

Biodiversity of ethnomedicinal plants from the B'laan Tribe in Mount Matutum Protected Landscape, Southern Mindanao, Philippines

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Abstract. Alinsug MV, Estandarte MHG, Somodio EMN, Sabarita MJJ, Deocaris CC. 2021. Biodiversity of ethnomedicinal plants from the B'laan Tribe in Mount Matutum Protected Landscape, Southern Mindanao, Philippines. *Biodiversitas* 23: 554-563. Mount Matutum Protected Landscape (MMPL) is one of the key biodiversity areas in Mindanao Island, Philippines, and is part of the ancestral domains of 18 indigenous peoples. The present study aims to establish a comprehensive inventory of the medicinal flora at MMPL according to the traditional healing practices of the B'laan, a tribal community whose cultural heritage is anchored to their interactions with nature and with a rich and understudied ethnomedicinal system. Focus group discussions and key informant interviews of the tribal healers from five tribal communities revealed 101 medicinal plants belonging to 33 families were identified. The plant species have therapeutic uses for 19 disease categories. Roots and leaves are the most utilized parts which are made into a decoction, the most common preparation for oral intake. Tawal-ulad (*Lunasia amara* Blanco), which is used as a treatment for snake bites, dengue, dysmenorrhea, constipation, rabies, and hypertension has the highest use value (UV). Informant Consensus Factor (ICF) analysis revealed that cholera, scabies, viral infections, warts, beriberi, diabetes, gastric ulcer are the most common diseases treated with medicinal plants by the B'laan tribal healers. The biodiversity of medicinal plants, although some remain unidentified at the species level, reflects the centuries-old ethnomedicinal knowledge of the B'laan Tribe. Our study is the first comprehensive documentation of the ethnomedicinal knowledge of the B'laan Tribe residing at MMPL.

Keywords: B'laan Tribe, ethnobotany, indigenous peoples, medicinal plants, Mount Matutum Protected Landscape

INTRODUCTION

Mount Matutum Protected Landscape (MMPL) encompasses 16,500 hectares of lowland forest. It is one of the key biodiversity areas in SOCCSKSARGEN (or Region XII), located in central Mindanao, Philippines, covering four provinces and a city: South Cotabato, Cotabato, Sultan Kudarat, Sarangani, and General Santos City. It covers a significant watershed that supplies 25% of the water requirements for the entire region. MMPL is also the nesting area of critically endangered Philippine eagle (*Pithecophaga jefferyi* Ogilvie-Grant, 1896). It also is home to rare endemic birds, such as the Mindanao lorikeet (*Saudareos johnstoniae* Hartert, E, 1903), Mindanao bleeding-heart (*Gallicolumba crinigera* Reichenbach, 1851), and the Mindanao broadbill (*Sarcophanops steerii* Sharpe, 1876). Endemic subspecies of snowy-browed flycatcher (*Ficedula hyperythra matutumensis* Kennedy, 1987) and other mammals endemic only to Mount Matutum are now critically endangered due to escalating deforestation within the area. Unfortunately, there are only a few biodiversity studies conducted due to its isolated geographical terrain and because of the dangers posed by the presence of armed jihadist groups, i.e., Abu Sayyaf, that

reside in the area (Garciano et al. 2014; Nuneza et al. 2015; Obemio et al. 2016; Nuneza et al. 2019).

According to the 2008 WHO fact sheet, approximately 80% of the population in Asia and Africa depend on plant-based traditional medicine. In the Philippines, there are 134 ethnic groups known to practice traditional medicine to this day. Eighteen ethnolinguistic groups including the B'laan Tribe are found in Southern Mindanao alone. The B'laan is an indigenous, non-Islamic, tribal community in Davao del Sur and South Cotabato. Known as hunters and food gatherers, the cultural heritage of the B'laans is essentially anchored to their interactions with nature (dela Cruz and Gorospe-Ramos 2006). Integral to the tribe's culture is their traditional healing practices of prayers and rituals associated with medicinal plants. The tribal healers carry honorable roles in the community assigned only to a few members based on ancestry. Thus, when an elderly tribal healer senses that one of his grandchildren may possess healing powers, all the traditional knowledge is verbally passed on to the appointed mentee. However, this process of knowledge transference threatens the tribe's healing system as the younger generation is more inclined to embrace modernization.

Thus, this study aims to unravel the biodiversity of ethnomedicinal system among the B'laan Tribe residing in five barangays of MMPL in Southern Mindanao, Philippines.

MATERIALS AND METHODS

Description of the study sites, field validation and sampling

Mount Matutum Protected Landscape (MMPL) geographically lies between $6^{\circ}27'30.99''$ to $6^{\circ}26'9''$ N latitude and $124^{\circ}58'37.5''$ to $125^{\circ}07'63.86''$ E longitude reaching an elevation of 2,286 masl. Mount Matutum is primarily a stratovolcano with a well preserved 302m-wide crater breached by 3 gorges and a base diameter of 25 km. With a densely forested floor of 120 km, lowland Dipterocarp forests comprise 44% (6,083 ha) while grasslands and shrubs constitute 15% allotting 37% to agricultural lands. Moreover, Type III climate prevails on its western side with a short dry season from March to May while Type IV climate persists on its eastern side where rainfall is evenly distributed throughout the year (USAID 2020).

The IP communities at five barangays within the MMPL, South Cotabato, namely, Brgy. Maligo, Acmonan, Kablon, Linan, and Miasong, Mindanao, Philippines were interviewed for the study. As shown in Figure 1, the five barangays are at the lower part of the mountain (lowland) approximately 600 m asl. Field validation, photo documentation, and geotagging of the medicinal plants were done. Voucher specimens were collected and deposited in the herbarium of the university.

Engagement with the tribal healers

Before the collection of data and the surveys, the team obtained the "gratuitous permit" and "certificate of pre-condition/free and prior informed consent (FPIC)" from the Department of Natural Resources (DENR) XII and the National Commission on Indigenous People (NCIP), respectively. The regional and national government agencies endorsed the documents to the team after a series of meetings and presentations of the project with the government offices; consultations and signing of Memorandum of Agreement (MOA) with the dad mulong (tribal healers), Punong Barangays, Indigenous Peoples Mandatory Representatives (IPMRs), Bong Fulong (tribal chieftain) and Fulong of the target barangays.

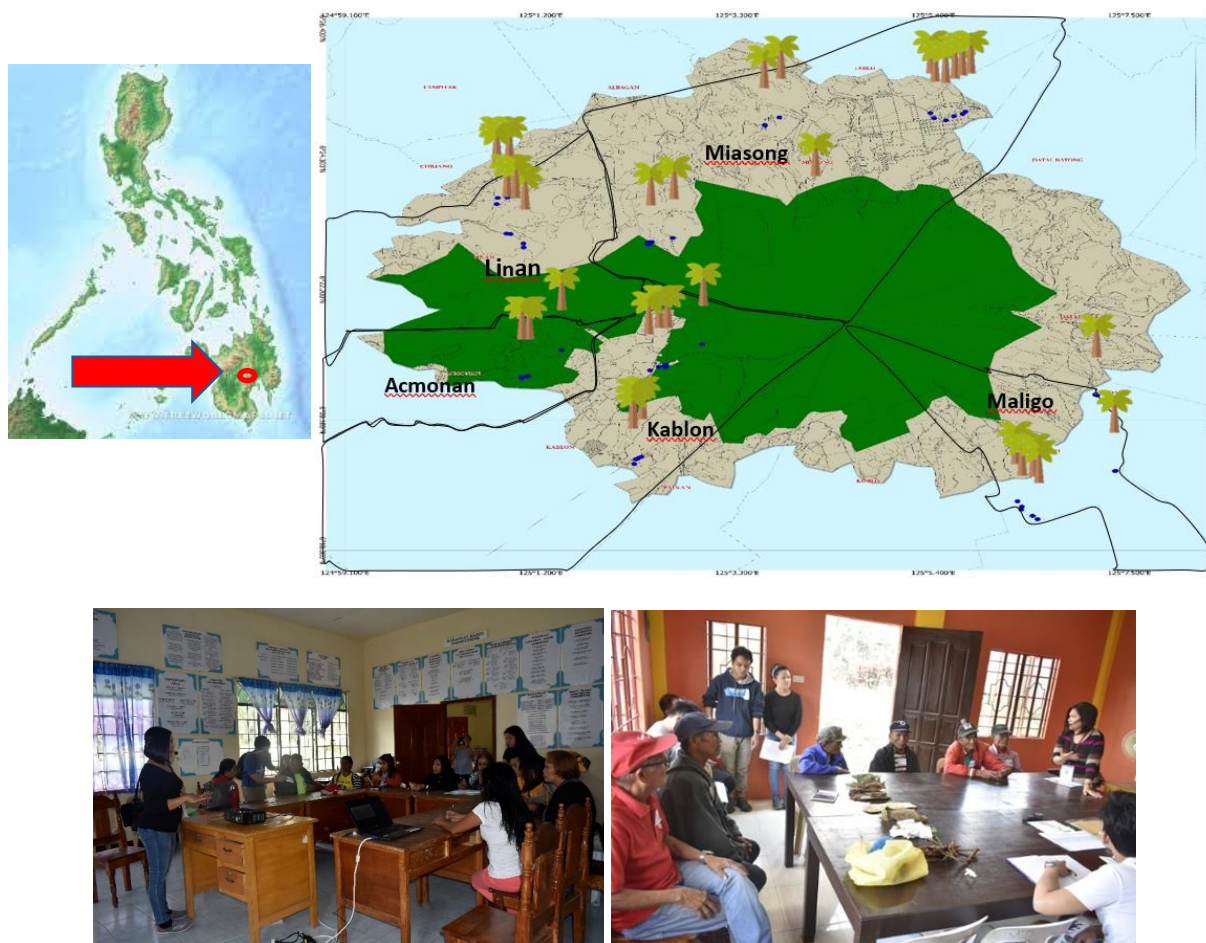


Figure 1. Study area where tribal healers from Mount Matutum Protected Landscape (MMPL) in Mindanao, Philippines were interviewed. A. Geographical information system of the five barangays as study areas in MMPL. B. Photographs during Focus Group Discussions with the B'laan tribal healers inside a tribal community house together with the researchers

Thirty tribal healers were involved in the focus group discussions (FGDs) and key informant interviews (KIIs). A semi-structured questionnaire obtained socio-demographic data from the tribal healers, including various information on the medicinal plants used by the B'laan Tribe (e.g., the local names, plant parts used, diseases targets, and the method of preparation and application).

At least five tribal healers were gathered at every research site and interviewed in the presence of barangay officials, IPMR, and IPS leaders. The research team visited the homes of the tribal healers who were unable to join the FGDs, e.g., due to old age.

During the FGDs, the tribal healers enumerated the plant parts used for treating ailments (Figure 2). Each tribal healer also described in detail and demonstrated, whenever possible, the traditional preparation and administration of the medicinal plants. Other tribal healers shared their knowledge regarding the presented plants to triangulate the information obtained.

The diseases associated with the medicinal plants were annotated based on the International Classification of Diseases and related health problems (ICD-10) by the World Health Organization version 2016 (<https://icd.who.int/browse10/2016/en>).

Data analysis

The relative importance of a plant species in the locality was derived by calculating the use-value (UV) of each ethnomedicinal.

$$UV = \frac{U}{N}$$

Where U is the plant-disease-use combination, and N is the total number of interviewees. A higher UV is associated with a medicinal plant with more reports for its use regardless of diseases treated. Thus, the more health ailments a medicinal plant is indicated for, the broader is its therapeutic usefulness to the community.

To determine the homogeneity of responses or how the medicinal plants used were having common agreement by most of the informants, the informant consensus factor (ICF) was derived.

$$ICF = \frac{Nur - Nt}{(Nur - 1)}$$

Where Nur is the number of use reports from the informants for a particular plant-use category, and Nt is the number of taxa or species used for the specific plant use-category for all informants. ICF values range from 0 to 1, with 1 being the highest level of agreement among the tribal healers.

The fidelity level (FL), or the percentage of the tribal healers claiming the use of a plant species for the same purpose was also derived.

$$FL (\%) = \frac{Np}{N} \times 100$$

Where Np is the number of informants that claim use of a plant species to treat a particular disease and N is the

number of informants that use the plants as a medicine to treat any given disease. Plant species that were mentioned less than five times were not considered in the computations for accuracy based on Bhatia et al. (2014). High FL percentage values infer that a plant is the most preferred species or taxa in treating a disease.

RESULTS AND DISCUSSION

Inventory and documentation of medicinal plants

Table 1 shows the inventory of the B'laan Tribe's medicinal plants with their corresponding UV. According to the tribal healers, it was their first time to experience formal documentation of their medicinal knowledge. The 101 medicinal plants were identified and documented from five barangays in MMPL represented by Maligo, Acmonan, Linan, Kablon, and Miasong. The results confirm that there are still more medicinal plants currently used by the B'laan Tribes. As presented in Figure 2A, majority of the medicinal plants were from Miasong and Maligo.

As shown in Figure 2B, tribal healers preferred using herbs because these plant types are accessible and abundant in their surroundings. Although trees dominated the floral species in MMPL based on the macrofloral resource assessment conducted by the Mindanao State University last 2014, most of the tree species were areas that are difficult to access. On the other hand, herbs are frequently found in lowland areas or within the vicinity of the tribal communities. Therefore, the tribal healers utilize herbs more than trees and shrubs.

The B'laans have a strong interdependence with their natural habitat and claim that plants are sacred as these are god's creations and gifts to their tribe. Like the Subanen indigenous communities of Lapuyan, Zamboanga del Sur studied by Pizon et al. (2016), the B'laans also believe that plants possess supernatural spirits and thus must be respected, valued if not revered. Like the other tribes in the Philippines, the community prefers to consult tribal healers since modern health care services are inaccessible and costly (Palaganas et al. 2001). Ethnomedicinal knowledge among the B'laan Tribe is maintained because the indigenous communities believe that the traditional healing practices are more practical and intertwined with their ancestral culture and identity. However, despite the normative beliefs, some tribal healers still advise their patients to seek professional doctor's services in the far-off urban centers, especially for life-threatening cases. Similar observations were reported from studies by Berdon et al. (2016), Labastida (2016), and Pizon et al. (2016) with the different tribes in the Philippines.

Preparation practices of the B'laan tribal healers

The distribution of the plant parts utilized by the B'laan tribal healers in treating ailments and diseases is shown in Figure 2C. Among the several plant parts used for traditional healing, roots and leaves were utilized with the same frequency at 29% and 26%, respectively. Similar findings were also observed among the Talaandig Tribe of Bukidnon, Southern Mindanao, where the leaves and roots

were the most commonly used plant parts for traditional healing (Naïve et al. 2021). According to Bisht (2017) parts of plants commonly used as traditional medicines are leaves, stems, bark, roots, flowers, fruit, seeds, and whole plants. Flowers, sap, and fruits were seldom utilized due to their availability and seasonality.

Decoction is the most preferred method (Figure 2D) similar to the traditional practices of tribal healers from North Cotabato (Rubio and Naïve 2018) and Bukidnon (Naïve et al. 2021). Whole plants for herbs, and barks and leaves for trees and shrubs were preferred. Tribal healers believed that there are more nutrients found in the roots than the rest of the plant because they perceive the roots as the primary access point by the plant for its survival.

Use value

Use values (UV) were derived based on the citation frequency of each medicinal plant among the respondents (Table 1). In the five sites of the B'laan Tribes, the most important medicinal plant was the tawad-ulad (*Lunasia amara* Blanco) (UV = 1.81). The lowest calculated UV was 0.03 for 22 plants. Among the different plant families used for various diseases categorized by the WHO, Asteraceae plants were versatile enough to be used in all types of diseases (Figure 3A). Moreover, the UV of each plant family was calculated according to its medicinal purposes. Rutaceae garnered the highest UV of 1.00 followed by Annonaceae (0.65), and Loranthaceae (0.52) (Figure 3B).

Plants with high UV are often easily harvested and found across accessible areas of MMPL, except for tawal-ulad, kayu danol, and makok. *L. amara*, the most important medicinal plant of the B'laans, is a shrub which is believed to treat a broad spectrum of diseases. Preparations by infusion, poultice, tincture, or extraction of the different parts of tawal-ulad have curative properties for specific diseases. The bark can be used for snake bites, rabies, and dengue; the roots for German measles or rashes; leaves for dysmenorrhea, constipation, and hypertension. Tawal-ulad is known to contain quinolone-type alkaloids that target the central nervous system. Its diverse alkaloid compounds have antimicrobial, antitumor, and cytotoxic properties (Prescott et al. 2006; Macabeo and Aguinaldo 2008; Totaan et al. 2018).

Informant consensus factor

The ICFs were stratified based on disease categories (Table 2). The values computed range from 0.71 to 0.89 with a mean ICF of 0.79 for all the plants. The highest ICF was for diseases of the blood and blood-forming organs and certain disorders that involve the immune system. In contrast, the lowest ICFs are for circulatory system ailments and neoplasms. Although there is a consensus among the tribal healers on the use report of a plant, different methods of preparation are required for treatment of specific ailments. For example, *L. amara* is used to treat rabies and dengue where it is prepared as poultice and can also treat constipation and stomachache where it is prepared as infusion.

Kayu-danol (landslide tree) is used to treat anemia, the disease with the highest ICF value (0.89). The second

highest ICF (0.84) was responsible for treating urinary tract infection, dysmenorrhea, pelvic organ prolapses, urinary incontinence, myoma, and kidney disorders. The tribal healers prepare decoctions of various plants, such as banana, bawan mlato, hagonoy, kalfagang, kalsonakofil, mammon-mamon, nabin lamfa, and slo'en, for these ailments.

Fidelity level

Each ailment has an FL that can be grouped into diseases of the nervous system (24%), diseases in the genitourinary system with two diseases, namely myoma (24%) and urinary incontinence (24%), pregnancy, childbirth, and the puerperium (4%), symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (12%), and lastly injury, poisoning and certain other consequences of external causes (12%). In this study, 22 plants with high FL values were used exclusively to cure a single ailment while 79 plants were used to treat two or more diseases displaying low fidelity levels. Seven plant species have the maximum FL of 100%, namely: bayag-usa, Chinese malunggay, kaltaas, kamang, siro, hagonoy, and buyo-buyo. These medicinal plants are used for cancer, diabetes, body odor, furuncles, and snake bites. Medicinal plants with high fidelity levels are reflected in Table 3.

It is also noteworthy that scientific reports also back many plant species associated with high FL against the diseases that they target. Kulfilbot, scientifically known as *Eleusine indica* L. Gaertn, is a weed or grass belonging to the Poaceae family. This plant was documented in Nigeria with medicinal claims such as diuretic, anti-helminthic, and cough. *E. indica* was described as exhibiting the most significant bioactivity against *Trypanosoma brucei*, responsible for the sleeping sickness disease caused by the tsetse fly (Gruyal 2014; Ogbale et al. 2018). It was also reported to treat diseases like hypertension, oliguria, urine retention, and influenza. The root was mainly used to detoxify harmful substances present in the body (depurative), to treat fever (febrifuge), to increase bowel movement (laxative), and to induce urination (diuretic) (Iqbal and Gnanaraj 2011). *E. indica* has effective antiplasmodial activity against *Plasmodium berghei*. The compounds present in the plant can slow down the growth of the parasite and inhibit malarial infection (Okokon et al. 2010). *E. indica* has significant hepatoprotective effects, specifically in hepatic injury or liver problems. The study of Iqbal and Gnanaraj (2011) shows that *E. indica* can reduce oxidative damage in the liver and increase antioxidant enzyme activities. This reported plant species can greatly contribute to the ethnopharmacopeia for drug discovery.

Overall, the diversity of medicinal plants also appears to reflect the predominant diseases and ailments in the B'laan community. It can be noted that the majority of the B'laans are generally fit as they are engaged in an active lifestyle such as walking, farming, and hunting. However, should there be instances of high blood pressure, obesity, STDs, AIDs, or other diseases that currently taunt the metropolis, the tribal healers shall access the spirit world to formulate plant-based medicine to heal their tribesmen.

Table 1. Inventory and use value of the medicinal plants used by the B'laan Tribe in Mount Matutum Protected Landscape, Mindanao, Philippines

Plant local name	Scientific name	Family	Location (barangay)	Folkloric claims (ailments)	Mode of preparation	Ui	N	UV
Adong	<i>Compositae</i> sp.	Asteraceae	Kablon	Urinary tract infection	Infusion	1	30	0.03
Alas	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Miasong	Tigdas, german measles	Steam exposure	3	30	0.10
Alingatong	<i>Urtica dioica</i> L.	Urticaceae	Kablon	Hypertension	Decoction	1	30	0.03
Almak	<i>Compositae</i> sp.	Asteraceae	Kablon	Dysmenorrhea, ovarian disorders	Decoction	1	30	0.03
Amgo-o	<i>Gymnostoma rumphianum</i> (Jung. ex Vriese) L.A.S.Johnson	Casuarinaceae	Miasong	Headache, fever	Steam exposure	1	30	0.03
Amomom	<i>Zingiberaceae</i> sp.	Zingiberaceae	Maligo	Furuncles	Decoction	2	30	0.06
Anib	<i>Coix lacryma-jobi</i>	Poaceae	Maligo	<i>Buyag</i>	Poultice	9	30	0.29
Aslot	<i>Compositae</i> sp.	Asteraceae	Miasong	Stomachache, diarrhea, nausea	Decoction	8	30	0.26
Atbel-ayom	<i>Cyanthillium cinereum</i> (L.) H.Rob.	Asteraceae	Miasong	Rabies, inflammation	Poultice	1	30	0.03
Baay	<i>Compositae</i> sp.	Asteraceae	Maligo	Buwa	Decoction	3	30	0.10
Balete Tree	<i>Ficus benjamina</i> Linn.	Moraceae	Miasong	Fatigue, <i>buyag</i>	Decoction	1	30	0.03
Balut	<i>Cyperaceae</i> sp.	Cyperaceae	Miasong	Fatigue (bughat)	Decoction	1	30	0.03
Banana	<i>Musa</i> sp.	Musaceae	Miasong	Inflammation, diuresis	Poultice	5	30	0.16
Barkaw	<i>Compositae</i> sp.	Asteraceae	Kablon	Hemorrhage	Decoction	3	30	0.10
Bawan ambok	<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	Asteraceae	Linan, miasong	Toothache, wounds, highblood	Poultice	5	30	0.16
Bawan milay	<i>Artemisia dubia</i> L. ex B.D.Jacks. var. asiatica Pamp.	Asteraceae	Kablon	Toothache, wounds	Poultice	6	30	0.19
Bawan mlato	<i>Sida acuta</i> Burm.f.	Malvaceae	Maligo, kablon, linan	Relapse, fever, stomachache, hair strengthening, fatigue, postpartum relapse	Decoction	27	30	0.87
Bawan mlibu	<i>Conyza bonariensis</i> (L.) Cronquist	Asteraceae	Maligo, kablon, acmonan, miasong	Wound, toothache, stomachache, wounds, tinea versicolor, vomiting, diarrhea	Poultice, decoction	18	30	0.58
Bayag-usa	<i>Voacanga globosa</i> (Blanco) Merr.	Apocynaceae	Kablon	Cancer, hernia	Decoction	8	30	0.26
Bên	<i>Compositae</i> sp.	Asteraceae	Linan	Fatigue, postpartum relapse	Decoction	3	30	0.10
Bugang	<i>Saccharum spontaneum</i> Linn.	Poaceae	Kablon	Heartburn, cardio diseases	Poultice	4	30	0.13
Bulong-a-blatan angok	<i>Saurauia</i> sp.	Actinidiaceae	Acmonan	Fatigue, postpartum relapse	Infusion	8	30	0.26
Buyo	<i>Piper betle</i> L.	Piperaceae	Maligo	Rashes, asthma, strengthening of teeth and gums, flatulence, cough	Poultice	6	30	0.19
Buyo-buyo	<i>Piper aduncum</i>	Piperaceae	Maligo	Snake bites	Poultice	5	30	0.16
Cactus	<i>Nopalea cochenillifera</i> (L.) Salm-Dyck	Cactaceae	Maligo	Headache	Poultice	3	30	0.10
Chinese Malunggay	<i>Sauropus androgynus</i>	Phyllanthaceae	Maligo	Diabetes	Decoction	6	30	0.19
Daupang	<i>Urena lobata</i>	Malvaceae	Miasong	Boils	Poultice	3	30	0.19
Dao	<i>Compositae</i> sp.	Asteraceae	Linan	Fatigue, postpartum relapse	Decoction	3	30	0.10
Dêf	<i>Compositae</i> sp.	Asteraceae	Linan	Measles, rashes, allergies	Liniment	16	30	0.52
Defdef	<i>Compositae</i> sp.	Asteraceae	Maligo	Warts	Decoction	1	30	0.03
Dilakuku	<i>Pseudelephantopus spicatus</i> (Juss.) Rohr	Asteraceae	Miasong	Stomachache, diarrhea	Decoction	8	30	0.26
Dita	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	Kablon, linan	Toothache, fever, dengue	Liniment	7	30	0.23
Donyal	<i>Compositae</i> sp.	Asteraceae	Kablon	Hyperacidity	Decoction	1	30	0.03
Duldol	<i>Ceiba pentandra</i> (L.) Gaertn	Malvaceae	Miasong	Fatigue, postpartum relapse	Decoction	1	30	0.03
Eskuba	<i>Sida acuta</i> Burm.f.	Malvaceae	Linan	Fatigue, postpartum	Decoction	1	30	0.03
Hagonoy	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Asteraceae	Miasong	Rashes, measles, toothache	Poultice	7	30	0.23
Kala(h)	<i>Compositae</i> sp.	Asteraceae	Linan	Arthritis	Poultice	2	30	0.06
Kalbalol	<i>Neonauclea reticulata</i> (Havil.) Merr.	Rubiaceae	Miasong	Hyperacidity	Poultice	9	30	0.29
Kalbangi	<i>Compositae</i> sp.	Asteraceae	Kablon	Appendicitis	Decoction	1	30	0.03

Kalfagang	<i>Ficus congesta</i>	Moraceae	Maligo	Viral infection, wound, hemorrhoids, rashes, boils, breast cancer	Poultice	31 30 1.00
Kalsangi	<i>Curculigo</i> sp.	Hypoxidaceae	Miasong	Headache, wounds	Poultice	1 30 0.03
Kalsonakofil	<i>Compositae</i> sp.	Asteraceae	Maligo	Hemorrhage, asthma, rheuma	Decoction	18 30 0.58
Kaltaas	<i>Homalomena philippinensis</i> Engl.	Araceae	Kablon	Strong body odor, bad smell	Poultice	7 30 0.23
Kamang	<i>Schefflera</i> sp.	Araliaceae	Kablon	Perspirant	Poultice	6 30 0.19
Kamit	<i>Rubus rosifolius</i> Sm.	Rosaceae	Kablon	Measles and chicken pox	Decoction	1 30 0.03
Kaningag	<i>Cinnamon</i> sp.	Lauraceae	Kablon	Cancer, fever	Decoction	10 30 0.32
Katmon	<i>Artocarpus</i> sp.	Moraceae	Maligo	Ulcer, gastrointestinal diseases	Decoction	10 30 0.32
Kayo-tawal	<i>Compositae</i> sp.	Asteraceae	Miasong	Stomachache, toothache, gastroenteritis, difficulty in breathing	Liniment	3 30 0.10
Kayu-damay	<i>Cypholophus macrocephalus</i> (Blume) Wedd.	Urticaceae	Maligo, kablon	Chickenpox, urinary tract infection, snake bite, cold sores, eczema, german measles, swelling, myoma, appendicitis	Decoction	13 30 0.42
Kayu-danol	<i>Rubiaceae</i> sp.	Rubiaceae	Maligo	Dysmenorrhea, myoma, leukemia, low hemoglobin count	Decoction	24 30 0.77
Kihol	<i>Amyema celebica</i> (Tiegh.) Danser	Loranthaceae	Acmonan	Postpartum relapse, fever, anemia	Decoction	16 30 0.52
Kilong-ulad	<i>Alocasia zebrina</i> Schott ex van Houtte	Araceae	Acmonan	Snake bites	Poultice	16 30 0.52
Klakeh	<i>Compositae</i> sp.	Asteraceae	Linan	Heartburn and hyperacidity	Liniment, poultice	2 30 0.06
Klis	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Miasong	Wounds	Poultice	1 30 0.03
Kringel	<i>Cinnamomum</i> sp.	Lauraceae	Kablon	Cancer, fever	Decoction	3 30 0.10
Kubel	<i>Compositae</i> sp.	Asteraceae	Kablon	Cough and colds	Decoction	15 30 0.48
Kufilbot	<i>Eleusine indica</i> (Linn.) Gaertn.	Poaceae	Maligo, kablon, linan, miasong	Paralysis, hair strengthening, myoma, postpartum relapse, bell's palsy, diuresis, fatigue, hard breathing	Maceration, steam exposure, infusion	25 30 0.81
Kukulanglitê	<i>Compositae</i> sp.	Asteraceae	Acmonan	Anemia, fatigue	Decoction	18 30 0.58
Kwakok	<i>Zingiber spectabili</i> Griff	Zingiberaceae	Maligo	Hemorrhoids	Poultice	8 30 0.26
Lampunaya	<i>Compositae</i> sp.	Asteraceae	Maligo	Cough, bruises	Poultice	8 30 0.26
Lino	<i>Compositae</i> sp.	Asteraceae	Acmonan	Snake bites, rabies, dengue	Decoction, infusion	16 30 0.52
Litotao	<i>Compositae</i> sp.	Asteraceae	Acmonan	Hemorrhage	Decoction	4 30 0.13
Lumit	<i>Compositae</i> sp.	Asteraceae	Linan	Fatigue, postpartum relapse	Decoction, infusion	3 30 0.10
Lutaf	<i>Ficus pseudopalma</i>	Moraceae	Maligo	Seizure	Poultice	3 30 0.10
Magba	<i>Angiopteris palmiformis</i> (Cav.) C. Chr.	Marattiaceae	Maligo	Silky and smooth hair	Decoction	5 30 0.16
Maglong	<i>Compositae</i> sp.	Asteraceae	Linan	Fever, dengue, headache, migraine, gastroenteritis, difficulty in breathing	Decoction	4 30 0.13
Makok	<i>Zingiber spectabile</i> Griff.	Zingiberaceae	Kablon, maligo	Hemorrhoids	Steam exposure	25 30 0.81
Maldamay	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Miasong	Sore eyes, dengue, urinary tract infection, kidney stones	Poultice	20 30 0.65
Malguilan	<i>Compositae</i>	Asteraceae	Maligo	Amoeba	Decoction	8 30 0.26
Malkoreng	<i>Compositae</i>	Asteraceae	Linan	German measles, insomnia	Poultice, decoction, maceration	9 30 0.29
Malok	<i>Compositae</i>	Asteraceae	Kablon	Hepatitis	Decoction	2 30 0.06
Mamon-mamon	<i>Acmella grandiflora</i> (Turcz.) R.K.Jansen	Asteraceae	Maligo, miasong	Toothache, mouth ulcer, convulsion, fever	Poultice	21 30 0.68
Mani-mani	<i>Arachis pintoi</i> Krapov. & W.C.Greg.	Fabaceae	Miasong	Beri-beri (for pregnant), scabies, rashes	Poultice	2 30 0.06
Martaan	<i>Ficus septica</i> Burm.f.	Moraceae	Kablon	Appendicitis, snake bite, spasm, rashes, warts, skin allergy, headache	Decoction	7 30 0.23
Mlangay	<i>Omalanthus macradenius</i> Pax & Hoffm	Euphorbiaceae	Maligo	Bruises and hemorrhoids	Steam exposure	24 30 0.77
M'nas	<i>Compositae</i> sp.	Asteraceae	Kablon	Boil and mumps	Poultice	2 30 0.06

Mya/Makahiya	<i>Mimosa pudica</i> L.	Fabaceae	Maligo	Hemorrhoids	Steam exposure	25 30 0.81
Nabin lamfa	<i>Mentha cordifolia</i> Lej. & Courtois auct.	Lamiaceae	Maligo	Headache, cough, constipation	Poultice	24 30 0.77
Nabin tambisan	<i>Artemisia vulgaris</i> L.	Asteraceae	Maligo, kablon, miasong	Fever, tinea versicolor, fatigue, paralysis	Poultice	19 30 0.61
Nabol	<i>Compositae</i> sp.	Asteraceae	Maligo, kablon	Mouth ulcer, mouth disorders, relapse	Poultice	36 30 1.16
Noful	<i>Compositae</i> sp.	Asteraceae	Maligo, linan	Hair loss, smooth labor, fever, dengue	Liniment	6 30 0.19
Noling	<i>Compositae</i> sp.	Asteraceae	Kablon	Cough, fever, body pains	Decoction	12 30 0.39
Pako	<i>Polystichum munitum</i>	Dryopteridaceae	Kablon	Rashes	Poultice	2 30 0.06
Saging	<i>Musa accuminata</i>	Musaceae	Miasong	Inflammation, diuresis	Decoction	2 30 0.06
Saklas	<i>Mitracarpus hirtus</i> (L.) DC.	Rubiaceae	Linan	Wounds, stomachache	Poultice, decoction	8 30 0.26
Sentimento	<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Verbenaceae	Miasong	Wounds, fatigue	Poultice	4 30 0.13
Serwak	<i>Cheilocostus speciosus</i> (J.Koenig)	Costaceae	Kablon	Sore eyes, inflammation, rubor	Poultice	3 30 0.10
Siro	<i>Compositae</i> sp.	Asteraceae	Maligo	Furuncles	Poultice	6 30 0.19
S'lalab	<i>Schismatoglottis calyptrata</i> (Roxb.) Zoll. & Moritzi	Araceae	Kablon	Fatigue	Decoction	4 30 0.13
Slo-en	<i>Compositae</i> sp.	Asteraceae	Maligo, linan	Postpartum relapse, fatigue	Decoction	8 30 0.26
Smoy	<i>Compositae</i> sp.	Asteraceae	Kablon	Antidote for stinging nettle tree	Poultice	1 30 0.03
Snabul-Siling	<i>Compositae</i> sp.	Asteraceae	Maligo	Rashes	Poultice	8 30 0.26
Talom	<i>Compositae</i> sp.	Asteraceae	Maligo	Cholera, toothache	Decoction	12 30 0.39
Tanag-ahok	<i>Rutaceae</i> sp.	Rutaceae	Acmonan	Urinary tract infection, prostate cancer	Decoction	6 30 0.19
Tapol na luya	<i>Compositae</i> sp.	Asteraceae	Maligo	Paralysis	Poultice	18 30 0.58
Tawal-kanlib	<i>Uvaria</i> sp.	Annonaceae	Acmonan	Snake bites, rabies, dengue	Decoction	20 30 0.65
Tawal-ulad	<i>Lunasia amara</i> Blanco	Rutaceae	Maligo, kablon	Snake bites, dengue, dysmenorrhea, constipation, rabies, hypertension, german measles, rashes, varicose veins, spasm	Infusion, poultice, tincture	56 30 1.81
Tobal	<i>Compositae</i> sp.	Asteraceae	Kablon	Fever	Decoction	1 30 0.03
Treskantots	<i>Hyptis capitata</i> Jacq.	Lamiaceae	Miasong	Hyperacidity	Decoction	1 30 0.03
Tunok-tunok	<i>Leonotis nepetifolia</i> (L.) R. Br.	Lamiaceae	Miasong	Gastroenteritis/stomach ulcer	Decoction	1 30 0.03
Wax Plant	<i>Hoya</i> sp.	Apocynaceae	Acmonan	Breast cancer	Decoction	1 30 0.03
Daupang	<i>Urena lobata</i> L.	Malvaceae	Miasong	Boils	Poultice	1 30 0.03
Unidentified spp. (clover-like leaf)	<i>Compositae</i> sp.	Asteraceae	Miasong	Gastroenteritis/stomach ulcer	Decoction	1 30 0.03
<i>Vernonia</i> sp	<i>Vernonia</i> sp.	Asteraceae	Kablon	Stomachache	Decoction	1 30 0.03

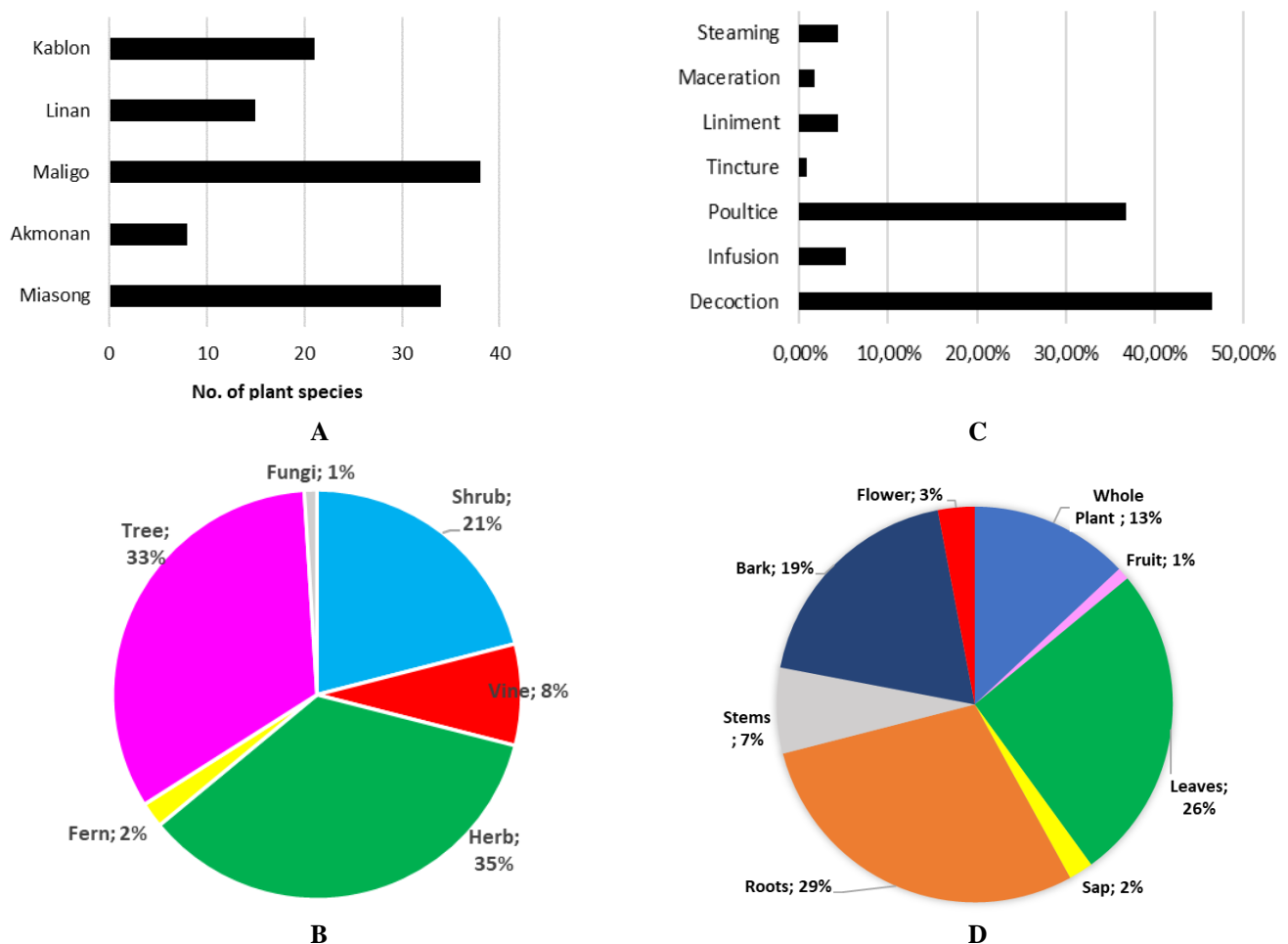


Figure 2. Utilization of ethnomedicinal plants by the B'laan Tribe, Mindanao, Philippines. A. Total number of medicinal plants surveyed from the five barangays, B. Types of plants exploited for medicinal purposes, C. Distribution of the various plant parts utilized by the B'laan tribal healers in treating ailments and diseases, D. Method of plant preparation for medicinal purposes

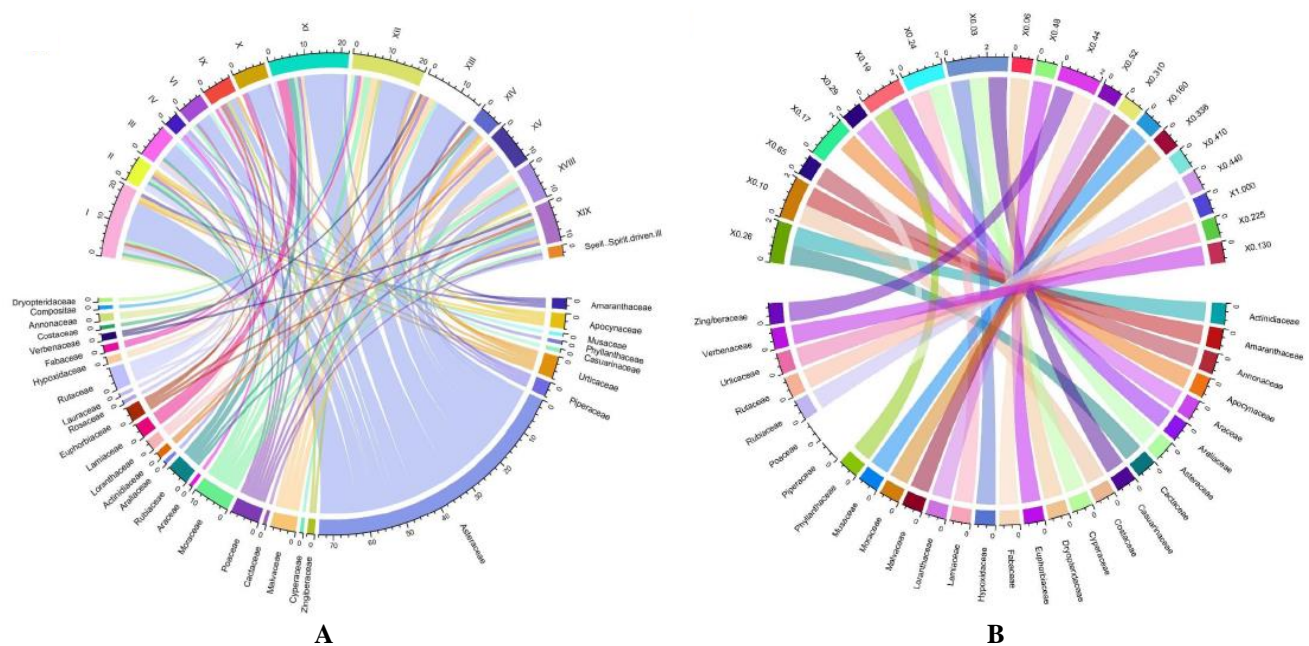


Figure 3. Ethnochord illustrating the various ethnomedicinal plants used to treat various diseases. A. Ethnochord showing the different plant families utilized for various disease categories set by the World Health Organization (WHO), B. Use values of the plant families exploited for their medicinal purposes

Table 2. Computed informant consensus factor of different categories of diseases

Disease category	ICD-10	No. of use reports	No. of species	ICF
Certain infectious and parasitic diseases	I	104	22	0.80
Neoplasms	II	22	7	0.71
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	III	10	2	0.89
Endocrine, nutritional, and metabolic diseases	IV	7	2	0.83
Diseases of the nervous system	VI	30	6	0.83
Diseases of the ear and mastoid process	VIII	6	2	0.80
Diseases of the circulatory system	IX	15	5	0.71
Diseases of the respiratory system	X	13	3	0.83
Diseases of the digestive system	XI	138	29	0.80
Diseases of the Skin and Subcutaneous tissue	XII	23	6	0.77
Diseases of the musculoskeletal system and connective tissue	XIII	12	3	0.82
Diseases of the genitourinary system	XIV	59	10	0.84
Pregnancy, childbirth, and the puerperium	XV	26	7	0.76
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	XVIII	160	45	0.72
Injury, poisoning and certain other consequences of external causes	XIX	94	26	0.73

Table 3. Fidelity level value of medicinal plants used by the B'laan Tribe, Mindanao, Philippines

Disease category	Plants	FL(%)
Certain infectious and parasitic diseases	Kalfagang	22.58
	Kayu-damay	46.15
	Talom	50
	Tawal-ulad	12.5
Neoplasms	Bayagusa	100
	Kayu-danol	25
	Magba	40
	Kayu-danol	25
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Chinese	100
	Malunggay	
	Mlangay	25
	Kufilbot	24
Diseases of the nervous system	Nabin	31.58
	tambisan	
	Tapol na luy-a	33.33
	Tawal-ulad	12.5
Diseases of the circulatory system	Kalsonakofil	33.33
Diseases of the respiratory system	Katmon	50
Diseases of the digestive system	Makok	24
Diseases of the skin and Subcutaneous tissue	Mamon-mamon	38.1
	Mlangay	25
	Bawan Mlato	22.22
	Mya	24
	Nabin lamfa	25
	Talom	50
	Tawal-ulad	12.5
	Kaltaas	100
Diseases of the skin and Subcutaneous tissue	Kamang	100
	Siro	100
Diseases of the musculoskeletal system and connective tissue	Kalsonakofil	33.33
Diseases of the genitourinary system	Banana	54.55
Diseases of the genitourinary	Kayu-damay	46.15

system	Kayu-danol	25
Pregnancy, childbirth, and the puerperium	Kufilbot	24
	Tawal-ulad	12.5
	Makok	24
	Banana	45.45
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	Bawan mlato	22.22
	Hagonoy	100
	Kalfagang	22.58
	Kalsonakofil	33.33
Injury, poisoning and certain other consequences of external causes	Mamon-mamon	23.81
	Nabin lamfa	25
	Slo'en	62.5
	Bawan-mlibu	33.33
Injury, poisoning and certain other consequences of external causes	Buyo-buyo	100
	Kalfagang	22.58
	Mlangay	25
	Tawal-ulad	12.5

Novelty and impact on ethnobotany

Our study is the first documentation of the rich ethnomedicinal knowledge of the B'laan Tribe residing at Mount Matutum Protected Landscape. Among the 101 ethnomedicinal plants recognized for traditional healing, 34 remain identified by taxonomists, indicating the limitations in understanding floral diversity in the protected area. Herbarium specimens have been sampled and deposited in the University herbarium for further study and comparison with other herbaria in the Philippines.

Two plants stood out: tawal-ulad and a local species of *Hoja*. Tawal-ulad is used for snake bites, dengue, dysmenorrhea, constipation, rabies, hypertension, German measles, rashes, varicose veins, and spasms. A species of *Hoja*, is believed to have the anti-breast cancer property by the tribal healers. Some *Hoya* species have been documented by Silalahi et al. (2015) as traditional

medicines against a vast array of cancers in North Sumatra, Indonesia. The pharmacological potency of these plants strongly merits further study and investigation towards drug development.

In conclusion, the inventory of 101 medicinal plants reflects the floral biodiversity of MMP and the centuries-old ethnomedicinal foundations of the B'laan Tribe. Although some plants remain unidentified at the species level, the natives are aware of their medicinal properties. Our study may open new avenues for pharmacological research for drug development or augment healthcare practices for a wide range of ailments such as plant-based anti-venom for snake bites, tea-based supplements for cancer, and others. As emphasized by the tribal healers, the effectiveness of the medicinal plants depends on prayers. However, documenting these cultural practices was not within the realm of this study.

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