

EDIBLE WILD FOOD PLANTS IN IFUGAO, PHILIPPINES: POTENTIAL FOR FOOD SECURITY

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Abstract

The study's objective was to document the edible wild food plants in Ifugao, Philippines, and their potential to combat food insecurity. The study used qualitative and quantitative data collected with a structured and semi-structured questionnaire through informal and formal interviews, field visits, and field data collection with free listings, participatory observations, individual discussions, key informant interviews, focus group discussions, direct observations, and photo documentation. Data on the indigenous knowledge and ethno botanical characteristics of the wild edible plants (WEPs) showed a total of 110 WEPs species belonging to three classes, 35 orders, and 46 families, mainly herbs, trees, and shrubs. The majority (69.09%) of the plant species had perennial life cycles found in multiple growth locations and having several edible parts. Most WEPs had diverse additional uses, and most were considered medicines. WEPs are excellent sources of vitamins, minerals, and fibers essential to maintain good health. The climate was under the Type I classification by Corona's system, with a short dry season and a pronounced wet season. The average annual rainfall was 2500-3600mm. The typhoon frequency was 2-2.5 times per year. The two municipalities had fertile and arable lands, diverse fauna and flora, forests, rivers, and springs. All (100%) the species collected were from their natural habitats meant for food. Only 42.73% of the WEPs had a market value, and 37.27% of the WEPs were domesticated. Three hundred pesos (PhP 300.00) was the average monthly income from selling WEPs. Data on WEPs and gender roles in upland farm households showed that the primary uses of the wild edible plants in the upland farm households were for food and income. Most (98.16) respondents revealed that the women were responsible for finding, collecting, utilizing, and cooking the WEPs. The people responsible for transferring the edibility of the WEPs were their grandparents (75.00%) and their mothers (23.00%).

Keywords: wild foods; food security; indigenous foods; upland farm households; natural habitat; indigenous knowledge; gender roles

1. INTRODUCTION

The economic standing of a nation affects the complexity of the issue of food security (Boliko, 2019). The Philippines is a developing nation with a significant food shortage (McCarthy, 2018). Wild edible plants (WEPs) serve a crucial role in providing food security and improving the nutrition of the diets of many individuals in poor nations (Lulekal et al., 2011; Ghorbani et al., 2012). WEPs refers to species that are taken or collected from their natural habitats in the wild and consumed by humans (Lulekal et al., 2011; Heywood, 2011; Seal, 2012). They serve as a staple diet for indigenous people, as a supplement for non-indigenous people, and as one of the key sources of monetary revenue for impoverished areas (Upreti et al., 2012; Ghorbani et al., 2012).

It is essential to have an awareness of traditional food plants in order to promote food security in a manner that is more environmentally responsible. This is owing to the fact that having this knowledge would improve the nutritional status of the household as well as its food security (Ohiokpehai, 2003). In addition, the disappearance of indigenous knowledge has been

recognized as a significant problem that has a destructive effect on the preservation of biological diversity (Keller et al., 2005). One of the most rural parts of the Philippines is the province of Ifugao. Highland farmers are identified as the most economically disadvantaged segment of the province's population by Ormilla (2022). A typical upland farmer who practices agriculture for subsistence earns about \$384 per year, which is approximately one fifth of the poverty criterion of \$1,140 per year.

While cultivated plants constitute the backbone of rural economies, they fall short of meeting even the most basic yearly food needs (Misra et al., 2008). Therefore, the gathering and consumption of wild edible plants has been "a way of life" for many rural populations throughout the world (Ghorbani et al., 2012). However, due to social change and acculturation processes, indigenous knowledge (or traditional knowledge) about the use of wild edible species is diminishing and even vanishing as a result of modernization and increasing contacts with western lifestyles (Termote et al., 2011). Moreover, one of the most negative effects to the effort to maintain biodiversity is the loss of traditional knowledge, which has been characterized as such.

Increasing agricultural production on its own is not enough to improve food security in the vast majority of developing countries, including the Philippines. The production of food needs to be actively integrated with the study, selection, and domestication of underutilized or wild edible plants that are significant to the local or regional area, as well as greater exploitation of these species. Hence, understanding of traditional food plants is essential for promoting basic food resources in a sustainable manner. This is due to the fact that this knowledge will improve food security at the home level (Ohiokpehai, 2003).

Due to this condition, little research on wild foods for food security has been performed. There are relatively few ethnobotanical studies in the country (Balangcod & Balangcod, 2011). Nonetheless, the ethnobotanical survey serves a crucial role in preserving traditional knowledge related with wild edible food plants and constitutes a nutritional analysis of the most extensively utilized species (Lulekal et al., 2011; Termote et al., 2011). People must be aware of the predominant traditional food plants in their regions and how they might be improved for long-term food security. In the Philippines, the diversity of plant species has multiple community-level applications. Certain plants are utilized for primary health care, as a supplement to subsistence meals, as a source of part-time employment, as a source of off-farm cash income, as fodder for cattle, and as building materials for green resilience infrastructures.

Gathering and consuming wild food plants from agricultural environments is a common practice in families across the globe.

This food resource is a vital component of the farmers' subsistence system in Ifugao, a province in the Philippines. In light of the aforementioned circumstances in Ifugao and the Philippines, it is urgent to perform a study to tackle food insecurity. No studies on the ethnobotanical investigation of wild edible food plants in Ifugao have been done as of yet. Thus, this study was done with the following goals in mind:

Objectives

1. Determine the indigenous knowledge and ethnobotanical characteristics of WEPs in all barangays of Tinoc and Mayoyao municipalities.
2. Assess and describe the natural habitat and its value in terms of the presence of WEPs in the two municipalities of Tinoc and Mayoyao, Ifugao.
3. Examine the difference between women's and men's traditional knowledge and practices with regard to the collection, preparation, and utilization of wild edible food plants.

2. METHODOLOGY

2.1 Research Design

The qualitative and quantitative data collection methods were used in the study using primary and secondary resources. A structured survey questionnaire was used through direct interaction between the researcher/interviewer and the respondents. The indigenous knowledge and ethnobotanical characteristics of WEPs, including natural habitat and its value with the presence of WEPs data, it was gathered through the use of a semi-structured questionnaire through an informal interview, field visits, field data collection with a free listing, participatory observations, individual discussions, key informant interview, focus group discussions, direct observations and a photo-documentation of the different species of WEPs.

The protocol for conducting focus group discussions was based on Krueger (2002). The participants of the focus group discussions were respondents who had enough knowledge of WEPs since they were local experts. The respondents with the highest WEPs listed during the free list method were the participants. There were separate focus group discussions for the men and women. Two focus group discussions (one for men and one for women) were conducted per 10 barangays. There were nine participants (one for men and one group for women) per focus group discourse. The topics discussed were the following: diversity, growth forms, life cycles, growth location and habitat, edible parts, uses and other uses, and mode of preparation of WEPs; abundance of WEPs for family food consumption, marketed and for domestication. Also, the data gathered on WEPs and gender role in upland farm households were validated during the focus group discussions. During the focus group discussion, each plant sample was presented to validate all the data gathered on the dimension of indigenous knowledge and ethnobotanical characteristics of WEPs. The method of free listing was based on different protocols (Quinlan, 2005; Setalaphruk & Price, 2007).

2.2. Study Area Sampling

Ifugao is one of the provinces of the Cordillera Administrative Region (CAR), Philippines. It is politically divided into 11 municipalities. Mayoyao and Tinoc, Ifugao, the sites of the study, are two of the municipalities of Ifugao. Tinoc has 12 barangays and Mayoyao has 27 barangays.

All respondents were rural upland farm households in all barangays of Tinoc and Mayoyao, Ifugao, with the highest poverty incidence (Ifugao Socio-Economic profile, 2010). Secondary data from the Department of Social Welfare and Development (DSWD) [2016] on household

compositions and the socio-economic profile of each household were used in selecting the respondents. All or 39 barangays of the two municipalities were taken as study sites with the highest poverty incidence (Figure 1). Tinoc has a total of 12 barangays and Mayoyao has a total of 27 barangays. In each barangay, 15 upland farm households were taken purposively as respondents giving a total of 585 households in the two municipalities. Stratified purposive sampling was used in the study.

Stratified purposive sampling was used in the study. The stratification has three stages. The first stage was to select the two municipalities of Tinoc and Mayoyao, Ifugao. The second stage of stratification was the selection or total enumeration of all the barangays of the two municipalities of Tinoc and Mayoyao, Ifugao. The third stage was the selection of 15 respondents based on purposive sampling. Purposive in the sense that there was a criterion set for the sample of the 15 respondents per barangay in the two municipalities of Tinoc and Mayoyao, Ifugao. The criterion set in choosing the 15 respondents was that they must belong to the upland farm households who are among the poor based on the income range below P5000.00 per cropping and have knowledge of WEPs. Secondary data from the Department of Social Welfare and Development (DSWD) [2016] on household compositions and the socio-economic profile of each household were used in selecting the respondents.

2.3 Plant Classification

Using keys, online plant databases, pictorial flora, plant dictionaries, and taxonomic references, typical local and scientific names of plants and their taxonomic categorization, such as classes, orders, and families, were determined (ASEAN Tropical Plant Database, 2005; Coronel, 2011; Missouri Botanical Garden, 2013; Plants of Southeast Asia, 2013; USDA, 2013). Specimens of species whose identity in the field was uncertain were transported to the Natural Science Department of Central Luzon State University, Science City of Munoz, Nueva Ecija, Philippines, for identification using their reference collections.

3. RESULTS

3.1. The life cycle of the WEPs

The annual and perennial life cycles were considered in this study. Most (69.09%) of the wild edible plants were perennial, and 30.91% annual (Figure 1).

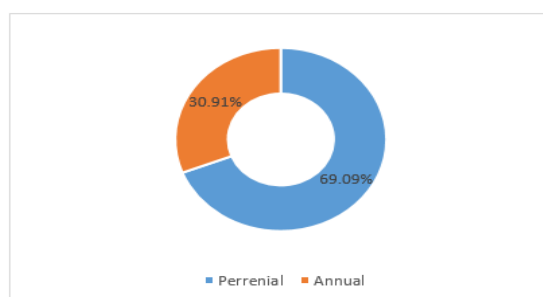


Figure 1: Life cycle of the WEPs

3.2. Growth Forms

There were six growth forms of the WEPs that were considered in this study such as the terrestrial herb, climber, shrub, tree, bamboo and rattan. Figure 2 shows that most of the wild edible plants were herbs (35.45%), followed by trees (28.18%) and the least were the bamboos (0.91%).

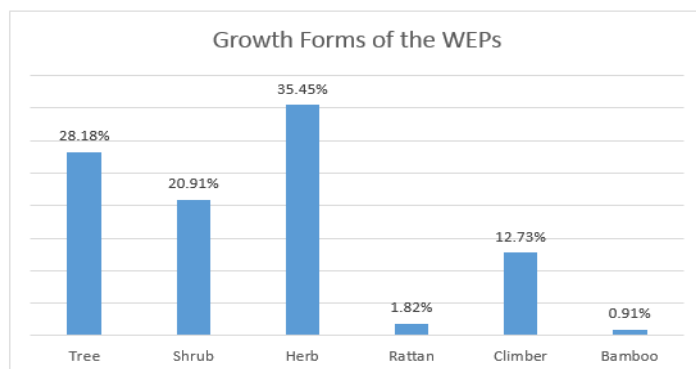


Figure 2: The growth form of the WEPs

3.3. Growth Locations

Eight (8) major growth locations of the wild edible plants were considered in this study: rice fields, forests, home gardens, woody areas, riversides, crop fields, swamps, and roadsides (Figure 3). A majority (68.18%) of the different wild edible plant species grew from multiple locations. Only (31.82%) grew in a single location.

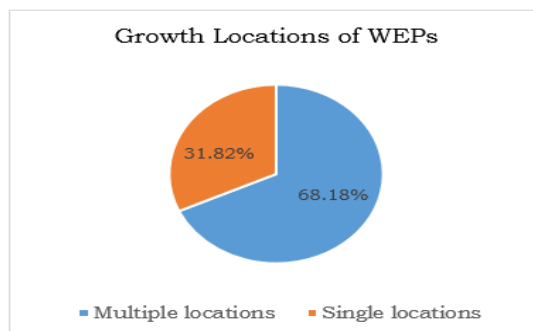


Figure 3: Growth locations of the WEPs

3.4. Edible Parts

The young shoots, fruits, whole aerial parts, leaves, stems, seeds, stalks, and roots were the consumable plant parts that were considered in this study. The majority (88.18%) of the WEPs had one edible part like the root of *Alocasia macrorrhizos* (L.) G. Don. About 5.54% of the WEPs had two edible parts, like the leaves and fruits of *Embelia philippinensis* A. DC. Only 4.55% of the WEPs had three edible parts (Figure 4).

Results (Figure 4) revealed that the highest consumable part of the WEPs were the fruits (48.18%) followed by the young shoots (22.73%), and the least were the leaves (1.82%).

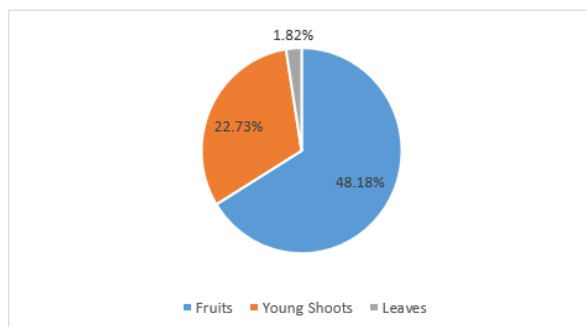


Figure 4: Edible parts of the WEPs

3.5. Number of Edible Parts

The young shoots, fruits, whole aerial parts, leaves, stems, seeds, stalks and roots were the consumable plant parts that were considered in this study. Majority (88.18%) of the WEPs had one edible part like the root of *Alocasia macrorrhizos* (L.) G. Don. About 5.54% of the WEPs had two edible parts like the leaves and fruits of *Embelia philippinensis* A. DC. And only 4.55% of the WEPs had three edible parts (Figure 5).

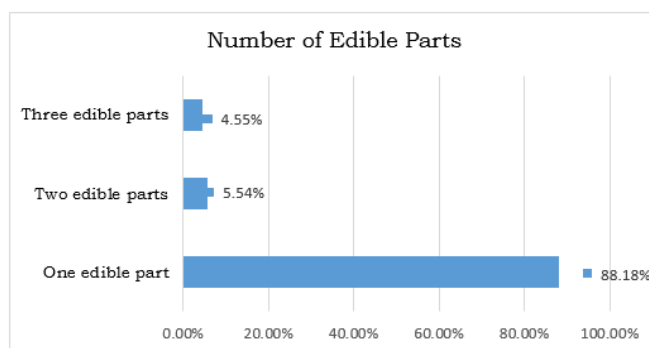


Figure 5: Consumable parts of the WEPs

3.6. Other Uses

Most of the WEPs collected from this study had other uses besides food (Figure 6). About 91.82% of the reported WEPs had additional uses like medicine, fodder, lumber, handicraft, domestic, and firewood.

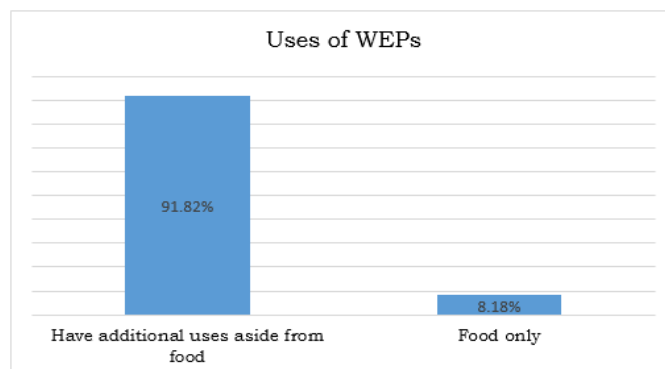


Figure 6: Uses of WEPs

Fifty-six species (50.91%) were used for medicine, and most were herbs (24 species). During the focus group discussions and interviews, these medicinal plants were used to treat cough, common colds, fever, dysentery, burns, diarrhea, gastropathy, etc.

3.7. Mode of Preparations

The Ifugao have unique cuisines. The different modes of preparation include raw, salad, sauteed, boiled, fried, and mixed with legumes, meat, or fish. About 47.27% of the species had multiple modes of preparation, and 52.73% had a single mode of preparation.

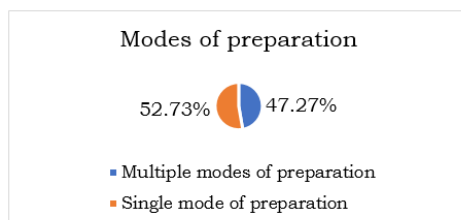


Figure 7: Modes of preparation

3.8. Edible State

Almost 43.64% of the WEPs were eaten raw. About 33.64% of the species were sauteed, boiled, fried, or mixed with legumes, meat, or fish, and only 5.45% were boiled only (Figure 8).

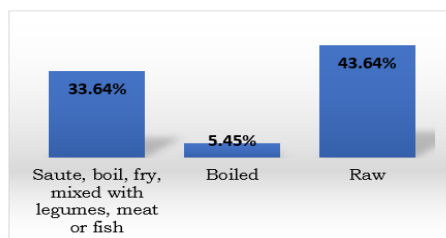


Figure 8:

3.9. Wild Edible Plants and Gender Roles in Upland Farm Households

Results (Figure 9) revealed that the primary uses of the wild edible plants for the upland farm households were for food (91.45%) and as a source of income (8.55%).

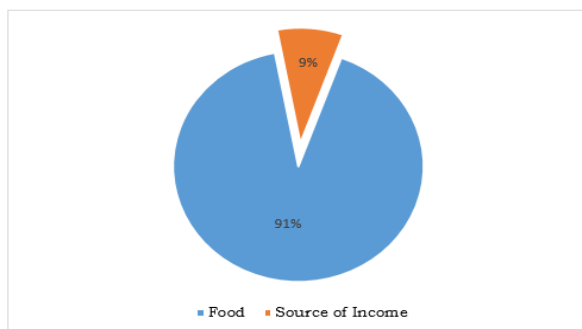


Figure 9: Primary uses of the WEPs

3.10. Nutrient Composition

The nutritional values of edible greens like green leafy vegetables were 9% calcium, 15% iron, 19% magnesium, 187% vitamin A, 10% vitamin B-6, and 46% vitamin C (Natural Food Series, 2018). For example, amaranths have excellent nutritional values because they contain essential micronutrients such as abs-carotene, iron, calcium, vitamin C, and folic acid. Amaranth leaves are rich in proteins and micronutrients such as iron, calcium, zinc, vitamin C, and vitamin A (Samota, 2017). Edible roots like the giant taro are rich in vitamin C, carbohydrates, zinc, vitamin E, magnesium, and iron, which are essential to maintain health (Temesgen and Retta, 2015).

3.11. Natural Habitat and Its Value in terms of the Presence of Wild Edible Plants (WEPs)

Mayoyao and Tinoc, Ifugao, Cordillera Administrative Region, Philippines, the study sites, are ruggedly mountainous. The climate is under the Type I classification by Corona's system with two distinct seasons, wet from May to October and dry from November to April (Corona, 2004). Both towns have a temperate climate with a short dry and pronounced wet season. The average annual rainfall is 2500-3600 mm. The typhoon frequency is 2-2.5 times yearly (Department of Interior and Local Government, 2018).

As to natural resources, the two municipalities have fertile lands, rich flora and fauna, forests, rivers, and springs. All WEPs were collected for food consumption from their natural habitats (Appendix Table 1). About 47 species (44.55%) of the WEPs collected from their natural habitat were primarily marketed (Table 1).

Table 1: List of marketed WEPs

No	Scientific Name	Family	Local Name	Edible Part/s
1	<i>Amaranthus blitum</i> L.	Amaranthaceae	Alleyyen/Aladjon	Young shoots
2	<i>Amaranthus gracilis</i> Desf.	Amaranthaceae	Alleyyen/Aladjon	Young shoots
3	<i>Amaranthus hybridus</i> L.	Amaranthaceae	Alleyyen/Aladjon	Young shoots
4	<i>Amaranthus spinosus</i>	Amaranthaceae	Alleyyen/Aladjon	Young shoots
5	<i>Rorippa indica</i> (L.) Hiern.	Brassicaceae	Kunde/ Unchoy	whole aerial part
6	<i>Mahinot esculenta</i> Crantz.	Euphorbiaceae	kahuy	young shoots, root
7	<i>Phaseolus lunatus</i> L.	Fabaceae	Antak	young shoots, seeds, fruits
8	<i>Pisum sativum</i> L.	Fabaceae	Pis	young shoots, fruits, seeds
9	<i>Morus alba</i> L.	Moraceae	Mulberry	young shoots, fruits
10	<i>Pasiflora edulis</i> Sims. f.	Passifloraceae	Haploda/masaplora	young shoots, fruits
11	<i>Pasiflora ligularis</i> Juss.	Passifloraceae	Haploda/masaplora	young shoots, fruits
12	<i>Pasiflora quadrangularis</i> Linn.	Passifloraceae	Haploda/masaplora	young shoots, fruits
13	<i>Athyrium esculentum</i> (Retz.) Copel.	Athyriaceae	Appaku	young shoots
14	<i>Portulaca oleracea</i> Linn.	Portulacaceae	Papait	young shoots
15	<i>Solanum nigrum</i> L.	Solanaceae	Nateng	young shoots/Fruit
16	<i>Momordica charantia</i> L.	Cucurbitaceae	Apapet	whole aerial part
17	<i>Saurauia sparsifolia</i>	Actinidiaceae	Dogwe	fruit
18	<i>Calamus manillensis</i> (Mart.) H. Wendl.	Arecaceae	Lituku	fruit, young stalk
19	<i>Garcinia binucao</i> (Blanco) Choisy	Clusiaceae	Balokok	fruit
20	<i>Garcinia intermedia</i> (Pittier) Hammel	Clusiaceae	Hantol	fruit
21	<i>Garcinia vidalii</i> Merr.	Clusiaceae	Bulon/Bili	fruit
22	<i>Dillenia philippinensis</i> Rolfe	Dilleniaceae	Ukapon	fruit
23	<i>Psidium guajava</i> Linn.	Myrtaceae	Ge-ab/Bayehbet	fruit
24	<i>Antidesma bunius</i> (L.) Spreng.	Phyllanthaceae	Bunne/fugnay	fruit
25	<i>Solanum betacea</i> Cav.	Solanaceae	Dulsi	fruit
26	<i>Solanum pimpinellifolium</i> L.	Solanaceae	Kammahit/Kammatih	fruit
27	<i>Capsicum frutescens</i> L.	Solanaceae	Hili/ Pahtiw	young shoots, fruits
28	<i>Carica papaya</i> L.	Caricaceae	Papaya	Fruits
29	<i>Citrus limon</i> (L.) Burm. f.	Rutaceae	Dalayap/Chalajap	Fruits
30	<i>Daucus carota</i> L. ssp <i>sativus</i> (Hoffm) Arcang.	Apiaceae	Kalut, salad	roots
31	<i>Mangifera indica</i> L.	Anacardiaceae	Manga/Manggah	Fruits

32	<i>Pasiflora foetida</i> L.	Passifloraceae	Haploda	young shoots, Fruit
33	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Laya/Lajah	roots
34	<i>Ipomoea batatas</i> L.	Convolvulaceae	Luhtu/Luktu	young shoots, roots
35	<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	Pako	young shoots
36	<i>Cajanus cajan</i> (L.) Millsp.	Fabaceae	Kuldi/oche	seeds
37	<i>Coffea Arabica</i> L.	Rubiaceae	Kopeh/Kape	seeds
38	<i>Evodia meliaefolia</i> (Hance) Benth.	Rutaceae	Galiwgiwon	Fruit
39	<i>Sarcandra glabra</i> (Thunb.) Nakai	Chloranthaceae	Gipas	Leaves
40	<i>Areca catechu</i> L.	Arecaceae	Moma	young stalk
41	<i>Artocarpus communis</i> J. R. & G. Forst.	Moraceae	Pakak	Fruit
42	<i>Psophocarpus tetragonolobus</i> (L.)DC.	Fabaceae	Billigan/Fuligan	fruit
43	<i>Vigna unguiculata</i> (L.) Walp.	Fabaceae	Bihni/Agwat	Young shoots, fruits, seeds
44	<i>Colocasia antiquorum</i> Schott.	Araceae	Latud	root
45	<i>Colocasia esculentum</i> (L.) Schott.	Araceae	Latud	Leaves, Stem, root
46	<i>Bambusa bambos</i> (L.) Voss	Poaceae	Kawayan	shoot
47	<i>Alocasia macrorrhizos</i> (L.) G. Don	Araceae	Phila, bila	root

3.12. List of domesticated WEPs

Only 41 species (37.27%) of the WEPs were domesticated to the upland farms. Only three hundred pesos (Php300.00) was their average monthly income in selling WEPs (Table 1).

Table 2: List of domesticated WEPs

No	Scientific Name	Family	Local Name	Edible Part/s
1	<i>Rorippa indica</i> (L.) Hiern.	Brassicaceae	Kunde/ Unchoy	whole aerial part
2	<i>Mahinot esculenta</i> Crantz.	Euphorbiaceae	kahuy	young shoots, root
3	<i>Phaseolus lunatus</i> L.	Fabaceae	Antak	young shoots, seeds, fruits
4	<i>Pisum sativum</i> L.	Fabaceae	Pis	young shoots,fruits, seeds
5	<i>Morus alba</i> L.	Moraceae	Malberi	young shoots, fruits
6	<i>Pasiflora edulis</i> Sims. f.	Passifloraceae	Haploda/masaplora	young shoots, fruits
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9	<i>Athyrium esculentum</i> (Retz.) Copel.	Athyriaceae	Appaku	young shoots
10	<i>Solanum nigrum</i> L.	Solanaceae	Nateng	yong shoots/Fruit
11	<i>Momordica charantia</i> L.	Cucurbitaceae	Apapet	whole aerial part

12	<i>Saurauia sparsifolia</i>	Actinidiaceae	Dogwe	fruit
13	<i>Calamus manillensis</i> (Mart.) H. Wendl.	Arecaceae	Lituku	fruit, young stalk
14	<i>Garcinia intermedia</i> (Pittier) Hammel	Clusiaceae	Hantol	fruit
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30	<i>Cajanus cajan</i> (L.) Millsp.	Fabaceae	Kuldi	seeds
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41	<i>Alocasia macrorrhizos</i> (L.) G. Don	Araceae	Phila, bila	root

Most (98.16%) of the respondents revealed that the women and their children were the ones responsible for finding, planting, collecting, utilizing, and cooking the WEPs (Table 3). The

people responsible for transferring the knowledge on the edibility of the WEPs were their grandmothers (75.00%) and their mothers (23.00%), as shown in Table 5.

Table 3: Gender roles in upland farm households

Characteristics	Respondents Response	Units
Responsible in finding, collecting, utilizing and cooking WEPs		
Women & Children	98.16	%
Men	1.84	%
Responsible in transferring the knowledge on the edibility of the WEPs		
Grandparents	76.01	%
Grandfather	1.01	%
Grandmother	75.00	%
Parents	23.99	%
Father	0.99	%
Mother	23.00	%

4. DISCUSSIONS

4.1. Socio-economic and Demographic Characteristics of the Upland Farm Households

Most respondents were female with low income, low educational level, and a large family. According to Alaimo (2005), these socio-demographic factors were associated with household food insecurity.

In terms of transportation, walking was reported to be their primary means of travel since there were no access roads in most of the barangays. This explains that there was a constraint in transporting their goods to the marketplace.

The primary food source consumed by the upland farm households was their production. Rice was their staple food, and sweet potato was their alternative source of staple food. Most of the respondents do not sell their rice products; instead, they only stock them for their consumption due to the limited land area for rice production. According to Allig (2006), farmers own an average rice paddy that ranges from 1000-2000 square meters to feed an average family of six (6) children. Since they have a limited area for rice production, they plant sweet potatoes as an alternative food source; thus, they can eat them three times a day.

Most of the respondents depended on their crops and animals for their living. Almost all the upland farm households were net purchasers of food, even if their livelihood was farming, since they had a very minimal area for farming. Allig (2011) estimates that a family of eight living off the average income of P3, 555.00 per cropping may live off their rice harvest for an average of seven (7) months. In order to pay for production costs and other necessities, such as children's school tuition and weddings, all upland farm households only sell a portion of their

products, such as vegetables and animals (save for rice). The results are consistent with those reported by Zakari et al (2014).

Researchers found that food insecurity is more common than previously thought. The vast majority of respondents (85.17%) expressed concern over a possible food shortage. They consume three meals a day, but they can't always afford or get their hands on the foods they enjoy, which has negative effects on their health and nutrition.

The majority of households only consume meat or fish on the day when their local market is open, once or twice per week, or when a member of the household is required to travel to the next major city for an essential errand. So, despite the fact that they have the intention of purchasing meat, they are not always able to gain access to markets in which meat is easily accessible for purchase. This observation lends credence to the findings reported by Zakari and colleagues (2014).

The fact that there was such a high frequency of food insecurity is another concerning finding. Almost 45.56 percent of respondents stated that their daily portion was always sufficient for the members of their household. The respondents who participated in the discussions and interviews with the focus groups agreed that July and August are the most challenging months of the year. According to Allig (2011), an average household of eight people consumed their rice harvest for an average of seven months, and the household made an average income of P3, 555.00 per cropping. At this most difficult era, the respondents reported that they had stocked up on rice and even sweet potatoes in their homes. Alternative foods that are considered to be staples include sweet potatoes. As the stock of rice runs out, they borrow money from their well-off relatives, neighbors, or friends and primarily pay for the labor that they put in.

4.2. Indigenous Knowledge and Ethnobotanical Characteristics of the Wild Edible Plants

There is a wide range of known wild edible plants in the region of study. This suggests that the WEPs were a staple food for upland farm families during times of plenty as well as times of scarcity. Perennial plants such as trees, shrubs, rattans, and bamboo were found to make up the vast majority of WEPs. The findings of this investigation corroborate the findings of Cruz and Price (2011).

Herbs, trees, shrubs, and climbers were the most commonly collected plant types in this study. This is because they can be found in great variety in the locations under study. The findings are consistent with those of Avouhou et al. (2012). *Amaranthus* species, *Rorippa indica* L. Hiern. (Figure 11), and *Athyrium esculentum* (Retz.) Copel are the most widely distributed herbs.

Virgin forest characterizes the research locations, therefore there are plenty of tall trees, bushes, and vines to see. *Saurauia elegans* (Choisy) Fern-Vill.(Figure 12), *Dillenia philippinensis* Rolfe, and *Garcinia vidalii* were the most frequent native trees found in the wild. Figure 13 *Vaccinium myrtoides* (Blume) Miq., *Mendinilla pendula* Merr., and *Ficus minahassae* are the most common shrubs.



Figure 11. *Rorippa indica* (L.) Hiern.



Figure 12. *Saurauia elegans* (Choisy) Fern-Vill



Figure 13. *Vaccinium myrtilloides* (Blume) Miq.

Common climbers are the *Momordica charantia*, *Phaseolus lunatus*, *Pasiflora edulis* (Figure 14), *Psophocarpus tetragonolobus*, and *Pasiflora regularis*.



Figure 14. *Pasiflora edulis*



Figure 15. *Rubus fraxinifolius* Hayata



Figure 16. *Athyrium esculentum*

WEPs can be found all over the anthropological map (Cruz & Price, 2011). Based on the results of this research, it is clear that the WEPs came from a wide range of environments, including grasslands, woodlands, urban backyards, riverbanks, farmland, swamps, and roadsides. Someone else also found something similar: (Ashagre et al., 2016; Kidane et al., 2014). This study also demonstrated that the WEPs can grow in a number of different sites. Because of this, we now understand why different species are relocated to different areas. Wild plant species migrate from one area to another, as reported by Cruz-Garcia and Price (2011), with the help of varying degrees of management.

Fruits, new growth, and leaves made up the bulk of the plant's edibles. The kids would pick up any fruit they could find, ripe or unripe, and eat it right away, without storing it for later. Such fruits were consumed as snacks in the hours between meals while herding live livestock and collecting firewood, corroborating the findings of studies by Kang et al. (2013), Kang et al. (2012), and Sun (2003). Reports to this effect have also been published by Agea et al. (2011) and Termote et al. (2010), as well as by Nedelcheva (2013).

Psidium guava Linn, *Carica papaya* L., and *Rubus* species are the most widely consumed wild fruits (Figure 15).

In most cases, the young shoots are prepared in one of four ways: sauteed, boiled, stir-fried, or combined with legumes, meat, or fish. Among the most popular vegetable sprouts are those of the *Amaranthus* species, the *Athyrium esculentum* (Figure 16), the *Momordica charantia*, the *Capsicum frutescens*, and the *Ipomea batatas*.

The study found that in addition to being consumed by humans, WEPs have a variety of other use in medicine, feed, lumber, fuel, handicraft, and even home settings. The nutritional and preventative benefits of these wild food-medicine plants are just as important as their medicinal

uses. The plants' versatility is evidence of their significance as both a means of survival and a component of the local heritage (Shrestha & Dhillon, 2006). Green leafy vegetables are packed with nutrients including vitamin C, vitamin K, iron, and calcium, and are a great source of fiber, folate, and carotenoids. Vital nutrients like vitamin C, carbohydrates, zinc, vitamin E, magnesium, and iron can be found in abundance in root vegetables. Nuts, on the other hand, are a healthy food choice because they contain healthy fats, fiber, and protein. Magnesium and vitamin E are only two of the many vitamins and minerals found in nuts (Flores-Mateo, 2013).

4.3. Natural Habitat and Its Value in terms of the Presence of Wild Edible Plants (WEPs)

WEPs were found in Tinoc and Mayoyao, Ifugao, Cordillera Administrative Region (CAR), Philippines, according to an ethnobotanical survey. The WEPs identified in this study are spread among the two municipalities. The subtropical environment is ideal for the development of many WEPs.

Tinoc covers a total area of 33,384 hectares. It is located at 16041' N latitude and 120079' E longitude. It is located on top of the Sleeping Beauty Mountain Range on the eastern side of Mount Pulag, the Philippines' second-highest mountain. It is approximately 2,700 meters above sea level. In most barangays, there are no access roads. Foot pathways are the sole way to get to the remote barangays. Despite its remoteness, it is endowed with abundant natural resources such as freshwater, sulfur, salt, and hot springs, with freshwater springs serving as a domestic source. The Pine forest, located between 900 meters above sea level, and the Mossy forest, located above 1400 meters above sea level, are two types of woods. It has four major rivers that run from the eastern portion of Ifugao to the lowlands of Lamut and Nueva Vizcaya, and then to the Magat Multi-purpose Dam.

In contrast, the total land area of Mayoyao is 36,413 hectares. It is a rural municipality with 17,153 hectares of land. The overall area of agricultural land is 47,11 percent. The principal agricultural products include palay, camote, corn, beans, and gabi. Furthermore, swine, cow, carabao, goat, dog, horse, chicken, duck, and turkey are raised as livestock (Cordillera Almanac, 1999). In addition, there are no access roads in the majority of barangays. Its natural resources consist of forests, rivers, springs, an abundance of flora and wildlife, and fertile land.

4.4. Wild Edible Plants and Gender Roles in Upland Farm Households

Local ecological knowledge is essential to the gathering and use of WEP since it is nearly impossible to collect, prepare, and eat wild edibles without knowing their habitat, toxicity, and seasonal abundance. Natural resource management and usage activities, including the successful incorporation of wild foods into the diet, have been the subject of numerous studies that have examined the connection between local ecological knowledge and the ethnobotanical skills necessary for success (Reyes-Garcia et al., 2005).

A lot of the work involved in making forest meals like soups, stews, and relishes for domestic consumption falls on the shoulders of women (FAO, 2013). Many women have great knowledge about how to find, collect, and prepare very nutritious forest foods that can boost a

family's basic food supply. Leaves, roots, seeds, and fruits are commonly gathered by women and children from the garden and the woods (Ashagre, Asfaw, and Kelbessa, 2016).

When compared to men's knowledge, women's tends to be more directly related to the needs of the household in terms of food and nutrition, as well as health and culture. According to research conducted in the Amazon by Shanley and Gaia (2001), women are better at recognizing and naming the trees, vegetables, vines, bushes, and herbs that can be harvested for food and medicine than men (i.e. fruit, bark, leaf, seed, and root). It is crucial to have this information on hand during times of widespread destruction and food scarcity. Women's knowledge of tree products, such as fruits and nuts, medicinal materials, and fire wood, is often vital in helping communities survive periods of food scarcity. In addition, during times of food shortages, wild foods can serve as a viable alternative to store-bought fare due to their high nutrient content.

WEPs are used to varying degrees depending on factors such as age, gender, and the time of year. Children and women, as well as Ashagre et al.'s reports, were found to be the primary collectors of these plants in this study (2016). This study's findings corroborated those of Ashagre et al. (2016) and Regassa et al. (2015), who found that female participants had a deeper understanding of WEPs than their male counterparts (2014).

5. CONCLUSION

A great diversity of WEPs contributed to the food and nutrition security of the upland farm households in Mayoyao and Tinoc, Ifugao. The data showed that most of the WEPs were terrestrial herbs, trees, and shrubs with multiple edible parts, diverse additional uses, and excellent sources of nutrients essential to maintaining good health, which can be found in multiple growth locations.

The study sites have a temperate climate, 2-2.5 per year typhoon frequency, and average annual rainfall of 2500-3600 mm. The study sites are ruggedly mountainous, having fertile and arable lands, diverse fauna and flora, forests, rivers, and springs. All the species were collected for food, income, and domestication. The average monthly payment for selling WEPs was very minimal.

The major role of the WEPs in the upland farm households was for food and income. Women and children played a significant role in finding, utilizing, and cooking the WEPs. Transferring knowledge on WEPs was the main role of the women.

Conflict Of Interest

The author declares that there are no conflicts of interest.

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References

1. Alaimo, K. (2005). Food Insecurity in the United States: An Overview. *Clinical Nutrition*, 20(4), 281-298.
2. Allig, T. D. (2006). Native rice based farming system. *Upland Farm Journal*, 25(1).
3. Allig, T. D. (2011). Enhancement of farm household income, food security and capability building on the province of Ifugao through the adoption of integrating crop management for indigenous and high yielding rice varieties. *Upland Farm Journal*.
4. Avouhou HT, Vodouhe RS, Bellon M, Kpeki B (2012) Ethnobotanical factors influencing the use and management of wild edible plants in agricultural environments in Benin. *Ethnobot Res Appl* 10:571–592
5. Balangod, T. D. & Balangcod, A. D. (2011). Ethnomedical knowledge of plants and health care practices among the Kalanguya tribe in Tinoc, Ifugao, Luzon, Philippines. *Indian Journal of Traditional Knowledge*, 10 (2), 227-238.
6. Balbarino, E., Gultiano, S., Pool, I., & Urich, P. (2001). Population and food security: Early research results from the Philippines.
7. Boliko, M. C. (2019). FAO and the situation of food security and nutrition in the world.
8. Cruz-Garcia, G. S. and Price, L. L. (2011). Ethnobotanical investigation of wild food plants used by rice farmers in Kalasin, Northeast Thailand, 7 (33).
9. DILG-CAR (1999). *Cordillera Almanac*, 1.
10. FAO (2013). *The State of Food Security in the World*. Rome: Food and Agricultural Organization.
11. Flores-Mateo, G., Rojas-Rueda, D., Basora, J., Ros, E., Salas-Salvadó, J.(2013). Nut intake and adiposity: meta-analysis of clinical trials. *Am J Clin Nutr*. 97(6):1346-55. doi: 10.3945/ajcn.111.031484.
12. Ghorbani, A., Langenberger, G. and Sauerborn, J. (2012). A comparison of the wild food plant use knowledge of ethnic minorities in Naban River Watershed National Nature Reserve, Yunnan, SW China. *J Ethnobiol Ethnomed*, 8, 17.
13. Heywood, V. H. (2011). Ethnopharmacology, food production, nutrition and biodiversity conservation:
14. *Journal of nutritional science and vitaminology*, 65(Supplement), S4-S8.
15. Keller, G.B., Mndiga, H., Maass, B. L. (2005). Diversity and genetic erosion of traditional vegetables in Tanzania from the farmer's point of view. *Plant Genet Resour Charact Util*, 3, 400–413.
16. Lulekal, E., Asfaw, Z., Kelbessa, E. and Van Damme, P. (2011). Wild edible plants in Ethiopia: a review on their potential to combat food insecurity. *Africa Focus*, 24, 71–121.
17. Lulekal, E., Asfaw, Z., Kelbessa, E. and Van Damme, P. (2011). Wild edible plants in Ethiopia: a review on their potential to combat food insecurity. *Africa Focus*, 24, 71–121.
18. Mathias, E. (2004) Ethnoveterinary medicine: Harnessing its potential. *Veterinary Bulletin* 74, 27-37
19. Mc Carthy, U., Uysal, I., Badia-Melis, R., Mercier, S., O'Donnell, C., & Ktenioudaki, A. (2018). Global food security—Issues, challenges and technological solutions.
20. Misra, S., Maikhuri, R., Kala, C., Rao, K. and Saxena, K. (2008). Wild leafy vegetables: A study of their subsistence dietetic support to the inhabitants of Nanda Devi Biosphere Reserve, India. *J Ethnobiol Ethnomed*, 4, 15.
21. Ohiokpehai, O. (2003). Nutritional aspects of street foods in Botswana. *Pakistan Journal of Nutrition*, 2(2), 76-81.

22. Ormilla, R. C. G. (2022). Socio-economic, psychological and environmental factors in the academic performance of elementary pupils of Alfonso Lista District, Ifugao, Philippines. *EDUCATUM Journal of Social Sciences*, 8(1), 1-12.
23. Philippine quarterly of culture and society, 29(1/2), 38-63.
24. Quinlan, M. (2005). Considerations for collecting freelists in the field: examples from Ethnobotany. *Field Methods*, 17 (3), 1–16.
25. Regassa, T. H., & Wortmann, C. S. (2014). Sweet sorghum as a bioenergy crop: literature review. *Biomass and Bioenergy*, 64, 348-355.
26. Reyes-García, V., Vadez, V., Huanca, T., Leonard, W., & Wilkie, D. (2005). Knowledge and consumption of wild plants: a comparative study in two Tsimane' villages in the Bolivian Amazon. *Ethnobotany Research and Applications*, 3, 201-208.
27. Seal, T. (2012). Evaluation of nutritional potential of wild edible plants, traditionally used by the tribal people of Meghalaya state in India. *Amer J Plant Nutr Fertil Tech*, 2, 9–26.
28. Setalaphruk, C. and Price, L. L. (2007). Children's traditional ecological knowledge of wild food resources: a case study in a rural village in Northeast Thailand. *Journal of Ethnobiology and Ethnomedicine*, 2007:33. DOI: 10.1186/1746-4269-3-33
29. Shanley, P., & Gaia, G. (2004). Poor Man's Fruit Turns Profitable. *Endopleura uchi* in managed groves near.
30. Shrestha, P. M., & Dhillon, S. S. (2006). Diversity and traditional knowledge concerning wild food species in a locally managed forest in Nepal. *Agroforestry Systems*, 66, 55-63.
31. Termote, C., Van Damme, P., Dhed'a Djailo, B. (2011). Eating from the wild: Turumbu, Mbole and Bali traditional knowledge on non-cultivated edible plants, District Tshopo, DR Congo. *Genet Resour Crop Evol*, 58:585–618.
32. Termote, C., Van, Damme, P., Dhed'a Djailo, B. (2010). Eating from the wild. Turumbu indigenous knowledge on non-cultivated edible plants, District Tshopo, DR. Congo. *Ecol Food Nutr*, 49:173–207.
33. *Trends in Food Science & Technology*, 77, 11-20.
34. Uprety, Y., Poudel, R., Shrestha, K., Rajbhandary, S., Tiwari, N., Shrestha, U. and Asselin, H. (2012) Diversity of use and local knowledge of wild edible plant resources in Nepal. *J Ethnobiol Ethnomed*, 8, 16.
35. Shrestha, P. M., & Dhillon, S. S. (2006). Diversity and traditional knowledge concerning wild food species in a locally managed forest in Nepal. *Agroforestry Systems*, 66, 55-63.
36. Zakari, S., Ying, L., Song, B. (2014). Factors influencing household food Security in West Africa: The case of Southern Niger. *Sustainability*.