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Fern and fern allies as non-timber forest product in Baler, Aurora, Philippines

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Abstract Ferns are group of vascular plants with fibrous roots and green leaves which belongs to Phylum Pteridophyta. They are well known to thrive in moist and shady forests. Due to the topographic configuration, abundant forest resources and the tremendous amount of rainfall it receives, the province of Aurora, Philippines provides a large number of different varieties of ferns. Aside from maintaining the biodiversity, ferns are commonly used as a source of medicine, food, ornamentals, as sources of fiber, bioremediation, and as organic material. It is therefore of utmost importance to conduct inventory studies regarding the different fern species thriving in the province as well as determine their local utilization to create a baseline data for future studies. The study revealed a total of thirty (32) pteridophytes, belonging to sixteen (16) families and twenty-two (22) genera. Local names were provided by the locals but were not used for the identification. Athyriaceae and Nephrolepidaceae recorded the highest number of species with four (4) representatives each, followed by Lygodiaceae, Polypodiaceae, and Pteridaceae with three (3) representatives each. Collected fern and fern allies were mainly used as food and sold in the market, medicine, needed materials in making handicrafts and used for their aesthetic value. The result of the study showed that the province of Baler, Aurora, Philippines hosts a variety of fern species and also has reflected the diverse culture of people in the utilization of pteridophytes in the province. The research finding would become a basis for a more in-depth study about ferns since they are not well studied in our country in terms of their, medicinal, pharmaceutical and nutritional value.

Keywords: Aurora, Biodiversity, Pteridophytes, Edibility

Introduction

Along the eastern portion of Sierra Madre Mountains, lies the province of Aurora. Its topographic configuration and its abundant forest resources (230,000 hectares or 70% of forest land area) made it possible to grow a vast quantity of plants and ferns are included.

Pteridophytes, mostly considered as the ferns and fern allies are vascular plants that have fibrous roots and green leaves. The method of reproduction made

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them strongly distinguished from other plants because instead of producing seeds they reproduce by making spores (Delos Angeles and Buot, 2012). Fern and fern allies being the second largest group of vascular plants, make an important contribution to the earth's plant diversity as they form a significant and dominant component of many plant communities (Benjamin, 2011). In the Philippines, there are about 1,100 species of ferns distributed among 154 genera and 34 families, according to recent classifications which have been reported to be present (Amoroso *et al.,* 2009; Barcelona *et al.,* 2013). However, only thirty-two (32) fern families are documented based on published materials and herbarium specimens (Delos Angeles and Buot, 2012).

Economically, ferns are not as important as seed plants but have significant importance. Some ferns are used for food because they are edible such as vegetable fern, fiddlehead of bracken, and cinnamon fern (Balyegan *et al*., 2012) and the whole plants of *Pterisen formis* (Mannan *et al*., 2008). *Microsorum* genus like "*Metuapua'a*" is good for aesthetic medicine (Fernández *et al*., 2010; Delos Angeles 2012 and Buot, 2007). Fern in genus Azolla such as mosquito fern, duck wood fern, fairy moss and water fern are used as biological fertilizer (Balyegan *et al*., 2012). In the Carbon Market, Cebu City, Philippines, *Lycopodium cernuum* L., *Gleichenia truncate*, *Nephrolepis exaltata* and *Nephrolepi cordifolia* are sold at the market and are used in flower arrangement. Pteridophytes sold at small stores in Sinoloan, Laguna and Real, Quezon as form of livelihood by local people. Giant staghorn fern, an ornamental fern is widely utilized for dyes, fibers, crafts, and building material in Mindanao (Catapang, 2012).

Edible fern locally known as "pako" is an ingredient of the famed native delicacy called the "pako salad". These edible ferns are commonly found in moist and shady part of coconut plantation and forest land areas in Baler, Aurora, Philippines. The rich resource of ferns adds to the peoples' source of income by selling it in the market and as source of food. Aside from providing source of food and income, they are also found to provide fiber, crafts and building material, abrasives (Srivasta, 2007) and biological fertilizer (Balyegan *et al.,* 2012). Ferns also possess medicinal and aesthetic value (Mustacisa, 2016).

Aurora province offered opportunities in research especially in species identification and composition. It was therefore of utmost importance to conduct the research project because it presented the prospects on the formulation of actions for its conservation and is determined their folkloric utilization to create baseline data for future studies.

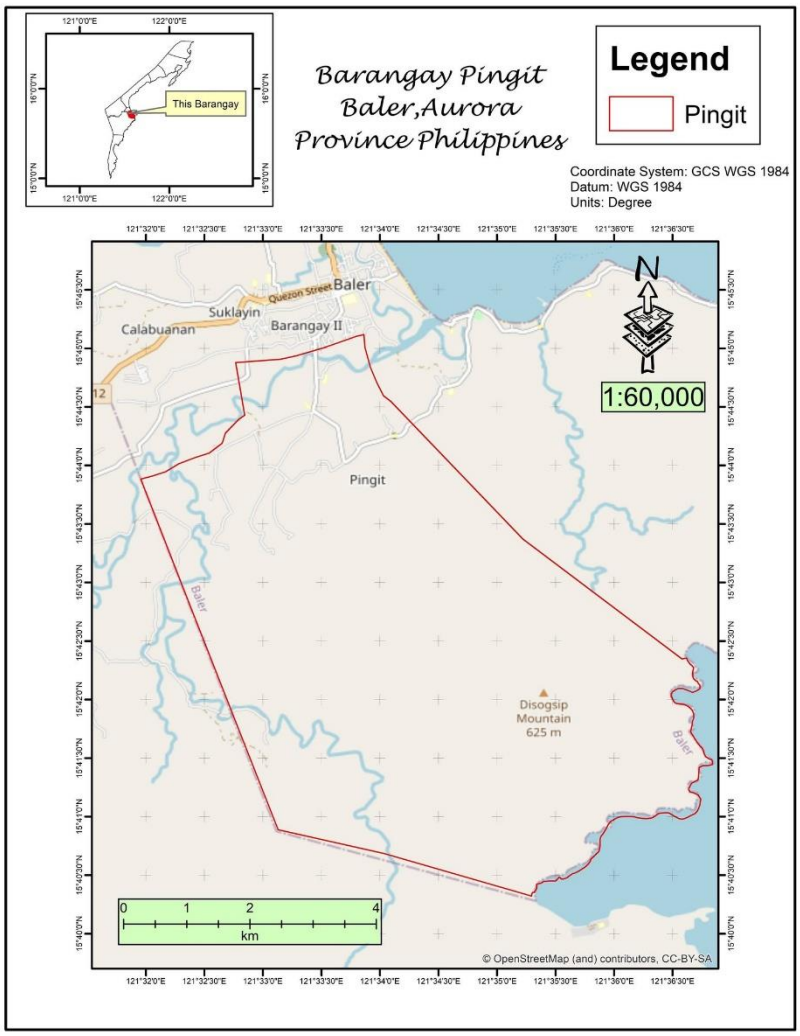

Figure 1. Location Map of Study Area

Materials and methods

Study site and respondents

The study site is in the mountainous area of Sitio Dipanamianan located in Brgy. Pingit, Baler, Aurora, Philippines. Geographical coordinates are 15 °41' 27" North, 121 °36' 21" East. Baler, the capital town, is a second class municipality in the province of Aurora, Philippines (Figure 1).

The community living in the area served as the respondents of the study. They are directly involved in the collection and utilization of ferns and fern allies

and were selected based on their knowledge and availability. Twenty respondents participated in the survey.

Survey questionnaire and interview

A questionnaire was developed for the survey to generate information about the utilization of ferns in the aspects of their lives. This was prepared in Filipino since the respondents are fluent in the language. The data of the survey and interview were summarized.

Collection and preservation of specimen

Collected specimens were tagged and labeled. After collection, specimens were soaked in 70% ethanol for 5-10 minutes to prevent bacterial contamination. After soaking, the plant samples were air dried for 5- 10 minutes. Fixation of tissue was done using 70% denatured alcohol which arrests the activity of abscissic acid to prevent the falling off of leaves and other parts of the plant (Guevara, 2005). The plants were dried and preserved into herbarium specimens. Finally, it was mounted in a standard size bristol board and labeled accordingly.

Identification of specimen

Identification of specimen was based on the structure and arrangement of the reproductive parts of the sporophyte which were the sori and the sporangia (Croft, 1999). Bases of identification also include the habitat, rhizome, branching of fronds, stipe, leaf arrangement, pinna, sori, shape of sori, margin, color and surface (Van Steenis and Holttum, 1982). Identification was done at the Department of Forestry and Environmental Sciences, Aurora State College of Technology, Baler, Aurora, Philippines. The identification of specimen is verified in the National Museum of the Philippines.

Results

A total of thirty-two (32) fern species were recorded (Table 1) from the study area belonging to sixteen (16) families and twenty-two (22) genera. Local names were provided by the locals but were not used for the identification. Athyriaceae and Nephrolepidaceae recorded the highest number of species with four (4) representatives each, followed by Lygodiaceae, Polypodiaceae, and Pteridaceae with three (3) representatives each.

Collected fern and fern allies were mainly used as food and sold in the market, medicine, used in making handicraft and used for their aesthetic value.

Out of thirty-two (32) collected species nineteen (19) are ornamentals, five (5) are used as food and sold in the market, four (4) are used in making handicrafts and three (3) are used as medicine.

Table 1. List of identified Ferns and Fern-allies in Sitio Dipanamianan located in Brgy. Pingit, Baler, Aurora, Philippines

Family Name	Scientific Name	Common Name	Uses
Aspleniaceae	*Asplenium nidus* L.	Pasgak	Ornament (garden)
	Asplenium antiquum Makino	Pasgak na pino	Ornament (garden)
Athyriaceae	*Diplazium pycnocarpon* (Spreng.) M. Broun	Sugargar	Ornament (decoration in wedding, birthday, graduation and burial)
	Diplazium esculentum (Retz.) Sw.	Pakong patag	Food and sold in the market
	Diplazium molokaiense W.J. Rob.	Pakong bundok	Food and sold in the market
	Deparia acrostichoides (Sw.) M. Kato	Pakupak	Ornament (decoration in wedding, birthday, graduation and burial)
Blechnaceae	*Stenoclaena milnei* Underw.	Agnaya	Food, Handicraft (basket, chair and hammock)
	Stenoclaena palustris (Burm.f.) Bedd.	Diliman	Food, Medicine
Cibotiaceae	*Cibotium schiedei* Schltdl & Cham.	Pakong bundok (maliit)	Food
Cyatheaceae	*Cyathea contaminans* (Wall. ex Hook.) Copel.	Pakong buwaya	Medicine (cure wounds), Ornamental (water shed, orchid's base)
Cystopteridaceae	*Gymnocarpium dryopteris* (L.) Newman	Bugayong	Ornament (decoration in wedding, birthday, graduation and burial)
Dennstaedtiaceae	*Microlepia speluncae* (L.) T. Moore	Pakong kalabaw	Ornament (covering other vegetables)
	Pteridium aquilinum (L.) Kuhn	Sakti	Ornament (water shed)
Dryopteridaceae	*Arachniodes aristata* (G. Forst.) Tindale	Pakupak	Ornament (decoration in wedding, birthday, graduation and burial)
Gleicheniaceae	*Dicranopteris linearis* (Burm. f.) Underw.	none	none
Lygodiaceae	*Lygodium japonicum* (Thunb.) Sw.	Nitong pula	Handicraft (basket, chair, hammock)
	Lygodium auriculatum (Willd.) Alston	Nitong baging	Handicraft (basket, chair, hammock)
	Lygodium circinnatum (Burm. f.) Sw.	Nito	Handicraft (basket, chair, hammock)
Marattiaceae	*Angiopteris evecta* (G. Forst.) Hoffm.	Pakong buwaya	none

Table 1. (Con.)

Family Name	Scientific Name	Common Name	Uses
Nephrolepidaceae	*Nephrolepis biserrata* (Sw.) Schott	Pakong jumbo	Ornament (decoration in wedding, birthday, graduation and burial)
	Nephrolepis brownii (Desv.) Hovenkamp & Miyam	Pakong brownies	Ornament (decoration in wedding, birthday, graduation and burial)
	Nephrolepis exaltata (L.) Schott	Overflow	Ornament (decoration in wedding, birthday, graduation and burial)
	Nephrolepis cordifolia (L.) C. Presl	Sugargar na puti	Ornament (decoration in wedding, birthday, graduation and burial)
Polypodiaceae	*Microsorum punctatum* (L.) Copel.	Pasgak na lalaki	Ornament (decoration in wedding, birthday, graduation and burial)
	Drynaria quercifolia (L.) J. Sm.	Pakpak lawin	Ornament (lantern), Medicine (cure bleeding)
	Pyrrosia piloselloides (L.) M.G. Price	Kuto-kuto	Medicine (remedy to wounds, boils, lump, lymp node, sponge bath and illness like ulcer)
Pteridaceae	*Pteris* sp.	Pakong bundok (malaki)	none
	Pteris tripartita Sw.	none	none
	Adiantum sp.	none	Ornamental (garden)
Selaginellaceae	*Selaginella plana* (Desv. ex Poir.) Hieron.	none	Ornament (decoration in wedding, birthday, graduation and burial)
Thelypteridaceae	*Cyclosorus heterocarpus* (Blume) Ching	Pakupak	Ornament (decoration in wedding, birthday, graduation and burial)
	Sphaerostephanos unitus (L.) Holttum	Pakong kalabaw	Ornament (decoration in wedding, birthday, graduation and burial)

Fern species such as *C. contaminans* (Figure 2A), *P. piloselloides* (Figure 2B), and *S. palustris* (Figure 2C) are used as medicine as remedy to wounds, boils, lump, lymp node, sponge bath and illness like ulcer. Fern species categorized as ornament are utilized mostly for decoration in weddings, birthday, graduation, burial, lantern, used as base in orchids and plants in the garden and water shed these species are *A. nidus*, *A. antiquum*, *D. pycnocarpon*, *D. acrostichoides*, *G. dryopteris*, *M. speluncae*, *P. aquilinum*, *A. aristata*, *N. biserrata*, *N. brownii*, *N. exaltata*, *N. cordifolia*, *M. punctatum*, *D. quercifolia*, *Adiantum* sp., *S. plana*, *C. heterocarpus*, *S. unitus*. Ferns under the family Lygodiaceae namely *L. japonicum*, *L. auriculatum*, and *L. circinnatum* (Figure 2D) are used in the community in making handicrafts like wooden chair, basket and hammocks. Along the economic uses of the collected species, fiddlehead of

ferns is also eaten and sold in the market these are *D. esculentum* (Figure 2E), *D. molokaiense*, *S. milnei*, *S. palustris*, and *C. schiedei*. Species such as *D. linearis*, *A. evecta*, *P. tripartita*, and *Pteris* sp. have no known uses in the community. Some pteridophytes also serves double purpose like *S. milnei* for food and handicraft, *S. palustris* for food and medicine, and *C. contaminans* for medicine and ornamental.

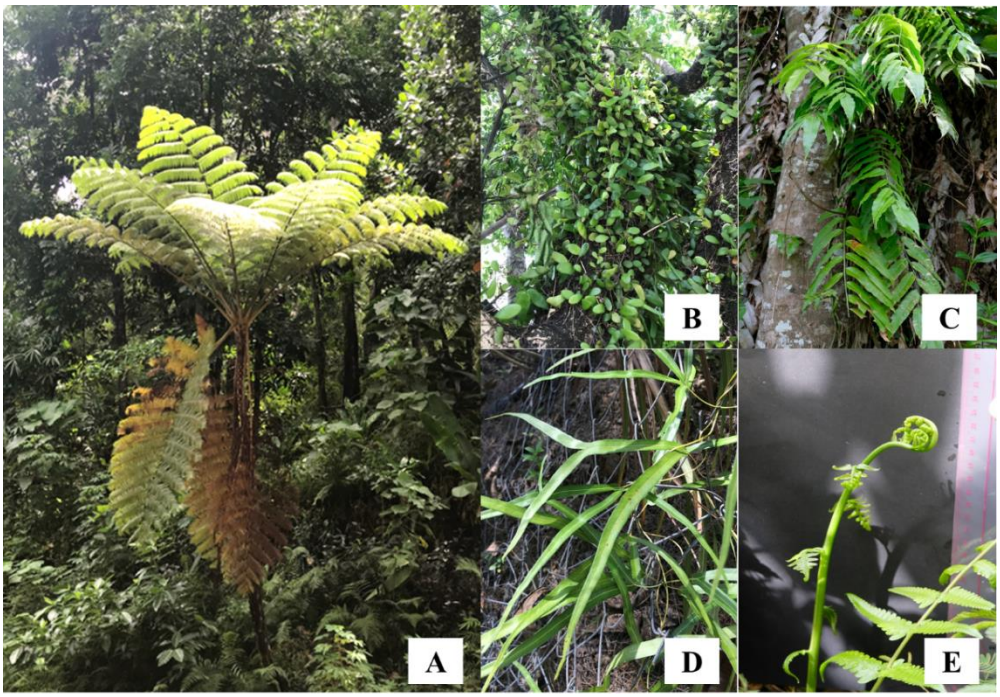

Figure 2. (A) *Cyathea contaminans* (Wall. ex Hook.) Copel., (B) *Pyrrosia piloselloides* (L.) M.G. Price, (C) *Stenoclaena palustris* (Burm.f.) Bedd., (D) *Lygodium circinnatum* (Burm. f.) Sw., (E) *Diplazium esculentum* (Retz.) Sw

Discussion

According to a recent classification of pteridophytes, there were 1,100 species of ferns and lycophytes distributed among 154 genera and 34 families and only 32 fern families were documented to be present in the Philippines (Delos Angeles and Buot, 2012). The abundance of pteridophytes species in the mountainous area of Sitio Dipanamianan located in Brgy. Pingit, Baler, Aurora, Philippines offers the richness of fern biodiversity in the community.

Pteridophytes do not only provide aesthetic qualities but it also utilized as native delicacy and medicine. Fern species are used for their ornamental value and are utilized mostly for decoration in weddings, birthday, graduation, burial,

lantern, used as base for orchids and plants in the garden and water shed. The locals in the community had their faith on medicinal ferns as.

Many studies found out that ferns have medicinal properties (Zamora, 2007). Some of these include the *Achrostichum aureum*, the paste created from its rhizome heals wounds, boils and used as anthelmintic. Its fertile fronds are used to treat syphilitic ulcers and its fronds are used as an antifungal agent. The frond extracts of *Adiantum caudatum* are effective in wound healing. The rootstock of *Asplenium nidus* is good for fever and elephantiasis, as an emollient, in cough and chest disease. *Christella parasitica* is used in treating gout and rheumatism. The remedy to wounds, boils, lump, lymp node, sponge bath and illness like ulcer rhizome of *Drynaria quercifolia* heals wounds and boils and also used as anthelmintic. Its rhizome is antibacterial, anti-inflammatory, tonic, and in the treatment of typhoid fever. The extract of *Microsorum punctatum* are purgative, diuretic and for healing wounds. The rhizome of *Pteridium aquilinum* is an astringent, anthelmintic and it is useful in diarrhea and for inflammations in the gastric and intestinal mucous membranes. The fronds of *Pteris cretica* have an antibacterial property and its paste is applied to wounds. The plant extract *Pteris vittata* is a demulcent.

The fiddlehead of edible ferns was utilized as vegetable, and sold to local market to earn a living. One of the well-known edible species of fern in Baler, Aurora is *Diplazium esculentum* (Figure 2E), locally known as "pako" is an ingredient of the famed native delicacy called the "pako salad" eaten with red eggs, tomatoes and onion. Some research studies advertised that most of the ferns were considered as edible particularly fern species in the family Aspleniaceae and Athyriaceae. According to the study of Maroyi (2014), the majority of edible pteridophytes are eaten as vegetables or potherbs with some eaten raw or salad. Fern species like *D. esculentum, D. sammatii, N. biseratta, N. cordifolia* and *O. polyphyllum* under Athyriaceae, Nephrolepidaceae and Ophioglossaceae families were reported to have a high nutritional value and an important source of macro and micro nutrients. These edible ferns can serve as food and alternative source of nutrients of the locality. This local knowledge is very useful as an alternative source of income for down turn people.

Pteridophytes are utilized for different purposes. Fern and fern allies in Aurora have seasonal growth thus there is a need to sustainably cultivate, utilize and preserve the rich resource of fern not just in the locality but also all over the province for continuous production throughout the year. The government should create programs that should be adopted by the locals in order to prevent over exploitation of species. The intervention is necessary in order to educate the people regarding the ill effect of loss of species from the habitat. This study will become a basis for a more in-depth study about ferns since they are not well

studied in our country in terms of their, medicinal, pharmaceutical and nutritional value.

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