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Research Note:

Floristic inventory of monocots in Mt. Pangasugan, Baybay, Leyte, Philippines

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ABSTRACT

Mt. Pangasugan which lies up to an elevation of 1,158 m ASL on the western slope of the Central Cordillera of Leyte is one of the unexplored mountains. Since directory of Philippine flora is still incomplete, a floristic inventory of the country's remaining forest is imperative. The study was conducted to provide a checklist of existing monocot flora in Mt. Pangasugan.

A total of 76 species belonging to 14 families and 51 genera were recorded. Family Araceae had the most number of genera while Family Palmae had the most number of species.

Keywords: flora, floristic composition, rainforest

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INTRODUCTION

Mt. Pangasugan lies on the western slope of the Central Cordillera of Leyte in Eastern Visayas (Figure 1). Its highest elevation of 1, 158 m ASL is situated at the western boundary of an area of primary forest that is 150 km^2 km. or more in extent (Heaney *et al*. 1989). This mountain has one of the few remaining forests in the Philippines that provide a home to a very diverse form of micro and macro animals (Margraf and Milan 1995).

Most botanical collections are situated in Luzon island (Madulid and Guttierez 1981) and those which need botanical exploration are the interior mountains of Mindanao and limestone forests of Samar and Leyte (Tan and Rojo, 1987). Mt Pangasugan is an unexplored mountain in the island of Leyte.

Until today the directory of Philippine flora is still incomplete. Herein lies the importance of conducting more floristic inventories of the country's remaining rainforest. Conservationists have exerted pressure on all disciplines of biology particularly taxonomy to take stock or to make inventory of the earth's species before they disappear. Conservation also cannot proceed without a thorough understanding of the components of the ecosystem that are being preserved. Therefore, inventory is requisite to conservation, particularly in tropical forests where many threatened species remain undescribed.

This paper provides a checklist of the monocotyledonous flora in Mt. Pangasugan before they become instinct.

MATERIALS AND METHODS

Description of the study site

Climate

The climate of Mt. Pangasugan is characterized as humid tropical monsoon with no pronounced maximum rain period and no dry season (Type 4 of the Coronas climate classification). Records from the Agrometeorological station at VSU showed an average annual rainfall of 2,600 mm in the coastal

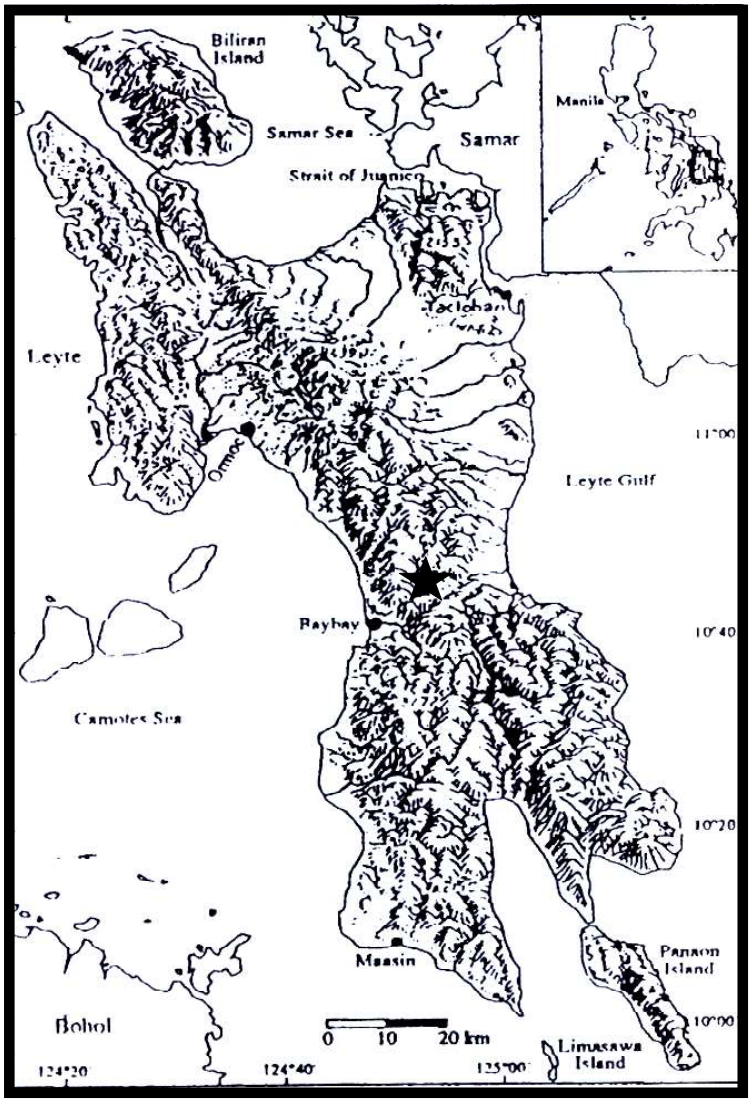


Figure 1. Map of Leyte island with an approximate position of Mt. Pangasugan indicated by a star

plain and more than 3,000 mm in the mountains. Temperature decreases by 0.6 °C per 100 m rise in elevation and it is estimated that at 500 m elevation in Mt. Pangasugan, temperature could be 24 °C (Asio, 1996).

During the conduct of the study, environmental variables such as temperature, relative humidity and light intensity were gathered from different sites. However, these data were obtained at different times of the day and on different days since measurements were done during the sampling of monocot species. It was observed that the temperature of the four sites in the western side of Mt. Pangasugan ranged from 23°C to 29°C. The temperature at the lower elevations (Site 1) had an average of 29.86 °C while Sites 2 and 3 varied only slightly between 27.5°C and 27°C, respectively. There was a relative decrease in temperature to 23°C near or at the summit (Site 4).

Relative humidity (RH) varied very slightly at all sites and ranged from 73% (Site 1) to 85.5% (Site 4). RH of 79% and 78.25% prevailed in Sites 2 and 3, respectively. Light intensity, on the other hand, was low at the lower elevation (Site 1 = 25.57 foot-candles and Site 2 = 57.63 foot-candles) while at higher elevations, it was comparably higher at 107.5 foot-candles (Site 3) and 76 foot candles (Site 4).

Geology and soils

The geology of Mt. Pangasugan is dominated by andesitic and basaltic pyroclastics ranging in age from Pliocene to Holocene. They commonly occur as volcanic agglomerates and pyroclastic breccia referred to as Pangasugan formation (Asio, 1996).

Soils were collected from the rooting depth of most tropical plants, which is 0-20 cm from the surface. Chemical analyses of composite soil samples taken at random per site revealed a slightly acid to near neutral soil condition. Site 1 had a pH value of 5.70 while Sites 2, 3 and 4 had 5.36, 5.40 and 6.30, respectively. The level of organic matter (OM) in the soil affects soil pH, nutrient availability and activity of soil organisms. Burnham (1975) reported that in the process of OM decomposition, organic acids are produced in large amount which could bring the pH of the soil to acidic level. It was observed that OM content of 10.50% in Site 1 increased to 15.50% and 22.75% in Sites 2 and 3, respectively. In site 4, OM content markedly dropped to 4.97%.

Soil nitrogen (N) increased from 0.41 % in Site 1 to 0.50% in Site 2 and 0.79% in Site 3. It abruptly dropped to 0.25% in Site 4. Troeh and Thompson (1993) reported that N in soil is mineralized as a result of the decomposition of complex organic compounds from the plant residues. From this, it could be inferred that higher OM would also yield high levels of soil N.

Available phosporus (P) in the soil is highest in near neutral pH (Troeh and Thompson, 1993). Soil available P was highest in Site 4 (3.02 ppm) having a soil pH value of 6.3. In Sites 1, 2, and 3 where the soils had low pH values, lower amounts of available P (2.15- 2.88 ppm) where observed.

Potassium (K), on the other hand, showed a decreasing trend from Site 1 (507.35 ppm), Site 2 (420.28 ppm) to Site 3 (353.66 ppm) and relatively increased to 1264.87 ppm in Site 4.

Vegetation

Langenberger *et al.* (2006) recorded a total of 685 vascular plant species found in Mount Pangasugan, which belonged to 289 genera and 111 families. Fifty percent of the species identified are endemic to the Philippines. Rubiaceae, Euphorbiaceae, Araceae, and Arecaceae were the most common families.

Based on visual observations during the reconnaissance survey, secondary growth forest dominated the lower elevations (near sea level to 300m ASL). Much of the Dipterocarp species dominated the middle elevations (300-900m ASL). However, between 900m ASL and the summit (1,158m ASL), the vegetation cover was not surveyed due to the very steep slope which made it inaccessible. Thus, observations were only made starting at 1,097m ASL to 1,158m ASL, which is the summit of Mt. Pangasugan. In the summit, mosses (*Bryophyta*) dominated the area and formed a dense carpet-like floor indicating it was of the mossy forest type.

Selection of sampling sites

A reconnaissance survey was first conducted at various sites in Mt. Pangasugan to identify representative sampling sites. Four sites at intervals of 300m ASL represented the different altitudes: Site 1 (91m - 300m ASL), Site 2 (301-600m ASL), Site 3 (601-900m ASL), and Site 4 (901m - 1,158m ASL). Site selection was based on homogeneity of vegetation and absence of

signs of undisturbance (i.e. it should be an undisturbed area). Sampling was also limited to the western side of the mountain (Figure 2). Homogenous vegetation refers to more or less natural and uniform vegetation. Undisturbed area is one with natural vegetation and shows no sign of human activity such as tree planting.

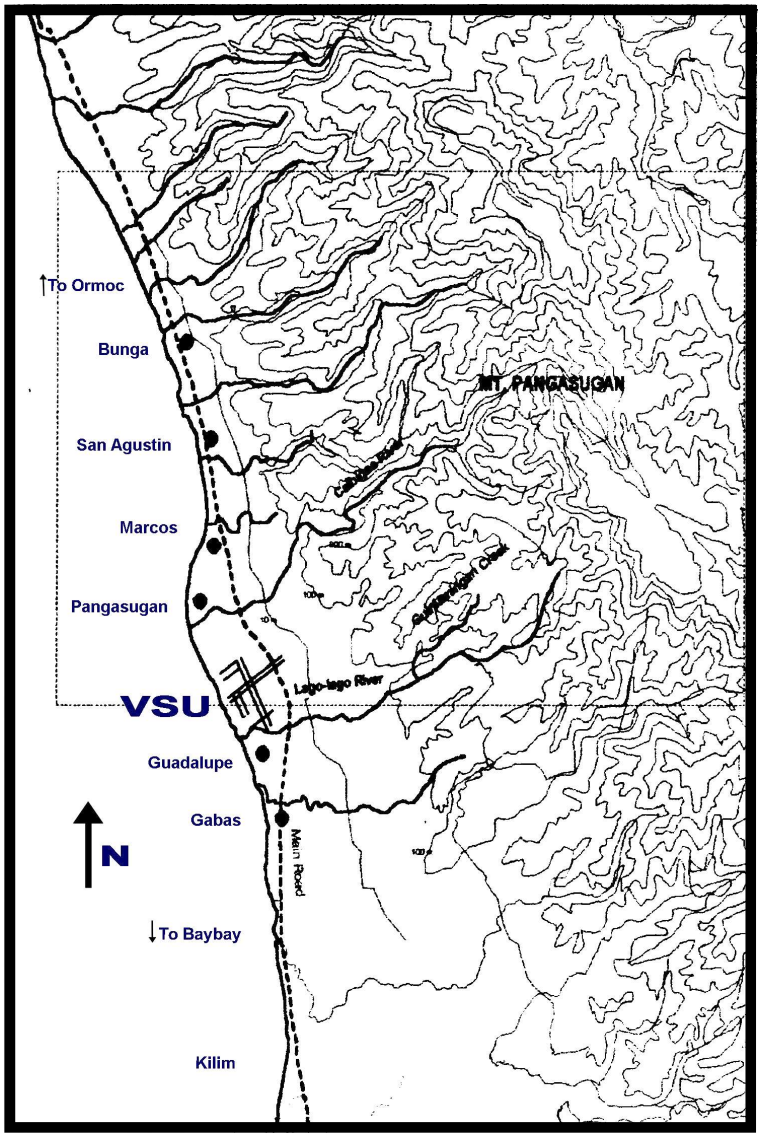
Sampling

Sampling was done using the Belt transect method. This involved laying out at least 20 transects of 25 m × 4 m upslope at approximately equal spacing with each sample site. A total of 32 quadrats with dimensions of 4 m × 4 m and 1 m × 1 m were systematically placed across the sampling area at each site. The entire transect served as the sampling areas for trees while the other 2 quadrats were the sampling area for shrubs and herbs, respectively.

Also monocotyledonous species intercepted in every quadrat were listed and counted. Representative samples of species tallied were collected and prepared into herbarium specimens. For thorough examination, photos were taken and illustrations were made (Figure 4). Herbarium specimens are being kept at the Herbarium, DPBAB, VSU, Baybay, Leyte and at the UPLB Museum of Natural History Herbarium, College, Laguna, Philippines.

Identification

Traditional methods of identification were used: a) expert determination using floras and manuals, b) recognition based on extensive past experiences of identifying plant groups in question, c) comparison of unknown with named specimens, photographs, illustrations or descriptions, d) use of growth habit of plants, leaf arrangements and other vegetative characters and plants identified using this method are usually up to genus only due to lack of reproductive structures. Some sterile specimens were identified using the first 3 methods mentioned above. Some of the references used during the identification of the monocotyledons collected were the following: Enumeration of Philippine Flowering Plants (Merrill, 1967), Flora of Manila (Merrill, 1912), Philippine Ornamental Plants (Steiner, 1986), Orchids of Java (Comber, 1990) and Philippine Orchids (Valmayor, 1981).



(Adapted from NAMRIA, ATEP, GIS and DASS)

Figure 2. Map of Mt.Pangasugan

A

B

Pandanaceae. A) Flower and B) Fruits of *Freycinetia multiflora* Merr. An endemic species in the Philippines

C

Pandanaceae. C) Growth habit and fruits of *Freycinetia vidalii* Hemsl.

D

E

Araceae. D) Growth ahbit and E) close-up view of *Homalomena philippinensis* Engl. Found to be 3rd most abundant species in Mt. Pangasugan and endemic to the Philippines

Figure 3. Some samples of monocotyledonous species in Mt. Pangasugan

F

G

Araceae. F) Growth habit and G) close-up view of *Schismatoglottis calyptrata* (Roxb.) Zoll. & Mor. This constitutes 2nd most abundant species in Mt. Pangasugan and reported to be mostly found in Leyte and Samar

H

Zingiberaceae. H) *Languas haenki* (Presl.) Merr. This is 4th most abundant species in Mt. Pangasugan

I

Orchidaceae. I) *Coelogyne asperata* Lind. Reported to be mostly found in Leyte and Samar

J

Marantaceae. J) *Phacelophrynium interruptum* Schum. Endemic species to the Philippines

K
Marantaceae. K) *Phrynium philippiense* Ridl. Endemic species to the Philippines

L
Palmae. L) *Areca ipot* Becc. Endemic species to the Philippines

M
Graminaea. M) Spike of *Scleria scrobiculata* Nees. The most abundant species in Mt. Pangasugan

RESULTS AND DISCUSSIONS

Table 1 shows the list of monocotyledons collected and their respective number of individuals in the different sites. The monocot population was relatively high in the lower and middle altitudes than at sites near or at the summit. This suggests that difference in species distribution across sites is due to varying habitat type.

Floristic composition and distribution of monocot species at different sites in Mt. Pangasugan are also affected by altitude. This could also be due to differences in climatic and edaphic conditions with the change in altitude (Beaman & Beaman, 1990). Such pattern of distribution along gradients of altitude suggests differences in adaptation of different monocot species to varying niche and habitat type.

Other ecological factors influenced by elevation were temperature, soil, species association, dispersal biology and man's activities. These parameters are important for further correlation studies of monocotyledonous species found at different altitudes. A total of 516 monocotyledonous plant representing 51 genera, 76 species belonging to 14 families (Table 2) had been recorded in the study area.

Araceae comprised the most number of genera followed by Orchidaceae, Zingiberaceae, and Palmae. Commelinaceae and Marantaceae were similar in number of genera (4) while Gramineae and Cyperaceae are the same at 3 genera. Pandanaceae, Liliaceae and Dioscoreaceae have 2 genera each and the least were observed in Musaceae, Hypoxidaceae and Apostasiaceae. The family Palmae or Arecaceae had the highest number with its species followed by Araceae having 13 species and Zingiberaceae with 10 species. The family Orchidaceae, Commelinaceae and Pandanaceae were represented by a relatively the same number of species (6-7) while Cyperaceae, and Musaceae are similar at three species each. Families Hypoxidaceae and Apostasiaceae had the least number of species. In the recent inventory done by Langenberger *et al*. (2006), members of Araceae and Arecaceae families were among the most common families found in Mount Pangasugan while Orchidaceae were poorly represented. However, in other vascular flora such as in Singapore, members of the monocots belonging to families Orchidaceae, Gramineae, and Cyperaceae are the most abundant (Turner, 2008).

Table 1. Checklist of monocotyledons in Mt. Pangasugan found at different sites

Plant Species	Family	Site			
		1	2	3	4
Schizotachyum diffusum (Blco.) Merr.	Gramineae	2	2	1	
Raphidophora Hassk.	Araceae		1		
Languas haenkei (Presl) Merr.	Zingiberaceae	3	14	1	
Scleria scrobiculata Nees.	Cyperaceae		12	3	6
Amydreum medium (Z & M) Nichols	Araceae		1		
Cyanotis cristata (Linn.) R. & S.	Commelinaceae		1		
Calanthe furcata Batem. (C. triplicata)	Orchidaceae		1		
Kolowratia elegans Presl.	Zingiberaceae		2		
Aglaonema oblongifolium (Roxb.) Kunth.	Araceae	5	2		
Rhaphidophora pinnata (L. F.) Schott.	Araceae	2	1		
Pothoidium lobbianum Schott.	Araceae		1		
Dioscorea pentaphylla Linn.	Dioscoreaceae	1			
Homalomena philippinensis Engl.	Araceae	10	3	1	
Molineria capitulata (Lour.) Herb.	Hypoxidaceae	3	8		
Phacelophrynium interruptum (Warb.) K. Schum	Marantaceae	4	3		
Musa balbesiana Colla	Musaceae	2			
Donax cannaeformis (Forst.) K. Schum.	Marantaceae	6	4		
Stenomeris discoreaefolia Planc.	Dioscoreaceae	1			
Schismatoglottis calyptrata (Roxb.) Zoll. & Mor.	Araceae	10	1		
Phrynium philippinense Ridl.	Marantaceae	2	1		
Calamus ornatus Blm.	Palmae	1			
Pinanga maculata Porte	Palmae	6	3		
Dictyospermum vitiense (Seem.) JKM	Commelinaceae	5	1		
Languas illustris (Ridl.) Merr.	Zingiberaceae	1	2	1	
Schizostachyum lima (Blco.) Merr.	Gramineae	1			
Heterospathe philippinensis Becc.	Palmae	3		2	1
Pollia secundiflora (Bl.) Bakh.	Commelinaceae	5			
Globba marantina Linn.	Zingiberaceae	1	2	3	
Forrestia hispida Less. & A. Rich.	Commelinaceae	6			
Costus speciosus (Koenig.) Sm.	Zingiberaceae	4			
Pandanus mapola Martelli	Pandanaceae	1			
Caryota cumingii Lodd.	Palmae	4	2		
Kolowratia congesta (Elm.) Merr.	Zingiberaceae	1	1		
Alocasia zebrina C. Koch and Veitch	Araceae	3	1	1	
Pollia macrophylla Benth.	Commelinaceae	1			
Musa textilis Nee.	Musaceae	2			
Musa acuminata Colla	Musaceae	1			
Pandanus Linn.	Pandanaceae	1	2		
Areca ipot Becc.	Palmae	1	1		
Alocasia heterophylla (Presl) Merr.	Araceae	2	4	1	
Freycinetia multiflora Merr.	Pandanaceae	1			
Gigantochloa laevis (Blco.) Merr.	Gramineae	1			
Pollia thyrsiflora Blm.	Commelinaceae	2			
Galeola philippinensis Ames	Orchidaceae	1			
Cyrtococcum oxyphyllum (Steud.) Stopf.	Gramineae	1			
Areca catechu Linn.	Palmae	1			

Table 1. Continued...

Plant Species	Family	Site			
		1	2	3	4
Alocasia pubera Schott	Araceae		1		
Spathiphyllum commutatum Schott	Araceae		1		
Catimbium speciosum (Wendl.) Holtt.	Zingiberaceae		5	1	
Calamus maximum Becc. (fr. C. Merrillii)	Palmae		1		
Pinanga insignis Becc.	Palmae		1	1	
Freycinetia vidalii Hemsl.	Pandanaceae		1		
Freycinetia negrosensis Merr.	Pandanaceae		2		
Calamus sp.	Palmae		2		
Calamus sp.	Palmae		2		
Spathoglottis Blm.	Orchidaceae		10	3	
Hypolytrum latifolium L. C. Rich.	Cyperaceae		5		
Daemonorops mollis (Blco.) Merr.	Palmae		1		
Maranta sp.	Marantaceae		1		
Heterospathe sp.	Palmae		1		
Rhaphidophora monticola Krause	Araceae			2	
Acanthophippium Blm. (A. mantinianum)	Orchidaceae		1		
Languas Koen.	Zingiberaceae		2		4
Globba Linn.	Zingiberaceae		1		
Scindapsus hederaceus Scott.	Araceae		1		
Calamus daemonorops	Palmae			1	
Adelmeria raffa (or rupa)	Zingiberaceae		3		
Cymbidium Sw.	Orchidaceae		1		
Dianella caerulea Sims	Liliaceae		2	1	
Carex nodiflora Boeck.	Cyperaceae				3
Habenaria Willd.	Orchidaceae				4
Freycinetia Gaudich (small leaf)	Pandanaceae				1
Smilax leucophylla Blm.	Liliaceae				1
Pinanga philippinensis Becc.	Palmae				1
Acoridium tenellum (Nees. & Meyen)	Orchidaceae			1	
Apostasia Blm.	Apostasiaceae		1		

Table 1a. Other Monocotyledonous species found in Mt. Pangasugan and not included in the sampling transects.

Plant Species	Family	Site			
		1	2	3	4
Malaxis laxa	Orchidaceae		1		
Goodyera	Orchidaceae			1	
Pothos Linn.	Araceae	1			
Scindapsus sp. Schott	Araceae		1		
Eria philippinensis Ames	Orchidaceae		1		
Coelogyne asperata Lind.	Orchidaceae	1			
Galeola sp.	Orchidaceae		1		
Appendicula sp.	Orchidaceae	1			
Dendrobium sp.	Orchidaceae	1			
Pothos ovatifolius Engl.	Araceae	1			
Agrostophyllum Blm.	Orchidaceae	1			
Thysanolaena maxima (Roxb.) Kunt.	Graminae		1		
Caryota sp.	Palmae		1		
Ephemerantha sp.	Orchidaceae		1		
Dendrochilum sp.	Orchidaceae		1		
Bulbophyllum sp.	Orchidaceae		1		
Eria sp.	Orchidaceae		1		
Areca catechu Linn.	Palmae		1		
Dioscorea luzonensis Schauer	Dioscoreaceae		1		
Korthalasia sp.	Palmae		1		
Freycinetia oblongifolia	Pandanaceae		1		
Freycinetia cumingiana Gaudich	Pandanaceae		1		
Trichoglottis rosea (Lindl.) Ames comb nov.	Orchidaceae		1		
Flagellaria indica Linn.	Flagellariaceae		1		
Aglaonema Schott	Araceae		1		
Alocasia Necker	Araceae		1		
Calanthe R. Brown	Orchidaceae		1		
Centotheca latifolia (Oesbeck.) Trin.	Graminae		1		

Table 2. Number of genera and species of monocotyledons found in Mt.Pangasugan

Family	No. of Genera	No. of Species
Araceae	9	13
Gramineae	3	4
Zingiberaceae	6	10
Cyperaceae	3	3
Commelinaceae	4	6
Orchidaceae	7	7
Dioscoreaceae	2	2
Musaceae	1	3
Hypoxidaceae	1	1
Apostasiaceae	1	1
Marantaceae	4	4
Palmae	6	14
Pandanaceae	2	6
Liliaceae	2	2
Total	51	76

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