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Inventory and Ethnobotanical Study of Medicinal Plants at Samar Island Natural Park, Philippines

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ABSTRACT

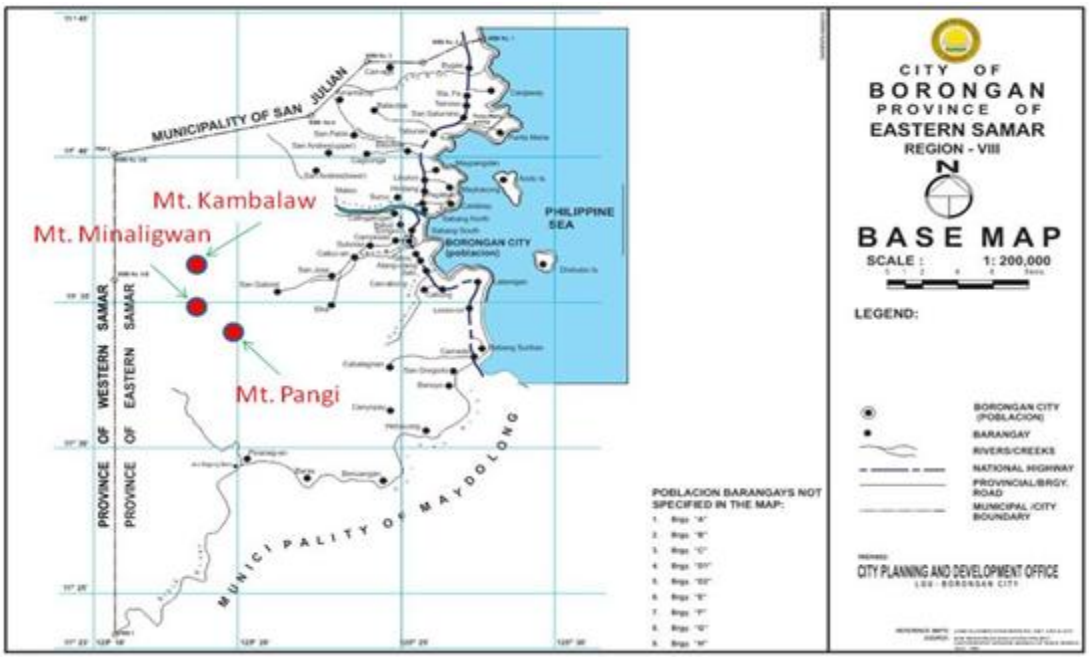
Introduction: *The Samar Island Natural Park (SINP) is a protected area because of high diversity of plant and animal species, some of which are endangered and endemic. To date, no plant assessment has been undertaken at SINP. This study seeks to investigate plant species' richness and diversity at SINP, with emphasis on the anecdotal uses of medicinal plants.* ***Methods:*** *A total of 62 plants have been collected by random and their voucher specimens identified. The self-care uses of medicinal plants identified by the locals have also been documented.* ***Results:*** *The 62 plants collected were mostly represented by the families Rubiaceae, Zingiberaceae, and Asteraceae. These include 7 endemic and 2 endangered species. Diversity is highest in the montane forest of Mt. Pangi. Centella asiatica L. has given the highest informant consensus factor and fidelity level as it has been indicated for 5 disease categories, while Cassia alata L. has given the highest use values regardless of the diseases treated. The most common dosage form that has been used is decoction of either the leaves or roots.* ***Conclusion:*** *This study aims to assess the richness of species and diversity of medicinal plants in SINP, and document their ethnomedicinal uses.*

Key words: *Centella asiatica, Rubiaceae, Zingiberaceae, Cassia alata and Asteraceae*

INTRODUCTION

The Samar Island Natural Park (SINP) covers 333,000 hectares of forests and an additional 125,400 hectares of buffer zone encompassing 36 municipalities and one city. Currently, there is a need to conserve the biodiversity in the area by providing sustainable ecological services and opportunities for equitable development. This study aims to assess the richness and diversity of plant species, with emphasis on medicinal plants in 3 mountains (Mt. Minaligwan, Mt. Kambalaw and Mt. Pangi) in Barangay San Gabriel of Borongan City (Figure 1). Hence, documentation on the self-care uses of identified medicinal plants was also warranted.

Fig. 1: Map Showing the Mountains Where Plants Were Collected



MATERIAL AND METHODS

About 62 plants were randomly collected on October 2012, June 2013, and February 2014, during both dry and wet seasons while on their flowering and fruiting stages, in the tropical forests of Mt. Minaligwan (460 masl), Mt. Kambalaw (464 masl), and Mt. Pangi (322 masl). The said mountains are characterized by their fern and dipterocarp forests with prominent palm trees in some areas. The lower agro-ecosystem consists chiefly of abaca and coconut plantations. There are small freshwater tributaries such as streams and falls in Mt. Pangi. The specimens were treated with a mixture of 95% ethanol and phenol (60:40) to prevent microbial growth and then oven-dried for 2-3 days[1]. Voucher specimens together with photographs of the plants in their natural habits were identified by curators at the University of Santo Tomas Herbarium (USTH) and the Philippine National Herbarium (PNH).

Eighteen local residents (14 females and 4 males) have been interviewed on the self-care uses of identified medicinal plants using a semi-structured questionnaire designed to yield information on informant consensus factors (ICF), fidelity levels (FL), use values (UV), disease categories and the most common dosage preparations. Majority of the female respondents have been selected on the basis of their inherited knowledge on the dosage preparation and therapeutic uses of medicinal plants. Most of the respondents finished high school while few attended some years in college. Some local residents were able to indicate the vernacular names of certain plants which have led to their identification upon consultation with the plant atlases of Quisumbing[2] and Madulid[3].

RESULTS AND DISCUSSIONS

Species Richness and Diversity

The 62 plants collected are dominated by the families Rubiaceae, Zingiberaceae and Asteraceae which registered 6 plants each. The rest of the families registered either 1 or 2 plants each. Surprisingly, Apocynaceae was not represented despite the abundance of plants from this family in the area. Arecaceae was also not represented despite the presence of dense palm trees in certain parts of the forests. Table 1 summarizes the species richness and diversity of plants at SINP.

Table 1: Species Richness and Diversity in 3 Mountains in Samar Island National Park

Area	Species Richness n = 62	Diversity Indices		
		Shannon	Dominance	Simpsons
Mt. Minaligwan	33.2 %	1.89	0.21	0.07
Mt. Kambalaw	31.5 %	2.67	0.38	0.12
Mt. Pangi	30.9 %	3.08	0.59	0.16

The 62 specimens collected was almost evenly distributed among the 3 mountains surveyed, thus, a low correspondence between species richness and any of the 3 diversity indices was obtained ($r > 0.5$). Nevertheless, there was a good linearity among the 3 diversity indices when plotted ($r > 0.90$). The dense thick dipterocarp and fern forests accounts for the equal distribution of species among the 3 mountains. Therefore, it is possible that a large number of species are common to each mountain. Plant assessment is important when ethnobotanical studies are done simultaneously since species richness and diversity may influence the use values of certain plants for certain ailment, category of a disease, or multiple indications for multiple disease states.

Endemic and Endangered Species

From the 62 plants collected, 4 species endemic to the Philippines have been identified, namely: *Alpinia elegans* K. Schum., *Biophytum sensitivum* DC., *Dendrobium papilio* Presl. and *Discocalys sp.* *Saurauia merrillii* Elmer is endemic to the provinces of Leyte and Samar. A pitcher plant species *Nepenthes truncata* and *Macaranga caudatifolia* Elmer, are both endemic and endangered (Figure 1). One plant, 12-1039 *Goniothalamus amuyon* Merr. is new to Samar while *Dianella ensifolia* DC. is newly-introduced to the Philippines. It is interesting to note that all the endemic plants have been identified as medicinal, therefore, warrants further *in vivo* pharmacological studies in experimental animals and phytochemical screenings.

Economically Important Plants

Economically important plants are used in the culinary industry (*Persea americana* Mill., *Zingiber officinale* L. and Peperomia pellucida BK.), the construction industry (*Pterocarpus indicus* Willd.) or the cosmetic industry (*Aloe vera* L.). A large number of plants collected (n = 20) are used for ornamental purposes. In most instances, all of the aforementioned plants have medicinal uses.

Fig. 1*: Nepenthes truncata* (left) and *Macaranga caudatifolia* (right)

Status of the Plants Collected

Figure 2 shows that 62 plants collected are dominated by herbs and trees. Table 2 compares tree statistics in the 3 mountains surveyed.

Fig. 2: Distribution of Plants According to Habits

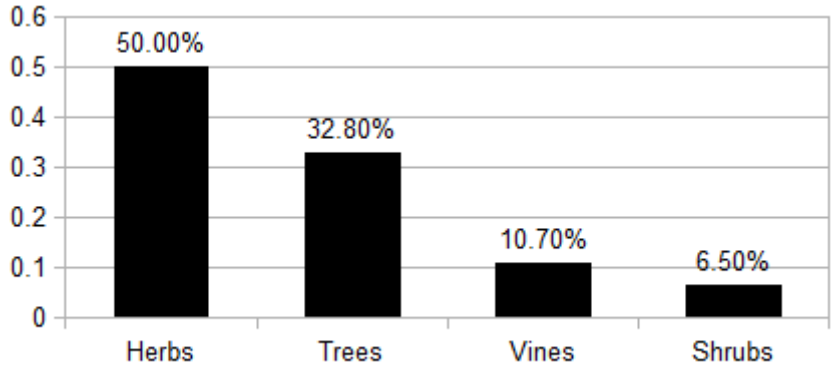


Table 2: Comparative Tree Statistics

Area	Mean Tree Height (Meters) ± RSD	Mean Tree Diameter (Cms.) ± RSD
Mt. Minaligwan	5.52 ± 0.23	48.9 ± 2.1
Mt. Kambalaw	5.87 ± 0.41	51.6 ± 3.3
Mt. Pangi	6.55 ± 0.18*	58.1 ± 2.4*

***** $p < 0.01$ vs. Mt. Minaligwan and Mt. Kambalaw

Most of the shrubs and vines are found at Mt. Pangi. Some vines such as *Psychotria* sp. and *Medinilla* sp. are found to be parasitic to adjacent surrounding plants. In terms of height and diameter, trees at Mt. Pangi are bigger than trees found in Mt Minaligwan and Mt. Kambalaw ($p < 0.01$). This is because Mt Pangi is more densely forested than the two neighboring mountains.

Ethnobotanical Studies Based on Disease Categories

All the 62 plants collected have been identified by the locals as having medicinal properties. Table 3 summarizes the statistics for each disease category. Everytime a plant is used to any extent in each disease category. it is considered as one use report.

Table 3: 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
Cardio-metabolic	*Lagerstroemia speciosa* Pers.	17	13	1	38.20%
Infectious/Poisoning	*Sanseviera zanzibarica* Roxb.	14	11	0.44	24.65%
Muscelo-skeletal	*Artemisia vulgaris* L.	13	9	0.41	21.50%
Gastro-intestinal/hepatobilliary	*Blumea balsamifera* DC	11	8	0.31	12.23%
Pulmonary	*Lantana camara* L.	7	8	0.25	11.16%
OB-Gynecological and Genito-Urinary	*Hydrocotyle vulgaris* Roxb.	6	7	0.2	66.21%
Eyes, Ears, Nose, Throat, Skin Diseases	*Cassia alata* L.	3	5	0.19	77.50%

Incidentally, cardio-metabolic diseases that obtained an informant consensus factor (ICF) value of 1.0 have given 100.0 % fidelity level (FL). High FL values, as in the case of *Cassia alata* L., which is known for its anti-fungal properties[4], are obtained for plants that are the most preferred species for a particular disease whereas low FL's have been obtained for plants that are indicated for several diseases such as *Lantana camara* L. Also, higher FL values have been obtained for plants that have low frequency of use reports. The ICF value, on the other hand, determines the agreement between informants over which plants should be used for each category of disease. A high ICF of 1.0 for cardio-metabolic diseases indicates high agreement among the informants.

The following plants collected are considered "official" in the Philippine Pharmacopoeia and the Philippine National Drug Formulary[5]: *Carmona retusa* L. for diarrhea, *Cassia alata* L. for fungal infections and *Blumea balsamifera* DC. for renal stones. Their "official" status signifies that they are considered cornerstones in herbal therapy as their development into drug products are justified by rigorous safety and efficacy clinical studies. High revenues have been generated as a result of propagating these plants.

Table 4 lists 10 out of the 62 medicinal plants collected that gave the highest use values (UV). The UV of a plant measures the relative importance of the species locally. There is a high UV value when there are many use reports for a single plant regardless of the diseases treated. Most plants listed in Table 4 are already common, indigenous and pantropical in distribution. It is interesting to note that some plants previously mentioned in the ICF and FL measurements (Table 3) reappeared here. These plants have been extensively studied for their therapeutic properties which explain for their high UV's. There is a good correspondence ($r > 0.90$) between the number of use reports and use values to indicate that the more diseases a plant is indicated, the broader is its therapeutic usefulness to the community.

Table 4: Plants with the Highest Use Values (N = 102)

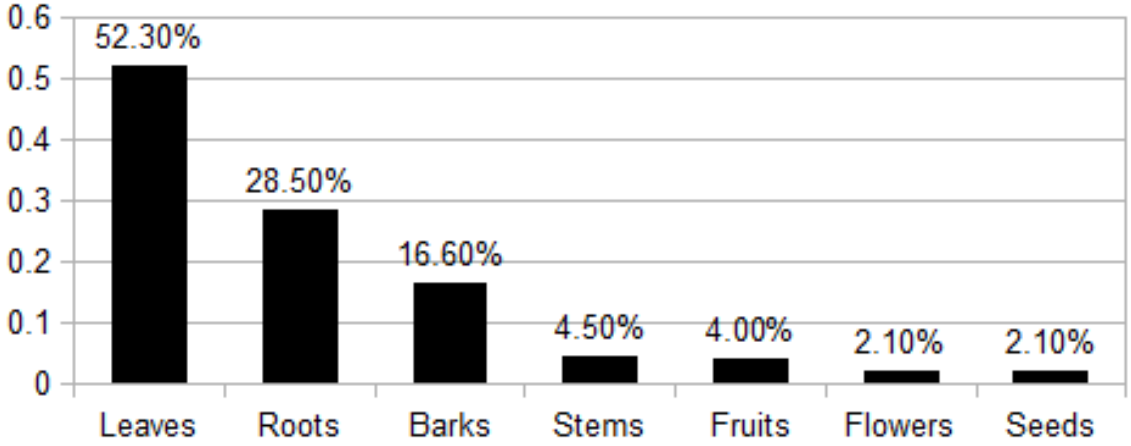
Scientific Name	No. of Use Reports	No. of Category	Use Value	Main Disease Treated	Plant Parts Used	Dosage Preparation
Centella asiatica L.	23	6	0.55	Chicken pox	WP	Decoction
Zingiber officinale Rosc.	20	6	0.53	Sore throat	Rh	Emollient
Blumea balsamifera DC	17	5	0.44	Renal stones	Lf	Decoction
Artemisia vulgaris L.	16	5	0.37	Headache	WP	Rubefacient
Persea americana Mill.	13	5	0.33	Diarrhea	Rt, Bk	Infusion
Acorus calamus L.	13	4	0.3	Snake bite	Lf	Sap
Peperomia pellucida HBK.	9	4	0.25	Gout	WP	Wine infusion
Pterocarpus indicus Willd.	8	3	0.19	Boils	Lf	Poultice
Lagerstroemia speciosa Pers.	7	3	0.14	Diabetes	Lf, Bk	Decoction
Alpinia elegans K. Schum.	7	3	0.12	Fever/flu	Rt	Infusion

*WP – whole plant; Rh – rhizomes; Lf – leaves; Bk – barks; Rt – roots

The leaves of *Centella asiatica* L. applied externally as a poultice is active against chicken pox[6]. The

leaves of *Lagerstroemia speciosa* L. affords the anti-diabetic triterpenoid compound corosolic acid[7]. The leaves of *Blumea balsamifera* DC is a diuretic and urolitholytic due to its sesquiterpene contents[8]. The polyphenolics from the leaves of *Aretemisia vulgaris* L. are anti-inflammatory and analgesic[9]. Figure 3 shows the proportions by which different plant parts are used for compounding.

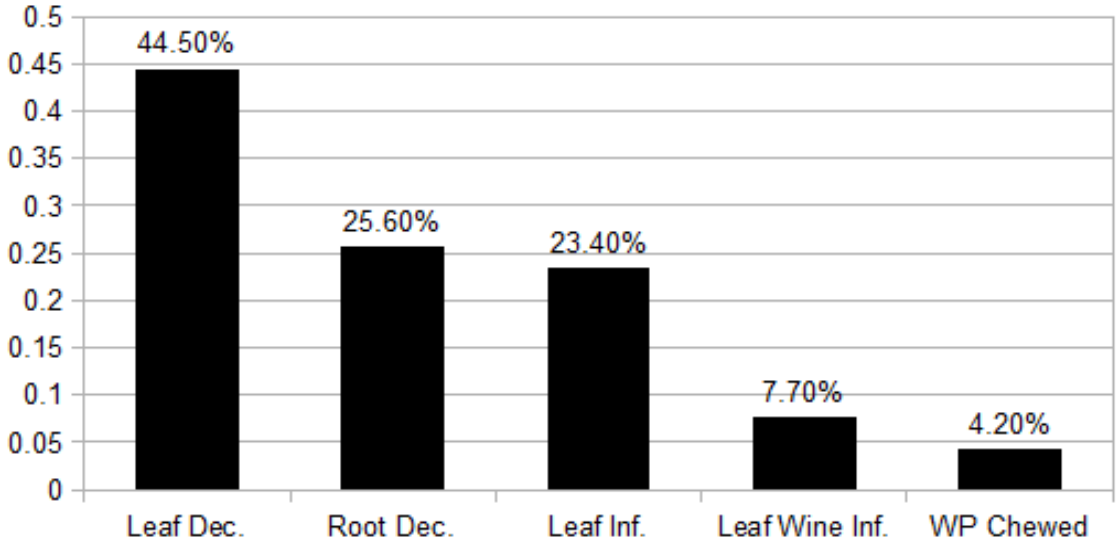
Fig. 3: Proportion of Plant Parts Used (N = 102)



In herbal medicine development, it is practical to use the leaves, roots, and barks as the biosynthesis of bioactive secondary metabolites occur in these plant parts, depending on the climate, soil quality, water supply and nutrients. The drawback with the use of leaves is due to the extraction of chlorophylls, fats, and pigments, which add to the crudeness of extracts, thus, interfere with pharmacological effects[10]. Of particular importance are some plants where more than one plant parts are used as in the case of *Persea americana* Mill. for which the leaves, fruits, and roots are used in different dosage forms for various ailments.

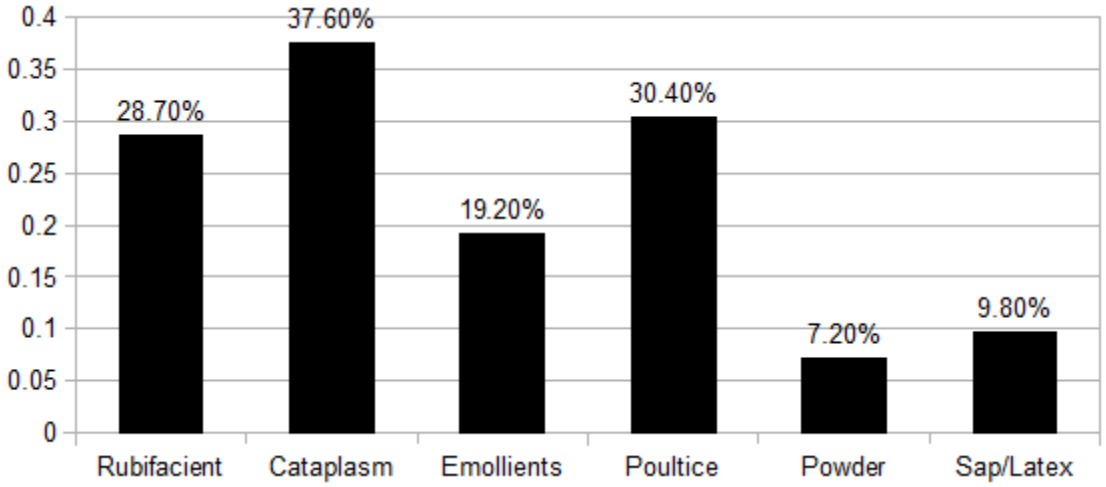
Out of the 62 medicinal plants collected, 38 plants (61.3 %) are used orally, 18 plants (29 %) are used externally or topically and 6 plants (9.7 %) are administered both internally and externally. The proportions by which internal and external preparations are prepared are given in Figures 4 and 5. In most cases, the leaves, barks, and roots are used to a high extent.

Figure 4: Proportions of Internal Preparations of the Medicinal Plants Collected (N = 79)



*Dec. - decoction; Inf. - infusion; WP – whole plant

Fig. 5: Proportions of External Preparations of the Medicinal Plants Collected (N = 43)



The respondents have mentioned the use of decoction for several plants but did not have the idea that the use of excessive heat during boiling can degrade bioactive substances present in these plants , thus, attenuating their therapeutic effects. Nevertheless, the informants attested to the efficacy of decoctions. In some plants such as *Centella asiatica* Urban, *Artemisia vulgaris* L. and *Persea americana* Mill., several preparations (i.e., infusions and decoctions) of the leaves, roots and barks are used. There was no mention on how poultices, cataplasms, emollients and rubifacents are specifically prepared although the issue of cleaning and hygiene in their compounding is of utmost importance, particularly if the application sites are infected.

CONCLUSIONS

This study has been able to assess the species richness and diversity of 62 plants collected from 3 mountains in Borongan City, Eastern Samar, Philippines. These plants include 6 endemic species and 2 species that are either endangered or vulnerable. An ethnobotanical survey has shown that 62 plants have medicinal values. The number of use reports for each of these plants generated data such as informant consensus factor, fidelity level and use values. These identify which disease categories are the majority of the plants indicated for or which plants have the highest frequency of use reports. The survey has also revealed information as to the proportion of plant parts used and the dosage forms prepared extemporaneously.

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