



## Ethnobotanical Studies on Indigenous Communities in the Philippines: Current Status, Challenges, Recommendations and Future Perspectives

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### ABSTRACT

Ethnobotany encompasses multidisciplinary fields such as systematics and taxonomy, pharmacognosy, pharmacology, phytochemistry, ecology, and conservation biology. This review article gives an account of the current status, challenges, recommendations and future perspectives of Philippine ethnobotanical studies on indigenous communities. Data mining related to ethnobotanical studies was performed retrieving updated search from online databases using series of keywords showing the elements of Philippine ethnobotany. Other literature was sourced from the university library. Philippine ethnobotanical studies still prevail and strengthen the dynamic nature of traditional knowledge among diverse cultural communities. Medical ethnobotany remains the central interest and continually attracted researchers in various fields of discipline. While some of these traditional practices have existed throughout the centuries, most studies reported a threatening loss of knowledge as the younger generation has changed or vanishing. We assessed that the traditional knowledge of indigenous communities is still under- documented across several ethnolinguistic groups in the Philippines. Challenges may vary in different cultures and localities. Philippine ethnobotanical studies enhance the quality of science by providing compensation to cultural groups with benefit-sharing and taking into account the importance of their plant resources and environmental concerns. Ethnobotanical surveys present the rich traditional plant knowledge of ethnic groups allowing them to make more educated decisions about their future directions. We recommend quantitative evaluations and experimental assessments of medicinal plants following ethics and standardized data-collecting protocols. Given our findings, we hope to encourage future researchers to formulate clear plans and systematically document ethnobotanical knowledge in the country before it is lost and forgotten.

### ARTICLE HISTORY

Received February 25, 2020

Accepted May 17, 2020

Published August 26, 2020

### KEYWORDS

Conservation biology; ethnobotany; perspectives; Philippines; recommendations; status.

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## INTRODUCTION

### Ethnobotany as an interdisciplinary field

Ethnobotany is generally defined as the study of plant and people relationships. This academic discipline was thought to emerge in the 19th century [1]. Ethnobotany is one of the subdisciplines of ethnobiology, among others like ethnopharmacology, ethnomedicine, ethnozoology, ethnoecology, ethnomycology, and ethnoveterinary, with usually indefinite boundaries [2]. The term “ethnobotany” was first defined by John Harshberger [3] as “the use of plants by aboriginal peoples” [4]. Subsequently, Schultes defined ethnobotany as “the study of the relationship which exists between people of primitive societies and their plant environment” [5]. Ethnobotany documents the knowledge of cultural interaction of people with plants [6]. This field became multi-disciplinary and several numbers of journals are devoted to this subject. Ethnobotanical-based selection of medicinal plants has gained in popularity as a means to identify which plants contain relevant compounds for further investigations to discover and develop new drugs. This practice has raised important issues on the traditional knowledge of indigenous peoples (IPs) [7]. Traditional medical knowledge of medicinal plants and their use by indigenous healers are not only essential for the conservation of cultural traditions and biodiversity but also for community healthcare and drug development in the present and future [8]. Medical ethnobotany is the most widely studied across disciplines.

### A brief history of Philippine medicinal plants

Medicinal plants are essential elements among indigenous medical systems in the Philippines. Historical accounts of medicinal plant use by Filipinos started in the pre-colonial Spanish period and because of the influence by Chinese traders. When the Spanish priests arrived in the 16th century, they also brought their own experience in the use of medicinal plants. Still, they also depend on the herb doctor known as the *arbularyos* or *herbolaryos* in the use of local plants. The use of medicinal plants in traditional medicine for Filipinos is very accessible because plants can be easily grown everywhere and are readily available [9]. Early Filipinos have extensive knowledge on medicinal plants and always have an antidote for every poison. They also believe that sickness and diseases are caused by the disharmony with the spiritual world and in order to be healed, the Gods must be pleased through incantations and rituals. A *baylan*, usually a female, becomes the mediator between the physical and spiritual world, which normally do the rituals [10] in which she incorporates some techniques such as massage,

fumigation, and the use of medicinal plants [11].

Earliest works on Philippine medicinal plants were written during the Spanish period, such as the well-known “Flora de Filipinas” in 1737 by Father Blanco and the “Plantas Medicinales de Filipinas” in 1892 by Trinidad Pardo de Tavera [12]. Later on, several scientists work on the medicinal plants and some books were published such as “Medicinal Plants of the Philippines”, where there are more than 850 documented medicinal plant species [13], and the three volumes of the “Useful Plants of the Philippines” in 1951-1957 by Brown [14]. One hundred thirty of these plants were used in the three or four provinces that were surveyed [9]. Tan and Sia [15] consolidated a top list of Philippine valuable medicinal plants in their book entitled “The Best 100 Philippine Medicinal Plants” that serves as a useful reference rooted from both traditional medical practices of Asian and Western culture.

Traditional medicine is a knowledge system compiled together by different generations from different societies before the age of modern medicine. It is also known as folk or indigenous medicine [16]. While most theories, beliefs and practices of indigenous cultures, their ethnomedicinal knowledge is valuable for health maintenance, including diagnosis, treatment and prevention of mental and physical illnesses [17]. The World Health Organization (WHO) had estimated that 70 percent of the population uses traditional and complementary medicine [18]. A great number of people in the population still use herbal medicine because of its affordable price, availability and easy usage. In the Philippines, as some land rich in medicinal plants, traditional medicine is widely used. Due to this, a list of ten plants approved by the Department of Health, namely (1) *Cassia alata* (akapulko), (2) *Momordica charantia* (amplaya), (3) *Allium sativum* (bawang), (4) *Psidium guajava* (bayabas), (5) *Vitex negundo* (lagundi), (6) *Quisqualis indica* (niyog- niyogan), (7) *Blumea balsamifera* (sambong), (8) *Ehretia microphylla* (tsaang gubat), (9) *Peperomia pellucida* (pansit-pansitan), and (10) *Clinopodium douglasii* (yerba buena). The traditional medicine in the Philippines shows the ethnographic variety of the nation’s indigenous communities, folk heritage, customs, and conventions.

### The Philippine ethnomedicinal flora and biodiversity

The Philippine flora accounts for more than 12,000 species, with ca. 1,500 medicinal plant species used by IPs and herbalists [19]. At present, there are even more than 1,500 of these medicinal plants identified in the Philippines, of which 177 are on the research list of the Philippine Council for Health Research and Development (PCHRD). A total of 120 medicinal plant species were

scientifically validated for safety and efficacy [9], and the top 100 medicinal plants were listed [15]. Philippines is renowned as megadiverse country [20] and one of the eight-biodiversity hottest hotspots in the world [21].

#### **Indigenous Cultural Communities/Indigenous Peoples (ICC/IPs) of the Philippines**

The Philippines is culturally rich in ethnicity, with around 110 ethnolinguistic groups [22-25]. Each of the Indigenous Cultural Communities/Indigenous Peoples (ICCs/IPs) has a prominent identity, language, socio-political systems, and practices [24]. The majority of these ICCs/IPs are inhabiting mainly in Mindanao (63%), followed by Luzon (34%) and few in Visayas (3%) [25]. The Philippines is home to more than 130 local languages of different cultures and beliefs, which have, in turn, contributed to the high diversity of traditional knowledge and practices of the people, including medicinal plants, to cure such diversified diseases.

The Episcopal Commission on Indigenous Peoples estimates that IPs in the Philippines belong to over forty ethnolinguistic groups [26], each with their language, history, and culture, constituting self-reliant frameworks of relationships with nature. With the many categorizations of IPs in the

Philippines, the total number of indigenous persons also varies. Recent estimates include 4.5–7.5 million people [27], 8–12 million people [28], and 6.5 million people [29]. The last census of 2010 included an ethnic variable for the first time. However, an official figure for the IPs of the Philippines has yet to materialize, and it is estimated that the country's indigenous population is between 10% and 20% of the national population [30]. The National Commission on Indigenous Peoples (NCIP) is the agency of the Philippine government that is responsible for protecting and empowering the rights of the IPs in partnership with the United Nations Development Programme (UNDP) [31]. More than a hundred ethnolinguistic groups were recognized in the Philippines, consisting of approximately 14 million people [25]. The Indigenous Peoples Rights Act (IPRA) of 1997 (Republic Act 8371) defined seven ethnographic areas in the country, namely: (i) Region I and Cordillera; (ii) Region II; (iii) the rest of Luzon; (iv) Island Groups including Mindoro, Palawan, Romblon, Panay, and the rest of the Visayas; (v) Northern and Western Mindanao; (vi) Southern and Eastern Mindanao; and (vii) Central Mindanao for purposes of IP representation to the NCIP as depicted on the Philippine ethnographic map (Fig. 1).

**CAR AND REGION I**

Bontoc, Balangao, Isneg, Tinguan, Kankanaey, Kalanguya-Ikalahan, Karao, Iwak, Ibaloi, Ayangan, Ifugao, Tuwali, Kalinga, Bago, Applai, Isneg, etc.

**ISLAND GROUPS**

**(REGION IV, VI & VII)**

Agutaynon, Tagbanua, Dagayanen, Cuyunon, Ke'ney (Tao't Bato), Batak, Pala'wan, Molbog, Iraya Mangyan, Hanunuo Mangyan, Alangan Mangyan, Bangon Mangyan, Buhid Mangyan, Tadyawan Mangyan, Batangan Mangyan, Gubatnon Mangyan, Ratagnon Mangyan, Ati, Panay Bukidnon (Sulod/Bukidnon), Magahat, Bukidnon-Korolanos, Ata, Escaya, Calamienan, Tagbanua, Bantoanon, Badjao, Kongking, Panay Bukidnon-Bukidnon-Sulod-Iraynon-Bukidnon, etc.

**NORTHERN AND WESTERN MINDANAO (REGION IX & X)**

Subanen, Subanen/Kalibugan, Arumanen Manobo, Arakan Manobo, Teduray, Dibabawon, Banwaon, Bagobo, Ubo Manobo, Manobo, Tagakaolo, Talaindig, Talaingod, Langilan, Mamanwa, Higaonon, B'laan, T'boli, Kalagan, Tagabawa, Matigsalog-Manobo, Tigwahanon, Tagabawa, Sangil, Iranon, Sama/Bandjao (Lua-an), Sama/Samal, Sama/Bangingi, Bukidnon, Umayamnon, etc.

**REGION II**

Agta, Kalanguya-Ikalahan, Bugkalot, Isinai, Gaddang, Aggay, Dumagat, Ibanag, Itawis, Ivatan, Yogad, Ibatan, Karao, Ilongot, Ayangan, Ichbayat-Ivatan, Kalanguya-Ayangan, etc.

**REGION III AND REST OF LUZON (REGION III, IV & V)**

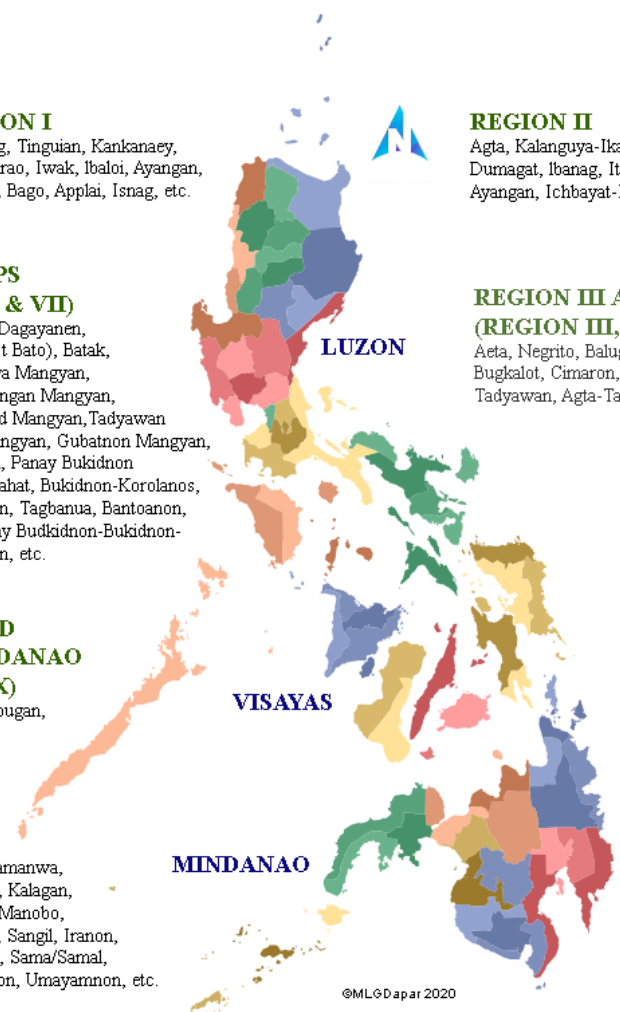
Aeta, Negrito, Baluga, Pugot, Abelling, Agta, Dumagat, Remontado, Bugkalot, Cimaron, Kabihug, Tabangnon, Abiyan, Isarog, Itom, Tadyawan, Agta-Tabangnon, etc.

**SOUTHERN AND EASTERN MINDANAO (REGION XI & XIII)**

Manobo, Mandaya, Mansaka, Manguangan, Dibabawon, Banwaon, Bagobo Clata, Tagakaolo, Ubo Manobo, Talaingod, Langilan, Mamanwa, Higaonon, B'laan, T'boli, Kalagan, Tigwahanon, Tagabawa/Bagobo, Sangil, Matigsahug, Giangan/Clata, Sama, Ata Manobo, Agusan Manobo, etc.

**CENTRAL MINDANAO (REGION XII)**

Aromanen, Teduray, Bagobo, Manobo, Ubo Manobo, Higaonon, Subanen, Manobo Blit, Maguindanao, Manobo-Dulangan, Maranao, Iranon, Karintik B'laan Lambangian, T'boli, B'laan, Lambangian, Tasaday, Kalagan, Tagakaolo, Arumanon-Manobo, Ubo-Menuvu, B'laan-Tagakaolo, etc.



**Figure 1: Philippine ethnographic map showing ethnolinguistic groups occupying in seven ethnographic areas**

**CURRENT STATUS OF PHILIPPINE ETHNOBOTANY**

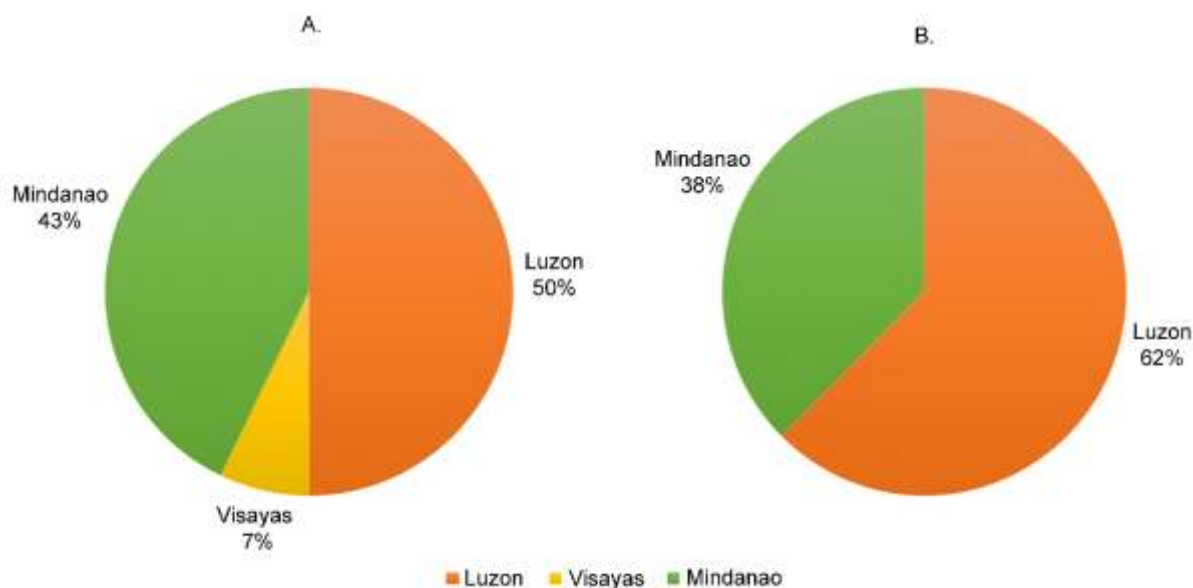
**Revisiting a Bibliometric Approach**

The development of ethnobotanical studies has improved the new cognitive and cultural approaches of ethnobiology. Ethnobotany has become internationalized in its development requiring plant nomenclature and classification as a way to understand about plants from the native's perspectives. Ethnobotany has attained a relatively high profile in recent years in the Philippines. A quick web check of "ethnobotany in the Philippines" in February 2020 revealed that there were 126,000 Google hits for this term. However, only 28 documents showed in the Scopus database using a combined search of "Ethnobotany" and "Philippines." Documentation reports of the Department of Health - Philippine Institute of

Traditional and Alternative Health Care (DOH-PITAHC), Department of Science and Technology - Philippine Council for Health Research and Development (DOST-PCHRD), and the Complementary and Traditional Medicine Study Group of the National Institutes of Health, University of the Philippines Manila (NIH-UPM) were also consolidated.

**Development of Philippine Ethnobotany**

Few ethnobotanical studies have so far been conducted to document ethnobotanical, ethnomedicinal, and ethnopharmacological knowledge of our ICCs/IPs. Overall, among the three major islands in the Philippines, the island of Luzon (61%) prevails the most number of indigenous tribes already surveyed, followed by Mindanao (36%) and Visayas (3%) (Fig. 2A-C).



**Figure 2: Percentage of ethnobotanical publications on recognized tribal communities in three major islands of the Philippines conducted by (A) Philippine universities, (B) Philippine government departments and institutes, and (C) both.**

The lists of surveyed tribal communities by universities for the last 10 years and by government departments and institutes during 1998-2002 were shown in Tables 1 and 2, respectively. All these consolidated literatures primarily involved medical ethnobotany as the main objective and interest.

**Table 1: Ethnobotanical studies conducted on indigenous tribes by Philippine universities tabulated chronologically for the last 10 years.**

No.	Tribal Community	Location	Island	Reference
1	Kalanguya	Tinoc, Ifugao	Luzon	[32]
2	Higaonon	Rogongon, Iligan City	Mindanao	[33]
3	Ayta	Porac, Pampanga	Luzon	[34]
4	Ivatan	Batan Island, Batanes	Luzon	[35]
5	Ati Negrito	Guimaras Island	Visayas	[36]
6	Subanen	Ozamis City	Mindanao	[37]
7	Subanen	Dumingag, Zamboanga del Sur	Mindanao	[38]
8	Ibaloi	Sablan, Benguet Province	Luzon	[39]
9	Ifugaos	Cordillera Mountains	Luzon	[40]
10	Muslim Maranaos	Iligan City	Mindanao	[41]
11	Subanen	Lapuyan, Zamboanga del Sur	Mindanao	[42]
12	Tagabawa	Sta. Cruz, Davao del Sur	Mindanao	[43]
13	Ayta	Dinalupihan, Bataan	Luzon	[44]
14	Ilongot-Egongot	Maria Aurora, Aurora	Luzon	[45]
15	Matigsalug	Mariog Distric, Davao City	Mindanao	[46]
16	Agusan Manobo	Agusan del Sur	Mindanao	[47]
17	Agusan Manobo	Sibagat, Agusan del Sur	Mindanao	[48]

**Table 2: Ethnobotanical studies conducted on indigenous tribes by Philippine government institutes tabulated chronologically (1998-2002).**

No	Tribal Community	Location	Institutions	Island	Reference
1	Bataks	Palawan	DOH-TMU	Luzon	[49]
2	Pala'wans	Palawan	DOH-TMU	Luzon	[50]
3	Tagbanuas	Palawan	DOH-TMU	Luzon	[51]
4	Ata-Manobo	Davao Province	DOH-PITAHC	Mindanao	[52]
5	Bagobo	Davao City	DOH-PITAHC	Mindanao	[53]
6	Busaos Kankana-ey	Mountain Province	DOH-PITAHC	Luzon	[54]
7	Dibabaon	Compostella Valley	DOH-PITAHC	Mindanao	[55]
8	Ifugao	Ifugao	DOH-PITAHC	Luzon	[56]
9	Isnag	Apayao	DOH-PITAHC	Luzon	[57]
10	Mandaya	Davao Oriental	DOH-PITAHC	Mindanao	[58]
11	Mansaka	Compostella Valley	DOH-PITAHC	Mindanao	[59]
12	Sumadel Kalinga	Kalinga	DOH-PITAHC	Luzon	[60]
13	Tadyawan Mangyan	Mindoro Island	UP-NIH	Luzon	[61]
14	Alangan Mangyan	Mindoro Island	UP-NIH	Luzon	[62]
15	Bugkalot	Nueva Vizcaya	UP-NIH	Luzon	[63]

Despite the present number of previously conducted surveys among the ICCs/IPs, this number is still insufficient to cover the breadth and depth of their immense body of traditional knowledge and other mainstream rural communities with rich plant genetic resources. However, ethnobotanical studies are being called to attention nowadays to save the knowledge among these ICCs/IPs as their knowledge and experience can help find drug leads and solve biodiversity crisis for future generation and sustainability of their rich and important plant genetic resources.

#### **Ethnobotany as a research**

Ethnobotany is a growing research since 19th century and continually expanding in various ethnic cultures around the globe. While few scientists conducted ethnobotanical studies in the Philippines, this field can lead to more fascinating and fulfilling opportunities. Ethnobotanist can work in a community, government, international agencies, or non-government organizations, and universities. Ethnobotanical research provides enjoyable analytical and statistical methods from qualitative, quantitative, and multiple method approaches. Although ethnobotanical researchers can work exclusively but doing it collaboratively with other people and institutions is highly valuable for more extensive documentation. Recording indigenous knowledge is essential in ethnobotany as research since traditional information is declining and cultural knowledge is being forgotten. Ethnobotanical research could save traditional practices, cultures, ecosystems, and languages whose loss is causing the forgetting. More often today, the threatening loss of knowledge is the result of deliberate or purposive

modern education, urbanization, media, and commercial arts. All researchers and people of goodwill must be encouraged to document the unique expertise of the indigenous peoples through ethnobotany as an essential part of the ongoing effort to save the natural and human worlds.

#### **Methods in Ethnobotany**

Over the years, the ethnobotanical scope of methods used to appraise relationships between people and plants has widened significantly. It is essential to develop first a research question before actual investigation for a feasible period of time. However, some medical ethnobotanical studies failed to provide a theoretical background of the research questions. The introduction should provide information on the national and regional traditional herbal medicine, ethnobotanical background, available health care options, and epidemiology in the area of research. Research questions should be emphasized, which can be tested by using several methods to provide lines of evidence and support. Some of these questions could be general, such as, "What medicinal plants are frequently used by the tribal community?" Or some specific questions, such as, "Why is the *Euphorbia hirta* L. (tawa-tawa) a traditionally important medicinal plant species as treatment for dengue fever?" Some questions may also extend previous studies, for instance: "Why do natives and indigenous peoples continually sustain their medicinal plant resources?" Or questions, like, "What should the cultural communities do to conserve and protect their medicinally or culturally important plant species?" All research works involving ethnobotany should be based on



hypotheses which can be assessed both or either a qualitative or quantitative approach.

Ethnobotanical studies involve the acquisition of ethics, permits, certifications, resolutions, and free and prior informed consents (FPICs) before the actual interview. Consultations and meetings with the tribal council of elders and the cultural community leaders should be conducted to discuss research intent as purely scholarly or academic. It is highly advisable to recognize their cultural practices by asking necessary rituals or immersion activities before you are allowed to enter their ancestral domains and territories. You may be asked to offer chicken, pig, and other needed materials in this activity. Embracing the cultural ritual of indigenous people could gain mutual agreement, support, and respect for your research intent. Ethnobotanists should have a signed FPICs among the respondents granting permission from the community for the actual interview. Field collection is usually conducted under the supervision of any expert respondents (i.e., tribal healer, leader, and member) and, if necessary, with the collaboration of a translator. After the field survey, plant samples should be collected for actual botanical identification and deposition of vouchers specimens for future reference material. Voucher specimens should be pressed, dried, and deposited in herbarium as mounted on herbarium sheets with documentation labels. Collected reproductive parts should be preserved for future identification. It is often advisable to make duplicate collections. Photographs of the plant habit and its parts, field, and sampling area should always be taken. Ideally, fieldwork should last at least a year or more for a complete observation of the floral, agricultural, and cultural cycle.

#### **Ethics and Permits**

Ethical approval and national governmental permits as required by the authorities should be complied prior to the conduct of the study. Ethnobotanists should secure ethical approval from an institutionalized ethics review board prior to the conduct of the study. However, a simple "ethics approval" will not suffice based on the stipulations of the Nagoya Protocol (Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization). In this case, an important consideration of permit acquisition from the local and indigenous communities or research participants should be taken into account. Upon securing ethics approval, obtaining the certification issued from the National Commission on Indigenous Peoples (NCIP) and the wildlife gratuitous permit issued by the Department of Environment and Natural Resources (DENR) should be processed from the respective regional

office of the study sites prior to conducting of research. The WHO

[64] developed a tool to determine the sustainability of medicinal plants and the quality of herbal drugs resulting in the development of guideline on good agricultural and medicinal plant collection practices. Some tribal communities require observance of their cultural rituals and immersion activities. Upon successful permission from their traditional healers and their deities, certification or resolution may be requested from the tribal community with a statement of support for the conduct of the study. FPICs following a specific code of ethics must be signed from the participants before the actual interview. Under the Nagoya Protocol, FPIC should be acquired from each participant in the research other than the tribal council of elders. Interviews and documentation of medicinal plants should not include any intrusion or actual experimentation of humans, which may cause harm or threat to their lives. It should not also involve any activities that may intentionally violate their rights nor exploit or destruct their sacred places or culturally sensitive areas restricted to their beliefs and tradition. National research regulations should coexist with international agreements, such as the Convention on Biological Diversity (CBD), the Nagoya Protocol (NP), Aichi Targets, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Astutik and company [65] emphasized the need for comprehensive information on the degree of rules enforcement (formal and informal) of medicinal plant use, commercialization, production, and management. All necessary permits, certifications, resolutions, and ethics approval must be secured first. The lack of appropriate research permits can lead to the rejection of even a comprehensive and scientifically brilliant paper.

#### **Laws and Policy**

The Philippine Constitution mandates state recognition, protection, promotion, and fulfillment of the rights of IPs. The Community-Based Forest Management Program was implemented in the Philippines in 1995 based on the Integrated Social Forestry Program in 1976. Thereafter, the ICCs/IPs were given security of tenure for 50 years by the issuance of Certificate of Ancestral Domain Claim (CADC). This issuance legitimized the existence of ICCs/IPs giving them the right to manage their ancestral domains and to occupy, manage and develop their lands in 1997, the Indigenous Peoples' Rights Act (Republic Act 8371) was passed and provided a Certificate of Ancestral Domain Title (CADT) among the ICCs/IPs promoting cultural conservation practices. Further, this has become the foundation of current

national policy among the ICCs/IPs.

### **Shared Benefits**

Research intent should indicate arrangements about benefit-sharing which includes the benefits of the respondents and the community in the totality of the research objectives. Research intent should recognize the intellectual property rights of the respective participants and their communities to possible future use of their knowledge. All research projects and studies should provide local commitments and research agreements specifying any means for the dissemination of research results, outreach programs to participants, and other potential benefit-sharing arrangements.

## **RESEARCH CHALLENGES OF PHILIPPINE ETHNOBOTANY**

### **Emerging Issues in Philippine Ethnobotany**

Historically, IPs have been subject to historical discrimination and marginalization from political processes and economic benefits in the Philippines [22]. Conflicts involving secessionists and communist insurgents threaten cultural communities [48]. Future researchers and stakeholder organizations should enforce the protection and participation of IPs in all decision-making with regards to justice, human rights, government programs, economic development, environmental protection, and conservation priorities. Some other issues involving ethnobotany are safety and quality control, intellectual property rights and biopiracy, and conversion of forests to agricultural lands. The marginal role of IPs in protected areas also becomes an issue on their ancestral rights. Mining operations are also taking over ancestral 'tribal' lands and destroying natural habitats while divesting people of their properties and traditional means of livelihood. Conflicts between the communist and the government affect the lives of the IPs.

The Philippine ecosystems have increasing pressure from mining, logging, climate change, and industrialization. Due to increasing urbanization as well as the creation of parks and protected areas, have excluded indigenous people from their territories. The exclusion deprived the indigenous peoples of their opportunities to carry out their cultural practices. More significant conservation efforts must be necessitated with inclusion of indigenous knowledge among cultural communities should be initiated. The NCIP and DENR are continually working to protect their ancestral domains, which have significant cultural importance to IPs. The increasing interest of Traditional, Complementary and Alternative Medicine (TCAM) opened up the idea of the

commercial potential of ethnomedicines by the herbal and pharmaceutical industries. This interest has led to a deepening awareness by indigenous people of issues related to "intellectual property rights" and that resulted in trusting issues of IPs from the government and private companies (e.g. pharmaceuticals) without their acknowledgment or involvement. Into the bargain, there is an aggravating concern that these plants may be poached, overharvested, disrespected by outside parties, companies, and irresponsible researchers. Under the NCIP Administrative Order No. 3 Series of 2012, all departments and other governmental agencies should secure Certification Precondition issued by the NCIP with FPICs and written consent of ICCs/IPs concerned. The Certification Precondition is based on the revised guidelines on FPIC and related processes. The acquisition of this certification could be an obstacle for any university students and researchers to conduct ethnobotanical studies and surveys on traditional knowledge among indigenous communities. This process strictly needs financial allotment and could cost more time, effort, and money prior to the conduct of the study. Because of that, we recommend the NCIP for more consideration and reasonable guidelines for students and researchers of ethnobotany whose main objective and ethical intent is to save the traditional knowledge of our ICCs/IPs in the country.

### **Possible Loss of Traditional Knowledge**

Traditional practices are normally handed to the next generation through verbal communication. The continuing loss of traditional knowledge is brought about by the absence of verbal communication to the next generation. The traditional practice could also be dying for a possible plant extinction and acculturation of the younger generation. The declining interest of the new generation and possible migration of educated members to urban areas may result in shifting into Western medical practices. As the government continually supports indigenous education and scholarship programs among the members of indigenous communities, their new learning of modern medicine and affordable over-the-counter drugs could decline traditional medical tradition. This scenario threatens their long healing traditions leading to discontinuation of their cultural medicinal plant practices.

## **GOVERNMENT SUPPORT AND FUNDING**

Continuous efforts are made by the Philippine government to support people's health through traditional and alternative health care. Anent this vision, the Republic Act 8423 (R.A. 8423) was passed which mandates the DOH-PITAHC to improve the quality and delivery of health care



services to the Filipino people through the development of traditional and alternative health care and its integration into the national health care delivery system [66]. In line with the national government directives, the DOST-PCHRD funds research proposals that are associated with the National Unified Health Research Agenda (NUHRA) and the National Harmonized Research and Development Agenda [67]. One of the PCHRD research priorities is the *Tuklas Lunas* which pertains to the drug discovery and development. Both DOH-PITAHC and PCHRD support research projects for establishing and streamlining the traditional systems of therapy, the discovery of natural medicines, and development of new drugs, which are all fundamental objectives for national public healthcare improvement.

## RECOMMENDATIONS AND FUTURE PERSPECTIVES

### Plant Identification and Authentication

Majority of the species included in this list was sourced out from the ethnopharmacological researches uploaded on *Philippine Traditional Knowledge Digital Library on Health* (PTKDL-Health) and *Co's Digital Flora of the Philippines* (CDFP). The scientific names were then validated through *The Plant List* and *Tropicos*.

Plant identification must include vernacular names and compare to some reference lists of plant names, such as the PTKDL-Health, *Dictionary of Philippines Plant Names* [68], and *A Dictionary of Plant Names* [69]. Morphological identification should also consider utilization of taxonomic keys from floras and monographs like Merrill [70], Zamora and Co [71], Madulid [72], *Flora Malesiana Series* [73], Rojo [74], Fernando et al. [75], Co et al. [76], LaFrankie [77], and CDFP [78]. Putative identification of the collected plant species can be brought to the Philippine National Herbarium (PNH) for further verification and with the assistance of botanists and experts.

Moreover, all scientific names should be verified, spellings and synonyms should be compared, and family classification should be checked using the following databases: *The Plant List* [79], *World Flora Online* [80], *The International Plant Names Index* [81], and *Tropicos* [82]. The occurrence, distribution, and species identification should be further verified using the updated CDFP [78]. In some cases, collected plant species could have a doubtful identity because of unfamiliarity, unidentifiable by present morphology (sterile or non-reproductive) from all collected plant materials, an integrative molecular approach is highly recommended using universal markers.

### Resource Management and Conservation

Ethnobotany is associated with ethnoecology and conservation biology by integrating and interpreting complex resource management strategies. The United Nations has recently warned threatening global species at risk of extinction but tapping the unique expertise of indigenous knowledge can help solve biodiversity crisis [83-85]. It was globally recognized that about 22% of the traditional indigenous territories are concurrent with accounted areas harboring 80% of the plant's biodiversity [86]. Indigenous knowledge is essential for forest conservation and sustainability. We recommend the inclusion of a conservation perspective for future ethnobotanical researches.

### Marketing and herbal tourism

Herbal plants are being conventionally used as medicine among the locals and traditionally practiced among various cultural communities. Aside from no or less side effects, herbal remedies are relatively effective and less expensive in comparison to modern allopathic medicines. The growing interest of herbal medicines in different countries has attracted more patients to use cost-effective herbal medicines and treatments. This type of tourism is known as herbal tourism, which opens up new opportunities for developing enterprises. Some mild diseases and severe health conditions are treated by traditional therapy from everyday life stress and tension. Patients with severe health and psychological problems could resort to stay in some fresh and unpolluted green sites, forests, and geographical areas for therapy. This means it can also be developed for herbal tourism. Some cities and municipalities in various provinces in the Philippines opened up new ventures providing better health and employment among the local and cultural communities. Such opportunities are some of the crucial advantages of herbal tourism in the country. Continuing research on the safety and efficacy of all Philippine medicinal plants must be conducted and supported by institutions and government agencies. The use of herbal medicine does not always guarantee no adverse or side effects. Some herbal drugs could be substituted, adulterated, and contaminated that pose health risks to consumers and patients. In this regard, the WHO [87] developed detailed guidelines for conducting scientific research on the safety and efficacy of herbal medicines in the cooperation of experts such as molecular biologists, biochemists, pharmacologists, and herbalists. Some researchers have established a standard reference material (SRM) herbal barcode library for some popular Philippine medicinal plants like *Vitex negundo* L. (lagundi) [88] and *Antidesma bunius* (L.) Spreng. (bignay) [89]. The

joint and continuous efforts of Philippine researchers and experts led to the enactment of the Republic Act 8423, also known as the Traditional and Alternative Medicine Act (TAMA) of 1997. Moreover, the applications of molecular confirmation, constituent, and cytotoxicity evaluation are very useful for species comparative analyses and verification [90].

### **Implications and Future Direction of Philippine Ethnobotany**

Philippine medicinal plants have attracted biologists in general since prehistoric times and continually draw interests among scholars in various research topics. More scientists and researchers are becoming more interested in the unique expertise of the IPs/ICCs, may it be anthropologists, ethnobiologists, ethnobotanists, ethnographers, pharmacologists and others. Ethnobotanical information of plants becomes an important source of information among researchers in several fields, such as biochemistry, natural products chemistry, pharmacy, biophysics, and other biomedical studies. Some medicinal plants traditionally used by many cultural communities have been recently scientifically validated [91–97].

In 2004, the Philippine Pharmacopeia has been declared through Executive Order No. 302 and adopted as the official book of standards and reference for pharmaceutical products and crude plant drugs [98]. However, several changes in healthcare, science and technology, and regulation have been implemented since its publication. Hence, the Philippine government should spearhead development of "*Philippine Herbal Pharmacopeia*" monographs of medicinal plants as well as herbal medicines with uniform format and standards.

### **DISCUSSION**

Despite the enormous ethnic variety and geographical dispersion of Philippine IPs, there are relatively few ethnobotanical publications of IPs or tribal communities in the Philippines. The documentation of the traditional medicinal plants used by the traditional healers in the Philippines is limited compared to the extent of the variety of cultures and the diversity of plants in the country. Ethnobotany, in totality, if investigated thoroughly and systematically, will yield results of great value to the scientists, physician, and experts such as botanists, taxonomists, phytochemists, pharmacists, environmentalists, conservation biologists, medical doctors, and allied professionals. Indigenous peoples in the Philippines have retained much of their traditional, pre-colonial culture, social institutions, and living practices. They have experienced geographical

isolation for so long lacking basic social services and other opportunities for economic development, educational programs and political involvement. Although they possess valuable natural resources like minerals and other forest products which are economically valuable materials in their territories, mining industries and other business-related companies penetrated their lands which escalated the tribal aggression against development and land grabbing.

Philippine ethnobotany is a field that involves the cooperation of researchers and local communities. It needs the participation of local and IPs as having important roles in the research process and recognizing their knowledge in ethical ways. Ethnobotanical discussions must be positioned in both academic and political spaces, including in the context of the rights of nature, in order to promote the conservation of biocultural diversity. The increasing recognition of indigenous peoples' rights to natural resource management in general and conservation efforts, in particular, has in the Philippines resulted in the formalization of their role in protected area management. The representation of indigenous communities in park management boards is legally required and consistently integrated into park management plans. While these measures provide the institutional basis according to indigenous people for an explicit role in park management, they should be given 'meaningful' participation.

We recommend revisiting the state of ethnobotanical studies in the Philippines, using a more comprehensive methodological approach to establish an overview of academic production disseminated in various educational and research institutions across the country.

### **CONCLUSION AND RECOMMENDATIONS**

This review provided an update on the current status, challenges, recommendations and future perspectives of current ethnobotanical studies on indigenous communities conducted in the Philippines. Ethnobotany broadly constitutes an extensive and complex field of research with a focal point on the interactions between humans and their plants. Based on the accounted Philippine ethnobotanical publications and reports, medical ethnobotany prevails the most widely studied. Despite the wealth of information between plants and indigenous knowledge among more than a hundred ethnolinguistic groups in the country, few groups were yet comprehensively documented. Investigations of traditional use and management of local plants have substantiated the existence of indigenous expertise not only about ethnoclassification, folkloric claims, and traditional medical uses of many plant species, but also the phenological and ecological knowledge of endemic

and indigenous species. Aside from its traditional roles in economic botany and future drug leads, ethnobotanical research is highly relevant to essential areas of study such as conservation biology, biodiversity prospecting, and vegetation management. We hope for more extensive and comprehensive ethnobotanical studies applying quantitative methods as basis for sustainable development and biodiversity conservation following ethics and standardized data-collecting protocols. We recommend government initiatives and programs conferring significant economic and shared cultural benefits for indigenous communities. Mutual support of the government and ethnobotanical researchers should be enforced for future studies and joint management of the natural environment and plant resources.

### ETHICS APPROVAL

As this review did not involve any human or animal subjects, ethical approval was not required.

### ACKNOWLEDGEMENTS

MLGD is grateful for his scholarship grant from the Department of Science and Technology - Accelerated Science and Technology Human Resource Development Program - National Science Consortium (DOST-ASTHRDP-NSC) while GJDA thanks the DOST- PCHRD and DOH-PITAHC for the support.

### FUNDING

This work was supported by the Department of Health - Philippine Institute of Traditional and Alternative Health Care (DOH-PITAHC).

### CONFLICT OF INTEREST

The authors declare that they have no competing interest.

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