Characterization and Promotion of Underutilized Indigenous Food Plants in Bayambang Pangasinan for Food Security

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Abstract - *Indigenous foods plants (IFPs) which serve as sources of macro and micro-nutrients continue to be neglected, underutilized, slowly forgotten and are disappearing at an alarming rate due to modernization, posing serious threats to food security. These observations led the researchers to conduct this study. Part one of this study aimed to describe the vegetative characteristics of the underutilized indigenous food plants (UIFPs) in Bayambang, Pangasinan, Philippines. Part two aimed at the level of awareness of these UIFPs among students of Pangasinan State University (PSU), Bayambang Campus who are becoming unfamiliar to these plants. Descriptive- survey method was used in this study. Results of this study revealed fifteen UIFPs that are found in the locality of Bayambang, Pangasinan which can be used as vegetable additives in Filipino dishes as well as can be eaten raw as salads. These UIFPs are known in the local dialect as: papait, talinum, ngalog, dilangbaka, pansitpansitan, taptapingar, bagbagkong, samsamping, tigi/ pungapong, itlog-gagamba, sili-silihan, binahian/chinese malunggay, sabsabitan, takip-kohol, and purpuriket/ ashitaba. On students' level of awareness on the UIFPs, findings showed that the student-respondents are very much aware of only one UIFP, slightly aware of four UIFP and totally not aware of 10 UIFPs. The study also revealed that the students prefer the cultivation of the UIFPs in school gardens and in the community as the best method of promoting awareness of the UIFPs. Accordingly, the age, residence, and areas of specialization of the student-respondents are factors that affect their level of awareness of the UIFPs regardless of their gender and economic status.*

Keywords: *underutilized, characterization, vegetative*

INTRODUCTION

Indigenous indigenous food plants (IFPs) are traditional edible plant species which are disappearing at an alarming rate at present and continue to pose serious threats to food security and agricultural production especially in areas that depend on them for food and livelihood [1].

In a news release from the Food and Agriculture Organization (FAO) in May 2012, Indigenous and traditional foods - which are sometimes undervalued and classified as 'foods of the poor' or 'forgotten foods' - can play an important role in helping the estimated 925 million people who suffer from hunger and malnutrition worldwide, 60 percent of whom live in the Asia-Pacific region, including the Philippines [2]. The article also noted that researches focused crop improvement on a few widely consumed crops that has helped meet the food needs of the rapidly growing world population, but it has narrowed dramatically the number of species upon which global food security and agricultural incomes may depend. As Deb et al. [3] emphasized in their study, considering the ever increasing population and consequent shortage of food grains, collection and utilization of various types of unutilized crops are considered very essential.

Moreover, the proliferation of instant food products being sold in the market nowadays continues to threaten the utilization of IFPs which significantly serve as alternative sources of macro and micro-nutrients. Consequently, these IFPs continue to be neglected, underutilized, and are slowly being forgotten leading to the inevitable non-cultivation and propagation of these important plant resources by the present generation of farmers. The present rising younger generation as well, is therefore, becoming unaware of the nutritive and economic value of these indigenous plant resources.

In May 2012, the United Nations organization held a symposium on neglected indigenous food in Thailand, which was attended by representatives of governments, UN agencies, the private sector, academic and research institutions, civil society as well as experts in agriculture, environment, health and nutrition. This symposium encouraged the attendees to "*Go local. Enhance local food security; and maximize the utilization of locally available foods*."

In consideration of the above-cited facts, the researchers commenced a two-phase study on Characterization and Promotion of Underutilized Indigenous Food Plants (UIFPs) in Bayambang,

Pangasinan. Phase I included a survey, documentation, collection of identified UIFPs in the town of Bayambang, Pangasinan, as well as characterization of these UIFPs in the in terms of their growth forms and vegetative parts being used as food. Phase II aimed for the promotion of these UIFP resources among college students for the purpose of making their generation realize how the utilization of these UIFPs can provide food security and nutrition for the communities regardless of their economic status.

METHODS

Research Design

This study made use of the descriptive survey method consisting of three activities: (1) survey, documentation, and collection of the available UIFPs in the different barangays in Bayambang, Pangasinan, Philippines; (2) vegetative and growth characterization of the UIFPs, and (3) promotion of awareness of the UIFPs.

Participants

The survey and documentation on the availability of UIFPs in the different barangays of Bayambang, Pangasinan employed 141 student- respondents enrolled in General Biology and General Botany during the first semester SY 2014-2015. A total of 17 barangays where the student- respondents reside became the source of 15 commonly identified UIFPs. These 17 barangays included: Dusoc, Ataynan, Bacnono, Bical, Malimpec, Tanolong, Sapang, Buayaen, Hermoza, Bongato, Malioer, Ambaya, Inanlorenza, Ligue, Mangayao, San Vicente, and Warding.

The promotion of awareness of the UIFPs employed the BSE students majoring in science and mathematics during the second semester of school year 2015-2016.

Data Collection

Survey, Documentation and Collection of UIFPs

The student-respondents were asked to make a survey in their respective barangays with the assistance of their parents, grandparents and other relatives who are assumed to have knowledge on the available UIFPs in their locality. A simple survey questionnaire was developed to serve as their guide in gathering information about: a) food plants that are available in their locality, b) the local names of these identified food plants, c) where these UIFPs grow, d) plant parts being used as food, and e) how these are prepared or used these plants as food.

Figure 1. *The area in the Science and Math Botanical garden where the UIFPs were propagated for observation and characterization*

Characterization of growth forms and vegetative parts utilized as food

Available samples of these identified food plants were then collected by the researchers thru the assistance of the student-respondents. These identified UIFPs were then grown in an area inside the school campus for purposes of characterization. The characterization is limited to the growth forms of each of these UIFPs, and the description of the vegetative parts that are utilized as food.

Promotion of awareness of the UIFPs

The BSE Science and Mathematics majors were employed as respondents in the promotion of awareness of the UIFPs. Using a questionnaire, their profile in terms of a) age, b) sex, c) residence, d) economic status, and e) specialization was determined and their level of awareness on the availability of the identified UIFPs was also established. Furthermore, the significant difference between the student-respondents profile and level of awareness was also determined. The questionnaire also determined the respondents' preferred method of promoting the UIFPs to the college students.

To promote awareness of the identified UIFPs, the thirty students enrolled in General Botany were required, as part of their course, to develop a recipe using the UIFPs to be introduced in their class. The students were asked to pair themselves and each pair was assigned one UIFP to use in their recipe.

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Table 1. Documentation of IFPs

Scientific name	Common name	How to eat
Mollugo oppositofolia	*papait*	as raw salad or as additive to vegetable recipes
Peperomia pellucida	*pansitpansitan*	
Talinum paniculatum	*taltalinum*	Stems, leaves and flowers can be eaten raw or additive to vegetable recipes
Portulaca oleracea	*ngalog*	
Sauropus androgynus	Chinese *malunggay*	
Amaranthus spinosus/viridis	*sabsabitan/kalunay*	
Acalypha indica	*maraotong*	
Physalis minima	*pantugpantugan*	
Polanisia icosandra	*silisilihan*	
Opuntia cochinillifera	*dilang-baka*	Pads and flowers are peeled and eaten raw, cooked or added to salads
Dregea volubilis	*bagbagkong*	Flowers are cooked as additive to vegetable recipes
Clitoria ternatea	*samsamping*	Pods are cooked as additive to vegetable recipes
Centella asiatica	*takipkuhol*	Leaves are eaten as raw or additive to vegetable recipes
Gynura Procumbens	*purpuriket/ ashitaba*	Leaves are eaten raw as salad.

Data Analysis

Frequency count was used in the survey, documentation and collection activity. The descriptive method was used in the characterization activity. Frequency counts and average weighted mean was used to determine the level of awareness of the UIFPs. A scale of 1-3 was used to indicate level of awareness with the following description: 1 - *not aware* (NA), 2 - *slightly aware* (SA) and 3- *very much aware* (VMA). ANOVA and t-test were employed in determining the significant difference between the students'' profile and their level of awareness of the UIFPs. Frequency counts and percentage was used on the level of palatability and acceptance on the UIFPs as food as well as in the respondents' preferred method of promoting awareness of the UIFPs.

RESULT AND DISCUSSION

Phase I: Survey, Documentation and Collection of UIFPs

There were a total of 141 student- respondents who cooperated in the survey and collection of available UIFPs distributed in the 17 barangays of Bayambang, Pangasinan. A total of 15 species from 12 families were commonly identified in the 17 barangays. These include three Euphorbiaceae species, two Portulacaceae, and one each from Cactaceae, Piperaceae, Asclepiadaceae, Fabaceae, Solanaceae, Caparidaceae, Amaranthaceae, Umbelliferae, and Apeaceae. Most of these UIFPs are found growing as common weeds in roadsides, thickets, rice paddies, in open waste places, and damp grasslands, except for *dilang baka* which is grown as an ornamental plant. Table 1 presents the way these IFPs are prepared or eaten.

Characterization of growth forms and vegetative parts utilized as food

Two of the UIFP species were vines, three have prostrate or spreading growth, nine have erect branched growth, and one is cactaceous. Table 2 presents the characterization of the UIFPs under study while Figure 2 showcases the plants.

Phase II: Promotion of awareness of the UIFPs

There were 218 BSE Science and Math major student-respondents from the Science and Mathematics Department of PSU Bayambang campus. Of these, 8 (3.67%) are chemistry majors 34 (15.6 %) are Physics majors, 46 (21.1%) are Biology majors, 52 (23.9%) are Physical Science majors, 78 (35.78%) Math majors. Their ages ranged from 17-33 years old, 87 (39.9%) were males, 131 (60.1%) were females. 62 (28.4%) resided within the town proper, and 156 (71.6%) resided outside the town proper or in the barangays outside the town proper. 175 (80.3%) belong the "below average" economic status, 42 (19.3%) belong to the "average" economic status and 1 (.4%) belonged to the "above average" economic status.

In terms of the level of awareness of the identified UIFPs, results showed that the respondents are very much aware about *Mollugo oppositifolia* (papait) as food plant.

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Table 2. Identified UIFPs and their vegetative and growth characteristics

Plant Identity	Growth form	Vegetative characteristic of parts used as food
Mollugo oppositifolia (papait) Family: Molluginaceae	Annual, herbaceous, prostrate, 10-40 cm	slender,succulent branched stem, spatulate to oblanceolate leaves, with smooth or entire margin, opposite or whorled arrangement in the stem. white, asympetalous flower with 5 petals.
Talinum paniculatum (taltalinum) Family: Portulacaceae	perennial erect shrub up to 50 cm	green fleshy succulent stem. glossy, bright green Leaves, spatulate to obovate-lanceolate, whorled arrangement in the stem.
Portulaca oleracea (ngalog) Family: Portulacaceae	annual, prostrate growing herb. 10-50 cm	succulent stems, purple-tinged, fleshy, oblong to obovate leaves up to 2.5 cm long with opposite attachment in the stem.
Opuntia cochinillifera (dilangbaka) Family: Cactaceae	perennial erect branched cactus up to 1 to 3 m	fleshy thick leafless stems or pads, oblong-ovate in shape with thick joints, about 15 to 25 centimeters long and may bear small spines
Peperomia pellucida (pansitpasitan) Family: Piperaceae	annual erect annual herb up to 40 cm in height.	very succulent round stems about 5 mm thick, alternate, heart-shaped, smooth and waxy Leaves, very slender green, erect flower Spikes 6mm long
Acalypha indica (maraotong/tapingar) Family: Euphorbiaceae	annual erect, simple or branched plant to a height of 30 to 80 cm	slightly hairy herbaceous stem, ovate leaves up to 6 cm long, with toothed margins and arranged alternately in the stem
Dregea volubilis (bagbagkong) Family: Asclepiadaceae	stout, smooth, woody vine.	The flowers cymes are axillary or grow from the stem nodes, slightly green and umbel-like.
Clitoria ternatea (samsamping) Family: Fabaceae	climbing vine.	The pods are linear,5 to 10 cm long, flat and dehiscent with 6 to 10 seeds.
Amorphophallus campanulatus (Tigi/ pungapung) Family: Araceae	perennial, stemless herb up to more than 1m high	corm root is depressed-globose, up to 30 centimeters in diameter, the stem-like structure is the petiole The leaf blades up to 1 m, trisected each section dichotomous bearing pinnate oblong-obovate leaflets.
Physalis minima (itlog gagamba) Family: Solanaceae	an annual erect, branched herb up to 0.8 meters high	succulent branches are green and cylindrical, ovate leaves with pointed tips, heart-shaped base, undulately lobed margins, round fruit enclosed by continuous calyx that is often purple tinged.
Polanisia icosandra (silisilihan) Family: Caparidaceae	annual erect branched herb up to 1 meter high	Compound Leaves have 3 to 5 leaflets, oblong to oblong-ovate, 1 to 3 cm long. The Flowers are in terminal racemes with the pedicels bearing yellow narrowly obovate petals about 7 to 8 mm long.
Sauropus androgynus (binahian/chinese malungay) Family: Euphorbiaceae	a perennial erect shrub up to 2.5 to 3 meters	leaves are dark green, 2 - 6 cm long, 1.5 to 3 cm wide, usually with pale speckled markings on the upper epidermis.
Amaranthus spinosus/viridis (kolitis/kalunay) Family: Amaranthaceae	erect, branched spiny herb, up to 60 cm height	Ovate leaves, alternately attached in the succulent stem by slightly long petioles, Inflorescences are terminal and axillary, simple or panicled with interrupted spikes.
Centella asiatica (takip kuhol) Family: Umbelliferae	prostrate, creeping, smooth perennial herbs	delicate slender stems arising from the roots and nodes of the stolons. ounded to reniform leaves,up to 2 to 5 cm wide, with palmate venation, and undulate-crenate margins.
Gynura Procumbens (purpuriket/ phil.ashitaba) Family: Asteracea	perennial herbaceous shrub up to 120 cm high	leaves are short stalked, ovate-elliptic or lanceolate in shape, up to 8 cm long, and 0.8 to 3.5 cm wide, with entire or toothed margins.

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Figure 2. Underutilized Indegenous Food Plants: **a.** *Physalis minima* (Itlog-gagamba) **b.** *Talinum paniculatum* (Taltalinum) **c.** *Portulaca oleracea* (ngalog) **d**. *Peperomia pellucida* (Pansit-pansitan) **e.** *Dregea volubilis* (bagbagkong) **f.** *Centella asiatica* (Takip-kohol, takip suso) **g**. *Mollugo oppositifolia* (papait) **h.** *Clitoria ternatea* (samsamping) **i.** *Amorphophallus campanulatus* (Tigi/ pungapung), **j.** *Polanisia icosandra* (silisilihan) **k.** *Sauropus androgynus* (Binahian, Chinese malungay) **l.** *Opuntia cochinillifera* (Dilang-baka) **m.** *Acalypha indica* (taptapingar/Maraotong) **n.** *Amaranthus viridis* (kalunay) **o.** *Amaranthus spinosus*(sabsabitan/kulitis) **p.** *Gynura Procumbens* (purpuriket, Phil.ashitaba) [4]-[10]

Results also indicated that the respondents are slightly aware about four IFPs: *Peperomia pellucida (Pansit-pansitan), Dregea volubilis* (bagbagkong), Sauropus androgynus (Binahian, chinese malungay), and *Amaranthus spinosus/viridis* (sabsabitan/kalunay). Moreover, results also showed that the student respondents are not aware of ten out of fifteen species of identified IFPs. These species include: *Talinum paniculatum* (Taltalinum), *Portulaca oleracea* (ngalog), *Opuntia cochinillifera* (Dilang-baka), Acalypha indica (taptapingar/Maraotong), *Clitoria ternatea* (samsamping), *Amorphophallus campanulatus* (Tigi/ pungapung), *Physalis minima* (Itlog-gagamba), *Polanisia icosandra* (silisilihan), *Gynura Procumbens* (purpuriket, Phil.ashitaba), and *Centella asiatica* (Takip-kohol, takip suso)

The test for the significant difference between the student-respondents' gender profile and their level of awareness of the UIFPs is presented in Table 3. The t-test results showed no significant difference of .097 between the gender of the respondents and their level of awareness which means that their being male or female does not have anything to do with their awareness of the UIFPs

Table 3. t-test of the respondents' gender and level of awareness of the UIFPs

Gender	Mean	Mean Difference	Sig.
Male	1.73	.09764	.097
Female	1.63		

The analysis of variance of the respondents' age profile and level of awareness of the UIFPs is presented in table 4.

Table 4. ANOVA of the respondents' age and level of awareness

Age (years)	Mean Difference	Sig.
18 and below	.17550*	.004
19-20	.12798	.307
21 and above	-.04752	.698

The table reveals that the students aged eighteen years old and below have a higher level of awareness than the students aged nineteen to twenty years old with a significant difference of .004, the respondents aged nineteen to twenty years old also have higher level of awareness that those aged twenty one and older.

The t-test results on the respondents' place of residence and their level of awareness of the UIFPs is shown in Table 5.

Table 5. t-test on the respondents' place of residence and their level of awareness of the UIFPs

Place of residence	Mean	Mean Difference	Sig.
Within Town	1.7734	.14037	.028
Outside town	1.6330		

As can be seen from the table, there is a significant difference of .028 indicating that those who live within the town proper have a higher level of awareness than those living outside the town proper or in the barangays outside the town proper.

Table 6 presents the analysis of variance on the respondents' area of specialization and level of awareness on the UIFPs. It is revealed in the table that the BSE Biological Science majors have a higher level of awareness than the BSE Physics and BSE Mathematics majors with a significant difference of .000 and .001 respectively; the BSE Physical Science majors have higher level of awareness than physics and math majors with a significant difference of .000 for both specializations; the physics, chemistry and math majors have no significant difference in their level of awareness on the UIFPs. These results indicate that the BSE biological science majors are the most aware of the UIFPs. This can be attributed to the fact that these students are more exposed to subjects in their specialization related to plants such as botany, ecology and environmental science.

Table 6. ANOVA of the respondents' BSE specialization and their level of awareness of the UIFPs

Area of Specialization	Area of Specialization	Mean Difference	Sig.
BSE Biological Science	PhySci	-.00694	.932
	Physics	.35946*	.000
	Chemistry	.26277	.089
	Math	.26421*	.001
BSE Physical Science	Physics	.36640*	.000
	Chemistry	.26971	.079
	Math	.27115*	.000
BSE Physics	Chemistry	-.09669	.541
	Math	-.09525	.250
BSE Chemistry	Math	.00144	.992

Table 7 presents the analysis of variance of the respondents' economic status and their level of awareness of the UIFPs. As can be gleaned from the table, there no significant difference between these two variables, indicating that their level of awareness is not affected by their economic status.

Table 7. ANOVA of the students' economic status and their level of awareness of the UIFPs

	Sum of Squares	Df	Sig.
Between Groups	.025	2	.934
Within Groups	39.320	215	
Total	39.345	217	

The student-respondents were also asked what their most preferred method of promoting the awareness of the UIFPs would be. Of the several choices they were given, the respondents chose cultivation of the UIFPs in the community as their preferred method (see table 8).

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Table 8. Most Preferred Way of Promoting Indigenous Food Plants

Methods of promoting awareness of the UIFPs	f	%
Food Tasting exhibit	58	26.7
Through Social Media	28	12.9
Indigenous food plants exhibit	56	25.8
Distribution of flyers of IFPs	4	1.8
Cultivation of IFP garden in school/community	71	32.7

On the development of recipes making use of the UIFPs, the students were able to prepare one recipe out their assigned UIFP. These recipes are: boiled mongo with silisilihan leaves as additive, sautéed kalunay with sliced tomatoes, shitake mixed vegies with taptapingar, boiled black beans with bagbagkong, ashitaba/ purpuriket fried rice, bulanglang with binahian, tomatoe-papait salad, cheesed pansitpansitan, pungapong chips, ngalog omelet, talinum tomatoe salad, sautéed dilangbaka with ground pork, and butterfly pea (samsamping) bibimbop,

SUMMARY OF FINDINGS

There were fifteen identified underutilized indigenous food plants in the seventeen barangays of bayambang pangasinan which are found growing as common weeds in roadsides, thickets, rice paddies, in open waste places, and damp grasslands. These are: *Mollugo oppositifolia* (papait), *Peperomia pellucida (Pansit-pansitan), Dregea volubilis* (bagbagkong), Sauropus androgynus (Binahian, chinese malungay), *Amaranthus spinosus/viridis* (sabsabitan/kalunay), *Talinum paniculatum* (Taltalinum), *Portulaca oleracea* (ngalog), *Opuntia cochinillifera* (Dilang-baka), Acalypha indica (taptapingar/ Maraotong), Clitoria ternatea (samsamping), *Amorphophallus campanulatus* (Tigi/ pungapung), Physalis minima (Itlog-gagamba), *Polanisia icosandra* (silisilihan), *Gynura Procumbens* (purpuriket, Phil.ashitaba),and *Centella asiatica* (Takip-kohol, takip suso). The stems, leaves and flowers are the common vegetative parts of these plants that are either used as additive to vegetable recipes or eaten raw as salads.

In terms of their growth characteristics, two of the identified IFP species grow as vines or liana, three have prostrate or spreading growth, nine have erect branched growth, and one is cactaceous. Most of the identified IFPs are herbaceous, mostly annual and few perennial. The stems, leaves and flowers of the identified IFPs that are utilized as food vary in their characteristics.

There were 218 science and math majors who are distributed in the five BSE specializations namely; BSE biological science, chemistry, physical science, physics, and mathematics with ages ranging from 17-33 years old, 156 of them are living in the different barangays of bayambang pangasinan, and 62 are living within the town proper, most of them belong to the "below average" economic status. Of the 15 identified indigenous food plants, only Mollugo oppositifolia (papait) is very much known to the 218 student respondents. Most of them are only slightly aware of four IFP species namely: *Peperomia pellucida (Pansit-pansitan), Dregea volubilis* (bagbagkong), Sauropus androgynus (Binahian, chinese malungay), and *Amaranthus spinosus/viridis* (sabsabitan/kalunay). All the other identified nine species are not known to the student respondents.

The test for the significant difference between the respondents' profile and level of awareness of the UIFPs revealed that the gender of the respondents does not play a role in their level of awareness of the UIFPs. The results also showed that the younger respondents are more aware of the UIFPs than the older respondents. In terms of their place of residence, results revealed that those who are living within the town proper are more aware of the UIFPs than those living in the barangays outside the town proper. of the five areas of BSE specializations in the science and math department, the BSE biological science majors are the most aware of the UIFPs. Furthermore, results of the study also indicated that the economic status of the student- respondents does not have anything to do with their level of awareness of the UIFPs.

RECOMMENDATION

The lack of awareness of the student-respondents on the UIFPs as revealed in the study needs to be addressed not only for the sake of saving the world's underutilized indigenous food plant resources but most importantly to preserve the nutrient-rich foods that can be readily availed by all regardless of age, gender or economic status. The researchers therefore recommend that more activities to promote not only awareness but also utilization of the identified UIFPs. Extension activities to the schools and in the barangays are appropriate to promote awareness and utilization of the identified UIFPs. Activities such as cookfests, foodtasting, and other similar activities can be organized featuring the different UIFPs. Furthermore, additional researches may be conducted in the discovery of other indigenous food plants.

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