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A Survey of Ethnomedicinal Plants in Surigao Del Sur Mountain Range, Philippines

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ABSTRACT

The province of Surigao del Sur in Southern Mindanao island, Philippines, has a vast flora of medicinal and a good number of endemic plants. This study assessed the anecdotal therapeutic uses of plants in this province. Sixty-six plants were randomly collected from a mountain range occupying three municipalities. Ten informants were surveyed about the self-care uses of these plants which include ten endemic species and are mostly represented by the family Rubiaceae. Species richness and diversity indices are highly correlated. Vitex negundo gave the highest informant consensus factor and fidelity level. Datura metel, Vitex negundo and Mimosa pudica gave the 3 highest use values. Decoctions are the most commonly used dosage forms. This study documented the ethnomedicinal uses of plants in Surigao del Sur.

***Key words**: Medicinal plants, Surigao del Sur, ethnobotanical survey.*

INTRODUCTION

Indigenous medicinal plants in the Philippines are investigated either for the *in vivo* and *vitro* pharmacological properties of any of their extracts or for the isolation of bioactive secondary metabolites. Recently, researchers found the need to assess medicinal plants in different vegetation types throughout the Philippines in terms of species richness, diversity and ecological status[1]. Studies have incorporated plant assessment with ethnobotanical investigation with the aim of documenting how locals use and administer medicinal plants for various categories of diseases[2]. To date, only limited reports are available as to the assessment of medicinal plants in certain areas, such as Mindanao island. The current study assessed the status of medicinal plants that are indigenous to the mountain range occupying 3 municipalities in the province of Surigao del Sur, Mindanao, Philippines.

MATERIALS AND METHODS

The survey was conducted from October 2012 to May 2013 to ensure the flowering and fruiting stages of the plants. Collection was done in a dense dipterocarp montane forests that continuously form a mountain range in Surigao del Sur, covering the municipalities of Tago ($08^0$58N$126^0$09E), Tandag ($09^0$04N$126^0$11E) and Lanuza ($09^0$14N$120^0$04E). The necessary local government permits were secured prior to the survey. A semi-structured questionnaire translated in the local dialect was used to interview 5 male and 5 female local healers to document the self-care uses of medicinal plants by the locals, including their method of preparation and dosage administration. A single use-report for 1 single plant for a particular disease was use as the quantitative unit for reporting self-care uses of these plants.

Plant collection was done by random sampling. The locals identified vernacular names of some plants which upon consultation a medicinal plant atlas generated information as to their scientific names and

families[3]. Specimens that are sun-dried were immediately mounted in herbarium sheets with official label. Specimens were pressed newspapers and treated with denatured alcohol in the laboratory. These plants were further soaked in a mixture of 95% ethanol and phenol (60:40) and subsequently oven-dried before they were mounted in herbarium sheets with official label.[4] Herbarium specimens and photographs in their natural habitats were submitted to the curators of the University of Santo Tomas Herbarium (USTH) and Philippine National Herbarium (PNH) for confirmation and/or identification.

RESULTS AND DISCUSSIONS

Species Richness According to Family

The 66 plants collected and identified are mostly represented by Rubiaceae which registered 9 plants (13.%). This was followed by Euphorbiaceae, Moraceae, Urticaceae and Zingiberaceae which registered 4 plants (i.e., 6.1%). The families that registered 3 plants each (4.5%) include Apocynaceae, Lamiaceae, Phyllantaceae and Vitaceae. Only 2 plants (3%) were found for the common families of Araceae, Annonaceae, Asteraceae, Begoniaceae, Diliniaceae and Myrtaceae. Only single species of plant is found for Malvaceae, Rosaceae and Solanaceae even if these were abundant in the collection sites. No plants were found for Rutaceae, Fabaceae, Arecaceae and Convolvulaceae.

Diversity and Species Richness According to Municipality

Table 1 lists the species richness in the 3 municipalities that occupied most of the mountain range in Surigao del Sur and their corresponding diversity indices which were computed using an MBI-R multi-site diversity index calculator[5].

Table I
Species Richness According to Municipality and their Diversity Indices

Vegetation Type	Species Richness	Diversity Indices		
		Simpson's	Shannon's	Dominance
Tago	62.10%	0.11	2.86	0.77
Lanuza	25.80%	0.05	1.65	0.68
Tandag	10.60%	0.08	1.97	0.31

There is a good positive correspondence between species richness and the diversity indices Simpson, Shannon and Dominance, giving Pearson r values of 0.9123, 0.9456 and 0.9565, respectively. This implies that diversity can be positively correlated with forest density. From observation, the mountain range in Tago has the thickest and mostly densed dipterocarp forest among the 3 municipalities. The montane forest of Tandag is close proximity to its agro-ecosystem vegetation and this explains for its low species count. It will be observed later that a higher diversity index of these medicinal plants will also account for bigger informant consensus factors and numbers of use-reports for specific illnesses.

Endemicity

The following plants were found either endemic to the Philippines or to Mindanao: *Cyathocalyx apoensis (*Elmer) J. Sinclair, *Begonia agusanensis* Merr., *Dillenia philippinensis* Rolfe., *Medinilla surigaoensis* Reg., *Syzygium longipedicellatum* Merr., *Ardisia squamulosa* Presl., *Neonauclea formicaria* (Elmer) Merr., *Leea philippinensis* Merr., *Alpinia brevilabris* Presl., *Globba campsophylla* K. Schum.

Among these, only *D. philippinensis* and *A. squamulosa* have been studied for their pharmacological effects and phytochemical constituents. Two triperpenes with antibacterial and antifungal properties have been isolated from the leaves of *D. philippinensis*[6]. From this plant, another triterpene and sulfated glucoside with activity against lung cancer cell lines have been isolated[7]. The leaf decoction of *A. squamulosa* is active against the *Herpes simplex*[8] while its hexane leaf extract increases spermatogenesis in rats[9] and its dichloromethane leaf extract afforded spinasterol which exhibit anti-angiogenic properties[10].

Ecological Status

Based on the Catalogue of Life (www.catalogueoflife.org), the following plants are either endangered,

threatened or vulnerable: *Cyathocalyx apoensis* (Elmer) J. Sinclair, *Aglaonema stenophyllum* Merr., *Aglaonema commutatum* Schott., *Begonia agusanensis* Merr., *Dillenia philippinensis* Rolfe., *Urena lobata* L., *Breynia rhamnoides* (Retz.) Muell. Arg., *Commersonia bartramia* (L.) Merr., *Leucosyke capitellata* (Poir) Wedd., *Alpinia brevilabris* Presl. and *Globba campsophylla* K. Schum.

Economic Status

Four ornamental plants have been identified, namely: *Dillenia philippinensis* Rolfe., *Allamanda cathartica* L., *Tacca palmata* Blume, *Actephila excelsa* (Dalz.) Muell.- Arg. and *Datura metel* L. The flowers and fruits of *Cyathocalyx apoensis* (Elmer) J. Sinclair are used in the cosmetics and shampoo making industries. The bark of this plant, together with *D. philippinensis,* are used by timber industries for making firewoods. The barks of *Donax canniformis* (G.F.) K. Schum. are used in nipa business.

Habit Statistics

From the 66 plants collected, 27 (40.9%) are trees, 18 (27.3%) are herbs, 16 (24.2%) and 5 (7%) are vines. The mean tree height in Tago (58.1 m) and Tandag (68 m) are comparable but are slightly higher than trees in Lanuza (46.5 m) with $p < 0.05$. Likewise, mean tree diameter in Tago (5.91 cms.) and Tandag (6.22 cms.) are comparable but are significantly higher than trees in Lanuza (4.22 cms.) with $p < 0.01$. Tree statistics are not well correlated with species richness, diversity indices and forest density.

Poisonous Plants

Two medicinally-important but poisonous plants have been found, namely: *Datura metel* L. and *Allamanda cathartica* L. The leaves of *D. metel* contains the alkaloids atropine and scopolamine which confers toxic narcotic effects when ingested[11]. *A. cathartica* contains the cardiotoxic cardenolide glycoside digoxin[12].

Anecdotal Indicators

The 10 respondents gave information on the medicinal uses of the 66 plants collected for each disease category surveyed. Every time a plant is used to any extent in each disease category, it was considered to be one use report. Table 2 tabulates the disease categories, informant consensus factor (ICF) and fidelity levels (FL).

Table II

Disease Categories with Informant Consensus Factor (ICF) and Fidelity Levels (FL)

Disease Category	Most Frequently Used Plants	No. of Use Reports	No. of Species	ICF	% FL
Pulmonary	*Vitex negundo* L.	12	4	1	100.00%
Gastro-intestinal	*Datura metel* L.	10	11	1	100.00%
Cardio-metabolic	*Allamanda cathartica* L.	9	13	1	55.60%
Musculo-skeletal	*Alpinia elegans* K. Schum.	7	9	1	62.10%
Infectious Diseases	*Ficus septica* Burm. F.	8	9	1	44.30%
Genito-urinary	*Mikania cordata* B.L. Rob.	3	5	0.3	23.40%
Skin Diseases	*Uncaria cordata* Merr.	6	7	0.5	11.80%
Neurological	*Mimosa pudica* L.	3	2	0.1	6.50%

The ICF value (0 – 1.0) determines the precision among informants as to which plants must be indicated for a particular disease category. An ICF of 1.0 was expected as the 5 disease categories for which it was categorized are the most prevalent in the Philippines[13].

The ICF, however, could not be considered as a singular indicator of use as there are overlapping use reports for certain plants. An example is *V. negundo* L. which is primarily used for cough and asthma but is also often used for infectious diseases[14]. Likewise, *D. metel* is used for both pulmonary and gastro-intestinal diseases[15]. *V. negundo* ("lagundi") is officially accepted in the Philippine National Drug Formulary and is considered as a cornerstone in the treatment of pulmonary diseases[16].

Incidentally, pulmonary and gastro-intestinal diseases which have ICF values of 1.0 also gave 100.0 % fidelity levels (FL). High FL values are obtained for the most preferred plant species for a single disease state whereas low FL values are obtained for plants that are indicated for several illnesses. Aside from *D. metel* and *V. negundo*, high FL values were also given for *Callicarpa longifolia* Lam. and *Ludwigia hyssopifolia* (G. Don) Exell, both of which are used extensively for diarrhea.

Table 3 lists 7 out of the 66 plants collected that gave the highest use values (UV). The UV of a plant quantifies its relative importance locally. High UV values are given when there are many use reports for a single plant without regards to the number of disease categories.

The pantropical distribution of the plants listed in Table 2 explains for their wide ranges of therapeutic options for which several diseases may be indicated. Literature survey reports that these plants have been extensively studied for their pharmacological activities and the large quantity of biologically-active secondary metabolites isolated therein, such as the alkaloids, triterpenes, polyphenolics and polyketides. These factors explain for their high UV's.

Modes and Methods of Dosage Preparations

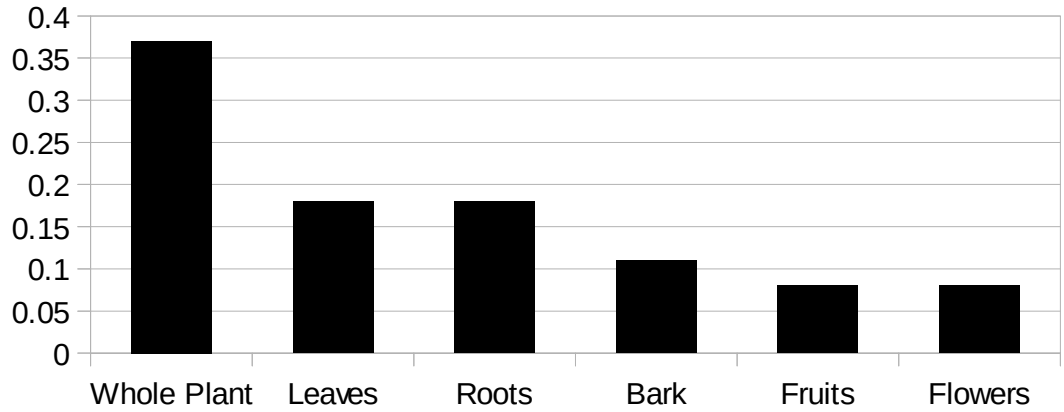
Figure 1 shows the percentage by which different plant parts of the 66 plants collected are used by the locals as reported by the 10 respondents.

Table III
Plants with the Highest Use Values (N = 66)

Scientific Name	No. of Use Reports	No. of Categories	Use Value	Main Disease	Plant Part	Preparation
Datura metel L.	17	6	0.48	Asthma	L/Fl.	Decoction
Vitex negundo L.	13	5	0.33	Asthma	L.	Infusion
Mimosa pudica L.	13	5	0.3	Diuretic	L.	Decoction
Tabernaemontana pandacaqui Lam.	8	4	0.29	Antibacterial	L./St.	Infusion
Leea philippinensis Merr.	7	4	0.14	Antibacterial	WP	Poultice
Allamanda cathartica L.	7	4	0.14	Hypertension	L/Sd	Infusion
Ficus septica Burm. F.	6	5	0.1	Diarrhea	Bk	Emollient

*L – leaves; Fl – flowers; St. - stems; WP – whole plant; Sd – seeds; Bk - barks

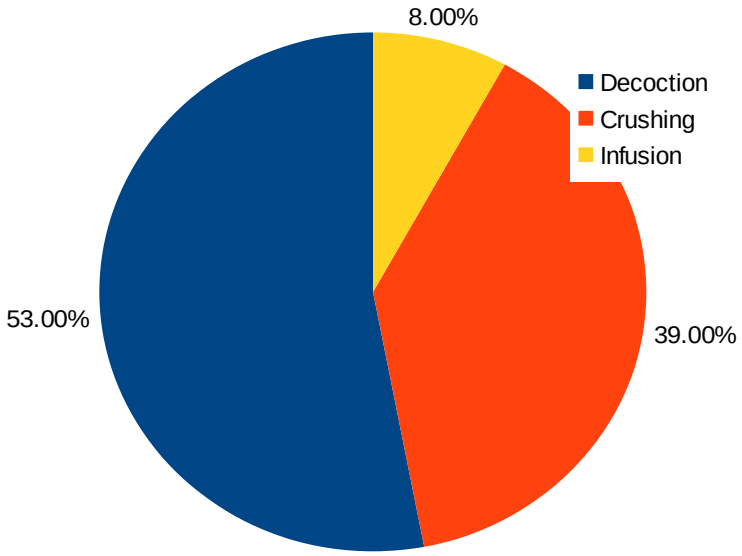
Fig.1: Proportion of Plant Parts Used



If the whole plants are to be considered, leaves can be used by as much as 30%. There are cases where several parts of a plant are used as with the case of *Allamanda cathartica* L. (leaves and fruits), *Datura metel* L. (leaves and flowers) and *Tabernaemontana pandacaqui* Lam. (roots, flowers and leaves). The leaves, roots and barks are the plant parts from where most secondary metabolites are concentrated that is why most phytotherapy and phytochemical researches focus on these parts[17].

Figure 2 shows how the different plant parts of the 66 specimens collected are used prior to their application in various parts of the human body.

Fig.2: Modes of Dosage Form Preparation



Decoction was found to be the most widely used dosage preparation and heating of the aqueous extracts were reported to be the most beneficial. This is probably due to the added extracting capacity of bioactive constituents when preparation is aided by the use of heat. The leaves, roots and barks were found to be the most widely used plant parts in decoction. Crushing of leaves, barks, stem barks, flowers and roots have been effectively prepared either as rubefacients (i.e., rubbed to relieved pain as in arthritis), emollients (i.e., used for their soothing moisturizing effects) and poultices (i.e. either as ointments, creams and lotions) for external uses. Of particular importance is the leaf sap of *Ryparosa cauliflora* Merr., which just like other plants from the family Euphorbiaceae possessed antibacterial properties and can be effectively used as such when leaves are crushed and prepared into any of the aforementioned topical preparations[18].

With the extensive use of decoctions, there is no written document on how these preparations were exactly prepared, leading to scrutinize how excessive amount of heat could possibly degrade bioactive phytochemical constituents, particularly the antioxidative polyphenolic substances which have several therapeutic uses. The use of poultices, emollients and rubefacients as topical preparations gave no information on hygienic considerations as most of the plant parts used herein are crushed. The leaves which are expected to contain most of plants' bioactive constituents are the most widely used in this survey.

The infusions and decoctions which were used internally are administered mostly by drinking (83%) for their systemic effects upon absorption of bioactive constituents into the blood. The rest are either chewed and swallowed (13%) or mixed with food (4%).

Some of the plants require several types of preparations for different ailments. This is exemplified by *Datura metel* L., *Vitex negundo* L. and *Tabernaemontana pandacaqui* Lam., the fruits, leaves and barks of which are compounded into several internal and external dosage forms to be used for cough, asthma, bacterial infections (i.e., systemic, topical and local), diabetes mellitus, hypertension and dyslipidemia.

CONCLUSIONS

This study confirms that plants are still valued for their medicinal purposes by the natives of Surigao del Sur, given the fact that they have difficult access to traditional modern health facilities such as government clinics and hospitals. The high species richness and diversity of plants in the mountain range occupying the municipalities of Tago, Tandag and Lanuza paved the way for the conduct of an ethnobotanical study which revealed the use values, consensus factors and fidelity levels of the 66 plants collected, including 10 endemic species. It is recommended that additional plant assessments and ethnobotanical studies be conducted in more areas of Surigao del Sur to increase sample size and number of informants. Pharmacological and phytochemical screenings of the endemic species are also warranted.

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