

Preliminary assessment of moss flora in Mt. Nebo, Valencia City, Bukidnon Philippines

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ABSTRACT

Description and identification of the morphological characters of moss flora in Mt. Nebo, Valencia Bukidnon Philippines was conducted. Alpha taxonomy across the vicinity of Malingon Falls was employed. Diagnostic characteristics such as habitat, plant habit, leaf features (leaf arrangement, costa, base, apex, margin, cells, alar cells) and sporophyte characters through microscopic examination were also conducted.

Forty-two (42) species, twenty eight (28) genera and sixteen (16) families of moss in Mt. Nebo were recorded. Of these, family Hypnaceae is the most species-rich among the sixteen families with six (6) species namely: *Ectropothecium buitenzorgii* (Bel.) Mitt., *E. ferrugineum* (C. Mull.) Jaeg., *E. striatulum* Dix. ex Bartr., *Isopterygium minutirameum* (C. Mull.) Jaeg., *Isopterygium* sp. and *Trachythecium micropyxis* (Broth.) Bartr. Family Neckeraceae followed next with five (5) species collected: *Himantocladium plumula* (Nees) Fleisch., *Homaliodendron microdendron* (Mont.) Fleisch., *Neckeropsis gracilenta* (Bosch & Lac.) Fleisch., *Neckeropsis lepineana* (Mont.) Fleisch. and *Pinatella ambigua* (Bosch & Lac.) Fleisch. Family Entodontaceae revealed four (4) species of mosses: *Campylodontium flavescens* (Hook.) Bosch & Lac., *Entodon bandongiae* (C. Mull.) Jaeg., *Entodon* sp., *Erythrodontium julaceum* (Schwaegr.) Par.. Family Fissidentaceae, Leucobryaceae and Pottiaceae revealed three (3) species and two (2) species for the family Bartramiaceae, Meteoriaceae, Polytrichaceae, Pterobryaceae, Sematophyllaceae and Thuidiaceae. Family Mniaceae, Orthotrichaceae, Phylloginiaceae and Racomitriaceae are families with only one (1) species. Fifty percent (50%) of the moss species collected were confined in tree trunk, twenty-four percent (24%) were confined in moist rock respectively. The least habitat preferences were observed hanging (epiphytic) to different substrate comprising five (5%) of the total species collected in the area.

Keywords: alpha taxonomy, mosses, taxonomic character

INTRODUCTION

Bryophytes are nonvascular, small, green, simple, spore-bearing plants and unique among land plants in having relatively large perennial, photosynthetic, and free-living, haploid gametophytes, unbranched diploid sporophytes and dependent to the maternal gametophyte throughout their life span, thus it is heteromorphic in their life span (Azuelo, 2011). They are divided into three separate phyla: Bryophyta (mosses) the most numbered with 15,000 species worldwide; Hepatophyta (liverworts) with 6,500 species and Anthocerophyta (hornworts) with approximately 100 species (Iwatsuki & Tan, 1991). Generally, bryophytes form a significant component in many forest ecosystems as they represent a large portion of forest biodiversity which evolved during the history of life on earth and have persisted for hundreds of millions years and are considered the closest modern relatives of the ancestors to the earliest terrestrial plants (Renzaglia et al. 2007).

Mt. Nebo is one of the elevated Barangays under the City of Valencia that lies between the latitudes 07°97195'N 124°98769'E with approximate elevation of 776 meters above sea level. Mt. Nebo still constitutes potential areas for floristic assessment such as short range forest ecosystem, waterfalls, and river banks. Malington falls is one of the natural ecosystems in Mt. Nebo covered with forest canopy and mixed floral groups such as Pteridophytes, Angiosperms, Gymnosperms and other understoreys. Consequently, it is surrounded with cultivated lands for agricultural use such as crop production and irrigation.

Local assessment of bryophytes present in the region especially in lower elevation will provide scientific knowledge concerning the status of bryophytes as well as to the species present in the area. The distribution of several species of non-vascular groups such as the mosses, liverworts and hornworts is dependent upon old-growth trees, and other substrates in the forests for survival (Azuelo et. al 2010). Henceforth, assessment may also determine the vulnerability of this plant group such as habitat loss and habitat degradation which may result to ecological damage and extinction of a species. Their presence in the biosphere is important since these plant groups are sensitive to environmental changes and have been successful as bio-indicators of air quality. As to the concern of climate change, habitat loss and other threats to the environment that affect the diversity and survival of bryofloral species, data gathered with regards to species richness thus this study is conducted to address the conservation and protection of species in the area.

METHODOLOGY

A letter of permit was secured from the Barangay Officials of Mt. Nebo and a courtesy call prior the conduct of the study. The study area was located at Malingon Falls, Mt. Nebo, Valencia City, Bukidnon. The falls is adjacent to the forest which constitutes an integral part of Mt. Nebo and is surrounded by cultivated land for agricultural use. It is approximately located 07°97'19.5"N 124°98'76.9"E with an elevation of 776 meters above sea level. The coordinates and elevation were determined using Global Positioning System (GPS, *etrex Venture HC Garmin*).

The collection process was done 200 meters across the perimeter of Malingon Falls through Alpha Taxonomy to inventory the species of moss flora. Forty-two (42) collected specimens were placed in paper packets and labeled with complete data including its complete description based on morphology and taxonomy and temporarily stored in cabinets at Science Room, College of Education, Central Mindanao University, Musuan, Bukidnon Philippines.

The specimens collected were classified, described and identified using the taxonomic keys of Bartram (1939). Plant habit, morphological characters of the leaf (leaf arrangement, costa, base, apex, margin, cells, alar cells) and sporophyte (size, shape, texture of capsule and seta, number of peristome teeth) were used to identify the species. Species identified were listed and tallied according to family, genera, and species. A digital camera was used for documentation during the actual collection of moss plants. For taxonomic description of each species collected, electric microscope was used for photomicrograph, classification, description and identification. Digital copy was stored as database for species information and future references.

RESULTS AND DISCUSSION

A. Species Richness

The preliminary assessment of moss flora in Mt. Nebo through alpha taxonomy was recorded. Results of the study revealed forty-two (42) species belonging to twenty eight (28) genera and sixteen (16) families.

As gleaned in Table 1, the moss species collected in Mt. Nebo, Valencia City, Bukidnon revealed that family Hypnaceae has the highest number of species among the sixteen (16) families with six (6) species namely: *Ectropothecium*

buitenzorgii (Bel.) Mitt., *E. ferrugineum* (C. Mull.) Jaeg., *E. striatulum* Dix. ex Bartr., *Isopterygium minutirameum* (C. Mull.) Jaeg., *Isopterygium* sp. and *Trachythecium micropyxis* (Broth.) Bartr. Family Mniaceae, Orthotrichaceae, Phyllogeniaceae and Racopilaceae are the least families with only one (1) species. Of these forty-two (42) species collected, two (2) species remained Unidentified but were properly described according to its observed morphological character. One (1) species of forty-two (42) is considered to be endemic in the Philippines namely *Ectropothecium ferrugineum* (C. Mull.) Jaeg. as reflected base on the assessment of bryophytes conducted by Azuelo et al. (2010) in Mt. Kitanglad Natural Park, Bukidnon.

Preliminary assessment of moss flora in the study area constitute variability of species in relation to families such that species count are lesser compared the result of the study conducted by Azuelo (2010) and Lubos (2010) in two highest peak in Bukidnon namely Mt. Kitanglad and Mt. Kalatungan respectively. The low species count of mosses in the study area confirmed the report and observation of Tan, Lubos, and Schwarz (2010) that mosses grow best in moist with increasing altitude. This would summarize the findings of the study that the diversity of mosses is greatly affected by the elevation and climatic condition that disfavors the survival of non-vascular plants. The continuous human exploitation in the area as well may lead to habitat loss that affects species abundance.

Table 1. Moss species collected in Mt. Nebo, Valencia City, Bukidnon

FAMILY	GENERA	SPECIES
BARTRAMIACEAE		
	<i>Philonotis</i>	<i>laxissima</i> (C. Mull.) Mitt.
	<i>Philonotis</i>	<i>roylei</i> (Hook. f.) Mitt.
ENTODONTACEAE		
	<i>Campyloodontium</i>	<i>flavescens</i> (Hook.) Bosch & Lac.
	<i>Entodon</i>	<i>bandongiae</i> (C.Mull.) Jaeg
	<i>Entodon</i>	sp.
	<i>Erythrodonium</i>	<i>julaceum</i> (Schwaeagr.)

		Par.
FISSIDENTACEAE		
	<i>Fissidens</i>	<i>mittenii</i> Par.
	<i>Fissidens</i>	<i>sylvaticus</i> Auct. non Griff.
	<i>Fissidens</i>	sp.
HYPNACEAE		
	<i>Ectropothecium</i>	<i>buitenzorgii</i> (Bel.) Mitt.
	<i>Ectropothecium</i>	<i>ferrugineum</i> (C. Mull.) Jaeg.
	<i>Ectropothecium</i>	<i>striatulum</i> Dix. ex Bartr.
	<i>Isopterygium</i>	<i>minutirameum</i> (C. Mull.) Jaeg.
	<i>Isopterygium</i>	sp.
	<i>Trachythecium</i>	<i>micropyxis</i> (Broth.) Bartr.
LEUCOBRYACEAE		
	<i>Leucophanes</i>	<i>candidum</i> (Schwaegr.) Lindb.
	<i>Leucophanes</i>	<i>glaucum</i> (Schwaegr.) Mitt.
	<i>Octoblepharum</i>	<i>albidum</i> Hedw.
METEORACEAE		
	<i>Barbella</i>	<i>rufifolioides</i> (Broth.)
	<i>Meteorium</i>	<i>miquelianum</i> (C.Mull.) Fleisch.
MNIACEAE		
	<i>Orthomnion</i>	<i>loheri</i> Broth.
NECKERACEAE		
	<i>Himantocladium</i>	<i>plumula</i> (Nees) Fleisch.

	<i>Homaliodendron</i>	<i>microdendron</i> (Mont.) Fleisch.
	<i>Neckeropsis</i>	<i>gracilentata</i> (Bosch & Lac.) Fleisch.
	<i>Neckeropsis</i>	<i>lepineana</i> (Mont.) Fleisch.
	<i>Pinatella</i>	<i>ambigua</i> (Bosch & Lac.) Fleisch.
ORTHOTRICHACEAE		
	<i>Macromitrium</i>	<i>semperi</i> C.Mull
PHYLLOGONIACEAE		
	<i>Orthorrhynchium</i>	<i>elegans</i> (Hook. f. & Wils.)
POLYTRICHACEAE		
	<i>Polytrichum</i>	sp. 1
	<i>Polytrichum</i>	<i>camussi</i> (Ther.) Touw.
POTTIACEAE		
	<i>Barbula</i>	<i>subulata</i> Broth.
	<i>Hyophila</i>	<i>involuta</i> (Hook.) (Jaeg.
	<i>Hyophila</i>	<i>rosea</i> Williams
PTEROBRYACEAE		
	<i>Symphysodontella</i>	<i>attenuatula</i> Fleisch.
	<i>Trachyloma</i>	sp.
RACOPILACEAE		
	<i>Racopilum</i>	<i>johannis-winkleri</i> Broth.
SEMATOPHYLLACEAE		
	<i>Acroporium</i>	<i>diminutum</i> (Brid.) Fleisch.
	<i>Meiothecium</i>	<i>attenuatum</i> Broth.
THUIDIACEAE		

	<i>Thuidium</i>	<i>cymbifolium</i> (Dozy & Molk)
	<i>Thuidium</i>	<i>pristocalyx</i> (C.Mull.) Jeag.
UNIDENTIFIED SPECIES		
	Unidentified sp.1	
	Unidentified sp.2	

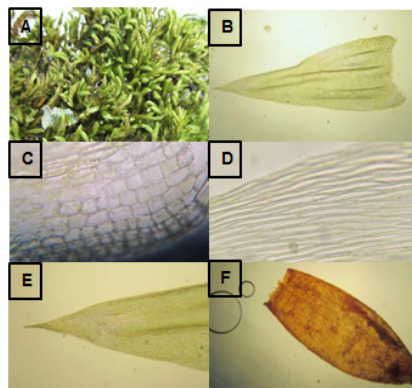
B. Taxonomy

The specimens were collected, classified and identified using the taxonomic keys of Bartram (1939) and existing herbaria, books and journals. The given data for each species include the description based on the observed morphology and diagnostic characters using laboratory microscope. This include the plant habit, morphological characters of the leaf (leaf arrangement, costa, base, apex, margin, cells, alar cells) and sporophyte (size, shape, texture of capsule and seta, number of peristome teeth) was used to identify the species.

Campylodontium flavescens (Hook.) Bosch & Lac.

Description:

Plant large, stems elongate, glossy. Golden green when fresh and dry. Leaves imbricate when dry and spreading/patent when wet. Leaf shape ovate-lanceolate, tapering upward, acuminate, deeply plicate. Leaf margin entire near base, minutely toothed near apex. Leaf base plain to near cordate. Ecostate. Leaf cells smooth, narrowly linear, basal cells quadrate, conspicuously differentiated group. Capsule erect, reddish, cylindrical in shape.



Plant habit (b) Leaf shaped (c) Basal cells both side (d) Leaf cells and leaf margin (e) Leaf apex (f) Sporophyte

Octoblepharum albidum Hedw.

Description:

Plant small, erect. Green to whitish green when fresh and dry. Leaf spreading/patent. Leaf shape ligulate. Leaf margin entire. Leaf apex rounded ending abruptly with short-pointed tip. Leaf base plain. Costa, broad, thick, excurrent made up of 2-4 layers of leucocysts of the single layer of chlorocysts. Leaf cells quadrate to rectangular in shape.

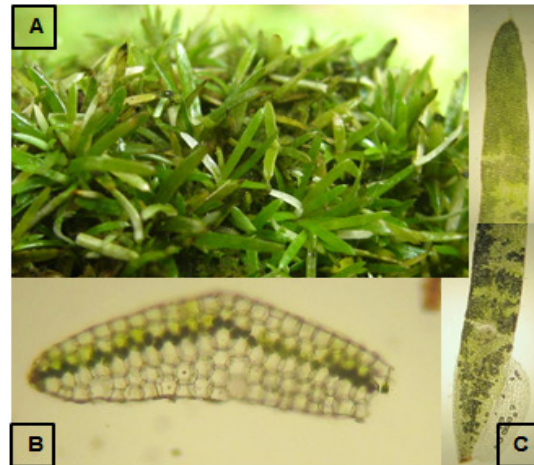


Plate 2. Morphology of *O. albidum* (a) Plant habit (b) Cross-section of leaf (c) Leaf shape

Polytrichum sp. 1

Description:

Plant medium, erect. Green fresh and dark green when dry. Leaves spreading/patent when fresh and imbricate when dry. Leaf shape ovate-lanceolate from broad base tapering upward. Leaf margin entire at base, serrulate near apex. Leaf apex acute. Leaf base plain. Costa percurrent. Cells rectangular to narrowly rectangular at base, cells above unknown. Lamellae layered with 4 cells. Sporophyte upright in a long seta, green, ovoid. Peristome teeth double.

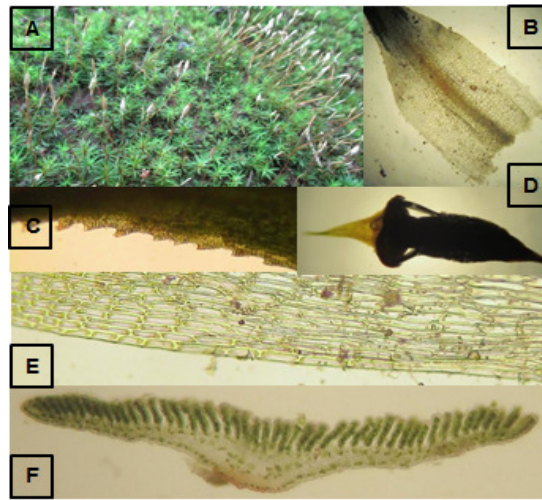


Plate 3. Morphology of *Polytrichum* sp. 1 (a) Plant habit (b) Leaf base (c) Leaf margin at apex (d) Sporophyte (e) Basal Cells and margin (f) Leaf cross-section

C. Habitat Preferences

The distribution and abundance of moss flora in the study area were confined in a specific microhabitat. Five (5) preferred habitats were identified namely: Decayed log, rock, soil, trunk and those that were found hanging or epiphytic (Table 4 and Figure 1). Data revealed that twenty one (21) or 50% of the total moss species were confined in tree trunks and ten (10) or 23.81% of the total species were found in moist rocks. Six (6) species were confined in decayed log, three (3) species found in soil and the least habitat preferences of mosses in the study area are those classified as epiphytic with only two (2) species. Results of the study is in conformity with the study of Gradstein et al. (2010) that majority of the mosses collected were confined in tree trunks, this is due to the fact that this serves as transition zone between forest floor and makes habitat favorable for moisture.

Table 2. Habitat preferences of moss species in Mt. Nebo, Valencia City, Bukidnon

Habitat Preference	Number of Species	Species Distribution
Decayed log	6	14.3%
Rock (Petrophytic/Saxicolous)	10	23.81%
Soil (Terricolous)	3	7.14%
Trunk (Corticolous)	21	50%
Hanging (Epiphytic)	2	4.77%
TOTAL	42	100%

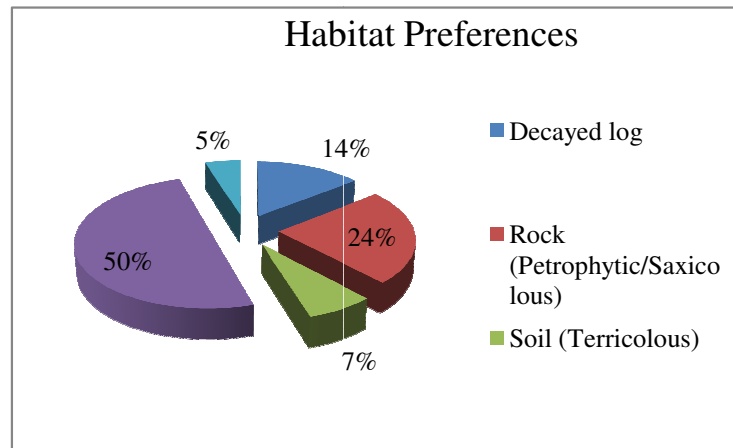


Fig 1. Percentage of habitat preferences of mosses in Mt. Nebo, Valencia City, Bukidnon

RECOMMENDATIONS

Greater inventory efforts are needed for bryoflora species in the total area of Mt. Nebo and establishment of sampling plots to determine the species diversity in the area. Nevertheless, conservation measures and strict implementation of policies and guidelines for the protection of both flora and fauna in the area.

REFERENCES

- Azuelo, A.G., L.G Sariana, M. Pabualan. (2010). Diversity and Ecological Status of Bryophytes in Mt. Kitanglad, Bukidnon. *Asian Journal of Biodiversity*, 1: 49-71.
- Azuelo, A.G., L.G Sariana, M. Pabualan. (2011). Some Medicinal Bryophytes: Their Ethnobotanical Uses and Morphology. *Asian Journal of Biodiversity*, 2: 49-80.
- Bartram, E.B. (1939). Mosses of the Philippines. *Philippine Journal of Science*, 68: 1-437.
- Gradstein, S. R, S. G. Sporn. (2010). Diversity of epiphytic bryophytes along land use gradients in the Tropics. *Nova Hedwigia Beiheft*, 138: 309-321
- Lubos, L.C. (2010). Species Richness, Distribution and Status of Mosses in Selected Mountains in Mindanao, Philippines, *Asian Journal of Biodiversity*, 1: 72-90.
- Renzaglia, K.S., S. Schuette, R.J. Duff, R. Ligrone, J. Shaw, B.D. Mishler, and J.G. Duckett. (2007). Bryophyte Phylogeny: Advancing the Molecular and Morphological Frontiers. *The Bryologist*. 110:179-213
- Tan, B.C., L.C. Lubos, U. Schwarz. (2000) New and Biogeographically Noteworthy Records of Philippine Mosses from Mindanao Island. *Tropical Bryology*, 18: 27-38.
- Tan, B.C., and Z. Iwatsuki. (1991). A New Annotated Philippine Moss Checklist. *Harvard Papers in Botany*. 3: 1-64.