

QUANTITATIVE ETHNOBOTANICAL DOCUMENTATION OF MEDICINAL PLANTS USED BY THE INDIGENOUS ATI TRIBES IN PANAY ISLAND, PHILIPPINES

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Received: 21 February 2022

Accepted: 22 March 2022

Published: 31 August 2022

ABSTRACT

The Ati (Negritos) are the aboriginal people of the Philippines comprising of more than 25 tribal groups that are scattered in the major islands of the country. In Panay Island of Western Visayas, they are recognized as gatherers, sellers, and traders of medicinal plants. This study aims to document the medicinal plants used by the two Ati tribes in Panay Island. Semi-structured interviews were conducted to determine the therapeutic use of medicinal plants in ethnomedicine. Use value (UV), relative frequency citation (RFC), relative importance index (RI), informant consensus factor (ICF), and fidelity level (FL) were used to evaluate the plant importance and Jaccard's Index (JI) was used to determine the similarity of the medicinal plants between the study sites. A total of 160 medicinal plant species in 55 families and 144 genera were used to treat 93 diseases in 17 different disease categories. The family Fabaceae was best represented with 17 species. The leaf was the most frequently used plant part and decoction was the most



common method of preparation. *Musa x paradisiaca* had the highest UV (0.69) and *Blumea balsamifera* had the highest RFC (0.56) and RI (0.89) values. Diseases and symptoms, signs or clinical findings of the respiratory system recorded the highest ICF (0.75) with high use report. *Spondias purpurea*, *Gynura procumbens*, and *Cyanthillium cinereum* had the highest FL (100%). The JI (29%) showed a low similarity of medicinal plant compositions between the study sites. This study serves as an ethnobotanical basis for further pharmacological research and investigations, and as an awareness for preserving cultural heritage, traditional knowledge, and biological diversity.

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Keywords: *Ati, Ethnobotany, Panay Island, Philippines, Traditional medicine*

INTRODUCTION

There are more than 476 million indigenous peoples worldwide with diverse and unique cultures, languages, and traditional knowledge (UN, 2021). They have the right to their own traditional medicines and practices which include conservation of their important medicinal plants (UNDRIP, 2007). One of the very first pieces of archaeological findings of medicinal plants usage has been found on Sumerian clay tablets dated in the 7th century (Petrovska, 2012). The use of magic, religion, and experimentation of plants as a healing practice has been used since the earliest times. Though indigenous people lived in different countries bounded by waters and communication was challenging, many of their healing methods have similarities (Kelly, 2009). Asia, which accounts for around two-thirds of the world's indigenous people (Tripura, 2017), recorded more than 38,660 species of medicinal plants used in traditional medicine and commercialization (Astutik et al., 2019). In the Philippines, which have more than 14 million indigenous peoples (NEDA, 2017), documented more than 1,500 medicinal plants utilized by traditional healers, and 120 species have been scientifically confirmed for safety and efficacy (Eusebio and Umali, 2004). The use of medicinal plants by the Filipinos started centuries ago, long before the Spanish colonization, and this customary practice is still evident until today especially for remote

areas where modern medicine is inaccessible (de Padua et al., 1999).

However, despite the abundant use of medicinal plants documented in the country, little is known about the use of the medicinal plants by the indigenous groups. One of the indigenous peoples groups in the country is the Negritos and they are considered as the earliest inhabitants of the Philippines. They are composed of about 25-34 tribal groups and are known in different names (Headland, 1987; Padilla, 2013). In Panay Island of Western Visayas the Negritos are called “Ati”. The Ati communities can be found in the aggregated mountainous settlements of the island. They are located in six municipalities in Aklan, six municipalities in Antique (NCIP, 2019), 15 municipalities in Iloilo (PPDO, 2018), and one in Capiz. Even until now, some Ati still practice nomadic lifestyle and travel in different municipalities and provinces to sell forest products. They are also recognized as gatherers, peddlers, seller, and traders of medicinal plants in the region. Although the Ati have a rich cultural usage of the medicinal plants and its products, limited studies have been documented about their ethnobotanical practice in traditional medicine. Some of the early documentations of the culturally important medicinal plants in Panay Islands were recorded in the anthropological studies conducted in the late 1950s in Iloilo (Rahmann and Maceda, 1958) and in Antique in the early 1960s (Rahmann and Maceda 1962). Some medicinal plants were also surveyed with complete local and scientific names in Barotac Viejo, Iloilo, the largest Ati settlement in the island in the late 1980s (Madulid et al., 1989). The previous study focused mainly on the descriptive listings of the commonly used medicinal plants in traditional medicine. However, quantitative analyses on the plants’ importance were not measured. Several ethnobotanical studies with quantitative analyses were conducted in the Negritos groups and subgroups in other provinces in the country and the most common indices that were employed are use value, informant consensus factor (Tangtengco et al., 2018; Obico and Rraggio, 2014; Canceran et al., 2021) and fidelity level (Ong and Kim 2014; Pablo, 2019). In this study, additional indices were employed: the relative abundance, relative frequency citation, and Jaccard’s similarity index.

Traditional practices used by the indigenous peoples were handed to the next generation mostly in oral forms and without the proper documentation. Therefore, it is very important to document this indigenous

knowledge before it is lost and forgotten. Documentation of these customary norms and practices of medicinal plants in ethnomedicine will serve as an opportunity to pursue further pharmacological research for drug discovery and formulation especially for the most recommended and preferred species and as an awareness for preserving cultural heritage, traditional knowledge, and biological diversity. The results of this study will also serve as the basis for the safe and effective alternative means in the health care delivery system. Hence, this study aims to document the indigenous knowledge on the medicinal plants used by the Ati tribes in ethnomedicine. Specifically, it also entails to document the traditional practices, the medicinal plant uses, and to evaluate the relative importance, consensus, and most preferred medicinal plants used by the Ati tribes in Malay, Aklan and in Tobias Fornier, Antique, Philippines.

METHODOLOGY

Study Area

The study was conducted in Brgy. Cubay Sur, Malay, Aklan and Sitio Pantad, Brgy. Igalawagan, Tobias Fornier, Antique as shown in Figure 1. The Ati community in Sitio Pantad is located in a small settlement area for itinerant and landless Ati families in the interior hinterland of the municipality of Tobias Fornier. There are about 45 families and 170 individuals living harmoniously in the village as of June 2020. On the other hand, the study site in Aklan is located in the Malaynon Ati tribe in the northern part of the municipality of Malay. There are 179 families with 304 individuals living in the tribe as of December 2019. The community is located near the Northwest Panay Peninsula Natural Park and is also accessible to the sea. Certification Precondition was acquired from the National Commission on Indigenous Peoples. The wildlife gratuitous permit was issued by the Department of Environment and Natural Resources Region-VI prior to the conduct of the study.

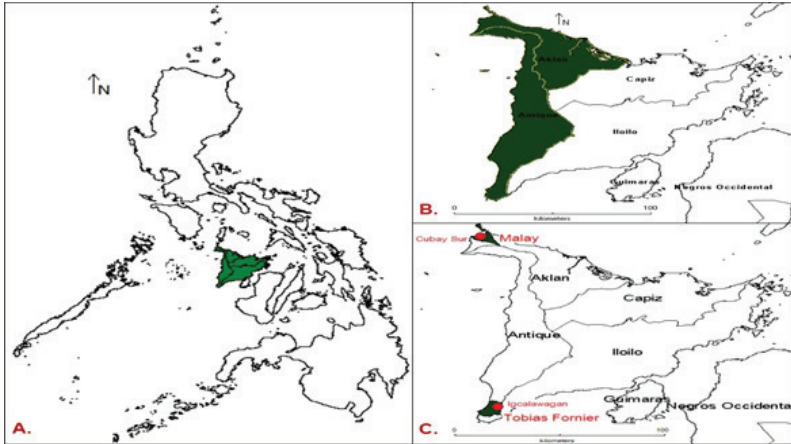


Figure 1. Location of the study sites in green: A. Panay Island in Visayas region of the Philippine archipelago, B. Provinces of Aklan and Antique C. Brgy. Cubay Sur and Brgy. Igcalawagan (red dot).

Source: Authors

Data Collection

A semi-structured questionnaire was used to interview the informants. A purposive sampling technique was used for the survey and the informants were initially identified by the tribal chieftains and by the council of elders. They were composed of arbularyo/arbularya, chieftains, council of elders, and other members of the community who have the knowledge and experience of using medicinal plants to treat medical problems.

A total of 55 informants (23 from Antique and 32 from Aklan), were interviewed at their own convenience in their respective communities. The interviews were conducted from March 2019 to December 2021. The informants were asked questions about their personal information and the plant parts used, the mode of preparation, and form of administration of the medicinal plants they used whenever they experienced any health related concerns.

In addition, focus group discussions were also conducted for the verification of the acquired data among the informants. This study was limited only to conduct interviews, collect medicinal plants, and did not

involve any activities that may intentionally violate the rights of the Ati nor exploit or destruct their sacred places or culturally sensitive areas restricted to their beliefs and tradition.

Plant Collection and Identification

Collection of medicinal plant samples were carried out with the help of the informants, herb doctors, and other members of the tribe who were knowledgeable on the identification and location of the medicinal plants. The collections of the plant specimens were normally done after the interview, and if the plants were available in the vicinity of the informant's house. Medicinal plants were also photographed for documentation purposes. Identification of the medicinal plants was done using different online databases such as Co's Digital Flora of the Philippines (Pelser et al., 2011 onwards), PhytoImages (Nickrent et al., 2006 onwards), Stuartxchange (Stuartxchange, 2021), and Plants of the World Online (POWO, 2021) then were verified by Mr. Danilo Tandang, a botanist at the Philippine National Museum Herbarium and Mr. Michael Calaramo of the Herbarium of Northwestern University Luzon. For the validation of the family and scientific names, Tropicos (Tropicos, 2021), World Flora Online (WFO, 2021), and International Plant Names Index (IPNI, 2021) were used.

Data Analyses

There were five indices used to quantify the importance of medicinal plants: use value (UV), relative frequency citation (RFC), relative important index (RI), informant consensus factor (ICF), and fidelity level (FL). In addition, To to measure the similarity of the medicinal plants between the two studied sites, Jaccard's similarity index (JI) was used.

The UV was used to assess the relative importance of the medicinal plants using the formula: $UV=U/N$, where U is the number of use report cited by each informant for a particular species, and N is the total number of informants participated in the study (Phillips and Gentry, 1993). RFC was used to evaluate the medicinal plants that are culturally important using the formula: $RFCs=FCs/N$, where FCs (frequency citation) is the number of informants who cited or mentioned a specific medicinal plant, and N is the total number of informants. The values range from 0 to 1, 1 being the

highest and it designates that all informants cited or mentioned that specific plant (Tardío and Pardo-De-Santayana, 2008). RI was used to determine the relative importance of medicinal plants by use-category using the formula: $RI = [RFCs(max) + RNUs(max)] / 2$, where $RFCs(max)$, $(RFCs(max) = FCs / FCmax)$ is the relative FCs of the medicinal plant species and is derived by dividing the FCs of a particular species by the number of FC of the medicinal plant species that has the maximum or highest frequency citation ($FCmax$). $RNUs(max)$, $(RNUs(max) = NUs / NUmax)$ is the relative number of the use category and is obtained by dividing the number of use category of a specific medicinal species (NUS) by the number of use categories of the species with the highest use category ($NUmax$). Values closest to 1 indicate that the medicinal plants are the most frequently cited as useful in different use categories by many informants in the community (Tardío and Pardo-De-Santayana, 2008).

ICF was used to rate the consensus of the ethnobotanical information from the participating informants using the formula: $ICF = (Nur - Nt) / (Nur - 1)$, where Nur is the number of use report/s of all medicinal plant/s used for each disease category, and Nt is the number of species used in that particular category (Heinrich et al., 1998). The result ranges from 0 to 1, and the value closest to 1 indicates that few medicinal plant species were being used, while a value close to 0 indicates that there were many medicinal plant species being used to treat a disease or illness in the same category.

FL was used to assess the percentage of the most preferred medicinal plant for a particular disease category using the formula: $FL = (Np / N) \times 100$, where Np is the number of informants who cited or mentioned the use of a medicinal plant for a particular disease category, and N is the total number of informants who cited that plant for any other use or purpose (Friedman et al., 1986). A high value indicates that a medicinal plant has the highest use-report and the most preferred species within a particular disease category.

Ji also known as Jaccard similarity coefficient or coefficient community was used to determine the similarity of medicinal plants among the two sites using the formula $J = C / (A + B) \times 100$, where C is the number of species common to two study sites; A is the number of species collected in study site 1; and B is the number of species collected in study site 2 (Jaccard, 1912). The values that are closer to 100, the has more similar the medicinal

plants between them. All statistical analyses were computed using Microsoft Excel for Microsoft 365 MSO version 2202.

In sum, There there were 17 different use or disease categories adapted and modified from the ICD-11 International Classification of Diseases 11th Revision of the World Health Organization (ICD, 2021) used in this ethnobotanical study.

RESULTS

Medicinal Plant Characteristics

A total of 160 medicinal plant species were identified in the two study sites in Panay Island, Philippines. The plants were distributed in 55 families and 144 genera and were used by the Ati to address 93 diseases/ purpose in 17 different disease or use categories. The family Fabaceae was best represented with 17 species, followed by Lamiaceae with 12 species, and Asteraceae with 10 species (Figure 2).

The detailed information of the medicinal plants such as the family, scientific names, local names as well as the plant parts used, disease or purpose, mode of preparation, form of administration, UV, RFC, and RI values are available upon request from the first author.

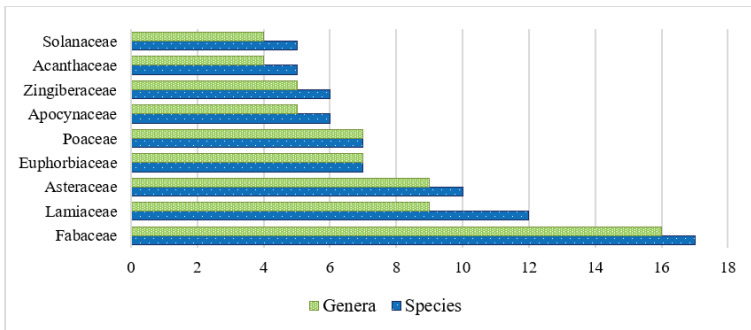


Figure 2. Medicinal Plants Family with High Number of Genera and Species

Source: Authors

Plant part used and mode of preparation and administration

Fourteen different medicinal plant parts were used by the Ati to address their health conditions and problems. The most frequently used parts were the leaf (46%), followed by root (13%), stem (10%), and bark (9%). Fruit (5%), rhizome (5%), seed (3%), latex (2%), and flower (2%) were also used but less frequently. Whole plant, bulb, aerial root, root, petiole, and tuber were less frequently used as shown in Figure 3.

Leaves are applied as fresh, heated, crushed, pounded, and boiled depending on the disease or illness to be addressed. To reduce the bitterness of the plant extract, sugar or mother’s breast milk is added to be taken by infants and children. Sometimes salt is added to the crushed leaves before rubbing its extract on the affected area on the body. Roots are usually boiled, and the decoction is taken orally. Sometimes roots are thinly sliced and infused in *Cocos nucifera*’s (coconut) oil to be applied topically. In some instance, the dried roots are used as an *karmen-karmen* (amulet) of infants and children against the charm of bad spirits. Stems are also used for its decoction or sometimes soaked in warm water then consumed orally. Fruits are eaten as fresh, boiled and the decoction is taken orally. It is also heated and applied directly on the afflicted area or processed into vinegar or oil.

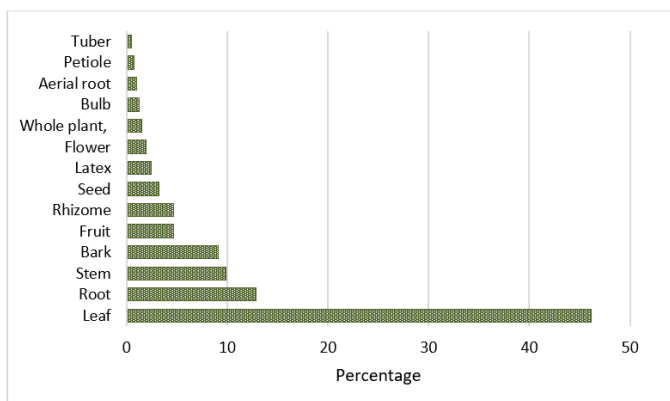


Figure 3. Medicinal Plant Parts Used

Source: Authors

The most common methods of preparation were decoction (29%), followed by crushing/pounding (24%), and applying parts directly (17%).

Heating (5%), scrape/grate (5%), infuse (5%), and eat/drink (4%) were also prepared but less frequently. Other mode of preparations are shown in Figure 4. Decoction is done normally by boiling preferably seven or a handful of fresh leaves or other plant parts such as fruits, roots, and barks for 15 minutes and then cooled for oral consumption or used for washing or bathing. It is part of the Ati culture, when they prepare for the remedy, seven different medicinal plants or seven pieces of the plant parts were used, and it is locally known as pito-pito (pito means seven). Sometimes three or five different medicinal plant species or plant parts were also prepared for treating the medical condition. Crushing is usually done with the young leaves and other soft plant parts and its extract is applied topically or taken orally. Pounding is done with hard plant parts such the rhizome, bark, and fruit. Then the extract is rubbed on the body or on the affected body parts.

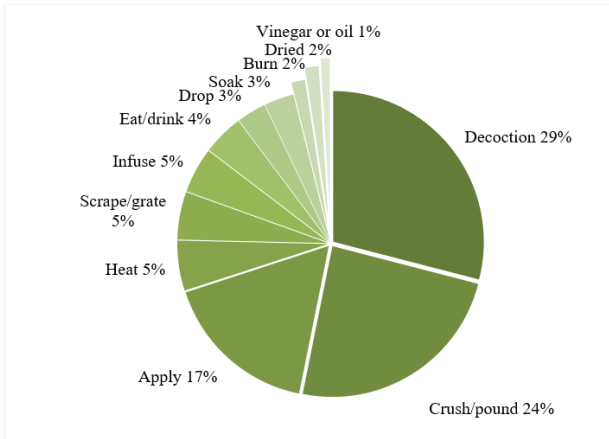


Figure 4. Preparation of Medicinal Plants used by the Ati Tribes in Panay.
Source: Authors

Use Value and Relative Frequency Citation

The UV was used to determine the relative importance of the medicinal plants as indicated with high use reports. Medicinal plants with the highest UV were *Musa x paradisiaca* (0.69), *Blumea balsamifera* (0.67), and *Jatropha curcas* (0.62). *M. x paradisiaca* (banana) is used in six categories and is frequently used for treating fever, headache, stomachache, diarrhea, asthma, cuts, wounds, fracture, athlete's foot, and food poisoning. High use-report is recorded for suppressing fever and headache by applying a

portion of a young leaf directly on the forehead. The plant can be found plentifully growing around the communities especially in the Aklan study site. *B. balsamifera* (blumea camphor) is used in seven different use or disease category and is widely known for treating myriad of health problems such as cough, fever, headache, stomachache, diarrhea, nausea, urinary tract infection, spasm, and for postpartum care and recovery.

Drinking leaf or root decoction or eating fresh young leaves for treating cough recorded the highest use report. *J. curcas* (physic nut tree) is used for the treatment of nine different conditions such as cuts/wounds, ear cleansing, fracture, fever, headache, muscle pain, nausea, oral thrush and tooth decay under seven different disease categories. It is preferred for the treatment of fracture by applying the fresh or heated leaves or bark on the affected area. Medicinal plants with the highest use value are usually used by the Ati in traditional medicine. This can be found growing in their community and are available when needed.

RFC was used to evaluate the effectivity of the medicinal plants and is determined by the high frequency citation from the informants. Medicinal plants with the highest RFC were *B. balsamifera* (0.56), followed by *M. x paradisiaca* (0.44) and *Coleus scutellarioides* (0.44) (Table 1). *C. scutellarioides* (painted nettle) is used in nine disease categories and is best known therapy for cough, black eye, fever, headache, ear problems, fracture, and muscle pain.

Relative Importance Index

RI was used to determine the relative importance of the medicinal plant species by disease categories. Medicinal plant with high RI value indicates high frequency citation from the informants and is frequently used in different disease categories. Medicinal plants with the highest RI values were *B. balsamifera* (0.89), and *C. scutellarioides* (0.89). *B. balsamifera* is used in seven disease categories: diseases and symptoms, signs or clinical findings of the respiratory system, diseases and symptoms, signs or clinical findings of the nervous system, diseases and symptoms, signs or clinical findings of the digestive system or abdomen, diseases of the genitourinary system, pregnancy, childbirth or the puerperium and conditions originating in the perinatal period, injury, poisoning or certain other consequences of

external causes, and general symptoms, signs or clinical findings.

C. scutellarioides is used in nine disease categories: diseases and symptoms, signs or clinical findings of the respiratory system, injury, poisoning or certain other consequences of external causes, general symptoms, signs or clinical findings, diseases and symptoms, signs or clinical findings of the nervous system, diseases of the ear or mastoid process, diseases of the musculoskeletal system or connective tissue, diseases and symptoms. Additionally, it is also used in signs or clinical findings of the digestive system or abdomen, diseases and symptom or signs involving the skin, and pregnancy, childbirth or the puerperium and conditions originating in the perinatal period. The top ten medicinal plants with high UV, RFC, and RI are shown in Table 1.

Table 1. Medicinal Plants with High UV, RFC, and RI

Rank	Medicinal Plants	UV	Medicinal Plants	RFC	Medicinal Plants	RI
1	Musa x paradisiaca	0.69	Blumea balsamifera	0.56	Blumea balsamifera	0.89
2	Blumea balsamifera	0.67	Musa x paradisiaca	0.44	Coleus scutellarioides	0.89
3	Jatropha curcas	0.62	Coleus scutellarioides	0.44	Musa x paradisiaca	0.72
4	Coleus scutellarioides	0.60	Tabernaemontana pandacaqui	0.38	Jatropha curcas	0.71
5	Euphorbia hirta	0.58	Stachytarpheta jamaicensis	0.38	Tabernaemontana pandacaqui	0.67
6	Psidium guajava	0.53	Jatropha curcas	0.36	Piper betle	0.65
7	Tabernaemontana pandacaqui	0.49	Euphorbia hirta	0.36	Annona muricata	0.60
8	Cymbopogon citratus	0.45	Hyptis suaveolens	0.35	Hyptis suaveolens	0.58
9	Hyptis suaveolens	0.44	Psidium guajava	0.33	Cymbopogon citratus	0.56
10	Stachytarpheta jamaicensis	0.42	Chrysophyllum cainito	0.33	Stachytarpheta jamaicensis	0.56

Source: Authors

Informant Consensus Factor and Fidelity Level

A total of 93 diseases or uses in 17 different disease categories were documented in this study as presented in Table 2. The ICF value was based on the number of use reports and the number of medicinal plant species used in each disease category. The results ranges from 0.24 to 0.75 and the highest values are under the categories of diseases of the ear or mastoid process, diseases of the circulatory system, and diseases of the circulatory system. Diseases of the ear or mastoid process recorded ear cleansing and ear problems and it is recorded as the disease or purpose with *Coleus scutellarioides*.

Additionally, it is recorded as the most cited species for treating ear problems. Diseases of the circulatory system only includes hypertension and *Gynura procumbens* (longevity spinach) as the frequently used plant. Disease and symptoms, signs or clinical findings of the respiratory system that are recorded are asthma, cough, pulmonary disease, and running nose. These as reported diseases or purpose with *Blumea balsamifera* and as a preferred medicinal plant for the therapy of cough.

The FL was used to evaluate the relative importance of a medicinal plant to treat a particular disease. A high value suggested that a particular medicinal plant species was cited to treat a specific disease and was highly suggested and preferred by many informants in the tribe. Four medicinal plants have a 100% FL value: *Spondias purpurea* (Spanish plum) for oral thrush under the category of certain infectious or parasitic diseases; *G. procumbens* for hypertension; *Cyanthillium cinereum* (ash coloured fleabane) for cuts/wounds under the category of injury, poisoning or certain other consequences of external causes; and *Uncaria sp.* (bakan) for inaswang under other cultural uses category (Table 2).

Table 2. Disease Category, Reported Disease or Uses, ICF, and FL of the Most Cited Species

Disease category	Reported diseases or uses under each category	No. of used taxa	Use Report	ICF	Most cited species for each category	FL (%)	Use or purpose of the most cited species
Certain infectious or parasitic diseases	Antheminthic(7), anti-rabies(3), anti-tetanus (2), athlete's foot(2), boils(4), chicken pox(2), dengue(3), measles(6), oral thrush(5), ringworm(1), scabies(1), Tinea versicolor(2), tuberculosis(3), typhoid fever(3), typhus(1), warts(1)	46	120	0.62	Spondias purpurea	100	Oral thrush
Neoplasms	Cancer(3), cancer of uterus(1)	4	8	0.57	Morinda citrifolia	60	Cancer
Endocrine, nutritional or metabolic diseases	Goiter(2)	2	3	0.50	Catharanthus roseus	33	Goiter
Mental, behavioural or neurodevelopmental disorders	Mental disorder(1), nervous tension(13)	14	18	0.24	Etingera philippinensis	60	Nervous tension
Diseases and symptoms, signs or clinical findings of the nervous system	Dizziness(13), epilepsy(7), headache(34), migraine(1), spasm(21)	76	173	0.56	Ficus septica	80	Headache
Diseases and symptoms, signs or clinical findings of the visual system	Blurred vision(1), cataract(1), sore eyes(8)	10	35	0.74	Euphorbia hirta	55	Sore eyes
Diseases of the ear or mastoid process	Ear cleansing(1), ear problems(1)	2	5	0.75	Coleus scutellarioides	13	Ear problems
Diseases of the circulatory system	Hypertension(2)	2	5	0.75	Gynura procumbens	100	Hypertension
Diseases and symptoms, signs or clinical findings of the respiratory system	Asthma(3), cough(26), pulmonary disease(1), running nose(3)	33	130	0.75	Blumea balsamifera	81	Cough

Diseases and symptoms, signs or clinical findings of the digestive system or abdomen	131	362	0.64	Stachytarpheta jamaicensis	76	Stomachache
Appendicitis(2), bloated stomach(10), blood in stool(5), colon cleansing(3), constipation(2), diarrhea(25), gallbladder disease(2), gastric pain(10), heartburn(3), hernia(1), liver disease(1), nausea(5), stomach ulcer(11), stomachache(36), toothache(4), tooth decay(3), vomiting blood(8)	32	56	0.44	Parameria laevigata	71	Skin disease
Diseases and symptom or signs involving the skin	26	34	0.24	Gmelina arborea	31	Muscle pain
Diseases of the musculoskeletal system or connective tissue	20	48	0.60	Homonoia riparia	73	UTI
Diseases of the genitourinary system	37	112	0.68	Canarium sp.	91	Postpartum care and recovery
Pregnancy, childbirth or the puerperium and conditions originating in the perinatal period						
Kidney failure(1), kidney stones(3), menstrual problem(2), urinary tract infection(13), uterine disease(1)						
Black nail(1), cyst(2), dandruff(1), hair growth(3), hair loss(2), lump(2), pus(1), skin disease(12), skin rashes(7), skin cleansing(1)						
Arthritis(6), muscle pain(15), muscle swelling(5)						
Abortifacient(9), contraceptive(1), lactation support(1), meconium aspiration syndrome(1), postpartum bleeding(1), postpartum care and recovery(22), promote placenta and fetus development(1), umbilical cord care(1)						

Injury, poisoning or certain other consequences of external causes	Black eye(3), burns(1), caterpillar dermatitis(1), cuts/wounds(25), fish/food poisoning(3), fracture(4), snake bite(1), splinter(1)	39	120	0.68	Cyanthillium cinereum	100	Cuts/wounds
General symptoms, signs or clinical findings	Body chills(1), fever(38)	39	121	0.68	Musa x paradisiaca	83	Fever
Other cultural uses	Hiwit(1), inaswang(4), karmen-karmen(5), bughat (4)	14	27	0.50	Uncaria sp.	100	Inaswang

Number inside the parentheses indicates the number of species in each reported disease or use.

Cultural terms: Inaswang: condition caused by aswang (witch) which has complicated symptoms; bughat: a recurring condition with different symptoms; hiwit: "sorcery" under the spell of black magic; karmen-karmen: serves as amulet or protection of infants and toddlers from the charm of spirits or unseen beings. Source: Authors

Jaccard's index

This comprehensive ethnobotanical study conducted in the Ati tribes in Panay Island showed a low similarity of medicinal plants used. The JI value was 29%. A total of 225 (109 from Aklan and 116 from Antique) medicinal plants were identified in the two sites, only 65 species were common. Despite their comparable mountainous topography, the two study sites possessed a very different medicinal plant compositions. Additionally, the tribes have diverse options for recommendation and preference of medicinal plants for different diseases or health conditions.

DISCUSSION

The ethnobotanical study conducted in the Ati communities in Tobias Fornier, Antique and Malay, Aklan revealed their rich cultural and traditional practice in ethnomedicine. The documentation of 160 medicinal plant species in 55 families and 144 genera showcased the diverse flora of the study sites.

The families of Fabaceae, Lamiaceae, and Asteraceae were best represented with high number of species used. The family Fabaceae recorded 15 medicinal plant species and were used in 23 different diseases or purposes across 10 different use or disease categories. Most of the medicinal purposes is under certain infectious or parasitic diseases and diseases and symptoms, signs or clinical findings of the digestive system or abdomen categories. The family contains wide variety of phytochemicals with high level of biological activities. It is one of the top five families with rich therapeutic uses in rural and indigenous communities of around the world (Molares and Ladio, 2012).

In terms of economic and agricultural importance, it ranks second after the family Poaceae and it ranks third as the largest family of flowering plants after Asteraceae and Orchidaceae. It is also known as Leguminosea or the bean, legume, and pea family (Wojciechowski and Jones, 2006). The family is also widely utilized by other Ati/Negrito tribes across the country (Madulid et al., 1989, Ong and Kim, 2014, Tantengco et al., 2018, Pablo, 2019). Lamiaceae also known as the mint family are composed of aromatic medicinal plants that contain essential oils with antimicrobial, antibacterial, and antioxidant properties that are being used in ethnomedicine for centuries (Mamadalieva et al., 2017, Nieto, 2017). Essential oils produced by this family exhibited anti-cancer activities (Mesquita et al., 2019, Pérez-González 2019).

Another type is known as Asteraceae. Asteraceae is also known as the daisy family and as one of the largest families of flowering plants along with Orchidaceae (Hindi, 2018). They contain bioactive compounds with anti-inflammatory, antimicrobial, antioxidant, and other various healing properties (Konovalov, 2014, Sülsen et al., 2017, Carvalho et al., 2018).

Leaves too play a role in medicinal plant. The use of leaves as the primarily medicinal plant part by the Ati tribes in Panay Island is parallel to other studies conducted in other Ati/Negritos communities (Ong and Kim, 2014; Tantengco et al., 2014; Pablo, 2019) and other indigenous groups in the country (Balangcod and Balangcod, 2015; Pizon et al., 2016; Odchimar et al. 2017; Baddu and Ouano, 2018; Madjos and Ramos, 2021; Montero and Geducos, 2021; Nuñez, 2021; Belgica et al., 2021; Cordero et al., 2022). Leaves are readily accessible and available when needed especially in the tropical countries like the Philippines. Leaves contain secondary metabolites that can inhibit bacterial growth (Chanda and Kaneria, 2011) and have the highest antioxidant, antibiotic, and other important chemical properties compared to other plant parts (Jain et al., 2019). The use of barks, roots, stems, and other plant parts were less utilized in this study, and this might cause negative effects if harvested in large quantities. Harvesting of barks, stems, and roots from the medicinal plants can cause damage and even mortality if collected in large quantities (Tugume, 2016).

Decoction is the most preferred preparation in this study and is comparable with other ethnobotanical studies conducted in other Ati/Negritos tribes (Ong and Kim, 2014, Tantengco et al., 2014, Pablo, 2019) and in other indigenous groups in the country (Pizon et al., 2016, Odchimar et al., 2017, Baddu and Ouano, 2018, Madjos and Ramos, 2021, 2021, Nuñez, 2021, Belgica et al., 2021, Cordero et al., 2022). It is usually administered orally especially for serious medical problems and is more effective than other traditional types (Yang and Ross, 2010). It can be also used as bathing especially for postpartum care and recovery and applied as wash for cuts/wounds and other skin problems.

Musa x paradisiaca has the highest UV and it is used by Ati to treat nine ailments in six different uses or disease categories. It is highly preferred by most informants as a therapy in suppressing fever and headache. Other studies demonstrate its anti-diabetic, anticancer, antihypertensive, antidiarrhea (Bhatnagar et al., 2019), antioxidant, antimicrobial, antifungal, antiviral activities, and temperature control properties (Jyothirmayi and Rao, 2015). Different species of *Musa* are being cultivated in the vicinity of the Ati communities that serve as food and source of livelihood. It is also one of the common plants that can be found in traditional ethnic house compounds in Malaysia (Zakaria et al., 2021). *Blumea balsamifera* recorded the highest

RFC (0.56) and highest RI (0.89) together with *Coleus scutellarioides*. It is used in 11 medicinal therapy under seven different usage or disease categories. It is one of the ten medicinal plants endorsed by the Philippine Department of Health (DOH) and as part of basic healthcare and clinically that proves to have diuretic and antiurolithiasis properties (WHO, 1997). It also contains phytochemicals that have antimicrobial, antioxidant, wound healing, antitumor, and anti-inflammation properties (Pang et al., 2014). Besides, it is grown in the home gardens for medicinal purposes and found to be resistant to insect's infestation (Hussain and Amir, 2022). *C. scutellarioides* recorded 12 usage under nine different disease categories. It has an antimicrobial effect, anti-inflammation, and antioxidant properties (Yanto et al., 2020).

Diseases of the ear or mastoid process, diseases of the circulatory system, and diseases and symptoms, signs or clinical findings of the respiratory system have the highest ICF value (0.75) with *C. scutellarioides*, *Gynura procumbens*, and *B. balsamifera* as the most preferred medicinal plants for each disease category, respectively. Among the most cited species for each 17 use or disease categories are *Spondias purpurea* for oral thrush, *G. procumbens* for hypertension, *Cyanthillium cinereum* for cuts/wounds, and *Uncaria* sp. for inaswang garnered 100% value for fidelity level. The therapeutic claims of these culturally important and preferred medicinal plants must be further validated through scientific experiments and investigations.

The low similarity of the medicinal plant compositions between the two study sites may be attributed by the different climate and forest composition of the two neighboring provinces. The Ati community in Aklan is in the northernmost part of the island and lies near a national park, while the Ati community in Antique is situated in the southernmost part of the island and surrounded by a rice farm terraces and few patches of secondary forest. The great distance and the rarity of constant communication between the two tribes could also affect the low JI.

The documentation of the medicinal plants used by the indigenous Ati tribes in ethnomedicine is an important contribution to the limited information of the traditional and complementary alternative medicine in Panay Island and in Western Visayas.

CONCLUSION

This ethnobotanical study revealed the rich and diverse cultural knowledge of the Ati tribes in ethnomedicine. The use medicinal plants in addressing different health conditions is greatly influenced by their traditions and indigenous beliefs. More ethnobotanical study is highly recommended to other Ati tribes in Panay Island. Further pharmacological research and investigations must be conducted to the culturally important medicinal plants especially to those plants that has high values in different indices. Moreover, the results of this study serve as an ethnobotanical basis for further pharmacological research and formulation as well preserving the cultural heritage, traditional knowledge, and biological diversity.

ACKNOWLEDGEMENTS

The authors would like to thank the Ati tribe members of Sitio Pantad and Brgy. Cubay Sur for sharing their valuable ethnobotanical knowledge. Grateful appreciation is given to the NCIP-ACSC and NCIP Region VI/VII for the issuance of the Certification Precondition and DENR-Region VI, and for the Wildlife gratuitous permit. Many thanks to Mr. Danilo Tandang of the Philippine National Museum and Mr. Michael Calaramo of the Herbarium of the Northwestern University Luzon for the assistance in identifying the medicinal plants. The first author would like to thank the Commission on Higher Education-Scholarship for Graduate Studies Local (K-12) for the scholarship and the second and third authors for the Digital Cooperation Fellowship from the Alexander von Humboldt Foundation.

FUNDING

The research had partial funding from the scholarship of the first author from the Commission on Higher Education K-12 scholarship programme and the Digital Cooperation Fellowship from the Alexander von Humboldt Foundation awarded to the second and third authors.

AUTHOR CONTRIBUTIONS

The first author conducted the fieldworks and drafted the manuscript. All authors designed the study, the second and the third authors supervised, reviewed, and proofread the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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