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A Preliminary Checklist of Vascular Plants in Tarak Ridge trail of Mt. Mariveles, Bataan, Philippines

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ABSTRACT Mount Mariveles is a potentially active stratovolcano and is one of the remaining forests in Bataan province that is under threat due to different anthropogenic factors. A checklist is essential for it and it will give baseline information on the species and their conservation status. This study aimed to provide a preliminary checklist of vascular plants at Tarak ridge (Mariveles trail) in Mt. Mariveles, Bataan. A belt transect was established at Tarak ridge trail from 400 meters above sea level (m asl) to 1000 m asl. Each transect has three plots of 10 m x 10 m. A total of 80 species belonging to 50 families and 74 genera were documented in this study. Poaceae family had the most numbered genera. Of the 80 flora species inventoried, 35 are shrubs, trees are 17, herbs are 14, 11 are epiphytes and 3 are vines. Among the 80 recorded flora, five species were endemic in the Philippines. Only three species were assessed for their conservation status based in IUCN categories and were assessed as Least concern. Two endemic species from Rubiaceae family, the *Psychotria luzoniensis* (Cham. & Schltdl.) Fern.-Vill was assessed as Least Concern while *Psychotria rubiginosa* Elmer ex Merr was originally assessed as Near-threatened but in a recent study it was assessed as Data Deficient (DD).

KEY WORDS Forest fire; GIS; Lardjem; NDVI; Regeneration; remote sensing; Checklist; endemic; floristic.

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INTRODUCTION

A regional assessment made by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2018) reported that biodiversity is declining in all regions of the world. According to the U.S. Agency for International Development (USAID, 2014), the estimated biodiversity loss is about 1000 species each year due to uncontrollable legal and illegal human activities. The highest rate of deforestation is in Southeast Asia. It loses its original area by 2100, which is about 78%, and its biodiversity has been projected up to 42% (Sodhi et al., 2010).

The Philippines is one of the countries with rich biodiversity, but it is a hotspot due to the rapid loss (Philippine Biodiversity Conservation Priorities, 2002). It has only 3% of the land area covered by primary forests (Myers et al., 2000), putting the current biodiversity at extreme risk (Langerbeger et al., 2006).

It lost 1.4% or 89,000 hectares of the forest area annually from 1990-2000 (FAO, 2003). Even with the extraordinary status of the Philippines as one of the world's 25 biodiversity hotspots (Myers et al., 2000; Brooks et al., 2006; Webb et al., 2010) as well as the threats of environmental destruction, the country's remaining forests and their biodiversity are poorly

represented in research (Langerberger, 2004). Historically, biodiversity hotspots are mostly insufficient in scientific reports and taxonomy (Cowling et al., 2010; Grieneisen, 2014) and distinct in achieving inventories comprehensively on different species (Sobral & Stehmann, 2009; Ferzza & Baumgratz, 2012). In previous years, most of the plant survey studies focused on the qualitative list of species, while quantitative studies on plant inventories for the Philippines are still relatively scarce (Villanueva & Buot, 2015; Santiago & Buot, 2017; Ordas et al., 2019). According to the study of Alsherif & Fadl (2016) and Yates et al. (2019) floristic surveys are important because these would help in proper monitoring and development of effective conservation strategies.

Bataan's significant features such as being an "industrial heartland", a "prime business hub", and a major transshipment point in Central Luzon (Provincial Government of Bataan and Partnership in Environmental Management for the Seas (PEMSEAS), 2017), contributed to the threat of biodiversity due to pollution and land conversion, leading to the destruction of plants and animals, especially in the forested areas in the Province. Mt. Mariveles, a potentially active stratovolcano, Philippine Institute of Volcanology and Seismology (Phivolcs, 2013), the highest mountain in Bataan with 1388 meters above sea level (m asl) (Bataan ICM Program, 2006) and one of the remaining forests in Bataan province (Balila et al., 2012), is under threat due to different anthropogenic factors. It has two trails, the Pantingan Peak and Tarak ridge.

The Tarak ridge is a well-known destination for mountaineers because it is one of Manila's major climbs. It is poorly explored in plant inventory and diversity, so meager information is available about plants' list and status in the Tarak ridge trail. There were different studies on inventory and diversity assessment of plants that were conducted in Luzon but the availability of flora inventory lacks in Mt. Mariveles, Bataan. Before the depletion of biodiversity in the said mountain due to different anthropogenic factors, an inventory of vascular plants should be conducted to generate knowledge on their checklist. Hence, this study aims to provide a preliminary checklist of vascular at Tarak ridge (Mariveles trail) in Mt. Mariveles, Bataan.

MATERIAL AND METHODS

Study area

Mt. Mariveles (14°30 N, 120°30 E) (Fig. 1) has 23,688 hectares. An area of forest is characterized as lowland, mossy forest and montane. This area includes an old-growth forest of Mt. Mariveles and old reforestation plantation in former Lamao Arsenal (PAWB-DENR, 2005).

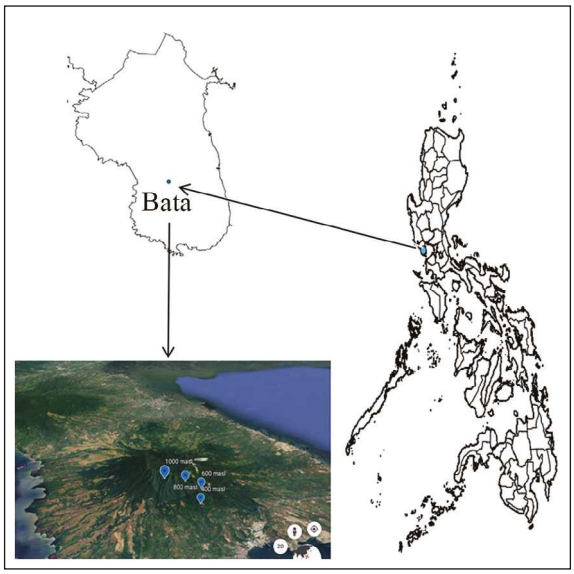


Figure 1. Map of the Philippines showing Bataan province where Mt. Mariveles is located generated using QGIS 1.7.4. Areas surveyed are marked in blue. (Mt. Mariveles map. http://earth.google.com).

It has two trails, the Mt. Mariveles trail (Tarak ridge) (Figs. 2–5) in Brgy. Alasasin, Mariveles and Bagac trail (Pantingan Peak) in Bagac. Bataan has a distinct climate, a dry and wet season and has Type I climate classification in the Coronas system. The rainy season begins in May to October, while the dry season is from November to April. The maximum rains occur from June to August. The mean average rainfall in August is most torrential at 633 mm.

Plant collection and identification

The plant collections/inventory was conducted last October 2019 to March 2020. A belt transect was established at Tarak ridge trail from 400 meters above sea level (m asl) to 1000 m asl. The

Figures 2–5. The Tarak ridge trail. Fig. 2: grassland area. Fig. 3: forest area. Fig. 4: Tarak ridge. Fig. 5: peak of Tarak ridge (photos taken by S. Vidallon).

transect was 10 m x 100 m log with longer width beyond the gradient and shorter width on the elevation gradient. Each transect has three plots of 10 m x 10 m. Plants on their reproductive stages were collected for precise identification of species. The specimens were processed for herbarium, and the vouchers specimen was submitted at the University of Santo Tomas Herbarium. There is no database on the information about the flora of Bataan thus the specimens were compared to Co's Digital Flora of the Philippines (Pelser et al., 2011) and compared to the digital herbarium specimen of the Herbarium Catalogue of Royal Botanic Gardens, Kew (http://www. kew.org). The plants conservation status was based on the Updated National List of Threatened Plants in the Philippines (Department of Environment and Natural Resources Administrative Order 2017–11) and the International Union for the Conservation of Nature (IUCN) Red List of Threatened species 2020–2. The specimens were verified by the University of the Philippines curators, Los Banos Museum of Natural History, Laguna.

Conservation Status and Endemicity

The conservation status of the plants was determine based on the categories from the IUCN Red List of Threatened Species (2020-2) and the Department of Environment and Natural Resources (DENR) - Administrative Order No. (DAO) 2017-11 (2017). The species were categorized as NE = Not Evaluated, DD = Data deficient, OT = Other Threatened Species, LC = Least Concern, V = Vul-

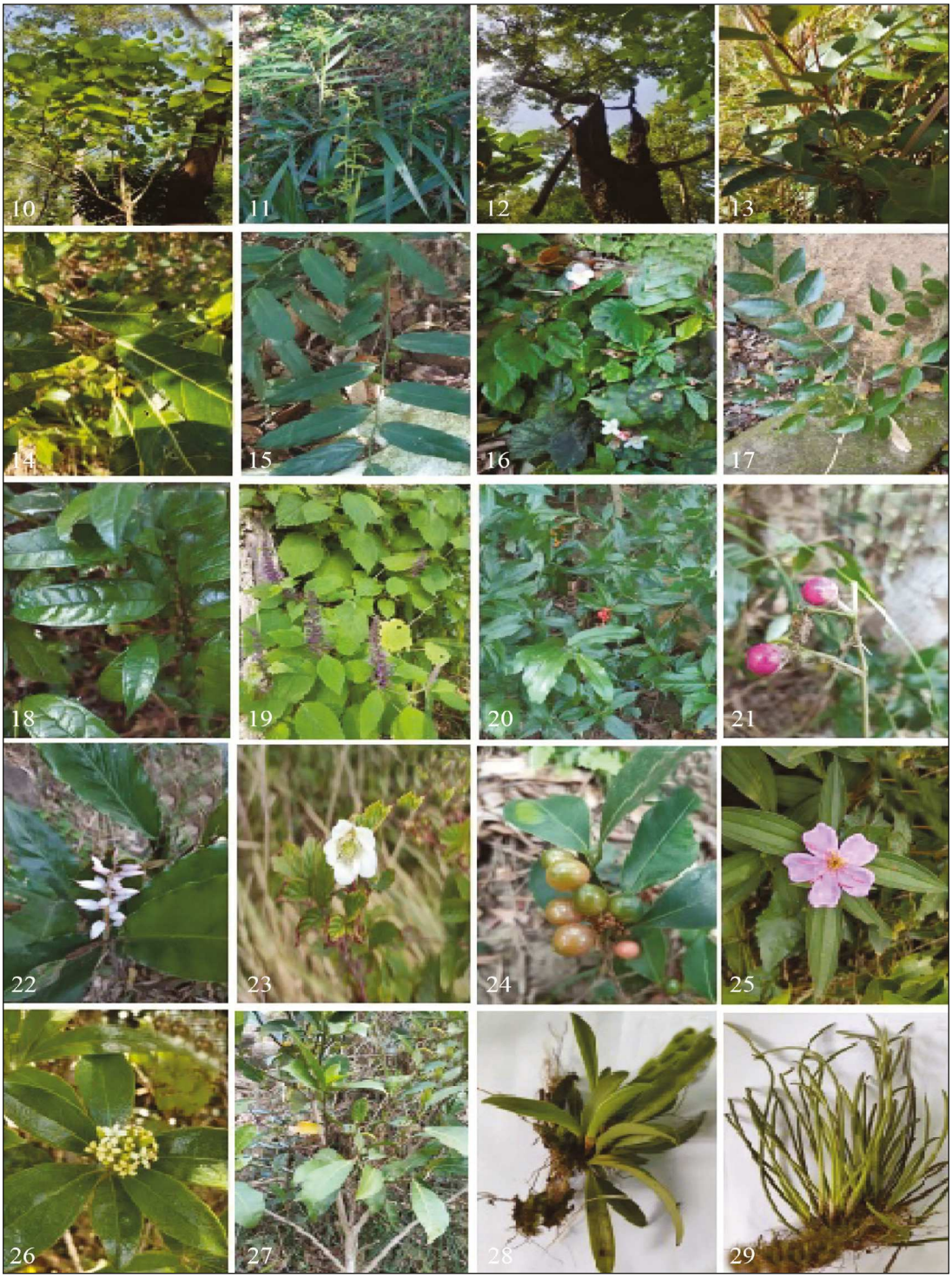
nerable, EN = Endangered, CR = Critically endangered), E = Philippine endemic, N = non-endemic.

RESULTS

Mostly agriculturals crops were observed at lower elevation, 400 meters above sea level (m asl). An agricultural crop like *Ananas comosus* (pineapple) was planted in the area (Fig. 6–9). The species of fruit trees were also observed such as *Sandoricum koetjape* (santol), *Artocarpus heterophyllus* (jackfruit) and *Mangifera indica* (Mangga) (Figs. 10–29). *Gmelina arborea,* was also recorded in 400 m asl (Fig. 10).

The observed plants were evidence of conversion of a mountain into agricultural lands. *Calamus usitatus* and *Acacia auriculiformis* were also observed in one of the plots in the same elevation. At a higher elevation, 600 m asl, the grassland area was observed and it was dominated by the grass species, *Imperata cylindrica* (Cogon). *Imperata* exists in quite large contiguous areas in the said elevation. The medium-sized trees, *Syzygium* sp., *Ecalyptus* sp. and *Ficus septica* were also observed in the grassland vegetation (Fig. 10). While doing the transect walk within the same elevation going to the campsite near Papaya river, different plant species were recorded, and some of these were: *Aristolochia* sp., *Begonia* sp., *Brucea mollis*, *Anaxagorea luzonensis*, *Coleus scutellarioides*., and *Sarcandra glabra* (Fig. 20). Different ferns were also observed at the same elevation like *Leptochilus ellipticus* and *Microsorum longissimum.* They were mostly located adjacent to the water source where there are high

Figures 6–9. The study sites at Tarak ridge trail in Mt. Mariveles. Fig. 6: agricultural land at 400 m asl. Fig. 7: grassland area at 600 m asl. Fig. 8: forest area at 800 m asl. Fig. 9: grassland area at 1000 m asl (photos taken by S. Vidallon).



Figures 10–29. Some of the recorded plants at Tarak ridge of Mt. Mariveles. Figs. 10-12: plants observed at 400 m asl. Fig. 10: *Gmelina arborea*. Fig. 11: *Calamus usitatus*. Fig. 12: *Acacia auriculiformis*. Figs. 13-20: plants observed at 600 m asl. Fig. 13: *Syzygium* sp. Fig. 14: *Ficus septica*. Fig. 15: *Aristolochia* sp. Fig. 16: *Begonia* sp. Fig. 17: *Brucea mollis*. Fig. 18: *Anaxagorea luzonensis*. Fig. 19: *Coleus scuttellaroides*. Fig. 20: *Sarcandra glabra* Figs. 21-22: plants observed at 800 m asl. Fig. 21: *Angyreia barnesii*. Fig. 22: *Alpinia haenkeni*. Figs. 23-24: plants observed at 1000 m asl. Fig. 23: *Rubus fraxinipolius*. Fig. 24: *Glycosmis parviflora*. Figs. 25-29: plants observed at the peak. Fig. 25: *Melastoma malabathricum*. Fig. 26: *Pittosporum ferrigeneum*. Fig. 27: *Ficus* sp. Fig. 28: *Bulbophyllum* sp. Fig. 29: *Ceratolystys* sp. (photos taken by S. Vidallon).

Figures 30–32. The fruiting branches of three Endemic Rubiaceae species. Fig. 30: *Ixora macrophylla.* Fig. 31: *Psychotria luzoniensis.* Fig. 32: *Psychotria rubiginosa* (photos taken by S. Vidallon).

moisture and shade. A shrub *Psychotria luzoniensis* (Figs. 30–32), was also observed at 600 and 1000 m asl while doing a transect walk. At the very steep, hilly part of the mountain (800 m asl), forest area, the height and the presence of very large buttressed trees like *Dipterocarpus* sp. can be observed. The understory comprises fewer species and fewer families than the canopy layer. Some observed plants at the said elevation were: the shrubs, *Ixora macrophylla*, *Psychotria rubiginosa* (Fig. 32), *Angyreia barnesii* (vine) and an herb, *Alpinia haenkei* (Fig. 22). At the mountain top, in 1000 m asl, *Imperata cylindrica* was also the dominant species. *Imperata* also exists in quite large contiguous areas in the said elevation but no tree species were observed within the grassland vegetation but a shrub was observed in the said vegetation and this was *Rubus fraxinipolius* (Fig. 23). The trees observed in one of the three plots at the same elevation was *Glycosmis parviflora* (Fig. 24).

Plant Groups	Total Number of		
	Families	Genera	Species
Shrubs	20	32	35
Trees	12	16	17
Herbs	8	13	14
Epiphytes	7	10	11
Vines	3	3	3
Total	50	74	80

Table 1. Taxonomic inventory of flora at Tarak ridge trail in Mt. Mariveles, Bataan.

During the transect walk going to the peak of the Tarak ridge other species were recorded, these were the shrubs, *Melastoma malabathricum* and *Pittosporum ferrugineum*, a tree species, *Ficus* sp. and epiphytes, *Bulbophyllum* sp. and *Ceratostilys* sp. (Fig. 29).

The preliminary data reveals 80 species of flora belonging to 50 families and 74 genera were recorded at Tarak ridge trail in Mt. Mariveles, Bataan. Of the 80 flora species inventoried, 35 are shrubs, 17 are trees, 14 are herbs, 11 are epiphytes and 3 are vines (Table 1). Among the 80 species recorded, 32 are ornamentals, 20 are ecosystems services, 13 are medicinal plants, 7 are crop-food, 5 are weeds and 3 are crop-wood. The Angiosperm family having the most number genera is Poaceae (7), followed by Lamiaceae and Asteraceae with 5 genera each. The rest of the plant families have three or fewer species. A total of 5 species recorded were endemic in the Philippines. These are *Angyreia barnesii* (Convolvulaceae), *Psychotria luzoniensis*, *Psychotria rubiginosa* and *Ixora marcophylla* (Rubiaceae) and *Brucea mollis* (Simiroubaceae) (Table 2). There were eight (8) species of pteridophytes belonging to six (6) families and seven (7) genera. Among the pteridophytes, Polypodiaceae family had two species, while the rest had one species each.

Out of 80 plant species recorded at Tarak ridge

Family	Species	Local Name	Habit	Endemicity	Conservation Status DENR - IUCN
Acanthaceae	*Strobilanthes* sp.		S	N	NE
Anacardiaceae	*Mangifera indica* L. (1753)	Mangga	T	N	NE
Anonaceae	*Anaxagorea luzonensis* A.Gray (1854)		T	N	NE
Anonaceae	*Phaeanthus ophthalmicus* (Roxb. Ex G Don) J. Sinclair 1955		T	N	NE
Apocynaceae	*Tabernaemontana - pandacaqui* Poir. in Lam (1806)	Kampupot	T	N	NE
Aquifoliaceae	*Ilex asprella* (Hook. And Arn.) Champ ex Benth (1908)		S	N	NE
Araceae	*Aglaonema commutatum* Schott (1856)		S	N	NE
Araceae	*Aglaonema* sp.		S		
Arecaceae	*Caryota cumingii* Lodd. ex C.Mart (1853)	Ubod	T	N	NE
Arecaceae	*Calamus usitatus* Blanco, Fl. Filip (1837)		T	N	LC
Aristolochiaceae	*Aristolochia* sp.		S		
Aspleniaceae	*Asplenium* sp.		E	N	NE
Asteraceae	*Chromolaena odorata* (L.) (1907) R.M.King & H.Rob		S	N	NE
Asteraceae	*Senecio* sp.		S		
Asteraceae	*Gynura vidaliana* Elmer (1906)		S	N	NE
Asteraceae	*Mikania cordata* (Burm.f.) B.L.Rob. (1934)		V	N	NE
Asteraceae	*Pseudelephantopus spicatus* (Juss.) Rohr (1792)		H	N	NE
Athryriaceae	*Athyrium drepanopterum* (Kunze) A. Br. Ex Milde (1867)		E	N	NE
Begoniaceae	*Begonia* sp.		H		
Bromeliaceae	*Ananas comosus* (L.) Merr (1917)	Pinya	H	N	NE
Celastraceae	*Salacia* sp.		S		
Chloranthaceae	*Sarcandra glabra* (Thunb.) (1930)		S	N	NE
Convolvulaceae	*Argyreia barnesii* Merr. *var.* Barnesii (1950)		V	E	NE
Crassulaceae	*Kalanchoe* sp.		H		
Cyperaceae	*Bolboschoenus fluviatilus* (Torr). Sojak (1972)		H	N	NE
Dipterocarpaceae	*Dipterocarpus* sp.		T		
Euphorbiaceae	*Croton* sp.		S		
Euphorbiaceae	*Excoecaria philippinensis* Merr.(1906)		S	N	NE
Fabaceae	*Acacia auriculiformis* A.Cunn. ex Benth (1842)	Auri	T	N	NE

Lamiaceae	*Gmelina arborea* Roxb. ex Sm (1810)	Gmelina	T	N	NE
Lamiaceae	*Achyrospermum densiflorum Blume (1826)*		S	N	NE
Lamiaceae	*Coleus scuttelarioides* (L.) Benth (1830)		S	N	NE
Lamiaceae	*Pogostemon* sp.		S		
Lamiaceae	*Clerodendrum japonicum* (Thunb.) (1826)		S	N	NE
Lygodiaceae	*Lygodium flexuosum* (L) Sw (1800)		E	N	NE
Melastomataceae	*Melastoma malabathricum* L.(1753)		S	N	NE
Meliaceae	*Sandoricum koetjape* (Burm.f.) Merr (1912)	Santol	T	N	LC
Moraceae	*Artocarpus heterophyllus* Lam (1789)	Langka	T	N	NE
Moraceae	*Ficus* sp. Merr.(1904)		T		
Moraceae	*Ficus septica* Burm.f. (1768)		T	N	NE
Myrtaceae	*Syzygium* sp.		T		
Myrtaceae	*Eucalyptus* sp.		T		
Nephrolepidiaceae	*Nephrolepis cordifolia* (L) C. Presl. (1836)		E	N	NE
Orchidaceae	*Coelogyne* sp.		E		
Orchidaceae	*Ceratostilys* sp.		E		
Orchidaceae	*Bulbophyllum* sp.		E		
Pandanaceae	*Pandanus* sp.		S		
Pentaphragmataceae	*Pentaphragma* sp.		H		
Phyllanthaceae	*Breynia androgyna* L. Chakrab. & N.P.Balakr (2012)		S	N	NE
Phyllanthaceae	*Cleisanthus* sp.		S		
Phyllanthaceae	*Breynia-vitis idaea* (Burm.f.) C.E.C. (1932)		S	N	NE
Pipperaceae	*Piper* sp.		V	N	NE.
Pittosporaceae	*Pittosporum ferruginaeum* W.T. Aiton (1811)		S	N	NE
Poaceae	*Cyrtococcum patens* (L) A. Camus (1921)		H	N	NE
Poaceae	*Agrostis* sp.		H		
Poaceae	*Pogonatherum crinitum* (Thunb.)Kunth (1833)		H	N	NE
Poaceae	*Panicum maximum* Jacq. (1781)		H	N	NE
Poaceae	*Imperata cylindrica* (L) Raeusch (1812)	Kogon	H	N	NE
Poaceae	*Bambusa* sp.		S		
Polypodiaceae	*Leptochilus ellipticus* (Thunb.) Noot (1977)		E	N	NE
Polypodiaceae	*Leptochilus* sp.		E		
Polypodiaceae	*Microsorum longissimum* J.Sm. (1947)		E	N	NE
Pteridaceae	*Adiantum diaphanum* Blume (1828)		E	N	NE
Rubiaceae	*Psychotria rubiginosa* Elmer ex Merr (1906)		S	E	DD
Rubiaceae	*Psychotria luzoniensis* (Cham. & Schltdl.) Fern.-Vill (1880)		S	E	LC

Rubiaceae	*Ixora macrophylla* Bartl. (1830)	S	E	NE
Rosaceae	*Rubus fraxinifolius* Poir (1806)	S	N	NE
Rutaceae	*Glycosmis parviflora* (Sims.) Little (19408)	S	N	NE
Sapindacaceae	*Allophylus* sp.	T		
Simiroubaceae	*Brucea mollis* Wall ex. Kurz (1873)	S	E	NE
Sparmanniaceae	*Grewia laevigata* Vahl. (1790)	S	N	NE
Stemonuraceae	*Codiocarpus merrittii* (Merr.) (1943)	T	N	NE
Taccaceae	*Tacca palmata* Blume (1827)	S	N	NE
Thymelaceae	*Wikstroemia lanceolata* Merr.(1905)	S	N	NE
Urticaceae	*Pipturus arborescens* (Link) C.B.Rob (1911)	S	N	NE
Verbenaceae	*Lantana camara* L. (1753)	S	N	NE
Vitaceae	*Leea philippinensis* Merr. 1906	S	N	NE
Zingiberaceae	*Amomum* sp.	H		
Zingiberaceae	*Alpinia* cf. *aquatica* (Retz.) Roscoe 1807	H	N	LC
Zingiberaceae	*Alpinia haenkei* C.Presl (1832)	H	N	NE

Table 2. Preliminary checklist of flora at Tarak ridge trail in Mt. Mariveles, Bataan. Plant families are arranged alphabetically followed by species of each family, Habit (T = tree, S = shrub, H = herb, V = vine, E = epiphyte), conservation status based on IUCN Red List of Threatened Species or the DENR Administrative Order (DAO) 2017-11 (NE = Not Evaluated, DD = Data deficient, OT = Other Threatened Species, LC = Least Concern, V = Vulnerable, EN = Endangered, CR = Critically endangered), endemicity based on Pelser et al., (2011-onwards) (E = Philippine endemic, N = non-endemic).

trail in Mt. Mariveles, only two plant species were evaluated for their conservation status based on IUCN and DENR category. *Sandoricum koetjape* of Meliaceae family, *Calamus usitatus* and *Alpinia* cf. *aquatica* assesed by IUCN as the Least concern. *Psychotria rubiginosa* (Rubiaceae) was originally assessed by Sohmer & Davis (2007) as Near-threatened but in the recent study of Biag & Alejandro (2020), it was assessed as Data Deficient (DD). According to them, it requires further surveys for additional distributional data while *Psychotria luzoniensis* was also assessed by Sohmer & Davis (2007) as Least Concern.

The endemicity of collected flora was based on Co's digital flora of the Philippines by Pelser et al. (2011). Only 6.25% of all species identified were endemic in the Philippines. All the recorded species from the Rubiaceae family are endemic in the Philippines (Figure 5). Among the five endemic species recorded, two species from the Rubiaceae family, *Psychotria rubiginosa* and *P. luzoniensis* (Fig. 4) were also assessed based on its conservation status.

DISCUSSION

Altitude, slope, latitude, aspect, rainfall and humidity play a role in forming plant communities and their composition. (Kharwall et al., 2005). The lower elevation (400 m asl) in Tarak ridge is being limited to agroforestry practices based on the species observed at the said elevation. According to the forest guide/local resident, some landowners converted their lands within the mountain into agricultural land. The fruit trees and crops observed at the said elevation were evidence for the said practices. *Gmelina arborea* Roxb., an introduced species (Villegas & Pollisco, 2008) recorded at the same elevation, is a fast-growing fire-resistant timber tree promoted by national and regional government institutions and used in the local furniture industry (Snelder, 2001). *Acacia auriculiformis* Benth planted at the same elevation, is a fast growing plantation species for pulp and timber production and multipurpose used in tropical Asia. Its importance as plantation species can be attributed to rapid-growth, compared to the quality of the wood and tolerance to a range

of soil types and pH values (Yamamoto et al., 2003). At 600 and 1000 m asl of the mountain, *Imperata cylindrica* (known locally as cogon) were the dominant species. In the Philippines, the most common form of vegetation in the uplands is grassland, predominantly *Imperata cylindrica* (known locally as cogon) (Garrity, et al., 1997). *Imperata cylindrica* may exists in quite large contiguous areas or small patches in a vegetation mosaic with shrubs or cropped fields (Garrity, et al.,1997). The former was observed in grassland area at Tarak ridge. At the turn of 20th century, 40% of Luzon island and extensive areas of other Philippine islands were covered with grassland. The land classification of 1919 estimated that grassland covered 19% of the entire country, a figure that stayed roughly constant through 1957 (Roth, 1983). *Imperata cylindrica* alone covers 35 million hectares throughout the region. These grasslands are important to some people living around them that use them for grazing animals or for shifting cultivation. Still, they generally provide few benefits relative to the lands' potential productivity (FAO, 2010). In the Philippines, the large areas of grasslands were converted to agricultural, resulting in the decline of the net area of grassland (Garrity et al., 1993). According to the residents, the grassland area at 600 m asl was recently cleared, for it will be planted with *Pterocarpus indicus* by private entities. The government is promoting the establishment of tree plantations by private entities as well as permanent reforestation activities using their assisted natural regeneration (ANR) technique where usually fast-growing tree species such as *Gmelina arborea*, *Acacia mangium*, *Pterocarpus indicus* and *Eucalyptus* sp. are planted (Lasco & Pulhin, 2000). ANR is a forest restoration and rehabilitation practice that is successfully using *Imperata cylindrica* (L.) Raeusch and other grass-dominated areas to convert them into productive forests. This effective technique relies on the natural process of plant succession. It is used for fire prevention and management, control of grazing, suppression of grasses and nurturing seedlings and sapling of indigenous trees (FAO, 2010). At 800 m asl, forest area with dominant tree species was observed with some shrubs, herbs and vines recorded. The understory comprises fewer species than the canopy layer.

Among the 80 recorded species at Tarak ridge in Mt. Mariveles, Poaceae family are the dominant species. It was predominated by *Imperata cylindrica* (Cogon), a perennial grasses of low forage quality (Snelder, 2001) specifically found at 600 and 1000 m asl in the said mountain. Poaceae is the fifth most-species rich family of flowering plants (Hodkinson & Parnell, 2007a, b; The Plant List, 2013). This family is also ecologically dominant, covering grasslands or bamboo forests approximately 40% of the Earth's land surface (Gibson, 2008). Grasses are the most important plant group, providing our staple cereals such as *Eragrostis*, *Hordeum*, *Oryza*, *Secale*, *Sorghum*, *Triticum*, and *Zea*; sugar crops such as *Saccharum* and *Sorghum*; reeds such as *Arundo* and *Phragmites*; and bamboo for food, building, and amenity materials such as *Bambusa* and *Phyllostachys* (Clayton & Renvoize, 1986; Hodkinson et al., 2000). Lamiaceae family with five recorded genera at Tarak ridge is one of the largest families among the dicotyledons and is the most diverse and widespread plant families in terms of ethnomedicine with many species that are highly aromatic due to the presence of external grandular structures that produce volatile oil (Sarac & Ugur, 2007; Guiliani & Bini, 2008). Asteraceae family or sunflower family, with also five recorded genera at Tarak ridge, consists of 1911 genera and 32,205 species wordlwide (Royal Botanic Gardens Kew and Missouri Botanic Garden, 2019). The members of the family of Asteraceae are distributed in every continent but Antartica (Funk et al., 2005).

Only seven (6.5 %) of the recorded plants were endemic in the Philippines. Three recorded species from Rubiaceae family were all endemic in the Philippines. Among these three species, *P. rubiginosa* is endemic in the Philippines but mainly in Luzon and was found in Divilacan, Isabela (Biag & Alejandro, 2020). It was also recorded in Cebu (Sohmer and Davis, 2007). Two endemic species from the Rubiaceae family, the *Psychotria rubiginosa* was originally assessed as Near-threatened (Sohmer and Davis, 2007) but in the recent study it was assessed as Data Deficient (DD) (Biag & Alejandro, 2020) while *Psychotria luzoniensis* was assessed as Least Concern (Sohmer & Davis, 2007). According to Williams et al. (1996), endemicity is defined as the state of having a limited geographic range, which could be confined to an area or to a country. Endemic species characteristics such as restricted distribution, one or few populations, small population size, declining population size, excessive collection by humans, short reproduction capacity, specific habitat conditions, and necessity of stable and con-

stant environment make them more vulnerable than others to anthropogenic threats and extinction (Isik, 2011). These endemic species should be carefully monitored and managed, and their conservation should be considered a global priority (Isik, 2011; Fogi et al., 2014).

Anthropogenic disturbances have played a role in modifying vegetation in tropical forests of the Philippines (Sopsop & Buot 2013), which lead to observable changes in land use along elevational gradients in most of the country's mountains. Different threats to the mountain's biodiversity were observed during botanical exploration, such as charcoal production and honey collecting. Said activities can be destructive to the natural resources of the forest. The upgrade of the unmaintained earthen road to the mountain also could give the locals easy access to the mountain that might cause overexploitation of its natural resources. Since the Tarak ridge is one of the well-known destinations for mountaineers as one of the major climbs near Manila, an increase in the number of tourists/mountaineers poses a threat to the mountain as undisciplined mountaineers left their garbage in the campsite. The guide was the one who picked up the trash that they left. Papaya river is near the campsite and the water in this river is potable. It is also the source of water for the residents at the foot of the mountain, so protection strategies and conservation law should be created and implemented to protect and preserve its natural resources even though it is not a protected area.

CONCLUSIONS

A series of field visits at Tarak ridge in Mt. Mariveles reveals 80 species of vascular plants dominated by Poaceae family. There were five endemic species in the recorded flora. Among the documented flora, only three species were assessed based on their conservation status by IUCN. The IUCN assessed three species as Least concern. Two endemic species from the Rubiaceae family, one was recently assessed as Near-threatened while the other was assessed as Least Concern. Different threats to biodiversity were encountered during the conduct of the study, these were the production of charcoal, collecting of honey, the upgrade of unmaintained road going to the mountain and the undisciplined tourists/mountaineers that throw their garbage on the mountain. Protection and conservation strategies should be created and implemented to protect and preserve its natural resources.

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