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Original article

Inventory of Ethnopharmacologically-significant plants used by the manobos in Surigao del Sur, Philippines

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ABSTRACT

Medicinal plants are important sources for the identification of novel drugs. However, their poor documentation may likely result in information loss particularly among indigenous communities that are now adopting western medication techniques. Hence, this ethnobotanical inventory aims to document the pharmacologically-important plants used by an indigenous community of the *Manobos* in Northernmost Surigao del Sur, Philippines. Ninety (90) informants of mixed gender from two study sites underwent informal interviews in isolation using their local dialect. Then, quantitative ethnobotanical indices such as Use Value (UV), Fidelity Level (FL) and Informant Consensus Factor (ICF) were determined based on the data provided by the informants. Conservation status of each medicinal plant was also identified from information in the International Union for Conservation Nature (IUCN). There are 66 species belonging to 41 plant families documented as significant medicinal plants for traditional medication of the tribe. Information from IUCN indicate also that *Shorea contorta* is critically endangered, *Vitex parviflora*, *Cinnamomum mercadoi*, and *Canarium ovatum* are vulnerable, *Adonidia merrillii* is nearly threatened while the rest are classified as least concerned (4), data deficient (2), and taxon has not been assessed (55). Three plants are recorded with highest UV, namely: *Calamus moti* (0.77), *Chrysophyllum cainito* (0.72), and *Gossypium herbaceum* Linn. (0.71) while ten plants representing nine categories of disease have 100% FL. These are *Ficus septica* for warts, *Piper betle* for goiter, *Citrus maxima* and *Vitex negundo* L. for cough, *Musa acuminata* × *Musa balbisiana* for boils, *Hibiscus rosasinensis* L. for swollen muscles, *Calamus moti* for postpartum care and recovery, *Nicotiana tabacum* for flatulence, and, *Plectranthus scutellarioides* for cuts and wounds. *Piper betle, Euphorbia hirta, Allium odorum L.,* and *Psidium guajava* record the highest ICF. In conclusion, this inventory reveals rich knowledge on medicinal plants of the Manobo people in Northern Surigao del Sur. There were 66 taxa documented believed to treat 48 diseases/ailments prevailing in their communities.

KEYWORDS: *ethnobotanical inventory, indigenous community, medicinal plants, Philippine Manobo Tribe*

1 INTRODUCTION

Wide spectra of medicinal plants have remained viable sources in the formulation and development of drugs across different contexts in the world (Ates, *et al*., 2003). The data of the World Health Organization (WHO) reported that approximately 80 percent of the world's population takes advantage of plants as a primary health care system because of its affordability, accessibility, and efficacy (Akerele, 1992). Consequently, ethnobotanical studies have captured the interest of scientific communities (Teklehaymanot, *et al*., 2007). However, there has been uneven distribution of ethnobotanical studies conducted around the world due to minimal effort exerted by few active research groups in certain geographical areas. Reyes-Garcia *et al.* (2007) reviewed 34 studies published between 1986 to 2005 and found out that these studies are densely concentrated in Latin America and only trace quantities in Asia.

In the Philippines, ethnobotanical inventories have attempted to document how locals utilize and administer medicinal plants to treat diverse forms of diseases (Abe *et al*., 2013). Yet, these are relatively few particularly in Mindanao (Olowa *et al*., 2012; Blasco, *et al*., 2014). Despite Mindanao accommodating vast amounts of flora, the progress of botanical exploration has been insulated because of dilemmas related to insurgency, lack of research efforts and financial constraints among local research practitioners (Aribal, *et al*., 2009). Unfortunately, this poor documentation may likely result in information loss. Folk knowledge of the locales on herbal medicine are only handed from one generation to another through oral communication (Amoin, *et al*., 2013). As time progresses, the introduction of new and alternative western medication techniques has gradually replaced indigenous practices (Ong, *et al*., 2011). Consequently, this mainstreaming has led to younger generations being unable to hold as much information on herbal medicines as their elderly generations do (Caniago, *et al*., 1998). This also holds true in one of the

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most organized ethnic tribes in Surigao del Sur who are the Manobos. The modern medical interventions provided by the provincial government have gradually modified their indigenous health system despite the claim that the tribe has maintained the homeostasis of their indigenous practices while adapting to the mainstream Filipino culture (Tomaquin, 2013).

With the expanding threat of displacing indigenous knowledge on ethno-medicine, two inventories were conducted in the province in the same year by Gruyal *et al.* (2014) and Blasco *et al.* (2014). However, the former was limited to documentation of medicinal plants, its mode of preparation, and the ailments the plants treated. Further, the key informants are those residing in lowlands only (Gruyal, *et al*., 2014). On the other hand, the latter was a random collection of 66 plants from mountain ranges of three municipalities, namely: Lanuza, Tandag, and Tago before informants examined the pharmacological uses of the collected species (Blasco, *et al*., 2014). Both ethnobotanical inventories rely on the knowledge of the lowlanders and failed to solicit from the Manobo Tribe which are in fact the natives of the province (Tomaquin, 2013). These gaps pave the way for the conception of this present endeavor aside from the fact that these traditional medicines have to be documented in order to be preserved. Not only the Manobos could benefit from these healthcare systems but the pluralistic society where they have mainstreamed will also do. To continue, the findings of this research are not limited to information contribution in the database of ethnobotanical inventories for future research directions. Instead, this provides prospective resources in the formulation of new drugs to combat certain diseases.

Objectives

This ethnobotanical inventory aims to document the pharmacologically-important plants used by the *Manobos* in Northernmost Surigao del Sur, Philippines. Specifically, this aimed to: (1) list the medicinal plants along with their conservation status, the diseases they treat, and the modes of preparation and route of administration; and, (2) determine frequently used species per category of disease, its fidelity level, and the particular disease or purpose it treats combining both study sites.

2 MATERIALS AND METHODS

Re-entry Protocols and Prior Arrangement

A letter of intent to conduct ethnobotanical inventory in two selected barangays inhabited by the Manobos was forwarded to the National Commission for Indigenous Peoples (NCIP) in the provincial office in Tandag City, Surigao del Sur. However, the researcher was referred by the office to the tribal chieftains or datus to seek for permission since they could not decide on their behalf. In this regard, the permission letters were channeled directly to the chieftains of the two study sites where the Manobos live asking their conferment. Although an approval was made, no specimen was collected per direction of the chieftains. Only photo documentation was allowed.

Study Area

Bordered with Carrascal Bay (north), Pacific Ocean (east), Lanuza bay (south), and Diwata range (west), municipalities of Carrascal and Cantilan lie between latitudes 9° 19' 60.00" - 9°23'53.93" N and longitudes 125° 58' 59.99" - 125°53'36.29" E. Both have verdant vegetation of edible ferns, vast timberlands, fertile lands, and among other basic necessities which are the reasons why the Manobos thrived in here after they fled from the baganis (warriors), the warlike Manobos in Agusan del Sur, in 18th century (Senoc, 1978). Today, they dominated the population of certain political subdivisions of Pantukan and Cabangahan. These barangays are situated mostly in an uneven topography such as rolling hills, upstream, and river banks. Originally, they thrived in the lowlands but the coming of migrants from the North and titling of lands had displaced them to mountainous areas, which the term Manobo is equated to (Tomaquin, 2013). But these areas are home to various flora of medicinal plants which is strategic for their ethnomedicinal practices to flourish and remain alive. The purposive selection of two study sites is due to the influx of migrants from lowlands to work in mining firms established in these barangays. In addition, both have health facilities operated by the government and are actively introducing modern medication techniques. These are perceived variables in the displacement of ethnobotanical knowledge of the Manobos.

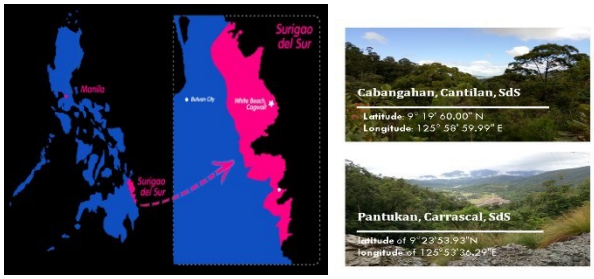

Figure 1. Location of Study Sites in Northernmost Surigao del Sur

Ethnobotanical Inventory

The fieldwork was carried out in December 2017 – March 2018 by which purposive sampling was done in the selection of the informants in the identified study sites. The informants were the aborigines and the *baylanons* (*i.e.,* folk healer of medical practitioner) identified and recommended by the chieftain with age greater than 40 years old as they have stayed for a long

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time, thus, familiar with the environment. This criterion is consistent with the ethnobotanical exploration conducted by Amoin, *et al.* (2013). Each study site had 45 respondents of mixed gender as long as they have met the age requirement and are practicing traditional medication (*i.e.,* the use of ethnomedicinal plants). The age distribution of both sampling sites was found to be insignificantly different based on Mann Whitney U Test, U = 256, p = 0.246. Congruent to the ethnobotanical inventories conducted by Olowa *et al.* (2012) and Morilla *et al.* (2014), the informants underwent informal interviews to minimize pressure and provide spontaneous responses. The interview was held in isolation using their local dialect to ensure that an individual's response was not influenced by other informants (Ong, *et al*., 2014). Each informant was given the freedom to name medicinal plants in its local name as many as he/she could and was inquired on the parts used, the ailment/is treated, and the modes of preparation and administration. While conducting the interview, the informant together with the researchers had a field walk to photograph the medicinal plant being used. All plants were observed *in situ* per direction of the chieftains. Samples were later identified as to its scientific name and categorized by family using the taxonomic works of Madulid (2001) and Quisumbing (1978).

Data Analysis

This ethnobotanical inventory has adopted the method of Ong (2014) in obtaining use categories (UC), use value (UV), fidelity level (FL) and informant consensus factor (ICF) of the medicinal plants which are further described below. The World Health Organization (2011, cited in Ong 2014) released the International Classification of Diseases broadly classified into 16. These are *"(1) Infectious and parasitic, (2) Neoplasms, tumor and tissue growth related, (3) Endocrine and metabolic, (4) related to the nervous system, (5) eye, (6) ear, (7) circulatory system, (8) respiratory system, (9) digestive system, (10) skin and subcutaneous tissue, (11) musculoskeletal system and connective tissue, (12) genitourinary system, (13) pregnancy and childbirth, postpartum care, and infant care related (14) symptoms, signs and abnormal clinical findings not elsewhere classified, (15) injury, poisoning and certain other consequences of external causes, and (16) factors influencing health status and contact with health services."* The use category of each ethnomedicinal plant is identified via this system of classification.

Use Report (UR) refers to the *frequency of use* of informants on a particular plant. A single plant could have multiple use reports from one informant alone because different parts could have different uses. In the event that an informant reported multiple-purposes of the plant but still fell into the same category of disease described in ICD, it was still regarded as a single use report (Amiguet *et al.*, 2005, cited in Ong 2014). On the other hand, Use Value (UV) determines the relative significance of the plant and is directly proportional to UR. This is computed as UV=(ΣU_i)/N, where U_i denotes the frequency of use reported while N indicates the total number of informants (Phillips & Gentry, 1993 cited in Ong, 2014).

Fidelity Level (FL) is the frequency of informants who cited the use of a plant for a specific purpose (I_p) over the total frequency of informants citing the plant for other purpose/s (I_u) regardless of the category. This is calculated as FL(%) = (I_p/I_u)x100. High FL values are attained when a certain plant is agreed to have uniform use among informants while low FL is obtained when that plant is used to treat various diseases/ailments (Friedman *et al*., 1986 cited in Ong, 2014). Lastly, Informant Consensus Factor (ICF) analyzed agreement among informants' medicinal plant knowledge on each category of disease and was computed through the subsequent formula: ICF = (N_{ur}-N_t)/(N_{ur}-1), where N_{ur} represents the number of use of informants in each category of disease while N_t represents the number of taxa used in a particular category of disease. High ICF values (approach to 1.00) are attained when only one or few plant species are reported to be used by a high proportion of informants for a particular category (Heinrich *et al.*, 1998 cited in Ong, 2014). ICF pinpoints potential species for the exploration of bioactive compounds (Canales *et al.*, 2005 cited in Ong, 2014).

3 RESULTS AND DISCUSSION

Table 1 shows that 66 species belonging to 41 plant families were documented as significant medicinal plants in traditional medication of the Manobos in Northern Surigao del Sur. There were six families identified with most number of species reported, namely, Lamiaceae (7), Asteraceae (4), Rutaceae (3), Malvaceae (3), Euphorbiaceae (3), and Arecaceae (3). The medicinal value of Lamiaceae is due to the concentration of volatile oils produced by the external glandular structures of the plant species belonging to it while the rich proportion of bioactive compounds available in Asteraceae could be responsible for their medicinal uses (Nurdan, *et al*., 2007; Giuliani, *et al*., 2008; Thomas, *et al*., 2009). Both families are also recognized for their medicinal significance in Bolovia and Uganda (Cussy-Poma, *et al*., 2017; Hamill, *et a*l., 2003).

Although no density count was made along with the inventory, data from IUCN classified the conservation status of the following notable plants: *Shorea contorta* as critically endangered, *Vitex parviflora*, *Cinnamomum mercadoi*, and *Canarium ovatum* as vulnerable, *Adonidia merrillii* as nearly threatened while the rest are classified as least concerned (4), data deficient (2), and taxon has

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not been assessed (55). The illegal logging of *Shorea contorta* (locally known as Koyla) for lumber and fixtures lead the tree being classified as critically endangered which in the context of both study sites also hold visible. The tough bark, pulp and timber produced by this tree is utilized for carpentry, shop fittings, hand tools, and flooring making it heavily exploited (Ragasa, *et al*., 2014). In terms of medicinal use, the tribe has been using its roots as treatment for diarrhea via decoction.

postpartum period or after childbirth. The rich number of medicinal plants in this category is due to the fact that traditional birthing practices have remained in practice. When pregnant women give birth, a 'mananabang' assists and prescribes medicinal plants for postpartum care and infant care. She has a large proportion of diseases and taxa reported in each category. ICD XIII takes the second spot with highest ICF after ICD III, V, VI, and XVI.

Table 2. Category of Disease, Informant Consensus Factor (ICF), and Fedility Level (FL) of notable plants

Number	Category Name	Reported disease or purposes under each category	ICD-10	No. of use report	No. of Taxa	ICF	Frequently used species	FL (%)	Particular disease or purpose
1	Infectious and parasitic diseases	chicken pox, hepatitis, mumps, wart, measles, colds, tonsillitis, and dengue fever	I	204	9	0.96	*Ficus septica*	100.00	warts
2	Endocrine and metabolic diseases	goiter	III	56	1	1.00	*Piper betle*	100.00	goiter
3	Diseases of the eye	sore eyes	V	10	1	1.00	*Euphorbia hirta*	20.00	sore eyes
4	Diseases of the ear	defeaning and ear infection	VI	19	1	1.00	*Allium odorum* L.	61.29	defeaning & ear infection
5	Diseases of the circulatory system	anemia, bruise, and high blood pressure	VII	93	3	0.98	*Curcuma longa* L.	66.67	bruise
6	Diseases of the respiratory system	asthma, cough and sore throat	VIII	319	13	0.96	*Citrus maxima*	100.00	cough
							Vitex negundo L.	100.00	cough
7	Diseases of the digestive system	constipation, diarrhea, tootache, canker sore, appetite enhacer, stomach ache, and deworming	IX	457	17	0.96	*Chrysophyllum cainito*		diarrhea
8	Diseases of the skin and subcutaneous tissue	boils, blister, and hair loss/fall	X	130	9	0.94	*Musa acuminata* × *Musa balbisiana*	100.00	boils
9	Diseases of the musculoskeletal system and connective tissue	swollen muscles and muscular pain	XI	29	3	0.93	*Hibiscus rosasinensis* L.	100.00	swollen muscles
10	Diseases of the genitourinary system	delayed menstruation, urinary tract infection, and dysmenorrheal	XII	105	6	0.95	*Peperomia oleracea* L.	76.79	urinary tract infection
11	Uses in pregnancy and childbirth, postpartum care, and infant care	infant care, new-born baby care, postpartum care and recovery, and milk production enhancer	XIII	302	10	0.97	*Calamus moti*	100.00	postpartum care and recovery
12	Symptoms, signs and abnormal clinical findings not elsewhere classified	abdominal pain, headache, fever, convulsion, overfatigue, spasm, dizziness and fainting, and flatulence	XIV	378	24	0.94	*Nicotiana tabacum*	100.00	flatulence
13	Injury, poisoning and certain other of external causes	cuts and wounds, bleeding wounds, and snake bites	XV	133	8	0.95	*Plectranthus scutellarioides*	100.00	cuts and wounds
14	Factors influencing health status and contact with health services	circumcision antiseptic	XVI	19	1	1.00	*Psidium guajava*	31.15	circumcision antiseptic

Overall, 48 ailments/diseases in 15 categories can be treated by the 66 reported medicinal plants. No medicinal plant has been documented to cure diseases associated with neoplasm, tumor, and tissue growth related. Symptoms, signs and abnormal clinical findings not elsewhere classified such as sicknesses related to convulsion, dizziness and fainting, fever, flatulence, headache, over fatigue and abdominal pain, and spasm take the highest number of categories with 17 taxa available for medication. Diseases/ailments in the digestive and respiratory system record 16 and 11 taxa available for treatment respectively. The prevalence of respiratory diseases in the study sites is considerably higher because the settlements are located at high altitude with cold temperature. Inhaled cold air, cooling of the body temperature and cold stress causes pathophysiological feedbacks like vasoconstriction in the respiratory tract mucosa as well as suppression of immune responses. These are variables for increased susceptibility to respiratory infections (Mourtzouko, *et al*., 2007). Interestingly, there is a relatively high proportion of medicinal plants (10) indicated to be significant for pregnancy and childbirth, postpartum care and recovery, and infant care. *Calamus moti* takes the highest ICF at 0.97 in this category. The decoction of its air-dried roots is taken orally by women in the

4 CONCLUSIONS

This inventory reveals rich knowledge on medicinal plants of the Manobo people in Northern Surigao del Sur. There were 66 taxa documented believed to treat 48 diseases/ailments prevailing in their communities with ICD XIV having the highest plant taxa available for medication. However, the majority of these do not have records concerning their conservation status from IUCN. Some may be endemic and the growing anthropogenic activities in these communities may likely result in the decline or extinction of their population. In this regard, studies documenting their density and promoting their conservation and preservation may be done. The study also found out that western medication techniques are gradually introduced among this tribal community as they mainstreamed to the lowlands culture. Hence, this study records their idiosyncrasies on traditional medication so that this knowledge may withstand despite the test of time and modernization.

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