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Species Richness and Status of Pteridophytes in North-Eastern Part of Mount Timolan Protected Landscape, Zamboanga del Sur, Philippines

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ABSTRACT

This study was conducted to assess the species composition and conservation status of pteridophytes in the north-eastern portion of Mount Timolan Protected Landscape. The studyrevealed a total of 98 species comprising 52 genera from 21 families. Tectariaceae, Polypodiaceae and Dryopteridaceae was the most represent family with Tectariaceae accounts the highest in terms of genera (9), followed by Polypodiaceae (8) and Dryopteridaceae (6). Whereas, Polypodiaceae has the highest in terms of species record (16 spp.), tailed by Tectariaceae (14 spp.) and Dryopteridaceae (10 spp.). Out of 98 recorded species, 95 were only identified up to species level. High number of accounted family of terrestrial ferns and lycophytes are known as good ecological indicator taxa for habitat destruction and level of human disturbances. In terms of status, eleven (11 spp.) are endemic to Philippines, eighteen (18 spp.) are economically important species, nine (9 spp.) vulnerable, five (5 spp.) classified as other threatened species and two (2 spp.) are non-native species of ferns and lycophytes was recorded. Generally, the high species richness of pteridophytes found in the north-eastern portion of Mount Timolan Protected Landscape are influenced by elevation gradient and susceptibility to human disturbances.

Keywords: endangered, ferns, lycophytes, endemic, assessment

INTRODUCTION

Pteridophytes also known as ferns and lycophytes are group of plants that reproduce through spores and consider as most economically important yet poorly documented non-flowering vascular plants (Amoroso et al., 2016). These group of plants are widely distributed in tropics and temperate regions with higher elevation (Oloyede and Odu, 2011). In Philippines are approximately 1,100 species of ferns and lycophytes belonging to 34 families from 154 genera (Smith et al., 2006). Roughly, this number continues to increase because of the extensive pteridological explorations done by scientists, researchers and other experts which leads to discoveries of new species of ferns and lycophytes (Amoroso et al;. 2020a; Amoroso et al., 2020b; Coritico, 2020). Pteridophytes are relatively information-rich species because the number of scientific studies in their systematics and evolution is relatively large across regions (Ebihara and Nitta, 2019). Some species have known aesthetic and economic importance such as ornamentals (Bharrati et.al. 2013), traditionally used to cure illnesses (Amoroso et al., 2013 and Yong, 2010) and as a source of food and dietary fibers (Amoroso et al., 2014). However, due to the alarming rate of deforestation in the country, many flora and fauna species are undeniably under threat. Among this are the human disturbances, which greatly affects the biodiversity of many vascular plants (Abotsi et al., 2020).

Mount Timolan Protected Landscape (MTPL) is strategically located in the four border towns of Tigbao, Guipos, San Miguel and Lapuyan, Zamboanga del Sur. It is one of the two identified protected area in the province of Zamboanga de Sur covering 2,244.54 hectarehighest elevation of 1,152 meter above sea level. It is known as ecotourism spot in the province and promote as a local tourist destination in the presence of a unique heart-shaped lake- the Lake Maragang. The Mount Timolan Protected Landscape formerly known as Zamboanga del Sur Provincial Park was proclaimed as Protected Area in 2000 by the virtue of Presidential Proclamation No. 354 in pursuance to the provisions of Republic Act 7586 otherwise known as National Integrated Protected Area System (NIPAS) Act of 1992. Moreover, the Mount Timolan Protected Landscape are among the protected areas in the country legislated in the Republic Act 11038 or the Expanded National Integrated Protected Area System (ENIPAS) Act of 2018(PAMB-MTPL, 2020). Despite of the importance of Mount Timolan Protected Landscape as watershed as it primarily forms the headwaters of its neighbouring municipalities and serves as the main source of river systems in lowland municipalities, very limited studies were done in the area.

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This include among others, Philippine native earthworm fauna (Aspe and James, 2016), slender toad (Sanguila et al. 2011), avifauna (Paguntalan et al. 2011), freshwater fish (Cudal et al. 2019)and angiosperms (Ducot et.al. 2020). Eventually these efforts led to the discovery of two new species namely Polypheretima zamboangensisAspe and James, 2011 and Plagiostachys lourdesiae(Ducot et al., 2020). Surprisingly, the flora and other fauna of Mount Timolan Protected Landscape is poorly identified and remains undocumented, hence this study. This is the time that the species composition, richness and status of pteridophytes and its allies in the north-eastern portion of Mount Timolan Protected Landscape will be reported. The Lake Maragang mentioned in the above text is popularly known as ecotourism site located in the north-eastern part of MTPL. This research was purposely conducted in the north-eastern part of MTPL because it is more susceptible to human disturbance. Thus, this study aims to provide preliminary checklist of pteridophytes primarily ferns as well as lycophytes to determinetheir conservation status which could possibly serve as benchmark data for policy formulation by the Protected Area Management Board (PAMB) in the protection and conservation of Mount Timolan Protected Landscape and its environs.

MATERIALS AND METHODS

Study site

This study was done in an established human trail in the north-eastern part of Mount Timolan Protected Landscape last December 2018(Figure 1). A series of transect walks was conducted from the Lake Maragang to the baseline going to Mount Timolan Protected Landscape peak.

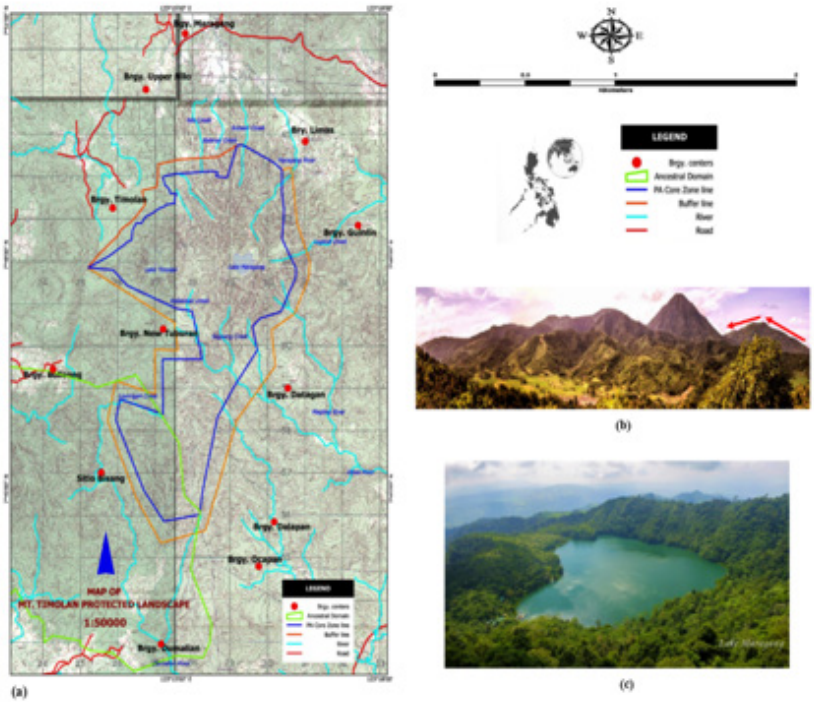
Species collection

In consonance with RA 9147 of 2001 or the Wildlife Resources Conservation and Protection Act, voucher specimens for each species were collected under the Wildlife Gratuitous Permit No. IX-02-2018.Collection of pteridophytes species was done in several transects lines measuring 2 km long and10 m wide. Species found within the transect were initially recorded, photo-documented along with their altitude using Global Positioning System (GPS) device. Voucher specimens for each species were collected for further identification and reference. Initial identification of collected species was done using pictorial handbook (Tandang et al., 2014), available published reports (Amoroso, 2013; Amoroso, 2014; Aya-ay, 2016), expert consultation and online database available in JSTOR's Global Plants website. Voucher specimens were also forwarded to Central Mindanao University for further verification of species identity. For classification of species, Pteridophyte Phylogeny Group I (PPG I 2016) served as the main reference. Conservation status of the recorded species where likewise identified following the criteria set by Department of Environment and Natural Resources – Administrative Order (DENR-DAO Series of 2017-11) and Union for the Conservation of Nature (IUCN 2016). Species richness on the other hand, was based on the total number of species accounted in the survey conducted.

RESULTS AND DISCUSSION

Species Richness

Thefirst pteridological survey in the northeastern portion of Mount Timolan Protected Landscape accounted a total of 98 species comprising 52 genera from 21 families based from the Pteridophyte Phylogeny Group I classification of ferns and lycophytes (PPG I 2016),(Table 1). The most dominant families include Tectariaceae, Polypodiaceae and Dryopteridaceae (Figure 2). Tectariaceae accounts the highest represented genera (9), followed by Polypodiaceae (8) and Dryopteridaceae (6). In terms of species abundance, Polypodiaceae has the highest (16), tailed by Tectariaceae (14) and Dryopteridaceae (10).



Out of the 98 recorded ferns and lycophytes, only three were identified up to genus level (Tectaria sp.Selaginella sp.and Nephrolepis sp.). Most of the recorded pteridophytes are terrestrial (71%), epiphytic (13%), were some are epiphytic/terrestrial (6.3%), mesophytic/terrestrial (3.2%), epiphytic/xerophyte (3.2%), mesophytic (3.2%) and epiphytic/lithophytic (1.1%). The herbaceous family of Selaginella, Lindsaeaseae and Hymenophylaceaeare mostly terrestrial in nature. The high number of accounted terrestrial fernfrom Family Aspleniaceae, Blechnaceae, Cyatheaceae, Dennstaedtiaceae, Dryopteridaceae, Gleicheniaceae, Hymenophyllaceae, Polypodiaceae and Pteridaceae are known as ecological indicator taxa for habitat disturbance due to species variation with regards to habitat adaptation and other climatic factor (Della and Falkenberg, 2019).

Table 1.

List of pteridophytes with conservation status in North-eastern part of Mount Timolan Protected Landscape, Zamboanga del Sur, Philippines.

Family	Species	Status	Habitat
ATHYRIACEAE	D. esculentum (Retz.) Holtt.	EIS	Terrestrial
	D. petiolare C.Presl.		Terrestrial
	Diplazium polypodioides Blume.		Terrestrial
	D. tenuifolium (Copel.)		Terrestrial
ASPLENIACEAE	A. anisodontum C.Presl		Epiphytic/Terrestrial
	A. callipteris Fée, Mém. Foug.	ECS	Epiphytic/Terrestrial
	A. cuneatum Lam., Encycl.		Epiphytic/Terrestrial
	A. nidus (L.)	EIS	Terrestrial
	Asplenium persicifolium J.Sm. ex Mett.,		Epiphytic/Terrestrial
	A. vittaeforme (Cav.)		Epiphytic/Terrestrial
	Blechnopsis finlaysoniana (Wall. ex Hook. & Grev.) C.Presl,	VU	
BLECHNACEAE	C.Presl,		Terrestrial
	Blechnopsis orientalis (L.) C.Presl	EIS	Terrestrial
	Oceaniopteris egregia (Copel.) Gasper & Salino	VU	Terrestrial
	Stenochlaena palustris (Burm.f.) Bedd.	EIS	Terrestrial
CYATHEACEAE	Sphaenopteris glauca (Blume.) R.M. Tryon	EN	Terrestrial
	S. polypoda R.M.Tryon		Terrestrial
DAVALLIACEAE	Davallia solida (G. Forst.) Sw.	OTS	Epiphytic
DENNSTAEDIACEAE	Pteridium aquilinum (L.) Khun	EIS	Terrestrial
DRYOPTERIDACEAE	Bolbitis heteroclita (C. Presl.) Ching		Terrestrial
	Dicranopteris curranii Copel.		Terrestrial
	D. flexuosa		Terrestrial
	D. linearis (Burm. F.) Underw.	EIS	Terrestrial
	E. bellarmanianum		Epiphytic
	E. blumeanum (Fée) J.Sm.		Epiphytic
	Elaphoglossum callifolium (Blume) T.Moore		Epiphytic
	Lomagramma merrillii (Holttum.)		Terrestrial/Epiphytic
	Pleocnemia macrodonta (Fée) Holttum		
	Polystichum acutidens		Terrestrial
GLEICHENIACEAE	Gleichenia truncata (Willd.)		Terrestrial
HYMENOPHYLLACEAE	Cephalomanes atrovirens (C. Presl.)		Terrestrial
	Hymenophyllum angulosum (Christ.)		Terrestrial
HUPERZIACEAE	Huperzia bayanica		Epiphytic
LINDSAEACEAE	L. doryphora K.U.Kramer.		Terrestrial
	Lindsaea fissa (Copel.)		Terrestrial
	L. tenuifolia Blume		Terrestrial
	Sphenomeris - chinensis (L.) Maxon	EIS	Terrestrial
	S. retusa (Cav.) Maxon		Terrestrial
	Tapeinidium pinnatum (Cav.) C. Chr.		Terrestrial
LOMARIOPSIDACEAE	N. biserrata (Sw.) Schott var. furcans	EIS	Terrestrial
	N. brownii (Desv.) Hovenk. & Miyam.		Terrestrial
	N. cordifolia (L.) Presl.	EIS	Terrestrial
	N. falcata (Cav.) C. Chr.	EIS	Terrestrial
	Nephrolepis flexuosa		Terrestrial
	Nephrolepis sp.		Terrestrial

LYCOPODIACEAE	Lycopodiella cernua (L.) Pic. Serm.		Terrestrial
LYGODIACEAE	L. auriculatum (Willd.)		Terrestrial
	L. circinnatum (Burm. F.) Sw.	EIS	Terrestrial
	L. japonicum (Thumb.) Sw.	EIS	Terrestrial
	Lygodium versteegii Christ.		Terrestrial
MARATTIACEAE	A. evecta (G. Forst.) Hoffm.	OTS	Mesophytic/Terrestrial
	Angiopteris palmiformis (Cav.) C. Chr.	OTS	Mesophytic/Terrestrial
OSMUNDACEAE	Osmunda banksiifolia (Presl.) Kuhn	OTS	Terrestrial
	O. bromelifolia (Presl.) Copel.		Terrestrial
POLYPODIACEAE	Aglaomorpha descensa (Copel.)	ECS	Epiphytic/Mesophytic
	A. heraclea (Kunze) Copel.	VU	Epiphytic/Xerophyte
	A. pilosa (J. Sm.) Copel.	VU	Epiphytic/Xerophyte
	A. quercifolia (L.)	EIS	Epiphytic/Mesophytic
	A. rigidula (Sw.)	EIS	Epiphytic/Mesophytic
	A. splendens (Hook. & Bauer) Copel.	VU	Epiphytic/Xerophyte
	Goniophlebium persicifolium (Desv.) Bedd.		Epiphytic
	Leptochilus macrophyllus (Blume)		Terrestrial
	Loxogramme avenia (Blume) C. Presl.		Terrestrial
	Microsorum punctatum (L.) Copel	VU	Epiphytic/lithophytic
	Phymatosorus adnascens (Sw.) Ching	EIS	Epiphytic
	P. commutatum Blume.		Epiphytic
	P. scolopendria (Burm.f.) Pic. Serm.	VU/ECS	Epiphytic
	Platycerium grande (J. Sm. Ex. Fee) Presl.	CR	Mesophytic
	Pyrrosia splendens (Presl.) Ching	VU	Epiphytic
	P. lanceolata (L.) Farw.		Epiphytic
PSILOTACEAE	Psilotum nudum (L.) P. Beauv.		Epiphytic
PTERIDACEAE	Adiantum mindanaoense Copel.		Terrestrial
	A. philippense (Linn.)		Terrestrial
	Antrophyum callifolium Blume, Enum. Pl. Javae		Terrestrial
	A. reticulatum (Forst.) Kaulf.		Terrestrial
	Coniogramme macrophylla (Blume.) Hieron		Terrestrial
	Haplopteris elongata (Sw.)		Terrestrial
	Pityrogramma calomelanos (L.) Link	NNS	Terrestrial
	Pteris ensiformis Burm.f.	EIS	Mesophytic
	P. pacifica Hieron.		Mesophytic
SELAGINELLACEAE	Selaginella cupressina (Willd.) Spring		Terrestrial
	S. delicatula (Desv.)		Terrestrial
	S. jagori (Warb.)	ECS	Terrestrial
	S. plana (Desv. ex Poir.) Hieron.	NNS	Terrestrial
	Selaginella sp.		Terrestrial
TECTARIACEAE	Christella dentata (Forssk.) Brownsey & Jermy		Terrestrial
	C. parasitica (L.) H. Lev.		Terrestrial
	Coryphopteris pubirachis var. philippinensis Holttum	ECS	Terrestrial
	Nannothelypteris inaequilobata Holttum	ECS	Terrestrial
	Parathelypteris beddomei var. eugracilis (Copel.) Holttum		Terrestrial
	Pneumatopteris laevis (Mett.) Holttum	ECS	Terrestrial
	Pronephrium nitidum (Holttum.) Holttum		Terrestrial
	P. xiphioides (Christ.) Holttum	ECS	Terrestrial
	Pseudophegopteris aurita (Hook.) Ching		Terrestrial
	Sphaerostephanos unitus (L.) Holttum		Terrestrial
	Tectaria. athyriosora M.G.Price	ECS	Terrestrial
	T. decurrens (Presl.) Copel.		Terrestrial/Mesophytic
	T. devexa (Kunze ex Mett.) Copel.	OTS	Terrestrial
	Tectaria sp.		Terrestrial

Note: VU (vulnerable); EN (endangered); CR (critically endangered); EIS (economically important species); ECS (endemic species); OTS (other threatened species); NNS (non-native species).Source: DENR-DAO Series of 2017-11 and IUCN, 2016.

The species richness recorded in this study, resembles that of Mt. Pinamantawan, Bukidnon with 121 spp. (Sumagaysay, 2012) but quite higher than Mt. Iraya, Batanes (121 *spp*; Barcelona, 2003), Mt. Pangasugan, Leyte (94 *spp*.; Belonias and Banoc, 1994), Pasonanca Natural Park, Zamboanga del Sur (72 *spp*.; Andas, 2015), Mt. Malukot, Batangas (40 *spp*.; Catapang et al., 2012).

Different pteridophyte taxadiversity also vary in topography with different range of elevations (Abotsi et al., 2020 and Nervo et al., 2019). In this study, some species of Aglaomorpha (A. heraclea, A. splendens and A. pilosa) which are epiphytic xerophyte often found in area with lower elevation (670 masl). The accessibility of the area is also a contributing factor that may influence species richness (Coritico et al., 2017). The filmy species of Hymenophyllaceae and other epiphytic species are frequently encountered in the mid-elevation forest (830 masl).Since, the mid-elevation forest of the area sampled are characterized by steep slopes and more ravine, not much of climbers are using the area as trail during their climb going to peak, thus, making the area less susceptible to disturbances.

Conservation status

Conservation status was based on the national

Figure 2. Some representative species from dominant families of Tectariaceae, Polypodiaceae and Dryopteridaceae: (A) D. linearis; (B) G. persicifolium; (C) L. avenia; (D) L. macrophyllus; (E) M. punctatum; (F) P. xiphioides; (G) P. nitidum; (H) C. parasitica; (I) L. merilli; (J) C. pubirachis var. philippinensis

list of threatened Philippine plant species (DENR-DAO 2017). It was carried out to identify beleaguered ferns and lycophytes species for protection, conservation and monitoring studies (Amoroso et. al., 2011). Markedly, the critically endangered P. grandeand endangered species of S. glauca were found respectively around the Lake Maragang and in theestablished open human trail of Mount Timolan Protected Landscape. Since the area is popularly known as tourist attraction, the identified two threatened species are susceptible to human disturbances. Whereas, a total of 11 spp. Philippine endemic, 18 spp. of economically important species, 9spp. vulnerable, 5spp. classified as other threatened species and 2 spp. non-native species of ferns and lycophytes was recorded (Table 1). Another notable species found along the open human trail is the vulnerable species of whisk fern, the P. nudum attached on the trunks of the Sphaeropteris polypoda.

Pteridophytes classification are poorly known especially to the locals and only little attention are given to this group. Based on the interview with some villagers, they only know some of Diplazium species, locally known as "pako" and Lygodium or "nito", both with respective value as food and for handicraft use. Nevertheless, some notable species listed as threatened species have unknown value and were simply considered as weeds.

CONCLUSIONS

Generally, the species richness of pteridophytes found in the north-eastern portion of Mount Timolan Protected Landscape is high. Mostly, all pteridophytes family were listed as potential ecological indicator for habitat quality degradation and forest destruction. However, fern species diversity to habitat disturbance relationship and other microenvironment factors requires further studies. Likewise, additional pteridological exploration in other part of the landscape is needed inestablishing a real profile on the ferns and lycophytes species found in Mount Timolan Protected Landscape.

In interim, effective forest conservation should be prioritised especially to the identified highly threatened species found in the side of established open human trails. Similarly, proper information dissemination through trainings about basic biodiversity research to the locals and other stakeholders of the Mount Timolan Protected should be conducted to conserved the area and mitigate measures in the survival of beleaguered ferns and lycophytes species as well as the other flora and fauna of Mount Timolan Protected Landscape.

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