

Taxonomic Studies and Ethnomedicinal uses of Zingiberaceae in the Mountain Ranges of Northern Antique, Philippines

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ABSTRACT: The gingers are well-known for their medicinal and economic significance and occur chiefly in the tropical regions of the world mainly in the Indo-Malaysian area of Asia. At present, however, Zingiberaceae are one of the least known group in the rapidly expanding recent knowledge of Philippine biodiversity. Thus, this study was conducted to identify the Zingiberaceae species present in the mountain ranges of northern Antique, determine their species richness, diversity and ethnomedicinal uses. Twenty three species in three tribes and eight genera of Zingiberaceae were collected. Among the 23 species collected, 16 species of Zingiberaceae are used traditionally by Antiqueños to alleviate and cure ailments such as the rhizomes of *Alpinia elegans* (C. Presl) K. Schum and *Etingera* cf. *philippinensis* (Ridl.) R.M. Sm for post-partum relapse, the fruits of *Amomum dealbatum* Roxb. and *Alpinia romblonensis* Elmer for loss bowel movement and the leaves of *Alpinia gigantifolia* (Elmer) R.M. Sm for fever. These results contribute not only to the future phylogenetic and pharmacologic studies of the family Zingiberaceae, but also to help define and refine conservation policies in the Philippines in order to offer better protection for narrowly endemic plant taxa.

Keywords: Zingiberaceae, Ethnomedicinal uses, mountain ranges, Northern Antique

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INTRODUCTION

Many of the people living in rural or mountainous areas are economically challenged and do not have sufficient access to modern medicine. The knowledge about those local medicinal resources was handed down through multiple of generations (Hanh, 2015). Herbal or plant medicine has a long and fascinating history that was developed and practiced by many ethnic group to a high degree. Even though, most of the traditional ‘folk healers’ do not have any modern medical training, their cures have in times produced spectacular results which still do today (Hallowell, 1994).

Zingiberaceae, the largest family in the order Zingiberales, is represented by approximately 1500 species in 57 genera which are widely distributed in tropical areas with a center of diversity in Asia (Chen, 1989, Larsen *et al.*, 1998, Larsen, 2005; Lamb *et al.*, 2013, Trimanto, 2017; De Boer *et al.*, 2018; Pushpa Thakur and Sarika 2016; Charjan and Dabhadkar, 2014). Zingiberaceae which is based on both morphological and molecular analyses includes four subfamilies and six tribes: Siphonochiloideae

(Siphonochileae), Tamijioideae (Tamijieae), Alpinioideae (Alpinieae, Riedelieae) and Zingiberoideae (Zingibereae, Globbeae) (Kress *et al.*, 2002). They are terrestrial, rarely epiphytic, rhizomatous, monocot herb which thrive in humid, moist, shaded forest and tributaries like riverbank, upper edge of a high waterfall, and small streams to open areas such as hillside and grassland. They are usually aromatic in all or at least one of their plant parts that are used for medicinal purposes, spices, cosmetics, perfumes, dyes and multipurpose aesthetic compound (Sirirugsa, 1999, Bunia & Mondal, 2012). Furthermore, Zingiberaceae are cultivated because of their conspicuous flowers (Te-lin & Larsen, 2000).

The province of Antique is a home of biodiversity both flora and fauna where long mountain ranges are suited for the habitation of endemic species like Zingiberaceae. However, some of the mountains are disturbed by human actions such as tourist activities, life-stock grazing, conversion to agricultural land and exploitation of natural resources. These activities affect the endemic flora and fauna living in the area.

Due to these biodiversity problems, it is important to investigate the taxonomy and distribution of Zingiberaceae, considering that Philippine Zingiberaceae is one of the least known group with a very little progress after Merrill's work in 1925 (Funakoshi & Fujiyama, 2004) and has an outdated study with less taxonomic work resulting to a difficult identification (Naive, 2017). Additionally, many species have undergone complex evolutionary and adaptive modifications as well as facing extinction that needs proper taxonomic treatment and conservation. Due also to modernization, millennials nowadays are more integrated to the mainstream society (Morilla, 2014) which is a threat in passing ethnomedicinal knowledge and practices because much of the plant knowledge we learned from our ancestors are transferred orally (Olowa *et al.*, 2012). Thus, it needs continuous documentation to conserve oral custom and support local health care (Mesfin *et al.*, 2013) because it's the foundation for many of the medical remedies we are now using (Heinerman, 1995) and hold answers to cure several diseases in the future (Gutierrez *et al.* 2013). Moreover, no prior study was conducted about taxonomic survey of Zingiberaceae and the identification of its ethnomedicinal uses in the mountain ranges of northern Antique. Therefore, this research provide significant information on the taxonomy, distribution and diversity of Zingiberaceae found in northern Antique as well as its ethnomedicinal uses.

METHODOLOGY

This study is a descriptive research which is a combination of both qualitative and quantitative research approach. This mixed methods of descriptive study aims to identify the different Zingiberaceae species that exist in the mountain ranges of northern Antique and determine its distribution by habitat, species richness, diversity and ethnomedicinal uses. It is devoted to the gathering of information about prevailing conditions or situation for the purpose of description and interpretation (Aggarwal, 2008).

This study focused only on the species that belong to the family Zingiberaceae in the mountain ranges of the northern Antique that includes five northern municipalities namely Libertad, Pandan, Sebaste, Culasi, and Tibiao conducted on May 2016 to February 2018 from 150-2000 m asl.

Species were collected in the mountain ranges of Antique during field work using opportunistic random sampling technique or commonly known as visual encounter method. Detailed photograph of the vegetative and reproductive part including the habit were taken for identification that were compared to available protologues. Data bases such as Co's Digital Flora of the Philippines and Living Plant Collection were utilized as well as seeking the help of Zingiberaceae experts.

In the case of unidentified species which is possibly new to science or novel, herbarium specimen were sent to the University of Santo Tomas for molecular analysis wherein species were identified through their DNA sequences.

In determining their ethnomedicinal uses, informants were identified using snowball sampling through the referral of the barangay officials, local folks and herbal healers. They were interviewed through focus group discussion using a researcher made semi-structured questionnaire as a guide about the traditional uses of the plants.

RESULTS AND DISCUSSIONS

The species of Zingiberaceae found in the Mountain Ranges of Northern Antique were listed in Table 1. The collection revealed a total of twenty three (23) species in eight (8) genera under three (3) tribes and two (2) subfamilies of Zingiberaceae (Table 2). Fourteen species were collected from Mt. Tuno and Tiguis, Tibiao; ten in Mt. Madjaas, Culasi; seven in Mt. Igpasungaw, Sebaste; and three species were from North-West Panay Peninsula Natural Park (NWPPNP) Pandan and Libertad.

Fig. 1 shows the Zingiberaceae species collected from different habitats in the four mountain ranges of northern Antique. It describes that Zingiberaceae species thrive well in damped canopies in Mt. Madjaas, Mt. Igpasungaw and NWPPNP while in Mt. Tuno and Tiguis they were found dominant along the tributaries which includes riverbank, streams, and edge of a waterfall. Other species of Zingiberaceae were found also in open areas like grassland, open hills and slopes. This supported the claim of Chen (1989) and Sirirugsa (1999) that Zingiberaceae species could be found in primary and secondary forest of tropical and subtropical areas with stable, damp and hot climate that favored their development and differentiation. Furthermore, according to Larsen *et al.* (1999), the ginger family grow vigorously in a range of habitat ranging from riverine to limestone area and from lowland to the montane regions, and often thrive in shady area but some species could be able to tolerate full exposure to sunlight. Among the three types of habitat identified, Table 3 shows that along the tributaries have the highest species richness at 35.83% followed by damped canopy at 35.45% and open areas have the lowest species richness at 28.72%. Furthermore, in terms of diversity index, along tributaries also have the highest diversity both in Shannon and Simpson diversity index at 1.97 and 0.128 while open areas got the lowest diversity at 1.27 and 0.082. This means that among the three main habitats of Zingiberaceae identified, Zingiberaceae were found mostly along the tributaries due to the presence of loam soil that is rich in minerals, colder temperature, and far from any human intervention that can inhibit the growth and propagation of Zingiberaceae species.

Table 1: List of Zingiberaceae species found in Northern Antique, Philippines.

Scientific Name	Local Name	Locality			
		Tuno & Tiguis, Tibiao	Mt. Madjaas, Culasi	Igpasungaw Sebaste	NWPPNP, Pandan & Libertad
<i>Alpinia apoensis</i> Elm.	Pitoy-pitoy				
<i>Alpinia elegans</i> (C. Presl) K. Schum	Bayumbong pula, de Castanilla, Panya				
<i>Alpinia galanga</i> (L.) Sw.	Langkawas				
<i>Alpinia gigantifolia</i> (Elmer) R.M. Sm.					
<i>Alpinia purpurata</i> (Vieill.) K. Schum.	Lampuyang pula				
<i>Alpinia romblonensis</i> Elmer	Bayumbong Niyog-niyog Panya				
<i>Alpinia zerumbet</i> (Pers.) Burt & R.M. Sm.	Paunan, Karupe				
<i>Adelmeria sp.</i>	Lampuyang				
<i>Amomum dealbatum</i> Roxb.	Tugis				
<i>Amomum lepnicarpum</i> Ridl.					
<i>Etilingera cf. philippinensis</i> (Ridl.) R.M. Sm.	Tagbak				
<i>Geocharis fusiformis</i> (Ridl.) R.M. Sm.					
<i>Meistera muricarpa</i> (Elmer) Škorni k. & M.F. Newman	Biraw				
<i>Vanoverberghia aff. sepulchrei</i> Merr.	Tagbak				
<i>Globba marantina</i> L.	Manok- manok baye				
<i>Globba campsophylla</i> K. Schum.	Manok- manok laki				
<i>Globba sp.</i>	Tabayag				
<i>Curcuma longa</i> L.	Kalawag				
<i>Curcuma rubescens</i> Roxb.	Lampuyang				
<i>Zingiber zerumbet</i> (L.) Smith	Pasaw				
<i>Zingiber officinale</i> Rosc.	Luy-a				
<i>Zingiber sp.1</i>	Banglay				
<i>Zingiber sp.2</i>	Pasaw				

Table 2: Systematics of Zingiberaceae species present in the Mountain Ranges of Northern Antique, Philippines.

Subfamilies	Tribe	Genus	Number of species
Alpinioideae	Alpinieae	<i>Alpinia</i>	8
		<i>Amomum</i>	2
		<i>Etlingera</i>	1
		<i>Geocharis</i>	1
		<i>Meistera</i>	1
		<i>Vanoverberghia</i>	1
Zingiberoideae	Globbeae	<i>Globba</i>	3
	Zingibereae	<i>Zingiber</i>	4

Table 3: Species richness and diversity index of various type of habitat of Zingiberaceae species in the mountain ranges of Northern Antique.

Type of Habitat	Species Richness	Diversity Index	
		Shannon	Simpson
Along Tributaries	35.83	1.97	0.128
Open Areas	28.72	1.27	0.082
Damped Canopy	35.45	1.93	0.125

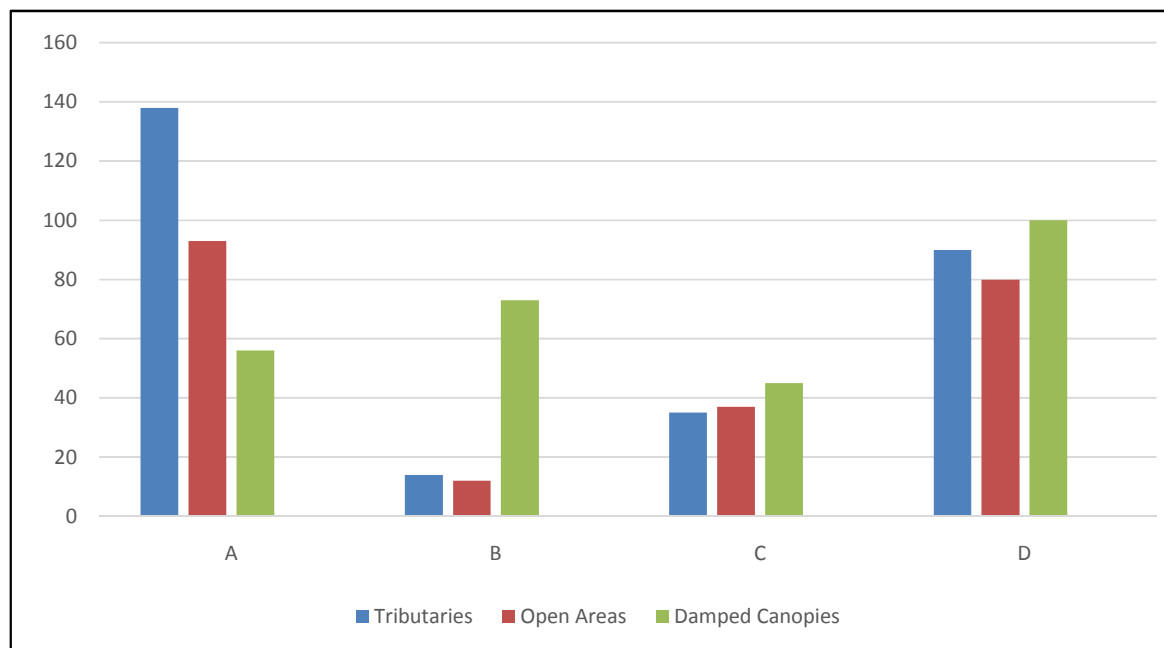


Fig. 1. Zingiberaceae species found in the mountain ranges according to distribution by habitat A. Mt. Tuno & Tiguis, Tibiao B. Mt. Madjaas, Culasi C. Mt. Igpasungaw, Sebaste D. NWPPNP, Pandan & Libertad.

Among the 23 species collected, 16 species of Zingiberaceae are used traditionally by Antiqueños to alleviate and cure ailments (Table 3) such as the decoction of the rhizome of *A. zerumbet* (Karupe, Paunan) for post-partum relapse (bughat) which were made through boiling the rhizome, and its seed for gastrointestinal disorder that is eaten; the leaves of *A. gigantifolia* (Tagbak) and *Z. zerumbet* are put in the forehead of a person with fever; the rhizome of *V. cf. sepulchrei* is used to cure *morit* and *amurutang* - a disease that is said to be a cause of *kulam*; and the

rhizome of *Z. zerumbet* is heated and mixed with oil to cure skin diseases and it could be mixed also with *C. longa* and *Z. officinale* for *sinda*; the rhizome of *A. elegans* (Panya pula) and *A. romblonensis* (Panya puti) are made into decoction and used as cough reliever. The shoot of *E. cf. philippinensis* (Tagbak) and *A. lepocarpum* (Tugis) are pounded, covered with a cloth and squeezed in the head to alleviate dizziness. The rhizomes of *A. galanga* are pounded and massage to knees or any affected area to heal inflammation and rheumatism.

Table 3. Ethnomedicinal uses of Zingiberaceae species found in Northern Antique, Philippines.

Scientific Name	Local Name	Disease	Plant Parts Used	Mode of Preparation	Administrati on
<i>Alpinia elegans</i> (C. Presl) K. Schum	Bayumbong pula de Castanilla, Panya pula	Post-partum relapse	Rhizome	Decoction	Internal
		Headache	Rhizome	Decoction	Internal
<i>Alpinia galangal</i> (L.) Sw.	Langkawas	<i>Alap-ap</i> ,	Rhizome	Pounding	External
		Rheumatism	Rhizome	Pounding	External
		Inflammation	Rhizome	Pounding	External
		Highblood	Rhizome	Decoction	Internal
		Allergy	Rhizome	Decoction	Internal
<i>Alpinia romblonensis</i> Elmer	Bayumbong, Niyog-niyog, Barungbong, Salibungbong	Anti-helminthic	Unripe Fruit	Eaten	Internal
		Loss Bowel Movement	Ripe Fruit	Eaten	Internal
		Nervousness	Rhizome	Decoction	Internal
		Stomach ache	Rhizome	Decoction	Internal
		<i>Pasmo</i>	Rhizome	Soaked in warm water	Internal
		Cough	Rhizome	Decoction	Internal
		Headache	Shoot	Pounding	External
		Headache	Leaves	Applied directly	External
<i>Alpinia gigantifolia</i> (Elmer) R.M. Sm.	Tagbak	Headache	Leaves	Applied directly	External
<i>Alpinia zerumbet</i> (Pers.) Burt & R.M. Sm.	Karupi, Paunan	Stomachache	Seed	Eaten	Internal
		Post-partum relapse	Rhizome	Decoction	Internal
<i>Anomum dealbatum</i> Roxb.	Tugis, Bisbis	Loss Bowel Movement	Fruit	Eaten	Internal
		Cough	Rhizome	Decoction	Internal
		Rheumatism	Rhizome	Pounding	External
		Arthritis	Rhizome	Pounding	External
<i>Anomum leptocarpum</i> Ridl.	Tugis	Mental disorder	Shoot	Pounding	External
		Dizziness	Shoot	Pounding	External
<i>Etilingera cf. philippinensis</i> (Ridl.) R.M. Sm.	Tagbak	Post-partum relapse	Rhizome	Decoction	Internal
		Stomach ache	Rhizome	Decoction	Internal
		<i>Hiwit/Kulam</i>	Rhizome	Decoction	Internal
		Nervousness	Rhizome	Decoction	Internal
		Cough	Rhizome	Decoction	Internal
<i>Meistera muricarpa</i> (Elmer) Škorni k. & M.F. Newman	Biraw	Loss Bowel Movement	Fruit	Eaten	Internal
		Cough	Rhizome	Decoction	Internal
<i>Vanoverberghia aff. sepulchrei</i> Merr.	Tagbak	<i>Morit, Amurugtang</i>	Rhizome	Pounding	External
<i>Globba marantina</i> L.	Manok-manok baye	Inflammation	Pseudostem	Pounding	External
		<i>Hiwit/Kulam</i>	Rhizome	Decoction	Internal
<i>Curcuma longa</i> L.	Kalawag	Urinary Tract Infection	Rhizome	Decoction	Internal
		Allergy	Rhizome	Pounding	External
		Diabetes	Rhizome	Decoction	Internal
		Heart Disease	Rhizome	Decoction	Internal
		Typhus	Rhizome	Pounding	External
		Nervousness	Rhizome	Decoction	Internal
		Stomach ache	Rhizome	Decoction	Internal
		<i>Baraod</i>	Rhizome	Pounding	External
		Migraine	Rhizome	Decoction	Internal
		Hypertension	Rhizome	Decoction	Internal
		<i>Sinda</i>	Rhizome	Applied directly	External
		<i>Curcuma rubescens</i> Roxb.	Lampuyang	Skin Disease	Rhizome
Urinary Tract Infection	Rhizome			Decoction	Internal
Stomach ache	Rhizome			Decoction	Internal
Anti-rabies	Rhizome			Heating	External
<i>Zingiber officinale</i> Rosc.	Luy-a	Stomachache	Rhizome	Decoction	Internal
		Headache	Rhizome	Applied directly	External
		Arthritis	Rhizome	Pounding	External
		Diabetes	Rhizome	Decoction	Internal
<i>Zingiber zerumbet</i> (L.) Smith	Pasaw	Cancer	Rhizome	Decoction	Internal
		Diabetes	Rhizome	Decoction	Internal
		Toothache	Rhizome	Pounding	External
		Rheumatism	Rhizome	Pounding	External
		Burn	Rhizome	Pounding	External
<i>Zingiber sp.1</i>	Banglay	Rheumatism	Rhizome	Soak in vinegar	External

CONCLUSIONS

This study concluded that there are 23 species of Zingiberaceae in the mountain ranges of northern Antique and 16 species are used traditionally by Antiqueños to alleviate and cure ailments. Furthermore, Zingiberaceae species could live in varied environment from moist and humid areas such as deep forest and along the streams and riverbank to dry areas such as grassland. But, they are more abundant in damped canopies and along the tributaries because of the presence of rich loam soil, colder temperature and far from human interventions that could inhibit the growth and propagation of the Zingiberaceae. It is highly recommended that the species must be conserve through species and habitat protection, ecological management and wise use of the species. Continuous documentation of ethnomedicinal plant must be done to save the medicinal culture and tradition of Antiqueños since most of these knowledge are transferred orally. Furthermore, molecular analysis is highly recommended to identify *Globba sp.*, *Zingiber sp. 1*, and *Zingiber sp. 2* for their possibility as new to science.

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