94.

Erawan TS, Alillah AN, Iskandar J. 2018. Ethnobotany of traditional rituals in the Karangwangi Village Cianjur District, West Java, Indonesia. Asian J Ethnobiol 1 (2): 52-60. DOI: 10.13057/asianjethnobiol/y010201.

Geng Y, Hu G, Ranjitkar S, Shi X, Zhang Y, Wang Y. 2017. The implications of ritual practices and ritual plant use on nature conservation: a case study among the Naxi in Yunnan Province, Southwest China. J Ethnobiol Ethnomed 13 (1): 1-11. DOI: 10.1186/s13002-017-0186-3.

Gomez BE, Mingoria S Reyes GV, Calvet LMontes C. 2010. Traditional ecological knowledge trends in the transition to a market economy: Empirical study in the Don Ana Natural Areas. Conserv Biol 24 (3): 721-729. DOI: 10.1111/j.1523-1739.2009.01401.x.

Hager TF. 2008. Processing and storage effects on monomeric anthocyanins, percent polymeric color, and antioxidant capacity of processed blackberry products. J Agric Food Chem 56 (3): 689-695. DOI: 10.1021/jf071994g.

Hakim L. 2014. Ethnobotany and home garden management: Food security, health, and agro-tourism. Selaras, Malang. [Indonesian]

Handayani A. 2015. Utilization of medical plants by people around Mount Simpang Nature Reserve, West Java. Pros Sem Nas Masy Biodiv Indon 1 (6): 1425-1432. [Indonesian]

Hariyadi B, Ticktin T. 2012. Uras: Medicinal and ritual plants of Serampas, Jambi Indonesia. J Ethnobot Res Appl 10: 133 149.

Helida A, Zuhud EAM, Hardjanto, Purwanto, Hikmat A. 2015. Index of cultural significance as a potential tool for conservation of plants diversity by communities in The Kerinci Seblat National Park. Jurnal Manajemen Hutan Tropika 21 (3): 192-201. DOI: 10.7226/jtfm.21.3.192. [Indonesian]

Iskandar J. 2016. Ethnobiology and cultural biodiversity in Indonesia. Indones J Anthropol 1 (1): 27-42.

Iskandar J, Iskandar BS. 2017. Various plants of traditional rituals: Ethnobotanical research among Baduy community. Biosaintifica 9 (1): 114-125. DOI: 10.15294/biosaintifika.v9i1.8117. [Indonesian]

Ju Y, Zhuo J, Lui B, Long C. 2013. Eating from the wild: Diversity of wild edible plants used by Tibetans in Shangrila-Region, Yunnan, China. J Ethnobiol Ethnomed 9 (1): 1-22. DOI: 10.1186/1746-4269-9-28

Kakudidi EK. 2004. Cultural and social uses of plants from and around Kibale National Park, Western Uganda. Afr J Ecol 42 (1): 114-118. DOI: 10.1111/j.1365-2028.2004.00472.x.

Mesfin K, Tekle G, Tesfay T. 2013. Ethnobotanical study of traditional medicinal plants used by indigenous people of Gemad District, Northern Ethiopia. J Med Plants Stud 1 (4): 32-37.

Monograph of Tenganan Village, Karangasem. 2020.

Munawaroh E, Saparita R, Purwanto Y. 2011. Community dependence on non-timber forest products in Malinau, East Kalimantan: an ethnobotany analysis and its implications for forest conservation. Berkala Hayati Special Edition 7A: 51-58.

Navia ZI, Audira D, Afifah N, Turnip K, Nuraini, Suwardi AB. 2020. Ethnobotanical investigation of spice and condiment plants used by the Taming tribe in Aceh, Indonesia. Biodiversitas 21 (10): 4467-4473. DOI: 10.13057/biodiv/d211001.

Nisyapuri FF, Johan I, Ruhyat P. 2018. Ethnobotany of medicinal plants in Wonoharjo Village, Pangandaran Regency, West Java. Biodiversity 4 (2): 122-132. DOI: 10.13057/psnmbi/m040205.

Nurdiani N. 2014. Snowball sampling techniques in dry land research. Comtech 5 (2): 1110-1118.

O'Neill AR, Badola HK, Dhyani PP, Rana SK. 2017. Integrating ethnobiological knowledge into biodiversity conservation in the eastern Himalayas. J Ethnobiol Ethnomed 13 (1): 1-14. DOI: 10.1186/s13002-017-0148-9.

Pieroni A, Anely N, Avni H, Mustafa B, Bruno S, Kevin C, Cassandra LQ. 2014. Local knowledge on plant and domestic remedies in the mountain village of Peshkopia (Eastern Albania). J Mt Sci 11 (1): 180-194. DOI: 10.1007/s11629-013-2651-3.

Purwanto Y. 2003. Ethnobotany Research Methods. Lab. Ethnobotany. Balitbang Botani, LIPI Biology Research and Development Center, Bogor, Indonesia. [Indonesian]

Putri NS, Dewi R, Fitriana. 2017. Ceremony bridal process in Teubang Phui Baru village, Montasik sub-district, Aceh Besar district. Jurnal

Ilmiah Mahasiswa Pendidikan Kesejahteraan Keluarga 2 (4): 42-57. [Indonesian]

Ristanto RH, Suryanda A, Rismayati AI, Rimadana A, Datau R. 2020. Ethnobotany: a plant of Hindu-Balinese religious rituals. Jurnal Pendidikan Biologi 5 (1): 96-105. DOI: 10.31932/jpbio.v5i1.642 [Indonesian]

Setiawan H, Qiptiyah M. 2014. Ethnobotany study of the Moronene tribe in the Rawa Aopa Watumohai National Park. Wallacea J Res 3 (2): 107-117. DOI: 10.18330/jwallacea.2014.vol3iss2pp107-117.

Sharma UK, Pegu S. 2011. Ethnobotany of religious and supernatural beliefs of the Mising tribes of Assam with special reference to the 'Dobur Uie'. J Ethnobiol Ethnomed 7 (1): 1-13. DOI: 10.1186/1746-4269-7-16.

Sheybani H, Charmchiyan M, Azadboni ZB. 2015. Factors affecting villagers' participation in forest conservation in the region of Miyandoroud. Indian J Fundam Appl Life Sci 5 (S1): 3724-3730.

Sujarwo W, Caneva G. 2016. Using quantitative indices to evaluate the cultural importance of food and nutraceutical plants: Comparative data from the Island of Bali (Indonesia). J Cul Her 18: 342-348. DOI: 10.1016/j.culher.2015.06.006.

Sujarwo W, Keim AP, Caneva G, Tonia C, Nicoletti M. 2016. Etnobotanical uses of neem (*Acadiractha Indica* A. Juss.; Meliaceae) leaves in Bali (Indonesia) and the Indian subcontinent in relation with historical background and phytochemical properties. J Ethnopharmacol 189: 186-193. DOI: 10.1016/j.jep.2016.05.014.

Sujarwo W, Keim AP. 2017. Ethnobotanical study of traditional building materials from the Island of Bali, Indonesia. Econ Bot 71 (3): 224-240. DOI: 10.1007/s12231-017-9385-z.

Sujarwo W, Caneva G, Zuccarello V. 2020. Patterns of plant use in religious offerings in Bali (Indonesia). Acta Bot Bras 34 (1): 40-53. DOI: 10.1590/0102-33062019abb0110.

Supiandi MI, Mahanal S, Zubaidah S, Julung HBEGE. 2019. Ethnobotany of traditional medicinal plants used by Dayak Desa community in Sintang, West Kalimantan, Indonesia. Biodiversitas 20 (5): 1264-1270. DOI: 10.13057/biodiv/d200516.

Surata IK, Gata IW, Sudiana IM. 2015. Ethnobotanical study of Balinese Hindu ceremonial plants as an effort to protect local wisdom. Jurnal Kajian Bali 5 (2): 265-284. [Indonesian]

Suryadarma IGP. 2017. Building the character of independence of an ethnobiological approach to local uniqueness in national perspectives and global reflections. Biotic National Seminar Proceedings. Yogyakarta, November 26, 2017. [Indonesian]

Sutrisno IH, Akob B, Navia ZI, Nuraini, Suwardi AB. 2020. Documentation of ritual plants used among the Aceh Tribe in Peureulak, East Aceh District, Indonesia. Biodiversitas 21 (11): 4990-4999. DOI: 10.13057/biodiv/d211102.

Suwardi AB, Navia ZI, Harmawan T, Syamsuardi, Mukhtar E. 2020. Ethnobotany and conservation of indigenous edible fruit plants in South Aceh, Indonesia. Biodiversitas 21 (5): 1850-1860. DOI: 10.13057/biodiv/d210511.

Tamalene MN, Al Mudhar MHI, Suarsini E, Rahman F, Hasan S. 2016. Ethnobotany of Canarium plant species used by Tobelo Dalam (Togutil) ethnic community of Halmahera Island, Indonesia. Biodiversitas 17 (1): 61-69. DOI: 10.13057/biodiv/d170109.

Tapundu AS, Anam S. 2015. Studi etnobotani tumbuhan obat pada Suku Seko di Desa Tanah Harapan Kabupaten Sigi, Sulawesi Tengah. Jurnal Biocelebes 9 (2): 66-86. [Indonesian]

Turner NJ. 1998. The importance of a rose: Evaluating the cultural significance of plants in Thompson and Lillooet Interior Salish. J Amer Anthropol 90 (2): 272-290. DOI: 10.1525/aa.1988.90.2.02a00020.

Yusro, Fathul, Yeni M, Farah D, Kazuhiro. 2014. Inventory of medicinal plants for fever used by four Dayak Sub Ethnic in West Kalimantan, Indonesia. Kuroshio Sci 8 (1): 33-38.

Vásquez A, Vibrans H, Vergara SF, Caballero J. 2016. Intracultural differences in local botanical knowledge and knowledge loss among the Mexican Isthmus Zapotecs. PLoS ONE 11 (3): e0151693. DOI: 10.1371/journal.pone.0151693.