Vol. 20 · March 2015
Print ISSN 2012-3981 • Online ISSN 2244-0445
doi: http://dx.doi.org/10.7719/jpair.v20i1.318
Journal Impact: H Index = 2 from Publish or Perish

JPAIR Multidisciplinary Research is produced
by PAIR, an ISO 9001:2008 QMS certified
by AJA Registrars, Inc.

Species Diversity of Rattan (Uay) in Selected Municipalities in the Province of Abra, Philippines

MARY JOAN T. GUZMAN
http://orcid.org 0000-0001-7106-2979
maryjoan.guzman@gmail.com
Abra State Institute of Science and Technology
Abra, Philippines

ABSTRACT

Rattan (Uay) is known for its commercial use such as furniture and handicrafts e.g. cabinets, bags, chairs, swings, and matting. The study determined the species diversity of rattan (uay) in Danglas, Licuan- Baay, Lagayan, Dagiuoman, Tubo, and Villaviciosa, Abra, Philippines. The researcher had gone through a fieldwork for plant collection, identification and taxonomic classification using a dichotomous key and to assess the species diversity using biological diversity indices. Phytochemical analysis of the leaves, roots, stalk of rattan (uay) was done. *Calamus merrilii, Calamus ornatus, Calamus microcarp*us, and *Calamus sp.* are the identified species of rattan in the province of Abra. They have similar morphological characteristics but they differ in size and color of the vines, position of the thorns and spines in the plant body, and leaf sizes. Phytochemical contents of the stalk, roots, and leaves of rattan (uay) contain the most abundant medicinal properties. Biological diversity indices revealed that *Calamus merrilii, Calamus ornatus, Calamus microcarp*us, and *Calamus sp.* were most abundant species of rattan (uay) found in Tubo, Dagiuoman, Danglas, Lagayan and least diverse in Baay- Licuan. Lapat System was the conservation and preservation method of rattan (uay) in Tubo and Dagiouman, Danglas, Lagayan, Baay-Licuan and Villaviciosa. These help the Abrenians generate income for their daily sustenance.

Keywords **-** Biodiversity, Tingguians, rattan, indigenous, endemic, diversity, species, Abra, Philippines

INTRODUCTION

The global perspective of rattan development emphasized the economic, socio-cultural and ecological importance of rattan to a large number of people in the world. The International network for Bamboo and Rattan (INBAR) & Food and Agriculture organization (FAO) 2000, focused on rattan development and noted the depletion and decline of rattan resources in their natural range of tropical forests in Asia and Africa due to exploitation, inadequate replenishment, poor forest management and loss of forest habitats. Southeast Asia dominated the international rattan trade with more than 600 species and 13 genera identified. Indonesia is the dominating export country of rattan furniture, mats, plaits and basketwork and China is the dominating import country of rattan canes. Vietnam is the third supplier of rattan furniture and basketwork to Europe, Germany and France. In the Philippines, it ranks four in the global export of rattan furniture and basketwork. In the Luzon part of the Philippines, there are 31 species of rattan and commonly located in Mindanao. Majority of the genera found are the *Calamus, Daemomorops, Korthalsia, and Plestocomia*. The most diverse among the group is the *Calamus*. There are 45 species, but 32 are endemic, nine species are found in Mindanao, and 11 species grow in Luzon. *Daemonorops* has 14 species, but 12 are endemic. The *Korthalsia* has only 1 species which is found only in Palawan. *Plestocomia* has only 2 species available and 1 is endemic in the country *(*Rivera, n.d*)*

Abra belongs to Cordillera Administrative Region (CAR) in Northern Luzon. It is a province of Ilocanos and Tingguian people. These Tingguians are considered to be indigenous, and their lifestyle is very simple and ordinary. Their livelihood depends on native animals and plants found in the area. Abra is abundant of native plants such as ampupuyat, karimbobet, siksiklat and other edible plants found in the place. Some of these plants are once described and identified by some taxonomists. With their researches, they found that some aboriginal plants are good source of dye. However, there are still unknown plants that are yet to be described and identified concerning their nutritional and medicinal uses.

Rattan is commonly referred by Abrenians as "uay". It is a climbing palm; it has climbing stems, and leaves covered with thorns or spines, hair, and bristles. It is locally grown in the tropical forest of Abra, and it grows much faster than some

other tropical woods. The online data about rattan were just limited because information about indigenous plants are mostly found in printed journals or books.

Based on the interview of the indigenous people in some areas where rattan (uay) is locally grown like Licuan-Baay, the young shoot tip called "pait" is edible. The "pait" is grilled and seasoned with bagoong; they consider it as an exotic food of Tingguian. They claim that its vegetative part can cure ailment and diseases like stomach ache and hypertension primarily because of its bitter taste. The opinion of the people on its medicinal usage is similar to some researcher's idea that some species of rattan in other countries can be used as medicine for many kinds of body aches.

Bamboos & Rattan resources which are the major commodity in Abra are now becoming endangered because of too much harvesting of forest resources for livelihood purposes. Indigenous people are unaware of the issue that these plant are vulnerable to endangerment. Local government Units (LGU) is finding ways of using bamboo and rattan resources to alleviate poverty and protect the environment. Hence, they encourage local researches to study on bamboo and rattan.

OBJECTIVES OF THE STUDY

The study aimed to determine the species diversity of rattan (uay) in the province of Abra. Specifically, it sought to characterize the character states of rattan and identify the taxonomic classification, phytochemical analysis and conservation & preservation of rattan in Abra.

MATERIALS AND METHODS

Materials

The materials used in the study were the ff; for Identification: One whole plant of rattan (uay) and dissecting microscope, for Characterization: Leaves, roots, flowers, fruits, seeds of rattan (uay), and dissecting microscope, for Phytochemical Analysis:1kilo of rattan (uay) leaves, roots & stem, for species diversity: Tape measure (50 feet), Rope, and Scientific Calculator and for Interview: Notebook and Pen

Research Ethics Protocol

The researchers made courtesy calls to mayors and community chieftains for the permission to conduct the study. They obtained gratuitous permit from the Department of Environment and Natural Resources office.

Research Sites

The large number of rattan species and their wide geographic range is matched by great ecological diversity. The knowledge of the population structure, distribution, rate of regeneration, the number of harvestable stems per hectare etc. of each species is essential and forms the basis of an understanding of potential sustainability.

A preliminary survey was done through interview to locate where rattan (uay) species are available (figure 1). The researchers had chosen Lagayan (light orange), Baay-Licuan (white), Villaviciosa (brown), Dagiouman (pink), Tubo (blue) and Danglas (dark violet). The selected sampling areas were from the municipalities of Abra where rattan (uay) is mostly abundant. The length of the sampling sites per sampling area was 10 x 50 m.

Figure 1. Map of Abra showing the location of the sources of Rattan (Uay)

Interview on Conservation and Preservation of Rattan (Uay)

The researchers went to the office of DENR and conducted an interview regarding the maintenance and conservation of rattan (uay) in the province of Abra. They also interviewed folks from the visited places in Abra regarding the usefulness, conservation, protection and preservation of rattan (uay) in their municipalities.

Laboratory works

a. Identification of rattan (uay)

Identification of rattan (uay) in Myanmar, Sulawesi, Maliku and Papousia were done through survey work and herbarial material but the taxonomic global nomenclatural identification of rattan were compiled in the ALICE database program (Dransfield, 1988). However, in this study, the researchers used the dichotomous key to identify taxonomic classification of rattan (uay) (Malabrigo Jr. & Fernando, 1993).

b. Description on the Morphological Characteristics

Samples of rattan (uay) were gathered and brought in the laboratory for the characterization of species based on the root type, leaf structures, flower, fruit, and seed (Simpson, 2010).

c. Phytochemical Analysis

In previous researches of rattan, cane anatomy by Weiner and Liese (1989) show significant differences between genera, groups of species within genera & differences between closely related species as anatomical basis for differing the qualities of rattan. Going beyond the characterization of anatomical, phylogeny & demography detail of rattan (uay), the researchers determine the chemical composition of each species of rattan (uay) through phytochemical analysis.

Plant samples were collected from the study sites. These were brought to Saint Luis University (SLU), Baguio City for chemical analysis.

d. Diversity of Rattan (Uay)

Species of rattan (uay) found in the sampling sites were counted and recorded individually to assess the species diversity of rattan (uay).

Research Design

The descriptive analysis was used in the study. The collection, identification, and the description of species of rattan (uay) in Baay- Licuan, Tubo, Daguioman, Danglas, Lagayan, and Villaviciosa were performed.

Data Gathered

1. Characterization of the character states of rattan (uay)
2. Identification of the taxonomic classification of rattan (uay)
3. Phytochemical analysis of the leaves, stems, and roots of rattan (uay)
4. Species diversity
    4.1. Area of sampling sites
    4.2. No. of individuals
    4.3. Diversity Indices
5. Conservation and Preservation of rattan (uay)

Statistical Analysis of Data

Diversity Indices such as Shannon- Weiner index, Margalef's index, and Simpson index were used to assess and compare the variety of rattan (uay) in the selected study sites.

Shannon- Weiner Index (H')

$H' = \sum [(ni/N) \times \ln (ni/N)]$

Where;

ni= number of individuals or amount of each species
N= total number of individuals or amount for the site
In= the natural log of the number

Simpson's index

$D = N (N-1)$

Where;

N= number of individuals
n= number of individuals per site

Margalef Index

$D = S-1 / \log N$

Where;

S= number of species per site
N= total number of individuals

Index of Similarity (Sim)

Sim= $3\sum nc / \sum n1 + n2 + n3$

Where;

nc= number of familiar species between sites

n1= number of species per site

RESULTS AND DISCUSSION

.

In the consultation on Rattan development by INBAR & FAO (2000), there were approximately 600 species of rattan (uay), of which some 10% were commercial species, some are restricted by natural ranges and majority of the world rattan resources were in one country – Indonesia. The largest rattan genus is *Calamus* with 370 species. It is predominantly an Asian genus & ranges from the Indian subcontinent and South China southwards and east through the Malaysian region to Fiji, Vanuatu and tropical and subtropical parts of eastern Australia. The remaining rattail genera, Daemonorops, Ceratolobus, Korthalsia, Plectocomia, Plectocomiopsis,Myrialepis, Calospatha, Pogonotium and are centred in Southeast Asia and have outliers further eastwards and northwards (Uhl & Dransfield, 1987; Dransfield, 1992a).

In the rural areas of the Philippines particularly in Abra province, the following genera of rattan (uay) were identified;

Taxonomic Classification of Rattan ("Uay")

Kingdom: Plantae

Division: Magnoliophyta

Class: Liliopsida (Monocots)

Order: Palmacae

Family: Palmae

Genus: Calamus

Species: merrillii

Scientific name: *Calamus merrilii*

Figure 2. *Calamus merrilii*

The leaves of *Calamus merrilii* are long and slender which are yellow to green in color. The leaflets are about 29 cm long and 0.6 cm wide. The leaves are about 85 inches long. The vines are green when fresh and pale yellow when matured and dried. Several thorns and spines are scattered over the plant. The shoot is not bitter. The internodes are about 8.5 cm long and 1.9 cm in diameter. It grows in the virgin forest or secondary thick forest. It is found in Licuan- Baay, Dagiouman, Danglas, Lagayan and Tubo.

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida (Monocots)
Order: Palmacae
Family: Palmae
Genus: Calamus
Species: ornatus
Scientific name: *Calamus ornatus*

Figure 3. *Calamus ornatus*

The leaves of *Calamus ornatus* are about 184 inches long. The leaflets are about 55 cm; 8.5 cm long and 1.5 cm wide with less numerous spines around the midribs. The shoot is very bitter. The stalk or vines are very tough and flexible which is green to white. The fruit is edible. The internodes are 5.5 cm long and about 1.7 cm in diameter. It is found in Tubo, Dagiouman, and Licuan- Baay.

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida (Monocots)
Order: Palmacae
Family: Palmae
Genus: Calamus
Species: sp.
Scientific name: *Calamus sp.*

Figure 4. *Calamus sp.*

The leaves are long and slender about 83 inches long. The leaflets are 115 cm, 8.2 cm long and 0.1 cm wide. The vines are fine from green to pale yellow. The internodes are 6 cm long with 0.4 cm in diameter. It is found in Lagayan and Danglas.

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida (Monocots)
Order: Palmacae
Family: Palmae
Genus: Calamus
Species: microcarpus
Scientific name: *Calamus microcarpus*

Figure 5. *Calamus microcarpus*

The leaves are about 33.5 inches long, and leaflets are about 13.5 cm long and 0.9 cm wide. Leaflets are in 62 cm. The vines are usually red, very slender about 1.8 cm diameter and internodes are 10 cm long. Spines, thorns, are reddish green. The shoot is bitter. It is found in Villaviciosa and some parts of Abra like Lagayan and Danglas.

The *Calamus merrilii, Calamus ornatus, Calamus microcarp*us, and *Calamus sp.* are the species of rattan mostly abundant in the province of Abra.

Some species of rattan are known in their local names like “nadao”,”sipat”, and “kugab” in Dagiuoman; “matkong and “patkong” in Lagayan, Danglas, and

Licuan – Baay; “gasagas” in Licuan- Baay; “damayen”,”nadao” and” paakad” in Tubo.

Based on the taxonomic classification and description of rattan species, *Calamus* is the largest of the 13 known genera and is distributed through the geographic range of rattans in Southeast Asia (Dransfield, 1993).

Morphological characteristics of Rattan (Uay)

Rattan species found in the Southeast Asia & Africa vary in terms of their ecological and morphological characteristics. Such variation include, forest type and light requirement, life forms, flowering, pollination and fruit & seed structure (Tellu,2005). Locally species of rattan (uay) in Abra were anatomically characterized as follows;

Roots

Figure 6. Root Structure of *Calamus merrilii*

The root of rattan is fibrous, and it is located underground. It’s whitish, brown or black in color. The diameter of the root of C. merrellii is 0.4 cm, C. ornatus is 0.6 cm, C. microcarpus is 0.3 cm, C. sp. is 0.2 cm wide and it is extended. The roots of the different species of rattan (uay) in the six selected municipalities are similar. The size of the roots varies from thin, thick, thicker, and thickest depending on its age.

Figure 7. Leaves Structure of *Calamus merrily*

Leaves

The leaf of rattan is pointed with numerous spines and thorns. It is pinnately compound, alternate and elongated. It is attached by a leaf sheath into the vines. Color varies from dark green, green to light green. The leaflets are alternate, elongated, and spines. The base is cuneate and narrowly acute apex with numerous spines in the entire margin.

Stem or Vines

Figure 8. Stem and Vine Structure of *Calamus merrilii*

The stem and vine structure of *Calamus merrilii* is an elongated, rounded, cylindrical and bilateral in symmetry. It serves as the attachment of leaves to which it clings. It is flexible and durable. It diameter and color differs from green, reddish, pale yellow to white in different species. The stem is determinate that later develops and transforms to flower (hapaxonthic). Bud for floral or inflorescence on the side is present. It exhibits exfoliating bark.

Flower

Figure 9. Flower Structure of *Calamus merrilii*

The inflorescence has two kinds: a) an inflorescence that bears on the lateral stem with more than once; and b) on the tip that once in a lifetime and after regeneration it will die. Inflorescence is scapose, pedicillate, about 4.8 cm long. Flowers are dioceous, alternate and actinomorphic. Perianth is biseriate that is spiral and campanulate. Calyx and corolla are valvate and apopetalous synsepalous. Merosity is trimerous with calyx of 0.05 cm in length and 0.1 cm width. Stamens are filamentous, uniseriate, staminodia, and didynamous. It is also exerted and alternipetalous. Filament is yellowish, elongated and subbasifixed. Anther is monothecal, longitudinal and latrose. Ovary is positioned inferiorly which is brown in color and circular. The style is located at the center. Stigmas are about 3 cm.

Fruits and Seeds

Figure 10. Fruit and Seed Structure of *Calamus merrilii*

The unripe fruit is green, and brown, yellow gold, beige plated with green when ripen. The skin is white that covers the pulp of the fruit and the seed is located inside the pulp. The fruit is spherical and drupe. The seed is black, rough and spherical in shape.

The description of the morphological characteristics of rattan (uay) observed in the study is similar with the review of the literature by Dransfield and Sunderland (2002), Rattan fruits are often brightly colored (white, yellow, orange or red) and the sarcotesta is also attractive to birds and mammals. Birds (e.g. hornbills) and primates are the main dispersers of rattan seeds in both Southeast Asia and Africa with primates and elephants also sharing a preference for the ripe fruit. In the Asian taxa, the seed is often covered with a sarcotesta (a fleshy seed coat). Incomplete removal of this sarcotesta often results in delayed germination suggesting that it contains some chemical germination inhibitors. Cultivation trials on many of the Southeast Asia species, as well as recent germination trials of the African taxa, have indicated that seeds will germinate under a wide range of light conditions. The resultant seedlings will remain for long periods on the forest floor awaiting sufficient light for them to develop, such as a tree fall (Adiwibowo, Sulasmi & Nisyawati, 2012). Rattans can be clustering (clump-forming) or solitary. Sustainability of such species relies on recruitment through sexual means, rather than through vegetative means. Rattan display two main modes of flowering: hapaxanthy and pleonanthy.

Phytochemical Analysis of *Calamus ornatus* (Limuran)

Table 1. Summary of Phytochemical Results of the roots, stem, leaves of *Calamus ornatus.*

PRELIMINARY TEST	CONSTITUENTS	PLANT ORGANS		
		STALK	LEAVES	ROOTS
a.Lead acetate test	gums, mucilages, glycosides	+++	+++	+++
B. Fehling's test	carbohydrates,reucing sugars	+++	+	+
C. Ferric chloride test	Tannin and tannin derivatives	+++	++	-
D.Millon's test	proteins & its derivatives	+++	++	++
Test for Physiologically Active Constituents				
1. Alkaloids				
1.1 Dragendorff's test	-alkaloids	-	+	+
1.2 Mayer's test	-alkaloids	+	+	+
2. Steroids				
2.1 Keller-killani	-deoxysugars	+	+	+
2.2 Lieberman-Buchard	-unsaturated sterols	-	+	-
2.3 Kedde test	-unsaturated lactones	-	-	-
3. Anthraquinones				
3.1 Borntrager's test	-anthraquinones	-	-	-
3.2 Modified Borntrager's test	-anthraquinones	-	-	-
4. Flavonoids	-leucoanthocyanins and			
4.1 Bate and Metcalf	cyanidin	-	-	-
4.2 Wilstatterr "cyaniding"	-y-benzopyrene nucleus	-	-	-
5. Saponins	-saponins			
5.1 Froth test	-unsaturated sterols and	+	-	-
5.2 Leibermann-Buchard	triterpenes	-	+	-
6. Tannins and Polyphenols	-tannins			
6.1 Gelatin test	-polyphenolic	-	-	-
6.2 Ferric chloride	compounds	+	+	-
7. Cyanogenic glycoside	-cyanogenic glycosides			
7.1 Guignard test		-	-	-

Legend: (+, ++, +++) – Degree of abundance

Phytochemical analysis results show that *Calamus ornatus* contains gums, mucilages, glycosides, carbohydrates, reducing sugars, tannin, tannin derivatives, deoxy sugars, proteins and its derivatives. They are mostly abundant in the stem, but also present in the roots and leaves of rattan. Alkaloids are present in the leaves and stalk but absent in the roots. Saponins are absent in the leaves and roots but are present in the stem. Polyphenol compounds are found in the stem, leaves, and unsaturated sterols and triterpenes are also present in the leaves but absent in the roots.

Glycosides have been used as antirheumatics and analgesics. Tannin may contain active compounds for the treatment of hypertension. Alkaloids are potent therapeutic compounds and saponins have beneficial effects on blood levels; they cause reduction, prevention, and reabsorption. They also serve as an antioxidant; it has no sugar which can reduce the risks of cancer and heart diseases and bone loss. Polyphenolic compounds can attribute to the antioxidant capacity of the human diet which is much larger than that of vitamins.

With the presence of different substances, it can be concluded that rattan (uay) is a medicinal plant.

Species diversity of the six Municipalities of the Province of Abra

Table 2. Summary of the species diversity indices of the 6 selected municipalities of the province of Abra

	Sampling Sites					
	Villaviciosa	Dagiuoman	Baay- Licuan	Tubo	Lagayan	Danglas
No. of individuals(N)	300	589	542	841	601	613
Species Richness	1	3	4	4	4	4
Shannon -Weiner Diversity Index	0	0.89	0.78	1.32	0.75	0.91
Evenness	0	1.73	1.83	2.23	1.67	1.64
Simpson's Diversity Index	0	0.29	0.38	0.58	0.27	0.36
Margalef's Index	0	1.02	0.74	0.96	0.86	1.16
Index of Similarity			1.19%			

Table 2 provides the comparison of the species diversity of the six selected municipalities of the province of Abra. It shows that Tubo has the highest number of individuals (841), and Villaviciosa has the least number of individuals (300). The species richness of Tubo, Lagayan, Baay- Licuan, and Danglas are the same (4) compared to Dagiuoman (3) and Villaviciosa having the least .

As shown in the study, Tubo has the highest diversity index in Shannon-Weiner (1.32) and Simpson's diversity index ((0.58) compared to Villaviciosa (0) having the least diversity index, and the least evenness of species. However, Margalef's index shows that Danglas has the highest diversity index (1.16) and Villaviciosa (0) is said to be the least. The index of similarity is 1.19%, means a less similarity due to the other species of vegetation that are abundant in the selected sampling sites.

Furthermore, biological diversity indices shows that rattan (uay) is more diverse in Tubo compared to Dagiuoman, Danglas, and Lagayan which are less distinct, and Licuan- Baay having the least diverse. Hence, the species diversity could be attributed to the location of the sampling sites, and conserving and preserving the resources of rattan (uay) in the locality. Moreover, according to the Department of Environment and Natural Resources (DENR) among the 27 towns of Abra, rattan is found in several municipalities. Rattan species are found in the virgin forest of or secondary thick forests of the upland towns and some parts of the lowland areas of Abra.

Likewise, Lapat system is observed in Tubo and Daguioman, which have the greatest species of rattan. Danglas, Lagayan, and Baay- Licuan do not practice the lapat system. These municipalities do not practice any conservation measures for rattans (uay) because folks have no idea on rattan (uay) as important in sustaining the ecological balance. Lagayan and Danglas are sources of commercially-used rattan in the province. Baay – Licuan has the least number of rattan due to over consumption of the shoot as food.

Conservation and Preservation of Rattan (Uay)

With regards to the maintenance and preservation of rattan, DENR is implementing rules and policies. They are patrolling and linking with the Local Government Officials (LGU) and Individual Cultural Communities (ICC) to mobilize, and help the office to protect and conserve the resources of rattan. They deputized or give authority to people to safeguard against fire occurrence, hunters and traditional practices that can alter the ecological balance. Community resolutions for forest protection and indigenous practices are advocated.

CONCLUSIONS

The International network for Bamboo and Rattan (INBAR) & Food and Agriculture Organization (FAO) 2000, there should be a need to ensure a sustainable supply of rattan through improved and equitable management of rattan around the globe.

*Calamus merrilii, Calamus ornatus, Calamus microcarp*us, and *Calamus sp.* were identified as most abundant species of rattan (uay) in the province of Abra. These species had similar characteristics. The shoot of *C. ornatus* is a source medicinal properties. Rattan (uay) in the selected municipalities of the province of Abra is abundant in some parts, and less diverse in other parts.

It is recommended that humans should conserve and preserve rattan resources. DENR should observe proper implementation of the laws regarding the cutting of rattan (uay*)* to prevent rattan for possible endangerment from the less diverse municipalities. The shoot of rattan is recommended for hypertension, diabetes, and body pains. Propagation techniques of rattan (uay) are highly recommended.

Based on the conservation status from the International Union for Conservation of Nature & Natural Resources (IUCN, 2008), it is necessary to domesticate the species of rattan outside the forest areas. Exploitation & development of NTFP's (Non-Timber Forest Products) should be linked with biodiversity conservation through integrating advances in biological technology with sustainable forest product processing. NTFP's produced products must be established in popular international markets and develop a range of products to meet domestic and local markets but not to limit the depletion of forest resources (Jasni, 2004).

TRANSLATIONAL RESEARCH

Abra province is endowed with rich species of Uay or commonly known as Rattan. It is one of its major commodities. These were utilized to make handicrafts and furniture. Tourists used to buy Abra Rattan products, thus, generating income to the Abra folks especially those living in the upland areas of Abra where rattan species are abundant. Native folks used rattan as shelter material and women used them as girdles around their waste. Some are making use of the red resins exuded from the fruits as glue and species of *Calamus ornatus* are processed and preserved as food. The shoot is also used as vegetable. There is still continuance of research study on the medicinal properties of *Calamus ornatus* based on its phytochemical analysis.

The Rattan products of Abra were usually advertised during fiestas and festivals where many tourists visit the province and through local/national media as well. The department of Trade & Industry (DTI –ABRA) encourages also rattan manufacturers of the province to join national/international exhibits of local products in the entire Philippines and outside the country. In this way, rattan products of Abra had known of its usefulness worldwide thru direct and internet selling like the global network of fair trade organization (IFAT).

Abra State Institute of Science and Technology (ASIST) is the only state college in the province, establishes a bamboosetum where Uay (Rattan) are grown and propagated.

LITERATURE CITED

Adiwibowo A, Sulasmi IS, Nisyawati. (2012).The relationships of forest biodiversity and rattan jernang (Deamonorops draco) sustainable harvesting by Anak Dalam tribe in Jambi, Sumatra. MBS & UNS Solo. Biodiversitas, Vol 13, Iss 1, pp. 46-51. DOI:10.13057/biodiv/d130109

International Network for Bamboo & Rattan (INBAR) and Food & Agriculture Organization (FAO).2000. Current Research Issues & Prospects for Conservation: Non-Wood Forest Products. Development Cooperation Agency (SIDA). Volume 14 of FAO Technical Papers. www.fao.org. docrep//003/Y2783E/Y2783E00.HTM

International Union for Conservation of Nature & Natural Resources (IUCN).2008. International Conference Proceedings: The Role of NTP's in Poverty Alleviation & Biodiversity Conservation: IUCN, Ha Noi, Vietnam, pp. 260 http://www.IUCN.org.vn

Jasni Titi Kalima. Study of Calamus occidentalis J.R. Witmo & J. Dransf. Species Commercial Values & Possible Utilization. Biodiversitas, Vol 5, Iss 2, 2004 pp. 61-65 http://biodiversitas.mipa.uns.ac id/D/D0502/D050204 pdf.

Dransfield, J., 1988. Prospects for rattan cultivation. In: M.J. Balick. The Palm-Tree of Life: Biology, Utilization and Conservation. Advances in Botany 6: 190- 200

Dransfield, J., 1992. The Rattan of Sarawak: Royal Botanic Gardens Kew & Sarawak Forest Department pp.213

Malabrigo Jr., P.L. & Fernando, E.S. (1993). "Interactive Identification and Information Retrieval on the Philippine Rattans." IAWA Journal – Brill Online – Books & Journals. 1993. Vol. 14. Issue 2. http://www.fao.org/docrep/ARTICLE/WFC/XII/0857-B1.HTM

Rivera, M. N. (n.d.) "Philippine National Report on Bamboo and Rattan." inbar int. Department of Environment and Natural Resources. ftp://ftp.fao.org/docrep/fao/010/ah788e/ah788e00.pdf

Simpson, M.G. 2010. "Evolution and diversity of plants". Plant Systematics .p. 185 https://www.elsevier.com/books/plant-systematics/simpson/978-0-12-374380-0

Sunderland, T. C.H. & Dransfield, J. (2002). *Species* Profiles Rattans. Fao Corporate Document Repository. Retrieved from http://www.fao.org docrep/003/y2783e/y2783e05.htm

TELLU, A. T. (2005). Identification keys on rattans (Calamus spp.) from Central Sulawesi based on anatomical structure of stems.

Uhl,N.W. & Dransfield, J, 1987. Genera palmarum: A classification of palms based on the work of H.E. Moore Jr. pp 610 The International Palm Society & the Bailey Hortorium, Kansas

Weiner, G. & Liese, W. 1989. Anatomical Structures and Differences of Rattan genera from Southeast Asia. J. Trop. Forest Science 1:122-132