New records of pteridophytes in Mount Matutum Protected Landscape, South Central Mindanao, Philippines with notes on its economic value and conservation status

Christine Dawn Galope-Obemio1, Inocencio E. Buot Jr.2,3 & Maria Celeste Banaticla-Hilario4,5

1 Science Department, College of Natural Sciences and Mathematics, Mindanao State University-General Santos City, Pattima, General Santos City 9500, Philippines.
2,3 Plant Biology Division, Institute of Biological Sciences, University of the Philippines Los Baños College, Laguna 4031, Philippines.
4 mbhilario1@up.edu.ph

Abstract: New records on distribution of pteridophytes in Mount Matutum Protected Landscape were documented. The species list was accounted with reference to specimen collections from various herbaria posted in digital databases and reliable literature on pteridophyte flora. Results further showed 105 new records for MMPL and its vicinity—South Cotabato, Sarangani province and General Santos City. From these, seven were new records for South Central Mindanao Region (Region 12). About 19 families, 56 genera were represented – 41 were ephiphytes, 10 lithophytes, and 45 soil inhabitants, the rest with dual habits — two (ground and lithophytic); seven (epiphytic and lithophytic). Moreover, 11 species were found to be threatened based on national list while local conservation assessment based on relative frequency noted 91 threatened species. A conservation plan for these valuable species in the protected landscape is also proposed to ensure sound intervention and sustainable environment for this plant group.

Keywords: Ferns, General Santos, lycophytes, Matutum, protected area, Sarangani, South Cotabato.
INTRODUCTION

A significant understory flora growing in the forest reserves are the pteridophytes or the ferns and lycophytes. These plants are widely distributed both in the tropical and temperate regions especially at higher elevations, and they flourish in moist, shaded habitats (Delos Angeles & Buot 2012). They are known to have high economic value as ornaments, food, and medicine, and are noted for its high ecological importance as indicators of environmental quality (Pouteau et al. 2016; Silva et al. 2018; Khine et al. 2019). Pteridophytes are also host to diverse faunal species (Ellwood & Foster 2004; Beaulieu et al. 2010; Scheffers et al. 2014). However, its richness and diversity are continuously challenged by geogenic and anthropogenic factors that lead to fragmentation and decrease in species over the years (Rodriguez et al. 2011; Silva et al. 2018). It is then very important to know the floristics of pteridophytes in the landscape to have a better understanding on appropriate conservation interventions.

The majestic Mount Matutum Protected Landscape (MMPLP) in the South Cotabato, Sarangani and General Santos (SOCSARGEN) region of southern Mindanao, is an important source of pteridophyte diversity. In fact, the entire island of Mindanao has been explored for pteridophyte diversity and about 186 species were identified (Hassler 2004-2022). Meanwhile, 11 species were described and named bearing the epithets of mindanaoensis, mindanensis or mindanaense – Adiantum mindanaoensis, Alsophila mindanensis, Cyclosorus mindanaoensis, Thelypteris mindanaensis, Microsorum mindanense, Polypodium mindanense, Polypodium punctatum ssp. mindanense, Polypodium punctatum var. mindanense, Selaginella mindanaoensis, Tectaria mindanaensis, and Aenigmopteris mindanaensis (Hassler 2004-2022). Though all of these except A. mindanaense were already considered synonyms, it still highlights the significant flora in this southern part of the country.

Mount Matutum was declared as protected area in 1995 through the Presidential Proclamation 552, and included in the roster of Key Biodiversity Areas (KBAs) (Conservation International - Philippines, Haribon Foundation and the Department of Environment and Natural Resources) and Important Bird Areas (IBAs) (Birdlife International 2018) making it a priority site for conservation. It holds forest wealth of significant flora, largely unexplored that could potentially be lost together with the ecosystem services they provide, with influx of population in the surrounding communities.

Scientific studies on Mt. Matutum’s biodiversity have been scarce with only a handful published accounts on trees (Obemio et al. 2016), and bryophytes (Azuelo et al. 2016). Similarly, assessments on its faunal resource were limited to anurans (Nuñeza et al. 2017a), reptiles (Nuñeza et al. 2017b), avians (Nuñeza et al. 2019), and bats (Nuñeza et al. 2015). Until this time, these remained the only published accounts for Mt. Matutum.

Interestingly, the earliest pteridophyte exploration in the protected area dates back to more than a hundred years ago (1917) by Copeland where he observed about 99 species. Among these, Gleichenia peltophora and Diplazium calliphyllum are known in the Philippines from this site only. Also, three species, though currently treated as synonyms, were named after the landscape, namely, Ctenopteris matutumensis, Dryopteris matutumensis, and Seligheea matutumensis. However, a concerted effort on documenting the Pteridophyte flora of the area remains unfinished.

The present attempt is thus the first of its kind in collating the details from various sources, including data from various herbaria and on recent field studies. It also seeks to present the economic uses associated with the pteridophytes and develop a local conservation status for each as many were not yet assessed with reference to the threatened list by the International Union for the Conservation of Nature (IUCN). As this study is the first attempt to document a more comprehensive account of the pteridophytes in the protected area, a lot of species then are new records for Mount Matutum and its vicinity – south central Mindanao region. The feature of these species is a remarkable milestone for MMPL and a significant step towards strengthening conservation interventions in the protected area. The authors seek to address the gap of an updated floristics and new records of pteridophytes in MMPL that would be crucial in their integration to conservation management as they are inevitably part of the ecosystem and function to enhance stability, resiliency, and sustainability of the landscape. This in turn cascade to the communities in form of ecosystem services, highlighting its conservation value.

MATERIALS AND METHODS

Study Area

Mount Matutum Protected Landscape (MMPL) is an important landmark and ecological watershed of South Cotabato and Sarangani Provinces in Southern Mindanao. It is surrounded by four municipalities (three
in South Cotabato; one Sarangani Province) and 14 barangays (12 South Cotabato, two Sarangani Province). A stratovolcano, this landscape stands to about 2,286 m, covering an approximate area of 14,000 ha of forestland, with 3,000 ha of a primary forest. A community of vascular (trees, pines, ferns) and non-vascular (mosses, liverworts, hornworts) plants thrive in this this primary forest.

The climate in the northwestern and southwestern parts of this protected area is tropical with significant rainfall throughout the year even in the driest months. It is classified as Type IV with reference to Philippine-climate types and tropical wet (Af category) based on the worldwide Köppen-Geiger. Monthly temperature variations are no greater than three degrees Celsius characterized by intense surface heating and high humidity resulting to daily formation of cumulus and cumulonimbus. These conditions favor the growth of different kinds of ferns and fern allies, which greatly prefer shaded and damp habitats. Moreover, the presence of rocky environments, slopes, and host trees make this landscape a host to diverse species of pteridophytes.

Field Methods

Assessment was done following the method of Banaticla & Buot (2004) and Delos Angeles & Buot (2015). A line transect of 10–20 m, depending on the heterogeneity of pteridophyte patches, was established. At least one transect was assessed for every 100 m elevation range. All fern and lycophytes along the transect were documented including epiphytes observed below 2.5 m.

Two sites in MMPL were considered as study areas to represent its northwestern slope (Image 1). Site 1 was in the municipality of Tupi, South Cotabato, accessible through the Glandang Trail (6.3500°N, 125.0570°E) while site 2 was in the municipality of Polomolok, South Cotabato, around the Keumang-Alnamang trail (6.3300°N, 125.0605°E).

A total 92 transects were subjected for sampling, Site 1 with 52 and Site 2 with 40 transects. Composition of ferns and fern allies were listed in every transect. Voucher specimens were collected in duplicate to triplicate whenever possible. Geographic location and elevation were determined using a geographic positioning system (GPS) device.

Laboratory Methods

Voucher preparation and identification

Collected specimens from MMPL were pressed and mounted in herbarium sheets. The herbarium specimens were stored, labeled, and prepared for distribution in Mindanao State University-General Santos City and Plant Biology Division, Institute of Biological Sciences, UPLB herbaria. Taxonomic identification and determination of distribution records were done using relevant taxonomic literature - Copeland (1958) and online databases (Pteridoportal: https://www.pteridoportal.org/portal/index.php, Co’s Digital Flora: https://www.philippineplants.org/, Ferns of the World: https://www.fernsoftheworld.com/). Experts in the field – Barbara Parris (Fern Research Foundation), Fulgent Coritico (Central Mindanao University, Bukidnon, Northern Mindanao), Cherie Cano (University of Southern Mindanao, Kabacan, North Cotabato), were also consulted to validate the specimen identification.

Based on these the new records, new distribution and rediscovered pteridophyte species in Mount Matutum and its vicinity - surrounding provinces of South Cotabato, Sarangani Province and city of General Santos were identified.

New records were evaluated and described with reference to relevant literature and database information. Key literature were the Fern Flora of the Philippines (Copeland 1958), and others such as Ebihara et al. (2006), Lehtonen et al. (2013), Parris & Sundue (2020). Database searches were also made through Cos Digital Flora of the Philippines (Pelser et al. 2011 in www.philippineplants.org), Catalogue of Life (Species 2020) (www.catalogueoflife.org), Flora of China (www.efloras.org) and Pteridoportal (Pteridophyte Collections Consortium) (www.pteridoportal.org) World Ferns (Hassler 2004–2022) and Flora Malesiana – www.floramalesiana.org (accessed 27 April 2018).

The conservation status of new records was determined from International Union for the Conservation of Nature (IUCN) Threatened List version 2021 from www.iucn.org, and the Department of Environment and Natural Resources (DENR) Administrative Orders (DAO) 2017–11 which features the Updated List of Threatened Philippine Plants and their Categories.

Local Conservation Assessment

Local assessment of conservation was done using the relative frequency of species distribution in MMPL with reference to the work of Villanueva and Buot (2020). Relative frequency (RF) was determined by the ratio of the number of transects where the species were observed and the total number of transects. Frequency below < 0.1% was considered critically endangered (CR), > 0.1 – 0.4% endangered (EN), > 0.4 – 0.7 vulnerable (VU),
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0.7 -1 nearly threatened (NT), and > 1 least concerned (LC). This local assessment highlighted the conservation status of those species found in MMPL that were not yet assessed in IUCN nor identified in DAO (2017–11).

RESULTS AND DISCUSSION

New Records in Mount Matutum Protected Landscape (MMPL)

Earlier studies recorded about 160 pteridophytes in Mount Matutum (Copeland 1917; Gaerlan et al. 1992; Gonzales 2001; Mindanao State University-General Santos City 2013), while this present undertaking adds another 105 taxa, totaling to 265 species in the Matutum area. Of these, 12 were lycophytes while 93 were monilophytes (ferns). As to habit, 45 were terrestrial, 41 epiphytes, 10 lithophytes and the rest showed dual habits such as terrestrial & lithophytic (two species) and epiphytic & lithophytic (seven species) (Table 1).

Copeland (1917) observed 57 ferns which were highlighted in his work on Fern Flora of the Philippines. Seventy-five years later, Gaerlan et al. (1992) collected 24 species as part of the biodiversity inventory of Philippine National Musuem. The next assessment was done in 2001 by Dr. Gonzales which showed 188 species and so far, the largest collection prior to this study. Meanwhile, MSU-GSC did an assessment in the lowland forest in 2013 and enlisted about 42 species. The works of Dr. Gonzales and MSU-GSC were unpublished records.

On the opposite side of MMPL, in Mount Busa, Kiamba, Sarangani Province, about 114 pteridophytes were observed from the exploration by Barcelona & Busemeyer (1993) based on digitized herbarium specimen collections from Miami University, Willard Sherman Turrell Herbarium (MU) and National Museum of Natural History-US Botany published in Pteridophyte Collections Consortium (www.pteridoportal.org). Meanwhile, in the Allah Valley Protected Landscape, northern part of MMPL, no records of pteridophytes have been known yet.

Interesting new records are the Athyrium nakanoi,
Table 1. Composition of new records in MMPL (with exsiccatea) and description of their spot characters and habit.

| Families and species composition (Common Name) | Description | Habit | Exsiccatea |
|-----------------------------------------------|-------------|-------|------------|
| I. Lycopodiopsida (Fern Allies)               |             |       |            |
| 1. Lycopodiaceae                              |             |       |            |
| *Huperzia javanica* (Sw.) Fraser-Jenk. (Fir clubmosses) | Stem ascending, dichotomously branched, leaves whorled, narrowly elliptic, margin serrate, apex caudate, spores trilete | Epiphyte. | OBEMI0453MSU |
| *Lycopodium clavatum* L. (Common clubmoss)    | Stem creeping with erect tips, dichotomously branched of unequal length, leaves small, moss-like, spirally arranged, dimorphic strobili, adventitious roots present | Ground. | OBEMI0587MSU |
| *Phlegmariurus delbrueckii* A.R. Field & Bostock (Tassel fern) | Pinnate, leaves alternate, compact, ovate-obtuse, 3 mm wide x 5 mm long, apex rounded-cuspidate, base cuneate, strobili dichotomous 20─35 mm, straight | Epiphyte | OBEMI0451MSU |
| *Phlegmariurus verticullatus* (L.f) A.R. Field (Tassel fern) | Stems dichotomously branching, leaves bristle-like, strobili terminal | Epiphyte | OBEMI0419MSU |
| *Pseudodiphasium volubile* (G. Forst.) Holub | Scrambling, horizontal stems, spreading, numerous dichotomous branching, dimorphic, fertile stems with short linear leaves, pendulous strobili at tip, sterile leaves widely spaced, linear-peltate. | Ground. | OBEMI0555MSU |
| 2. Selaginellaceae                             |             |       |            |
| *Selaginella boninensis* Baker (Spikemoss)    | Stems long, creeping, large leaves oblong, alternate small leaves ovate, spiral, apex acute, base rounded, rhizophore filiform | Lithophyte | OBEMI0485MSU |
| *Selaginella biformis* A. Br. ex Kuhn (Spikemoss) | Stems long, creeping, branched on upper part, stramineous, primary leafy branches flattened, ovate, leaves on stem ovate-lanceolate, apex acute, base rounded, rhizophore on rhizomes | Lithophyte | OBEMI0549MSU |
| *Selaginella engleri* Hieron (Spikemoss)      | Stems erect, fronds bipinate, alternate, pinna ovate, sporangia at tips of fertile pinna, branched microphylls contiguous | Ground | OBEMI07396PBDH |
| *Selaginella gastrophylla* Warb. (Spikemoss)   | Stems erect, fronds bipinate, alternate, pinna ovate, leaves on stems unappressed, widely spaced, microphyll not contiguous, sporangia at tips of fertile pinna, cylindrical | Ground | OBEMI0488MSU |
| *Selaginella involvens* (Sw.) Spring (Spikemoss) | Stems erect, leaves on stems scale-like, pale yellow, median stems branched, fronds pinnate, ovate-triangular, ventral leaves contiguous, sporangia terminal | Lithophyte | OBEMI0486MSU |
| *Selaginella remotifolia* Spring (Spikemoss)   | Stems branched from base; secondary branches forked. Fronds pinnate, axillary leaves ovate, acute, leaves on branches elliptic-lanceolate, not overlapping | Ground | OBEMI0489MSU |
| II. Polypodiopsida (Ferns)                    |             |       |            |
| 1. Aspleniaceae                               |             |       |            |
| *Asplenium affine* Sw.                        | Pinnatifid-bipinnatifid.alternate, opposite at base, petiolulate, lobed, acuminate apex, pinnules alternate, rounded apex, cuneate base, stalked, acrosopic pinnules smaller, lower pinnules more lobed. Sori linear forming V shape over lamina veins | Lithophyte | OBEMI0052MSU |
| *Asplenium cuneatum* Lam.                    | Lamina ovate. Pinna triangular; apex aristate, base convex, pinnules fan-shape, basal pinnules larger, lobed, apex toothed, base convex-truncate, actinodromous. Sori linear 3─4 interspersed over veins | Epiphyte | OBEMI0053MSU |
| *Asplenium elmeri* Christ                   | Stipe clumped or solitary. Lamina bipinnate, ovate, alternate, pinnules alternate, basal pinnule larger, fan-shaped. Sori laminar, linear, single or paired at segments. | Lithophyte | OBEMI0056MSU |
| *Asplenium harrhidum* Kauff. (Lacy spleenwort) | Stipe scaly, lamina pinnate, alternate, lobes cut down halfway the costa, margin with deep sinuses, pinna linear-lanceolate, apex attenuate, base convex. Sori linear parallel and very near the costa | Ground | OBEMI0074MSU |
| *Asplenium laserepitifolium* Lam.             | Lamina tripinnate, alternate, pinnae ovate, pinnules obovate, rachis dark brown, apex acute, base cuneate. Sori linear incline over veinlets. | Epiphyte | OBEMI07283PBDH |
| *Asplenium lobulatum* Mett.                  | Stipe clumped (2 or more), Lamina pinnate, triangular, acuminate apex, truncate base, basiscopic pinna opposite, acrosopic subopposite, reduced, pinnules lanceolate, acuminate, truncate-cuneate-convex base, margin serrate. Some basal pinnules forming prominent lobes on one side of the blade. Sori linear, inclined close to midrib | Epiphyte | OBEMI0169MSU |
### Families and species composition

#### Common Name

| Family | Genus | Species | Description | Habit | Exsiccat |
|--------|-------|---------|-------------|-------|----------|
| Asplenium longissimum Blume | Asplenium | longissimum | Pinnate, ovate, attenuate apex, base, truncate, pinna alternate, stalked or sessile, apex attenuate, base truncate-convex. Sori linear inclined close to costa | Ground | OBEMIO7395PBDH |
| Asplenium pellucidum Lam. | Asplenium | pellucidum | Stipe clumped, Lamina elliptic, pinna lanceolate-triangular, leaf base covering rachis on the ventral side, margin lobed, apex acute, base truncate. Sori linear inclined with ends touching the costa | Epiphyte | OBEMIO303MSU |
| Hymenasplenium excisum (C. Presl) S. Linds. | Hymenasplenium | excisum | Pinnate, thin, papyraceous, wedge-shape, rounded apex, truncate base, toothed, unlobed, sori linear over veins, 2 venation cladodromous, decurrent attachment, stele haplostele, x-shape xylem. | Epiphyte | OBEMIO049MSU |
| Hymenasplenium subnormale Copel. | Hymenasplenium | subnormale | Pinnate, lamina ovate-triangular, cordate base, attenuate apex, pinna ovate reduced at apex, opposite-subopposite, rounded apex, truncate base, sori linear, inclined halfway from costa | Lithophyte | OBEMIO7395PBDH |

#### 2. Athyriaceae

| Family | Genus | Species | Description | Habit | Exsiccat |
|--------|-------|---------|-------------|-------|----------|
| Athyrium puncticalle (Blume) T. Moore | Athyrium | puncticalle | Evergreen pinnatifid, Lamina triangular-lanceolate, pinna stalked, margins serrate, apex acute, base cuneate, basiscopic pinna strongly auriculate. Sori medial on the veins, round | Ground | OBEMIO7252PBDH |
| Athyrium nakanoii Makino | Athyrium | nakanoii | Evergreen, rhizome creeping-ascending, erect, frond solitary or caespitose, bipinnate, lamina papyraceous, pinnae linear-lanceolate, pinnales, pinnate, deltoid, apex acuminate, base truncate, basal pinnales ovate-lanceolate. Margin shallowly lobed. Sori continuous, U-shape, over tertiary veins | Ground | OBEMIO7251PBDH |
| Cercomeris bonnoffensis (C. Chr.) K. Ivatts. & M.G.Price | Cercomeris | bonnoffensis | Stipe clumped, frond coriaceous, pinnae short-stalked, wide ovate, rounded-acute apex, base of the pinna asymmetric, deeply-lobed. Sori linear grooved over craspedodromous veins. | Ground | OBEMIO7253PBDH |
| Diplazium dilatatum Blume (Twinsorus ferns) | Diplazium | dilatatum | Fronds pinnate-bipinnatifid, lamina dark green adaxially, pinnae opposite-sub-opposite, sessile-subsessile, acroscopic pinna smaller, less lobed, base of pinnule wider, apex acuminate, base truncate. Sori linear aligned along costa forming v-shape | Ground | OBEMIO235MSU |
| Diplazium geophilum Alderw. (Twinsorus ferns) | Diplazium | geophilum | Evergreen pinnatifid, Lamina triangular-lanceolate, pinnae short-stalked, wide ovate, rounded-acute apex, base of the pinna asymmetric, deeply-lobed. Sori linear grooved over craspedodromous veins. | Ground | OBEMIO225MSU |
| Diplazium sorzogonense (C. Presl.) C. Presl. (Twinsorus ferns) | Diplazium | sorzogonense | Stipe clumped, fronds pinnatifid, pinnae oblong-triangular, apex acuminate, base cuneate, basal and apical segments reduced. Sori linear, on veins half-way to margin | Ground | OBEMIO602MSU |

#### 3. Cystaceae

| Family | Genus | Species | Description | Habit | Exsiccat |
|--------|-------|---------|-------------|-------|----------|
| Alsophila apoensis (Copel) R.M. Tryon | Alsophila | apoensis | Tree fern. Trippinnatifid, Frond glabrescent, coriaceous, pinnales sessile, oblong, short acuminate, segments serrulate toward apex. Sori costal, globose | Ground | OBEMIO7255PBDH |
| Alsophila hermannii R.M. Tryon | Alsophila | hermannii | Tree fern. Trippinnatifid, Frond glabrescent, coriaceous, pinnales sessile, triangular, caudate, truncate, sori toward apex. Sori costal, globose | Ground | OBEMIO7256PBDH |
| Alsophila heterochlamydea (Copel.) R.M. Tryon | Alsophila | heterochlamydea | Tree fern. Trippinnatifid, Pinnales sessile, pinnae at base, segments oblong, serrulate at apex. Sori costal, obsolete. | Ground | OBEMIO001MSU |
| Spheeropteris elmeri (Copel) R.M. Tryon | Spheeropteris | elmeri | Tree fern. Trippinnate. Pinnales triangular, apex caudate, base truncate, segments oblong, apex rounded, thin, papyraceous. Sori costal, small, circular on sides of secondary veins | Ground | OBEMIO177MSU |
| Spheeropteris glauca (Blume) R.M. Tryon | Spheeropteris | glauca | Tree fern. Trippinnate. Pinnales triangular, acuminate apex, truncate base, untoothed, segments oblong, papyraceous, rounded apex, sessile, up to 14 veins on a side. Sori costal, globose about 7 pairs | Ground | OBEMIO029MSU |
| Spheeropteris lepifera (I.Sm. ex Hook.) Copel. | Spheeropteris | lepifera | Tree ferns. Trippinnate. Pinnales short-stalked, oblong, truncate base, segments pinnae, linear, acute apex. Sori costal, globose | Ground | OBEMIO7257PBDH |

#### 4. Dennstaedtiaceae

| Family | Genus | Species | Description | Habit | Exsiccat |
|--------|-------|---------|-------------|-------|----------|
| Histiopteris incisa (Thumb.) I.Sm. (Bat’s wing fern) | Histiopteris | incisa | Rhizome robust, creeping, fronds widely spaced, widely ovate slightly dimorphic with fertile lobes slightly narrower, pinnae pale green, opposite, wide-angle with deep lobation on margins, sori marginal continuous, linear and exindusiate surrounded by reflexed leaf margin. | Ground | OBEMIO7258PBDH |
## Families and species composition

| Common Name | Description | Habit | Exsic cata |
|-------------|-------------|-------|------------|
| *Microlepis strigosa* (Thunb.) C. Presl (Lace Fern) | Fronds wide-ovate, bipinnatifid, pinnules alternate, attenuate apex, convex base, pinnules sub sessile, | Ground | OBEMIO7259PBDH |
| *Monachosorum henryi* Christ | Rhizome erect. Lamina ovate-triangular, pinna oblong, pinnules ovate lanceolate, base truncate-round, thin, basal pinnules more lobed, apical pinnules more lanceolate, sori circular at vein ends, petiole round, solenostele stele, 2-linear vascular bundles. | Ground | OBEMIO176M5U |

### 5. Dicksoniaceae

| Common Name | Description | Habit | Exsic cata |
|-------------|-------------|-------|------------|
| *Dicksonia amarosoana* Lehnhrt & Coritico (Amorosso’s wooly tree fern) | Ground tree fern. Tripin nat ifid, lamina dark green adaxially, light green abaxially, pinna sub sessile, lanceolate, base truncate, attenuate apex, basal segment shorter, sori circular, spores globose. | Ground | OBEMIO7260PBDH |

### 6. Dryopteridaceae

| Common Name | Description | Habit | Exsic cata |
|-------------|-------------|-------|------------|
| *Arachniodes amabilis* (Blume) Tindale | Rhizome creeping. Fronds oblong-ovate, bipinnate, coriaceous, acroscopic pinnules reduced, apex caudate, base cuneate, terminal on veins. | Ground, Lithophyte | OBEMIO7325PBDH |
| *Bolbitis heteroclitca* (C. Presl) Ching | Rhizome horizontal. Frond odd-pinnate, opposite, apical lamina larger, elliptic, caudate apex, cuneate base, margin crenose, dimorphic, secondary veins brochidodromous, tertiary veins reticulate, opposite-subopposite, tertiary veins. Sori naked covering fertile blades. | Epiphyte | OBEMIO7261PBDH |
| *Dryopteris hendersonii* (Bedd.) C. Chr. (Wood fern). | Tripin nat ifid. Fronds wide ovate, pinnae alternate, base pinnae larger, pinnules triangular-oblong, acuminate apex, truncate-oblique base, lobe, apex toothed. Sori round, indusiate. | Ground | OBEMIO484M5U |
| *Dryopteris purpurascens* (Blume) Christ (Wood fern). | Frond pinnate-bipinnate, alternate, pinnules triangular, apex acuminate with alternate tooth along margins, pinnules triangular, acuminate apex, rounded base, base pinnules of larger pinna pinate, toothed, acroscopic pinnules toothed. Sori costal, round, side by side the midvein. | Ground | OBEMIO502M5U |
| *Dryopteris permagna* M. Price (Wood fern). | Ground, bipinnatifid on acroscopic pinna tri pin nat ifid on lower pinna, alternate, triangular, acuminate apex, base truncate, acroscopic segments pinnatifid, lower to middle segments serrate. Sori round, parallel along midrib and secondary veins. | Ground | OBEMIO7262PBDH |
| *Polystichum moluccense* T. Moore | Tri pin nat ifid, alternate, dark green adaxial, pinnae oblong, acuminate apex, rounded base, pinnules thick, rough, ovate-triangular, base lobed, truncate-oblique, apex acute, toothed. Sori round, lamina over veinlet tips. | Epiphyte | OBEMIO393M5U |
| *Polystichum elmeri* Copel. | Bipinnate, alternate, light green on adaxial, pinnae oblong, acuminate apex, convex base, pinnules thick, rough, ovate, base truncate-oblique. | Epiphyte | OBEMIO5833M5U |
| *Terenophyllum aculeatum* (Blume) Mett. ex Kuhn | Bathypophyl pinnate-bipinnate, alternate, dichotomously branched, rhizome creeping. Lamina pinate, lanceolate. Fertile pinna alternate, linear. Sori continuous covering entire blade of fertile leaf. | Epiphyte, Climber | OBEMIO7263PBDH |

### 7. Hymenophyllaceae

| Common Name | Description | Habit | Exsic cata |
|-------------|-------------|-------|------------|
| *Abrodictyum plumo* (Hook.) Ebihara & K. Iwats. | Rhizome creeping. Fronds tufted, alternate, oblong, opposite at base, pinna reduced, needle-like middle pinna larger, segments clumped, dichotomous tips. Sori cup-shape at vein ends of basal segments. | Epiphyte | OBEMIO468M5U |
| *Abrodictyum obscurum* (Blume) Ebihara & K. Iwats. | Rhizome creeping, stipe dark or light brown, lamina tri pin nat ifid, herbaceous, triangular-ovate, pinnae oblong-ovate, apex obtuse-acute, widely-tooth, base cuneate. Sori apical on some segments, involucres cylindrical. | Lithophyte | OBEMIO469M5U |
| *Crepidomanes minutum* (Blume) K. Iwats. | Rhizome branching, stipe dark brown, lamina ovate, base cuneate, thin filmy, entire, segments linear, apex obtuse, base rounded-cordate. Involucres funneliform. | Lithophyte | OBEMIO7264PBDH |
| *Crepidomanes grande* (Copel.) Ebihara & K. Iwats. | Rhizome short, erect, tufted fronds, lamina quadripinnate, ovate-oblong. Sori tabular on distal part of fronds | Ground, Lithophyte | OBEMIO735M5U |
| *Hymenophyllum ramosi* Copel. (Filmy fern) | Rhizomes long, creeping, lamina pinnate-tripinnatifid, elliptic-triangular, alternate, pinna ovate, Sori bud-shape on acropetal portion of lamina | Epiphyte | OBEMIO616M5U |
| *Hymenophyllum denticulatum* Sw. (Filmy fern) | Rhizomes long, creeping, rachis narrowly-winged, toothed, lamina bipinnatifid, pinnae alternate, wide-ovate, margins wide-serrate, veins prominent at abaxial portion. Sori cup-shape at tips of acroscopic segments | Epiphyte, Lithophyte | OBEMIO546M5U |
## Families and species composition (Common Name)

| Genus | Scientific Name | Description | Habit | Exsiccat |
|-------|----------------|-------------|-------|----------|
| **Hymenophyllum** | fimbriatum J. Sm (Filmy fern) | Rhizomes long, creeping, rachis narrowly-winged entire nearly toward the base, alternate, elliptic, pinnae ovate pinnatisect, Sori at tip of acroscopic segments with slightly extruded involucres | Epiphyte, Lithophyte | OBEMIO545MSU |
| **Hymenophyllum** | haesichium (Bosch) C. Chr. (Filmy fern) | Rhizome long, creeping, rachis narrowly-winged almost inconspicuous, pinnatifid, alternate, margins toothed, elliptic, pinnae deltoid, sparsely toothed, unequally cuneate-oblque. Sori on acroscopic segments, involucres elongate-elliptic, receptacles exerted. | Epiphyte, Lithophyte | OBEMIO7266PBDH |
| **Hymenophyllum** | abruptatum Blume (Filmy fern) | Rhizomes, long, creeping, bipinnatifid, alternate, wide space between pinnae, pinnae wide-ovate, terminal segments filiform margin entire, sori involucres wide, round. | Epiphyte, Lithophyte | OBEMIO544MSU |
| **Hymenophyllum** | nitidulum (Bosch) Ebihara & K Iwats. (Filmy fern) | Rhizomes long, creeping, filiform, stipes almost wingless, lamina obovate, dichotomously lobed, dissected at base, lobes linear or forked. Sori terminal on lobes, involucres deltoid-like, sunken | Epiphyte | OBEMIO736MSU |
| **Hymenophyllum** | pallidum (Blume) Ebihara & K Iwats. (Filmy fern) | Rhizomes long, creeping, stipes hairy at base, lamina bipinnatifid, oblong, obtuse apex, cuneate base, pinnae alternate, sessile, ovate. Sori terminal on acroscopic pinnae, enclosed | Epiphyte, Lithophyte | OBEMIO547MSU |
| **Hymenophyllum** | thiudium Harrington (Filmy fern) | Rhizome, long, creeping, stipes hairy at base, lamina bipinnatifid-tripinnatifid, pinna alternate, ovate, cuneate base, pinnae alternate, sessile, ovate. Sori terminal on acroscopic pinnae, margin entire, cuneate-oblique. | Epiphyte, Lithophyte | OBEMIO7268PBDH |
| **Vandenboschia** | auriculata (Blume) Copel. | Frond creeping, alternate, oblong, petiolulate, basal pinnules wider, wide ovate. Sori apical on acroscopic segments. | Epiphyte | OBEMIO7269PBDH |
| **Leucostegia** | truncata (D. Don) Fraser-Jenk. | Fronds tripinnate, ovate, coriaceous, pinna alternate, triangular, size increasing toward base, pinnules ovate-triangular, apex acuminate, base convex, basal segments in basal pinnule deeply lobed, widely ovate, rounded base, obtuse apex. Sori kidney-shaped on veinlet ends. | Ground | OBEMIO347MSU |
| **Odontosoria** | retusa (Cav.) J. Sm. | Fronds tripinnate-pinnate, pinnae alternate, ovate, stalked decurrent to rachis, acuminate apex, base convex, pinnules fan-shape, stalked, truncate apex, cuneate base. Sori linear on apex of pinnules in false indusium | Ground | OBEMIO737MSU |
| **Tapeinidium** | pinnatum (Cav.) C. Chr. | Rhizome short, creeping, fronds pinnate, elliptic-oblong, papyraceous, pinna linear, apex acuminate, suboblong, rachis stramineous, margin shallowly crenate, apex acuminate, base cuneate. Sori submarginal on vein ends, cup-shape indusia | Ground | OBEMIO7274PBDH |
| **Tapeinidium** | gracile (Blume) Alderw. | Rhizome short, creeping, fronds ovate, alternate, pinna elliptic-linear, acuminate apex, rounded base, upper pinna pinnatifid, lower pinnules pinnatifid, linear. Sori round, marginal | Ground | OBEMIO738MSU |
| **Lindsaea** | pulchella (J. Sm.) Mett. ex Kuhn | Rhizome long, creeping, fronds linear, acuminate apex, papyraceous, lower pinnule opposite, upper sub-opposite, triangular, truncate apex, cuneate base. Sori submarginal on vein ends. | Epiphyte, Climber | OBEMIO7270PBDH |
| **Osmolindsaea** | odorata (Roxb.) Lehtonen & Lehtonen | Rhizome short, creeping, fronds pinnate, lamina wide, lanceolate, pinnae alternate, truncate apex, slightly lobed, convex base. Sori marginal, elongated, interrupted | Lithophyte | OBEMIO739MSU |
| **Angiopteris** | evecta Sw. (Giant fern) | Fronds tripinnate, alternate, pinna elliptic-oblong, fleshy, pinnules stalked, apex acuminate, serrate, rounded base, margin crenose, Sori submarginal, oval shape. | Ground | OBEMIO7275PBDH |
| **Ptisana** | pellucido (C. Presl) Murdock | Fronds bipinnate, alternate, fleshy, pinnae ovate, pinnules lanceolate, apex acuminate, base rounded, margins serrate. Sori ovate, submarginal. | Ground | OBEMIO428MSU |
### New Records of Pteridophytes in Mount Matutum

**Galope-Obemio et al.**

#### Families and Species Composition

| Family | Common Name | Description | Habit | Exsiccati |
|--------|-------------|-------------|-------|-----------|
| 11. Oleandraceae | *Oleandra sibbaldi* Grev. | Rhizome long-creeping, fronds elliptic, base cuneate, apex acuminate, membranous, with sparse catenate hairs, costa, hairy, darker on lower surface. Sori inframedial, reniform. | Epiphyte | OBEMIO099MSU |
| 12. Ophioglossaceae | *Botrychium douglasii* Wall. ex Hook. & Grev. (Moonwort) | Rhizome erect, lamina bipinnate, pinnate to bipinnate, herbaceous, pinnae alternate-subopposite, short stalked or subsessile, triangular, pinnules ovate, apex acute-acuminate, base rounded, serratate, basal pinnules lobed. Sori round on separate fertile stalks | Ground | OBEMIO7276PBDH |
| 13. Plagiogyriaceae | *Plagiogyria glauca* (Blume) Mett. | Pinnate, Fronds ovate, pinnula linear; acuminate, base truncate, subsessile, glaucous ventral surface, adaxial surface green, margin serrate. Sori tetrahedral | Ground, Lithophyte | OBEMIO0473MSU |
| 14. Polypodiaceae | *Calymmodon gracillimus* (Copel.) Nakai ex H. Ito | Small, caespitose, linear, segments alternate, triangular, up to 2mm. Sori round numerous enclosed by folds of margin. | Epiphyte | OBEMIO7277 PBDH |
|  | *Chrysogrammitis glandulosa* (J.Sm.) Parris | Pinnatisect. Lamina lanceolate, apex acute, base cuneate. Segments triangular, larger at middle, decreasing toward apex. Sori round, 1 in acroscopic segments, 2-3 along middle segments. | Epiphyte, Lithophyte | OBEMIO0033MSU |
|  | *Dryania aglaomorpha* Christenh. (Oak leaf fern) | Pinnatisect, dimorphic, coriaceous, margin crenose. Sori continuous, oval-square-shaped almost filling the segment | Epiphyte, Lithophyte | OBEMIO7279 PBDH |
|  | *Dryania descensa* Copel. (Oak leaf fern) | Pinnatisect, dimorphic, coriaceous, margin crenose. Sori circular scattered on abaxial surface | Epiphyte, Lithophyte | OBEMIO7280PBDH |
|  | *Dasygrammitis malaccana* (Baker) Parris | Stipe clumped, fronds pinnate, lanceolate-oblong, aristate, base cuneate, pinnula alternate-sub-opposite, sessile, linear, apex rounded. Sori continuous on apical portion of pinna | Epiphyte | OBEMIO740MSU |
|  | *Goniophlebium subauriculatum* (Blume) C. Presl (Lacy Pine Fern) | Pinnate, alternate, pinnula linear, light green, apex acuminate, base auriculate, short-stalked, margin mildly serrate. Sori globose, parallel with midrib, within reticulate veinlets. | Epiphyte | OBEMIO467MSU |
|  | *Goniophlebium persicifolium* (Desv.) Bedd. | Pinnate, alternate, stalked, pinnula lanceolate, apex narrowly acuminate, base oblique, margins crenose to mildly serrate. Sori orbicular on both sides of midrib within reticulate veinlets | Epiphyte | OBEMIO539MSU |
|  | *Goniophlebium pseudoconnatum* Copel. | Pinnate, alternate, pinnula linear, dark green, apex acuminate, base auriculate, short-stalked, margin mildly serrate. Sori globose, parallel with midrib, within reticulate veinlets. | Epiphyte | OBEMIO540MSU |
|  | *Leptochilus insignis* (Blume) Fraser-Jenk. | Pinnatisect. Pinna broadly ovate, rounded base, acute apex, sinus increasing to the base, segments elliptic, aristate. Sori oval randomly interspersed | Epiphyte. | OBEMIO115MSU |
|  | *Laxogramme avenia* (Blume) C. Presl | Simple, lamina linear-ovate, acute apex, base attenuate, midrib raised on abaxial side, symmetrical. Sori tubular, parallel the midrib on acroscopic side. | Epiphyte. | OBEMIO741MSU |
|  | *Laxogramme paralelia* Copel. | Simple lamina, obovate. Dark green abaxial, light green adaxial, Sori linear lining the veins spaced increasingly to the middle of the blade. | Epiphyte. | OBEMIO742MSU |
|  | *Laxogramme scolopendriodes* (Gaudich.) C.V.Morton | Simple lamina, lanceolate, Sori linear inclined on the midrib at acroscopic side Epiphyte, Lithophyte | OBEMIO0033MSU |
|  | *Oreogrammitis jagoriana* (Mett ex Kuhn) Parris & Sundue | Simple, leaf linear, hirsute, apex obtuse, base attenuate, margin entire, Sori circular, exindusiate, one on each side of costa. | Epiphyte | OBEMIO0057MSU |
|  | *Oreogrammitis reinwardt* (Blume) Parris | Simple, small-leaf, apex acuminate, base attenuate, margin crenate or non-crenate, hirsute, Sori circular, exindusiate, one on each side of midrib. | Epiphyte | OBEMIO0596MSU |
|  | *Prosopis celebica* (Blume) Tagawa & K. Iwats. | Stipe clumped, lamina elliptic, pinnatissect, coriaceous, pinnula linear. Sori oval, submarginal | Epiphyte | OBEMIO743MSU |
|  | *Prosopis multicaudata* (Copel) Parris | Stipe clumped, lamina widely elliptic, pinnatissect, coriaceous, pinnula linear, apex attenuate. Sori oval at an angle toward the midrib, halfway from apex never reaching the base. | Epiphyte. | OBEMIO370MSU |
|  | *Seliguesa albidosquamata* (Blume) Parris | Odd-pinnate. Alternate, Long-stalked. Pinna lanceolate, stalked, apex acuminate, base cuneate, symmetrical, margin entire, lined with bright white scales. Sori small, dot shape between the midrib and margin | Epiphyte | OBEMIO728PBDH |
### New records of pteridophytes in Mount Matutum Galope-Obemio et al.

#### Families and species composition

| Family | Genus, Species | Description | Habit | Exsiccate |
|--------|----------------|-------------|-------|----------|
| **Pteridaceae** | | | | |
| **Thelypteridaceae** | | | | |
| **Pteridaceae** | | | | |
| **Tectaria** | **Tectaria dissecta** (G.Forst.) Lellinger | Rhizome ascending, Stipe solitary, fronds pinnatifid-bipinnatifid, pinna opposite, margin deeply-lobed, apex acuminate, base rounded. Sori interspersed over the abaxial portion of the lamina | Ground | OBEMIO7298PBDH |
| | **Tectaria melanocaulos** (Blume) Copel. | Stipe and rachis black, inanitifid-bipinnatifid large-leaf, wide-ovate, basal pinnae pinnate, margins serrate and lobed, apex acuminate, base rounded. Sori interspersed over the abaxial portion of the lamina | Ground | OBEMIO7297PBDH |
| **Chingia** | **Chingia ferox** (Blume) Holttum | Fronds pinnate, stipes to rachis bristle-like, pinna alternate, short-stalked, acuminate, round base, basal pinna oriented downwards, margin mildly lobed, Sori circular in two adjacent rows within each lobe segment | Ground | OBEMIO7292PBDH |
| | **Christella acuminata** (Houtt.) Holttum | Pinnatifid, lamina wide-ovate, pinna opposite at base, sub-opposite towards acroscopic pinna, acuminate, base sagitate with basal pinna oriented downwards, pinnate triangular, acuminate, truncate. Sori circular submarginal terminating at ends of lobes | Ground | OBEMIO179MSU |
| | **Christella dentata** (Forssk.) Brownsey & Jermy | Pinnatifid, Lamina widely elliptic, apical and basal pinna reduced, oblong, acuminate, basal pinna oriented downwards, margins moderately lobed. Sori circular, submarginal | Ground | OBEMIO745MSU |
| | **Pneumatopteris laevis** (Mett.) Holttum | Stipes clumped, frond pinnate, widely-ovate, alternate, acuminate, pinnate lanceolate, | Ground | OBEMIO541MSU |
| | **Pneumatopteris nitidula** (C. Presl) Holttum | Acuminate, obtuse. Sori-circular submarginal | Ground | OBEMIO7294PBDH |
| | **Pronephrium nitidum** Holttum | Pinnatifid. Lamina wide ovate, pinna opposite, deeply-lobed, 190 mm long x 130 mm wide, basal pinna pinnate sessile, rachis black. Sori interspersed within tertiary veins forming areoles. | Lithophyte | OBEMIO744MSU |
| | **Sphaerostephanos ellipticus** (Rosenst.) Holttum | Stipes clumped, rachis pilose, frond pinnate, wide-elliptic, pinna linear-triangular, acuminate, truncate, margin moderately-lobed. Sori circular over lamina in lobe margins | Ground | OBEMIO7296PBDH |
Similarly, *jagoriana* was last observed in 1904 & 1909 and 1904 & 1924, respectively, in Mount Apo and Davao Region ([www.pteridoportal.org](http://www.pteridoportal.org)). These new records in MMPL provide significant contribution to the biodiversity heritage of Mindanao island. Prior to this study, published accounts on pteridophyte diversity has largely been from two regions — 10 (Mt. Malindang & Mt. Kitanglad Range in Bukidnon) and 11 (Mt. Hamiguitan Range). The highest richness reported here was in Mt. Kitanglad Range which totalled to 439 with a total account of 632 species for the entire Mindanao island (Amoroso et al. 2011). It is expected then that the account on species richness will change with the results from this study.

Several species were also highlighted as useful either as medicine, food, or ornamental (Table 2). Tree ferns (*Alsophila*, *Sphaeropteris*) have been used as source for the region with type specimens found in Mindanao — Agusan & Zamboanga, from 1911–1912 collections ([www.pteridoportal.org](http://www.pteridoportal.org)).

Also forming the new records for South Central Mindanao are *Asplenium laserpitifolium*, *D. geophilum*, *P. multicaudatum* and *P. celebica* which were all observed in the montane forest of MMPL. There were also ferns discovered by E. Copeland in 1917 which at that time were second occurrence records in the entire Philippines — *Sphaerostephanos urdanetensis*, *Cornopteris opaca*, *Cornopteris philippinensis*. Meanwhile, based on worldwide database for herbarium collections, two species in Mount Matutum recorded by Copeland in 1917 remained to be the only record so far in the country namely *G. peltophora* and *Diplazium calliphyllum*.

### Table 2. Economic uses from several new records of ferns and lycophytes in MMPL.

| Species | Uses | Reference |
|---------|------|-----------|
| *Adiantum* spp. | Ornamental | Oloyede 2012 |
| *Angiopteris evecta* | Medicinal. Leaf extract used to treat dysentery, blood diseases and ulcers. Spores used to treat leprosy and other skin diseases. Antiviral, antihyperglycemc and analgesic | Benjamin 2011 |
| *Asplenium cuneatum* Lam. | Medicinal. Vermifuges (anthelmintic) | Burkill 1985 |
| *Asplenium* spp. | Ornamental | Simpson 2019 |
| *Christella dentata* (Forssk.) Brownsey & Jermy | Medicinal. Anti-bacterial. Antihyperglycemic and analgesic activity of leaves | Srivastava 2007; Manhas et al. 2018 |
| *Drynaria* spp. | Ornamental | Simpson 2019 |
| *Dryopteris* spp. | Medicinal. Abortifacient, anthelmintic. Food. Rhizomes source of fats (90% monoethenoid acids) | May 1978; Srivastava 2007; Mannan et al. 2008; |
| *Lycopodium clavatum* L. | Medical. Emetic for stomach disorders, cure for kidney and lung diseases, analgesic, antioxidant, anti-cancer anti-inflammatory, neuroprotective, immunomodulatory and hepatoprotective nelseeding and heal wounds, treatment for learning and memory impairment, diurectic and anti-spasromatic, cure headaches. Household Material (mats) | May 1978; Srivastava 2007; Benjamin 2011; Oloyede 2012; Hanif et al. 2015; Bhardwaj & Misra 2018 |
| *Pseudodiphasium volubile* (G. Forst.) Holub | Ornamental. Table decoration | Benjamin 2011 |
| *Odontosoria chinensis* (L.) J. Sm. | Medicinal. Cure for chronic enteritis. Ornamental. Landscape plant | Ho et al. 2010; Oloyede 2012 |
| Tree ferns (*Alsophila*, *Sphaeropteris*) | Food. Rhizomes as source of starch | Ripperton 1924; Leach 2003 |
of starch in Hawaii (Ripperton 1924; May 1978; Leach 2003) while in India it is sought from stems of giant ferns *Angiopteris* (Liu et al. 2012). Starch is an important product worldwide used for different purposes — preservative, thickening agent, food enhancer and stabilizer and key ingredients in pastas, soups, sauces (Mason 2009; Egharevba 2019). Fern starch has been used as additive along with rice, potato and corn flour in the production of liquor and soft drinks (Liu et al. 2012). Meanwhile, fats from rhizomes have been extracted from *Dryopteris* which contains 90% monoethenoid (unsaturated) acids (May 1978).

Medicinal ferns have been used since ancient times for common diseases — gastric, inflammatory, infections, because of the ethnobotanical knowledge on their potential as antibacterial, anti-inflammatory, diuretics and pain killers passed on to generations (Ho et al. 2010). Medicinal value was identified in *Lycopodium clavatum*, *Selaginella involvens*, *Angiopteris evecta*, *Christella dentata*, *Asplenium cuneatum*, and *Dryopteris* species while ornamental uses were featured in several *Asplenium*, *Adiantum* and, *Drynaria* species, and in *Odontosoria chinensis* and *Pseudodiphasium volubile* (Table 2). On the other hand, ornamental ferns have been sought to provide aesthetic value for the enjoyment of the public and potentially for environmental protection and management (Oloyede 2012) and interestingly, more money is spent for this than for all other uses (May 1978).

Notable from the list of new records is *L. clavatum* having been widely documented for medicinal purposes. It has been known as emetic for stomach disorders (Srivastava 2007), cure for kidney and lung diseases, analgesic, antioxidant, anti-cancer, anti-inflammatory, neuroprotective, immunomodulatory, and hepatoprotective (Bhardwaj & Misra 2018). It was also explored as potent treatment for learning and memory impairment (Hanif et al. 2015). It is diuretic...
and anti-spasmodic and also smoked with Selaginella rupestris to cure headaches (Watt & Brandwijk 1962). In Sweden, L. clavatum is also woven into mats (May 1978).

The checklist of new records for MMPL highlights the significance of the landscape as biodiversity area in South Central Mindanao. It confirms the favorable environment brought about by stable ecosystem processes in the landscape (MMPL), thereby able to house unique plants, enhancing the natural heritage. The discovery of these new records after more than 100 years, is a significant achievement, realizing that there had been few explorations in between then and now. Moreover, knowledge of species occurrence is crucial to biodiversity conservation as this provides basis for scientific-based efforts to restore diversity at its different levels (Pavlik 1995; Mehltreter 2010; Cutko 2009; Green et al. 2009; Weigelt et al. 2019). It is perceived that this study would jumpstart the continuous and regular monitoring and inventory of pteridophytes in order to aid planning, management, and policy development for the protected area. This would further lead to the inclusion of MMPL pteridophyte flora in national and worldwide botanical data and provide extensive compilation of geographic species at regional, national, and global levels.

The discovery of many economic uses of ferns and lycophytes is very instrumental to raising awareness and appreciation on the utilitarian values of this plant group. Studies to elucidate the bioactive products found in its various plant parts have led to its integration in drug discovery and potential use for various chronic and infectious diseases (Ho et al. 2010; Baskaran et al. 2018). Likewise, its ornamental values serve a pivotal role in environmental protection and management interventions and can be harnessed to improve environmental landscapes (Oloyede 2012). As the country is among the richest in pteridophyte diversity in Asia, avenues for expanding current knowledge on their utilitarian as well as ecological values are numerous, waiting to be explored.
Conservation status of the new records

With reference to IUCN Threatened List 2021, it can be grasped that all new records in MMPL belong to the Not Assessed (NA) category. The DAO-2017–11 of DENR is another reference which also integrated the national red list of threatened species (in reference to IUCN) developed in 2008 by Fernando et al. (2008). From this, a total of 11 species from new records were in the threatened category. The rest belong to other wildlife species (OWS) which refers to the native species in the landscape that were not classified to any of the threatened category. Meanwhile, seven of these new records were found to be endemic, confined only in the country.

Local assessment tool based on the relative frequency values showed a different picture as many of the OWS in DAO were placed in threatened category (Table 3). From the NA of IUCN, the OWS of DAO and native species which is roughly the least-concerned at national, and global levels, 20 were classified under CR, 44 under EN, six VU and nine NT. Only nine species were noted to be relatively the same with least concern status. Meanwhile, from the not threatened but endemic species (NA in IUCN, OWS in DAO and Endemic), two were found to be CR, three EN and one VU.

Under the threatened and native species category (NA in IUCN, threatened in DAO, native), one was found as CR, three were endangered, two vulnerable, one NT and four were LC. Further, the threatened and endemic category enlisted one VU and three LC species.

The local conservation status developed in this study is a simple categorical classification intended to have an immediate reference for conservation priority of pteridophyte species in MMPL. It is a vital alternative in the absence of data from IUCN which generally considers global distribution of high-valued plant species (Langenberger 2006; Villanueva & Buot 2020). As can be drawn from this study, the new records in MMPL were not yet assessed in IUCN except for one species, Sphaeropteris glauca, which was classified as least concerned. Some were also highlighted in the national list DAO 2017–11. The use of relative frequency scores could serve as reliable representation of the species’ adaptation, higher RF as widely-adapted while low RF values depict restricted-range species. It is significant as in the case of MMPL which needs immediate reference as scientific information is scarce. Moreover, it can be modified in the future to include other factors that may influence their diversity and distribution such as harvest use, economic uses, threats, and other ecological factors similar to those highlighted in several works (Bacchetta et al. 2012; Rana et al. 2020; Villanueva & Buot 2020).

High priority species based on local assessment along with their endemicity and threatened status at the national level (DAO 2017–11) would serve as basis for inclusion in management plans and advocacy interventions for MMPL. Based on frequency records, these species are not widely-adapted and their elevation range is limited. Alongside that is the gradual increase of human-led activities that can potentially threaten the health of the landscape. The rise of tourist sites, plantation areas, and human settlements around MMPL, collection of wildlife species in prohibited zones, and unauthorized trekking activities in MMPL would in the long run cause degradation of the landscape. Moreover, majority of these locally threatened flora are found along montane to upper montane forest (1,600–2,000 m). As such, this study proposed for the recognition of this altitudinal range as fern biodiversity hotspot. As such, conservation programs can be focused towards the species in this zone as they could be the most sensitive to environmental changes and may in the future vanish in the landscape.

CONCLUSION

The discovery of more than one hundred new records for South Central Mindanao region and MMPL highlights its rich natural heritage and confirms its significance as key biodiversity area for pteridophytes. It is a significant addition to current botanical information as it addressed gaps in knowledge of ferns and lycophytes. The determination of conservation priority species and hotspot fern area (1,600–2,000 m) is hoped to serve as vital reference for the integration of pteridophytes in local conservation plans for MMPL.

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Table 3. New records in MMPL highlighting their category as to geographic distribution, international (IUCN), national (DAO) and local assessment based on relative frequency (RF).

| Families and Species Composition | Species category as regards geographic distribution | IUCN | DAO 2017-11 Relative Frequency (RF) | Local Assessment based on RF |
|---------------------------------|-----------------------------------------------------|------|-------------------------------------|-------------------------------|
| **1. Lycopodiaceae**            |                                                     |      |                                     |                               |
| *Huperzia javanica* (Sw.) Fraser-Jenk. | Indigenous                                         | NA   | OWS                                 | 0.403 VU                      |
| *Lycopodium clavatum* L.        | Indigenous                                           | NA   | OWS                                 | 0.109 EN                      |
| *Phlegmariurus delbruickii A.R. Field & Bostock* | Indigenous                                         | NA   | OWS                                 | 0 CR                          |
| *Phlegmariurus verticillatus* (L.f) A.R. Field | Indigenous                                         | NA   | OWS                                 | 0.019 CR                      |
| *Pseudodiphasium volubile* (G. Forst.) Holub | Indigenous                                         | NA   | OWS                                 | 0 CR                          |
| **2. Selaginellaceae**          |                                                     |      |                                     |                               |
| *Selaginella boninensis* Baker  | Indigenous                                           | NA   | OWS                                 | 0.33 EN                       |
| *Selaginella biformis* A. Br. ex Kuhn | Indigenous                                         | NA   | OWS                                 | 0.11 EN                       |
| *Selaginella cupressina* (Willd.) Spring | Indigenous                                         | NA   | OWS                                 | 0.11 EN                       |
| *Selaginella engleri* Hieron.   | Indigenous                                           | NA   | OWS                                 | 0.22 EN                       |
| *Selaginella gastrophylla* Warb. | Indigenous                                           | NA   | OWS                                 | 0.7 NT                        |
| *Selaginella involvens* (Sw.) Spring | Indigenous                                         | NA   | OWS                                 | 0.44 VU                       |
| *Selaginella remotifolia* Spring | Indigenous                                         | NA   | OWS                                 | 0.28 EN                       |
| **1. Aspleniaceae**             |                                                     |      |                                     |                               |
| *Asplenium affine* Sw.          | Indigenous                                           | NA   | OWS                                 | 0 CR                          |
| *Asplenium cuneatum* Lam.       | Indigenous                                           | NA   | OWS                                 | 0.14 EN                       |
| *Asplenium elmeri* Christ       | Indigenous                                           | NA   | OWS                                 | 0.31 EN                       |
| *Asplenium hoffridum* Kauff.    | Indigenous                                           | NA   | OWS                                 | 0.31 EN                       |
| *Asplenium laseraffitifolium* Lam. | Indigenous                                         | NA   | OWS                                 | 0.21 EN                       |
| *Asplenium lobulatum* Mett.     | Indigenous                                           | NA   | OWS                                 | 1.56 LC                       |
| *Asplenium longisimum* Blume    | Indigenous                                           | NA   | OWS                                 | 0.7 NT                        |
| *Asplenium pellucidum* Lam.     | Indigenous                                           | NA   | OWS                                 | 0.44 VU                       |
| *Hymenasplenium excisum* (C. Prestl) S. Linds. | Indigenous                                         | NA   | OWS                                 | 2.19 LC                       |
| *Hymenasplenium subnormale* (Copel.) Nakaike | Indigenous                                         | NA   | OWS                                 | 0.22 EN                       |
| **2. Athyriaceae**              |                                                     |      |                                     |                               |
| *Athyrium nakanoi* Makino       | Indigenous                                           | NA   | EN                                  | 0.33 EN                       |
| *Athyrium punctataule* (Blume) T. Moore | Indigenous                                         | NA   | OWS                                 | 0.22 EN                       |
| *Cornopteris banaenhensis* (C. Chr.) K. Iwats. & M.G. Price | Indigenous                                         | NA   | OWS                                 | 0 CR                          |
| *Diplazium dilatatum* Blume     | Indigenous                                           | NA   | OWS                                 | 1.44 LC                       |
| *Diplazium geophilum* Alderw.   | Indigenous                                           | NA   | OWS                                 | 0.38 EN                       |
| *Diplazium pseudocyathifolium* Rosenst. | Indigenous                                         | NA   | EN                                  | 0.22 EN                       |
| **3. Cyatheaceae**              |                                                     |      |                                     |                               |
| *Alsophila apoaeis* (Copel.) R.M. Tryon | Endemic                                             | NA   | EN                                  | 0.42 VU                       |
| *Alsophila hermannii R.M. Tryon | Endemic                                             | NA   | EN                                  | 1.56 LC                       |
| *Sphaeropteris elmeri* (Copel.) R.M. Tryon | Endemic                                             | NA   | VU                                  | 0.28 EN                       |
| *Sphaeropteris glauco* (Blume) R.M. Tryon | Indigenous                                         | LC   | EN                                  | 1.69 LC                       |
| *Alsophila heterochlamydea* (Copel.) R.M. Tryon | Endemic                                             | NA   | VU                                  | 1.56 LC                       |
| *Sphaeropteris lepifera* (J.Sm. ex Hook.) R.M. Tryon | Indigenous                                         | NA   | EN                                  | 0.28 EN                       |
| **4. Dennstaedtiaceae**         |                                                     |      |                                     |                               |
| *Histiopteris incisa* (Thumb.) J.Sm. | Indigenous                                         | NA   | OWS                                 | 0.88 NT                       |
| *Microlepia enulae* (Thumb.) C. Presl | Indigenous                                         | NA   | OWS                                 | 0.22 EN                       |
| Families and Species Composition | Species category as regards geographic distribution | IUCN | DAO 2017-11 | Relative Frequency (RF) | Local Assessment based on RF |
|----------------------------------|----------------------------------------------------|------|--------------|-------------------------|----------------------------|
| *Monachosorum henryi* Christ     | Indigenous                                         | NA   | OWS          | 2                       | LC                         |
| 5. *Dicksoniaceae*               |                                                    |      |              |                         |                            |
| *Dicksonia amarosaana* Lehnert & Coritic | Endemic                                       | NA   | OWS          | 0.42                    | VU                         |
| 6. *Dryopteridaceae*             |                                                    |      |              |                         |                            |
| *Bolbitis enulotae* (C. Presl) Ching | Indigenous                                  | NA   | OWS          | 0.42                    | VU                         |
| *Dryopteris hendersoni* (Bedd.) C. Chr. | Indigenous                                | NA   | OWS          | 0.22                    | EN                         |
| *Dryopteris purpurascens* (Blume) Christ | Indigenous                              | NA   | OWS          | 0                      | CR                         |
| *Dryopteris permagna* M. Price | Indigenous                                         | NA   | EN           | 0                       | CR                         |
| *Polystichum moluccense* T. Moore | Indigenous                                  | NA   | EN           | 0.82                    | NT                         |
| *Polystichum elmeri* Copel.      | Indigenous                                         | NA   | OWS          | 0.18                    | EN                         |
| Teratophyllum aculeatum (Blume) Mett. ex Kuh | Indigenous          | NA   | OWS          | 0                       | CR                         |
| 7. *Hymenophyllaceae*            |                                                    |      |              |                         |                            |
| *Abdractium pluma* (Hook.) Ebihara & K.Iwats. | Indigenous                              | NA   | OWS          | 0.56                    | VU                         |
| *Abdractium obscurum* (Blume) Ebihara & K. Iwats. | Indigenous                        | NA   | OWS          | 0.31                    | EN                         |
| *Crepidomanes minutum* (Blume) K. Iwats. | Indigenous                              | NA   | OWS          | 0                      | CR                         |
| *Crepidomanes grande* (Copel.) Ebihara & K. Iwats. | Indigenous                        | NA   | OWS          | 0.14                    | EN                         |
| *Hymenophyllum raani* Copel.     | Indigenous                                         | NA   | OWS          | 0                       | CR                         |
| *Hymenophyllum denticulatum* Sw. | Indigenous                                         | NA   | OWS          | 0.11                    | EN                         |
| *Hymenophyllum fimbriatum* J. Sm. | Indigenous                                         | NA   | OWS          | 0.94                    | NT                         |
| *Hymenophyllum holochilum* (Bosch) C. Chr. | Indigenous                      | NA   | OWS          | 0                       | CR                         |
| *Hymenophyllum imbricatum* Blume | Indigenous                                         | NA   | OWS          | 0.88                    | NT                         |
| *Hymenophyllum nitidulum* (Bosch) Ebihara & K. Iwats. | Indigenous                      | NA   | OWS          | 0.14                    | EN                         |
| *Hymenophyllum pallidum* (Blume) Ebihara & K. Iwats. | Indigenous                      | NA   | OWS          | 0.94                    | NT                         |
| *Hymenophyllum serrulatum* (C. Presl) C. Chr. | Indigenous                      | NA   | OWS          | 0.19                    | EN                         |
| *Hymenophyllum thidium* Harrington | Indigenous                                         | NA   | OWS          | 0.12                    | EN                         |
| Vandenboschia auriculata (Blume) Copel. | Indigenous                      | NA   | OWS          | 0.11                    | EN                         |
| 8. *Hypodematiaceae*             |                                                    |      |              |                         |                            |
| *Leucostegia truncata* (D. Don) Fraser-Jenk. | Indigenous                      | NA   | OWS          | 0.88                    | NT                         |
| 9. *Lindsaeaceae*                |                                                    |      |              |                         |                            |
| *Lindsaea pubercial* (J. Sm.) Mett. ex Kuhn | Indigenous                      | NA   | OWS          | 0.14                    | EN                         |
| *Odontosoria retusa* (Cav.) J. Sm. | Indigenous                                         | NA   | OWS          | 0.14                    | EN                         |
| *Osmolindesia adorata* (Rowb.) Lehtonen & Lehtonen | Indigenous                        | NA   | OWS          | 0.14                    | EN                         |
| *Tapeinidium gracile* (Blume) Alderw. | Indigenous                      | NA   | OWS          | 0.14                    | EN                         |
| *Tapeinidium pinnatum* (Cav.) C. Chr. | Indigenous                      | NA   | OWS          | 0.28                    | EN                         |
| 10. *Mariatiaeae*                |                                                    |      |              |                         |                            |
| *Angiopteris evecta* Sw.         | Indigenous                                         | NA   | OTS          | 1.56                    | LC                         |
| *Pitsana pellucida* (C. Presl) Murdock | Indigenous                      | NA   | OWS          | 1.31                    | LC                         |
| 11. *Oleandraceae*               |                                                    |      |              |                         |                            |
| *Oleandra sibbaldi* Grev.        | Indigenous                                         | NA   | OWS          | 0.14                    | EN                         |
| 12. *Ophioglossaceae*            |                                                    |      |              |                         |                            |
| *Botrychium daucifolium* Wall. ex Hook. & Grev. | Indigenous                      | NA   | OWS          | 0.75                    | NT                         |
### Families and Species Composition

| Species category as regards geographic distribution | IUCN | DAO 2017-11 Relative Frequency (RF) | Local Assessment based on RF |
|-----------------------------------------------------|------|-----------------------------------|-------------------------------|
| **13. Plagiogyriaceae** | | | |
| Plagiogyria glauca (Blume) Mett. | Indigenous | NA | OWS | 1.38 | LC |
| **14. Polypodiaceae** | | | |
| Calyptodon gracilimus (Copel.) Naik ex H. Itô | Indigenous | NA | OWS | 0.13 | EN |
| Chrysogrammitis glandulosa (J.Sm.) Parris | Indigenous | NA | OWS | 0.14 | EN |
| Dasypodiumtis moluccana (Baker) Parris | Indigenous | NA | OWS | 0.44 | VU |
| Drynaria aglaomorpha Christenh. | Indigenous | NA | VU | 0.22 | EN |
| Drynaria descensos Copel. | Endemic | NA | OWS | 0.11 | EN |
| Goniothallus perticifolium (Desv.) Bedd. | Indigenous | NA | OWS | 1 | NT |
| Goniothallus pseudoconnatum (Copel.) Copel. | Indigenous | NA | OWS | 1.44 | LC |
| Goniothallus subauriculatum (Blume) C. Presl | Indigenous | NA | OWS | 0 | CR |
| Leptochilus insignis (Blume) Fraser-Jenks. | Indigenous | NA | OWS | 0 | CR |
| Laxagramme avenia (Blume) C. Presl | Indigenous | NA | OWS | 0.06 | CR |
| Laxagramme paraelelela Copel. | Indigenous | NA | OWS | 0.06 | CR |
| Laxagramme scolopendriodes (Gaudich.) H.V.Morton | Indigenous | NA | OWS | 0 | CR |
| Oregrammitis beddomeana (Alderw) T.C.Hsu Parris & Sundue | Indigenous | NA | OWS | 0.19 | EN |
| Oregrammitis reinwardtii (Blume) Parris | Indigenous | NA | OWS | 0.14 | EN |
| Oregrammitis torricelliana (Brause) Parris | Indigenous | NA | OWS | 0.11 | EN |
| Proaspatia contigua (G. Forst.) C. Presl | Indigenous | NA | OWS | 0.14 | EN |
| Proaspatia celebica (Blume) Tagawa & K. Iwats. | Indigenous | NA | OWS | 0.15 | CR |
| Proaspatia multicaudatum (Blume) Tagawa & K. Iwats. | Indigenous | NA | OWS | 0 | CR |
| Proaspatia venulosa (Blume) M.G. Price | Indigenous | NA | OWS | 0.14 | EN |
| Selliguea albidolivata (Blume) Parris | Indigenous | NA | OWS | 0.14 | EN |
| Thylacopteris papillosa (Blume) Kunze ex J.Sm. | Indigenous | NA | OWS | 0.33 | EN |
| Tomophyllum macrum (Copel.) Parris | Endemic | NA | OWS | 0.14 | EN |
| Tomophyllum millefolium (Blume) Parris | Indigenous | NA | OWS | 0.14 | EN |
| **15. Pteridaceae** | | | |
| Adiantum hosei Baker | Indigenous | NA | OWS | 0.75 | NT |
| Anthrophyllum parvulum Blume | Indigenous | NA | OWS | 0.14 | EN |
| Pteris appositipinnata Fee | Indigenous | NA | OWS | 1.25 | LC |
| Vaginularia junghunii Fee | Indigenous | NA | OWS | 0.22 | EN |
| **16. Thelypteridaceae** | | | |
| Chingia ferox (Blume) Holttum | Indigenous | NA | OWS | 0 | CR |
| Christella acuminata (Houtt.) Holttum | Indigenous | NA | OWS | 0.89 | NT |
| Christella dentata (Forssk.) Brownsey & Jermy | Indigenous | NA | OWS | 0.11 | EN |
| Pneumatopteris iaevis (Mett.) Holttum | Indigenous | NA | OWS | 0.75 | NT |
| Pneumatopteris nidula (C. Presl) Holttum | Endemic | NA | OWS | 0 | CR |
| Pronephrium nitidum Holttum | Indigenous | NA | OWS | 0 | CR |
| Sphaerotheca ellipticous (Rosenst.) Holttum | Endemic | NA | OWS | 0 | CR |
| **17. Tectariaceae** | | | |
| Tectario melanocaulos (Blume) Copel. | Indigenous | NA | OWS | 0 | CR |
| Tectario dissecta (G. Forst.) Lellinger | Indigenous | NA | OWS | 0 | CR |

Legend: NA (Not Assessed), OWS (Other Wildlife Species), CR (Critically endangered), EN (Endangered), NT (Near threatened), LC (Least Concern)
New records of pteridophytes in Mount Matutum

Galope-Obemio et al.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 November 2022 | 14(11): 22039–22057

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Communications

New records of pteridophytes in Mount Matutum Protected Landscape, South Central Mindanao, Philippines with notes on its economic value and conservation status
– Christine Dawn Galope-Obemio, Inocencio E. Buot Jr. & Maria Celeste Banatica-Hilario, Pp. 22039–22057

Some threatened woody plant species recorded from forests over limestone of the Philippines
– Inocencio E. Buot Jr., Marne G. Origenes, Ren Divien R. Obeña, Elaine Loreen C. Villanueva & Marjorie D. delos Angeles, Pp. 22058–22079

Status of mangrove forest in Timaco Mangrove Swamp, Cotabato City, Philippines
– Cherie Cano-Mangaoang, Zandra Caderon Amino & Baingan Brahim Mastur, Pp. 22080–22085

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– Debonina Dutta & Aparajita De, Pp. 22086–22097

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– K. Vinaya & C.F. Binoy, Pp. 22098–22104

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Paresis as a limiting factor in the reproductive efficiency of a nesting colony of Lepidochelys olivacea (Eschscholtz, 1829) in La Escobilla beach, Oaxaca, Mexico
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A new species of genus Neocerura Matsumura, 1929 (Notodontidae: Lepidoptera) from India
– Amritpal Singh Kaleka & Rishi Kumar, Pp. 22184–22189

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