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Ethnobotany, field mapping and physiological review on folkloric medicinal plants among TAUSUG in Isabela City, Basilan, Philippines

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Abstract
With the recent shift of medicines to phytotherapy, ethnobotany currently provides an important framework for drug development. Herein, an ethnobotanical study, field mapping, and physiological review were conducted on folkloric medicinal plants utilized by the Tausugs of Isabela City, Basilan Province. A snowball sampling was employed to 50 key informants through a semi-constructed survey questionnaire. Voucher specimens during field mapping were collected for scientific identification. Results revealed 39 species belonging to 27 Families that are utilized by the Tausugs of Isabela City, Basilan Province to cure various diseases. Family Fabaceae is the most represented with five (5) species. Common health problems being experienced by the Tausugs include fever, cough, wounds, physical relapse (locally referred to as *bughat*), hyperacidity, and abdominal pain. Leaves are the most exploited plant part through the decoction process. Physiological reviews validate the medicinal plant's use and effectiveness, except for *Musa acuminata* bract which needs further studies.

Keywords: ethnobotany, snowball sampling, Tausug, Isabela City, Basilan

1. Introduction
One of the unique benefits of plants is its ability to provide healing to various illnesses and injuries [1]. These medicinal plants are an integral part of the health care system recognized throughout the world [2]. The science of utilizing these medicinal plants by the local peoples is termed as ethnobotany [3]. Ethnobotany has currently led to a resurgence of scientific interest towards drug development initiatives since it is safe, effective, and inexpensive [4].
Herbal plants' contribution to phototherapy is still enormous where recently, 11% out of 252 drugs come from a flowering plant's active bioisolates [5, 6]. Different plant parts have important secondary metabolites which are therapeutic [7]. According to Penton-Arias & Haines [8], many of their bioactive natural products are still unidentified. With high plant biodiversity and rich in indigenous cultural variability [9], Philippines is considered a favorable country for drug discovery [10].
Among the more than 170 ethnolinguistic groups in the country are the Tausugs [11]. Isabela City in Basilan Province is a home for a number of Tausugs [12]. Tausugs are one of the largest Muslim groups which are originally from the Sulu archipelago. These people were able to retain their ancient practices and beliefs of their tribal heritage such as ethnobotanical practices [13].
Since ethnobotanical practices play a role in primary health care of many local tribes such as the Tausugs, there is a need to document such practices. More ethnobotanical researches should be encouraged before the traditional knowledge of different ethnic groups disappears [9]. Further, the conduct of physiological reviews to ethnobotanical practices provides scientific bases on its safety and rational use which is considered a challenging scientific task [14, 15]. Thus, this study was conceptualized.

2. Materials and Methods
2.1 Sampling site selection
Isabela City (GPS 6° 42' North, 121° 58' East; 15.7 mASL elevation) is a coastal component city in the island province of Basilan [16]. It serves as the provincial capital. Its population as determined by the 2015 Census was 112,788. It is also a home for a number of Tausugs. The area possesses a large variety of plants that include coconut, rubber trees, mangroves, and other plants which are greatly considered to be medicinal [11]. Figure 1 shows the map and the actual study site.

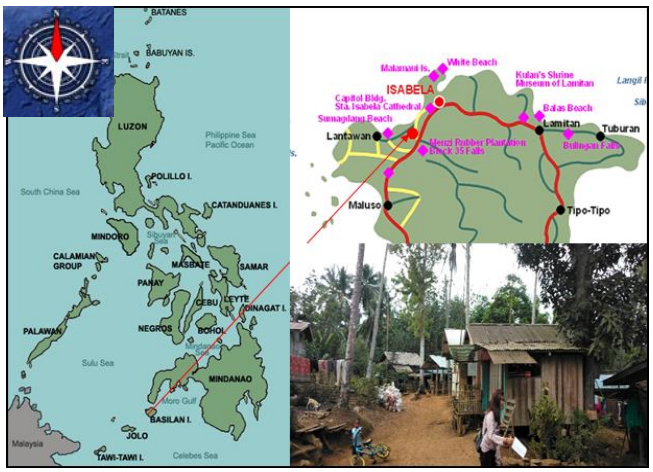

Fig 1: Map (modified from google images.com) and one of the study sites far from the city proper.

Barangays that are far from the city were purposively chosen due to its limited access to health facilities.

2.2 Ethical Considerations
Since this study involves an interview, an ethics clearance from the Western Mindanao State University-Research Ethics Oversight Committee (WMSU-REOC), Zamboanga City has complied. A free-prior informed consent was read to the key informants and should be signed before considering them as part of the respondents. Further, permission from the barangay captains was also considered as well as from the National Commission of Muslim Filipinos (NCMF).

2.3 Ethnobotanical Study
Ethnobotanical study was accomplished through the use of a semi-constructed questionnaire. This is comprised of questions on the traditional healing practices using medicinal plants, specific plant part, mode of preparation and its folkloric use in the different far-flung barangays with Tausug communities in Isabela City, Basilan Province.

2.4. Sampling and Sample Size
A snowball sampling method was employed to 50 key respondents who have utilized medicinal plants in treating diseases for a year and of legal age.

2.5. Field Mapping and Collection of Voucher Specimen
Field mapping was carried out to collect samples of medicinal plants within the locality. Sample medicinal plants were collected with the assistance of the village experts. These were then pressed and mounted on herbarium sheets following herbarium techniques. These specimens served as vouchers of the plants identified as medicinal plants utilized by the Tausugs and deposited at the Western Mindanao State University (WMSU) Herbarium. Spatial data (latitude, longitude, and elevation) needed to validate and record the existence of the medicinal plants was also obtained during field mapping and recorded in a field record sheet. Scientific names were determined by identifying herbarium specimens. Validation was also done by an expert.

2.6. Physiological Review
This part includes search strategy on ethnobotanical/ethnomedicinal studies reporting on specific medicinal plants used for traditional practices. Search approaches include published MSc/PhD thesis research reports or funded researches using Google search engine and local university websites and published journal articles using international scientific databases including PubMed, Science Direct, Web of Science, Google Scholar, etc. Screening of search outputs was performed in two stages: the title and abstract of identified journal articles/theses were overviewed. Thereafter, suitable articles/theses were downloaded and critically inspected for inclusion in the review in terms of the medicinal plants' active bioisolates and bioactivities.

3. Results and Discussion
The knowledge regarding medicinal plants has long been practiced since time immemorial by the different ethnic tribes and accordingly, just being passed down from the forefathers through oral communications to the next of their kin [17]. In the Philippines, knowledge on traditional medicine is being passed on by their forefathers through performing it visually and linguistic communication [3]. In some instances, prayers are also incorporated in the plants before administering it to the ill person.

The Tausug tribe of Isabela City, Basilan Province exhibited the use of a wide variety of plants in treating different types of illnesses. A total of thirty-nine (39) species belonging to 27 Families are utilized, with *Blumea balsamifera* (L.) DC (sambong) of the Family Asteraceae as the frequently answered medicinal plant in treating physical relapse (*bughat*), hypertension and measles. This supports the study of De Guzman *et al.* [3] as still the frequently utilized plant among the Visayan tribe of Zamboanga Sibugay however, in terms of its folkloric use; it is utilized in treating cough, colds and fever.

Other species utilized are commonly known to be plants with great medicinal properties as approved by the Department of Health of the Philippines namely: *Allium sativum* (Amaryllidaceae), *Cassia alata* (Fabaceae), *Psidum guajava* (Myrtaceae), *Peperomia pellucida* (Piperaceae) and *Vitex negundo* from Family Asteraceae. According to Domingo [18], these plants are clinically tested to treat various ailments. Table 1 shows the ethnobotanical practices and physiological review on medicinal plants utilized by the Tausug tribe of Isabela City, Basilan.

Table 1: Ethnobotanical practices and physiological review on medicinal plants utilized by the Tausug tribe of Isabela City, Basilan.

Family/ Scientific Name (Incl. Author)	Common Name (local + English	Indigenous name (Tausug)	Plant part used	Mode of Preparation	Folkloric Use	Physiological Review		Research done by Institution (References)
						Bioactivities	Active isolates	
Ammaryllidaceae								
Allium sativum L.	Garlic	Bawang	Cloves	Pound and apply directly	First aid for antirabies	Anti hypertensive, antibacterial, antiviral, antifungal, anticancer	Allicin	[19]
Anacardiaceae								
Spondias purpurea L.	Ciniguelas/ Spanish Plum	Singguelas	Stem / Bark	Steam, Decoction	Mouth sore, diarrhea, cough,	Antioxidant, antiulcer	Flavonoids, caffeic acid and epigallo catechin	Universidad Federal de Pernambuco, Recife, Brazil [20]
Annonaceae								
Annona	Guyabano/	Labanus	Leaves	Decoction	Hyper	Tran	Alkaloid, annona	University of

muricata	Soursop				tension	quilizing effect, cancer cells inhibitor, anti inflamma-tory, antidiabetic	ceous acetogenin, flavonol, triglycosidephenoli cyclo peptide	Malaya [21]
Apiaceae								
Centella asiatica	Centella	Panggagah	Leaves	Decoction	Fever	Hypotensive, wound healing and vascular effects	Collagen, saponins	[22]
Arecaceae								
Cocos nucifera	Coconut	Lahing	Flower (white) Bark	Infusion for bath ecoction	Measles Abdominal pain	Antioxidant, anti inflamma-tory	Phenols, flavonoids, glycosides, tannins, alkaloids, and saponins	Jaipur National University, Jaipur, Rajasthan, India [23, 24]
Asparagaceae								
Dracaena trifasciata	Cylindrical snake plant	Espada	Leaves	Direct chewing	Tetanus	Antioxidant	Tannins, saponins, terpenoids, glycosides, quinones	Universiti Sains Malaysia, Malaysia [25]
Asteraceae								
Blumea balsamifera (L.) DC	Sambong/ Blumea camphor	Daklan bulan	Leaves	Decoction	Physical relapse, hyper tension, measles	Anti microbial, anti inflamma-tory, anti spasmodic	Flavonoids	Chinese Academy of Tropical Agriculture Sciences [26]
Chromo laena odorata (L.) R.M King & H.Rob	Hagonoy/ Devil Weed	Lahunay	Leaves	Pound and apply directly	Wounds	Keratinocyte proliferation	Flavonoids, phyto prostane compound including chromo moric acid	[27]
Balsaminaceae								
Impatiens balsamina	Kamantigue/ Rose balsam	Saunggah	Leaves and stems	Decoction	Urinary tract infection	Anti microbial, antidiabetic	Glycosides	[28]
Caricaceae								
Carica papaya L.	Papaya	Kapaya	Leaves	Decoction	Fever	Cytotoxic, antibacterial	Chymo papain, quercitin	[29]
Clusiaceae								
Garcinia mangos-tana	Mangosteen	Manggis	Fruit peeling	Decoction of dried fruit peelings	Diarrhea	Antioxidant, anti proliferative, proapoptotic, anti inflamma-tory, anti-carcinogenic, antimicrobial	Xanthones, flavonoids, triter penoidand benzo phenones	[30]
Euphorbiaceae								
Jatropha curcas L.	Physic nut	Tangan tangan	Leaves	Poultice	Swelling, bruises	Anti microbial, anticancer	Alkaloids	[31]
Fabaceae								
Caesalpinia sappan	Sappan wood	Sibukaw	Leaves	Decoction	Tuber culosis	Anti inflamma-tory	Haematein, flavonoids	[32]
Gliricidia sepium	Madre de cacao/ St. Vincent Plum	Madri kakao	Leaves	Pound and apply directly as a body scrub	Scabies, fungal infection, rashes	Anti microbial, antiscabies, antiviral	Formosin, formono netin	[33]
Mimosa pudica L.	Makahiya/ Touch-me-not	Sipug-sipug	Roots	Decoction	Myoma, abdominal pain	Anti asthmatic, aphrodisiac, analgesic, anti depressant	Flavonoids, C-glycosides, sterols, terpenoids, tannins, fatty acids, alkaloids, non-protein amino acid (mimosine)	[34]
Cassia alata	Acapulco	Andalan	Leaves	Pound and apply directly as a body scrub	*Tinea versicolor*	Anti mutagenic, antifungal, analgesic, anti inflamma-tory and hypo glycaemic activities	Secondary metabolites	[35]

Tamarindus indica	Tamarind	Sampaloc	Leaves	Decoction of the leaves for taking a bath	Measles	Antidiabetic, anti microbial, antivenomic, antioxidant, laxative, ameliorative	Essential amino acids, potassium, malic acid, tartaric acid	[36]
Lamiaceae								
Coleus blumei	Mayana	Mayana	Leaves	Pound and apply directly	Wounds	Analgesic, anti inflamma-tory, anti microbial	Alkaloids	[37]
Gmelina arborea Roxb.	Gmelina	Jibilina	Leaves	Direct application to the head and stomach	Fever, colds	Antioxidant, antidiabetic. antibacterial,	Ethanol, n-butanol, ethyl acetate	[38]
Origanum vulgare L.	Oregano	Origano	Leaves	Decoction	Cough, colds	Anti microbial activity	Methanol, dichloro methane, cyclo hexane, phenolic compounds	[39]
Vitex negundo L.	Lagundi/ Five-leaved chaste tree	Lagundi	Leaves	Decoction	Cough, fever	Anti-inflamma-tory, analgesic, cytotoxic effects	Phyto-chemical secondary metabo-lites	Department of Biosciences, Sri Sathya Sai University, India [40]
Lauraceae								
Persea americana Mill.	Avocado/ Alligator Pear	Abokado	Leaves	Decoction	Consti pation	Antioxidant, anti inflamma-tory	Ethanol, phenolic compounds	[41]
Malvaceae								
Abelmoschus esculentus	Okra	Okra	Fruits	Infusion	Hyper tension	Cardio-protective, renal protective, neuro-protective, anti-cancer, analgesic, anti-ulcer, anti-bacterial, anti-fatigue	Flavonoids, poly saccharides	[42]
Ceiba pentandra	Kapok	Kapuk	Bark	Infusion	Fever	Anti microbial, diuretic, aphrodisiac, analgesic	Flavonoids, isoflavones	[43]
Meliaceae								
Sandoricum koetjape (Burm.f.) Merr.	Santol	Santul	Bark and leaves	Decoction	Diarrhea	Anti-inflam-mation	Limonoids	[44]
Swietenia macrophylla King	Maho gany	Mahugani	Seeds	Decoction	Cough	Anti microbial, anti inflamma-tory, antioxidant, anti mutagenic, anticancer, antitumor, antidiabetic	Limonoids and its derivatives	University of Malaya, Kuala Lumpur Malaysia [45]
Menispermaceae								
Tiliacora tiandra	Yanang	Jannang	Roots	Decoction	Mouth ulcer, fever	Antioxidant	Carotenoid,phenolic compounds	Ubon Ratchathani University, Thailand [46]
Moraceae								
Artocarpus hetero-phyllus Lam.	Jack fruit	Nangka	Leaves	Decoction	Hyper acidity	Anti inflamma-tory	Flavonoids	Universiti Teknologi Malaysia, Malaysia [47]
Moringaceae								
Moringa oleifera Lam.	Malung-gay/ Horse raddish	Malung-gay	Leaves	Pound and apply directly	Bruises	Cytotoxic, anti inflammation	Vitamins, phenolic acids, flavonoids,	[48]

	tree						isothio cyanates, tannins, saponins	
Musaceae								
Musa acuminata	Banana	Saying	Bract	Crushed and apply directly to the head	Colds, fever	-		
Myrtaceae								
Psidium guajava L.	Bayabas/Guava	Bayabas	Leaves	Decoction Pound and apply directly	Fever, cough Wound	Anti diarrheal, antiseptic, anti spasmodic, antioxidant, anti microbial, anti inflamma-tory	Saponins, tannins, alkaloids, flavonoids, glycosides, poly phenols, reducing compounds	University of Granada, Spain [49]
Ochnaceae								
Ochna serrulata	Mickey mouse bush	Santing	Leaves	Decoction	Physical relapse	Anti microbial	Bi-flavonoids	Dongguk University, Korea [50]
Pandanaceae								
Pandanus amarylli-folius	Pandan	Pangdan magih	Leaves and roots	Decoction can be used for bath	Rheumatism	Antioxidant, anti inflamma-tory	Panda-marine B and pandali-zines C and D	[51]
Piperaceae								
Piper betel Blanco	Betel	Buyo	Leaves	Chewing Decoction	Dental caries Cough	Anticancer, antibacterial	Alkaloids, tannins, steroids, chavibetol and chavicol	[52]
Peperomia pellucida (L.) Kunth	Sinaw sinaw	Lansang lansang	Leaves	Decoction Pound and apply directly	Headache, toothache Wound dressing	Anti microbial, antioxidant, anti inflamma-tory, analgesic	Alkaloids, flavonoids, saponins, terpenoids, steroids, glycosides	[53]
Poaceae								
Cymbopogon citratus (DC.) Stapf	Lemon grass	Sai	Stem	Pound and whiff	Nausea	Anti inflamma-tory, anticancer	Essential oil components	Mindanao State University-Iligan Institute of Technology, Philippines [54, 55, 56, 57]
Solanaceae								
Solanum nigrum	Black night shade	Antutungaw	Whole plant	Infusion of the whole young plant	Fever	Anti tumorigenic, antioxidant, anti inflamma-tory, antipyretic agent	Glyco alkaloids (sola margine, solasonine solanine)	[58]
Zingiberaceae								
Curcuma longa L.	Turmeric	Dulaw	Rhi-zomes	Decoction Use the infusion as eyedrops	Myoma, hepatitis, physical relapse Sore eyes, stye	Antioxidant, antiulcer	Alkaloids, terpenoids, curcu minoids	Department of Medicine, The University of Arizona, Tucson, AZ [59]
Zingiber officinale Roscoe	Ginger	Luy-a	Rhi-zomes	Decoction, then drink	Cough	Antioxidant, anti inflamma-tory, anti microbial, anticancer, anti emetic activities	Phenolic compounds (gingerols and shogaols), terpenes,	[60]

Leaf part is the most exploited plant part when compared to roots, bark or fruits. As supported by the works of Morilla *et al*. [7] and Okoewale [61], the leaves contain important phytochemicals such as tannins, alkaloids and flavonoids which accounts for its effective healing capacity. Aside from this, harnessing leaves is convenient and beneficial rather than those who require roots and the whole plant [62].

In terms of family, the family with the highest number of medicinal plants is Fabaceae (5). According to Ahmad *et al*. [63], they possess important biomolecules with pharmacological importance which is mainly flavonoids. At the same time, phytochemical investigations revealed that it has the presence of saponins, glucosides, and trypsin inhibitors which accounts for its anti-inflammatory, antimicrobial, antiscabies, antiviral, antiasthmatic, aphrodisiac, analgesic, antidepressant, antimutagenic, antifungal, and analgesic bioactivities. Lamiaceae family revealed four (4) species, which includes the well-known *Vitex negundo* used in treating cough. Accordingly, it has medicinal constituents such as aromatic essential oils, tannins and organic acids which exhibit antimicrobial, anti inflammatory, analgesic and cytotoxic effects [64].

Decoction is the most widely used mode of preparation in extracting important phytochemicals. According to De Guzman *et al*. [3], this is the most common process in formulating herbal medicines. This preparation involves the boiling of the plant materials to soften the plant and release its active bioisolates. Based on the responses, the common health problems being experienced by the Tausugs are fever, cough, wounds and scabies, physical relapse locally referred to as *bughat*, hyperacidity, abdominal pain and diarrhea.

Health-seeking behavior of the Tausugs includes inaccessible health facilities, availability of the medicinal plants within the locality and effectiveness based on personal experience. Phytotherapy or the use of medicinal plants in curing illnesses was currently given more attention since it is effective and safe [65]. The World Health Organization (WHO) [6] also stressed the use of medicinal plants in some Asian and African countries due to economic and geographical constraints.

Physiological review from the different published researches reveals significant bioactivities and important bioisolates for most of the medicinal plants used by the Tausugs of Isabela City, Basilan, except for *Musa acuminata* bract which needs further studies. According to Madjos & Luceño [29], medicinal plants contain natural products which are potential sources of human drugs.

In summary, the Tausugs of Isabela City Basilan possessed a wealth of knowledge in ethnobotanical care and they recognized their traditional healers *(mangungubat)* which utilize medicinal plants that are just available in nature.

4. Conclusion and Recommendation

Thirty-nine (39) species belonging to 27 Families are utilized by the Tausugs of Isabela City, Basilan Province to cure various diseases in which Family Fabaceae is the most represented. Common health problems being experienced by the Tausugs include fever, cough, wounds, physical relapse (locally referred to as *bughat*), hyperacidity, abdominal pain and diarrhea. Leaves are the most exploited plant part through a decoction process. Physiological reviews validate the medicinal plant's use and effectiveness, except for *Musa acuminata* bract which need further studies.

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