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Checklist and Conservation Status of Ferns and Lycophytes of Mt. Sinaka, Arakan, North Cotabato, Southern Philippines

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ABSTRACT

An inventory of ferns and lycophytes was conducted in Mt. Sinaka, North Cotabato through repeated transect walks across vegetation types to determine species richness, species similarity, conservation and ecological status. Results revealed 163 species belonging to 26 families and 73 genera. Of these, 144 species are ferns and 19 are lycophytes. The species richness constitutes about 15% and 29% of the total number of ferns and lycophytes in the Philippines and Mindanao Island, respectively. The majority of the growth forms are terrestrial having 73 species, followed by epiphytes with 64 species, tree ferns 9, hemi-epiphytes 2 and lithophytes with only 1 species and 14 other species were observed to have more than one growth form. Of the 19 threatened species recorded, 7 species are endangered, 9 are vulnerable and 3 as Other Threatened Species. Eleven species are broadly Philippine endemic while two are Mindanao endemic species, *viz*., *Lindsaea hamiguitanensis* and *Tectaria weberi*. This checklist will serve as a supporting document to formulate a science-based policy for the conservation and protection of the biological resources in Mt. Sinaka.

Keywords: flagship species, sampling plot, transect walk, pteridophytes.

INTRODUCTION

Philippine archipelago recorded a total of 1037 pteridophyte species belonging to 40 families and 172 genera (Pelser *et al*., 2011 onwards). Moreover, 202 species are noted to be threatened (Fernando *et al*., 2008) and 266 species are endemic (Pelser *et al*., 2011 onwards). In Mindanao island, 632 (60%) species are documented (Amoroso *et al*., 2012). Additionally, 130 species (20%) distributed to 24 families and 66 genera are found in the four long term ecological research sites in Mindanao namely Mt. Apo (North Cotabato), Mt. Hamiguitan (Davao Oriental), Mt. Kitanglad (Bukidnon) and Mt. Malindang (Misamis Occidental) (Amoroso *et al*., 2015). From this, 45 species are classified as threatened belonging to 16 families and 25 genera (Coritico and Amoroso, 2020).

Mount Sinaka is home of different flora and fauna including the Philippine flagship species, the Philippine Eagle. It is also one of the remaining forest fragments in Arakan Valley within Greater Mindanao and it has been rated as "Extremely High Critical" in conservation importance according to the Philippine Biodiversity Conservation Priority-setting Program. Mt. Sinaka is a Key Biodiversity Area (KBA) candidate, being home to a highly diverse endemic flora and fauna species (FPE, 2020). It has a highest elevation of 1,690 m asl and with a land area of approximately 3,000 hectares. It is located at 7° 29' 22" N and 125° 15' 22" E, east of Marilog District of Davao City, San Miguel and west of barangays Tumanding, Salasang, Lanao Kuran, and Datu Ladayon of Arakan, North Cotabato (Mallari *et al*., 2001; Panal *et al*., 2015; FPE, 2017).

Each of these barangays created a Bantay Kalikasan (BK) organization as mandated by the municipality of Arakan. This organization was established to protect and monitor the area (Salvador and Ibanez, 2006; FPE, 2017).

Illegal logging is the primary extractive activity that severely affects Arakan Valley's natural resources. Land clearing for agriculture, including slash-and-burn practices, also create immense pressure on the forest cover. Additionally, difficulty in protecting the areas because of increasing population, extreme environmental conditions, and varied cultural traditions among the residents further compound the problem were the major threats that affects its diversity (FPE, 2020). Thus, this inadequacy of information of local biodiversity has affected the drafting of policy-making, and implementation of the conservation of biological resources in Mt. Sinaka, Arakan, North Cotabato. Moreover, there is no published checklist of ferns and lycophytes in Mt. Sinaka. Thus, this paper assessed the conservation and ecological status of pteridophytes in Mt. Sinaka. This paper would also serve as basis for the conservation of the remaining threatened and endemic pteridophytes in Mt. Sinaka.

METHODS AND MATERIALS

Species Inventory and Permits

An inventory of ferns and lycophytes was conducted in lower montane rainforest (912– 1170 m asl) and upper montane rainforest (1170– 1609 m asl), through a series of transect walk (5 m both sites) and opportunistic sampling techniques in the established trails of Sitio Bagtok, Barangay Tumanding (1345 m asl), Sitio Libas, Barangay San Miguel (1348 m asl), and Purok 2, Barangay Salasang (1609 m asl) Arakan, North Cotabato (Figure 1).

A Gratuitous Permit was secured from Department of Environment and Natural Resources (DENR) through CENRO Matalam Region 12 before field sampling and collection of specimens in the area.

Collection, Processing, and Identification of Specimens

Collection of the specimens followed the procedure of Coritico et al. (2020) and used the wet method in the preservation of collected specimens (Hodge, 1947). Specimens were identified using monographs, floras, and other publications such as, Copeland's Fern Flora of the Philippines (1958), the Flora Malesiana Series, and digitized plant specimens available in Global Plants on JSTOR and Co's Digital Flora. Taxonomic identification was verified by Fulgent P. Coritico and Victor B. Amoroso.

Growth forms

The growth forms of identified pteridophyte species were classified as terrestrial, holoepiphytes, arborescent, hemi-epiphyte and lithophytic (Madison, 1977; Biedinger and Fischer, 1996).

Species Similarity

Bray–Curtis Cluster Analysis was used for the multivariate analysis of assemblage data, for sound biological reasons (Kembel, 2012). The data for the above mentioned tests made use of BioDiversity Pro 2.0 software in analyzing the data.

Assessment of Conservation and Ecological Status

The conservation status of the recorded species was based on the national list of threatened Philippine plants (DENR-DAO, 2017) which follows the standard criteria of the International Union for the Conservation of Nature. Ecological status of identified flora was noted based on Copeland (1958) and Co's Digital Flora of the Philippines (Pelser *et al*., 2011 onwards). This information serves as a basis for governmental agencies that set environmental policies by the DENR and local government units (LGUs) for monitoring and protecting threatened and endemic species within the mountain range and its vicinity.

RESULTS AND DISCUSSION

Species Richness

Inventory of ferns and lycophytes in Mt. Sinaka revealed a total of 163 species belonging to 26 families and 73 genera. These are composed of 144 species are ferns and 19 are lycophytes (Table 1; Figure 2A). Of these families identified, Polypodiaceae has the highest number of species (28) followed by Pteridaceae (14 species), Dryopteridaceae (13 species), Aspleniaceae, Selaginellaceae with 12 species each, Hymenophyllaceae and Thelypteridaceae with 9 species each (Figure 2B). On the other hand, lycophytes are represented by Lycopodiaceae and Selaginellaceae with 7 and 12 species, respectively. The most diverse genera are *Selaginella* P. Beauv., (12 species) *Asplenium* L. (11 species), *Diplazium* Sw. and *Davallia* Sm. (6 species each), *Tectaria*, and *Phlegmariurus* Holub (5 species each), *Sphaeropteris* Bernh., *Alsophila* R.Br., *Elaphoglossum* Schott ex J.Sm.,, *Tapeinidium* (Presl) C.Chr. and *Selliguea* Bory. (4 species each) (Figure 2C).

The species richness of this study is closely lower than that of Mt. Tago range with 203 species (Coritico *et al*., 2020), Mt. Kitanglad 275 species (Amoroso *et al*., 1996), Mt. Malindang in Misamis Occidental with 280 species (Amoroso *et al*., 2012). However, it is higher than Mt. Hamiguitan Range Wildlife Sanctuary in Davao Oriental with 152 species (Amoroso *et al*., 2016) and Mt. Agad-Agad, Lanao del Norte (Coritico et al., 2020). The

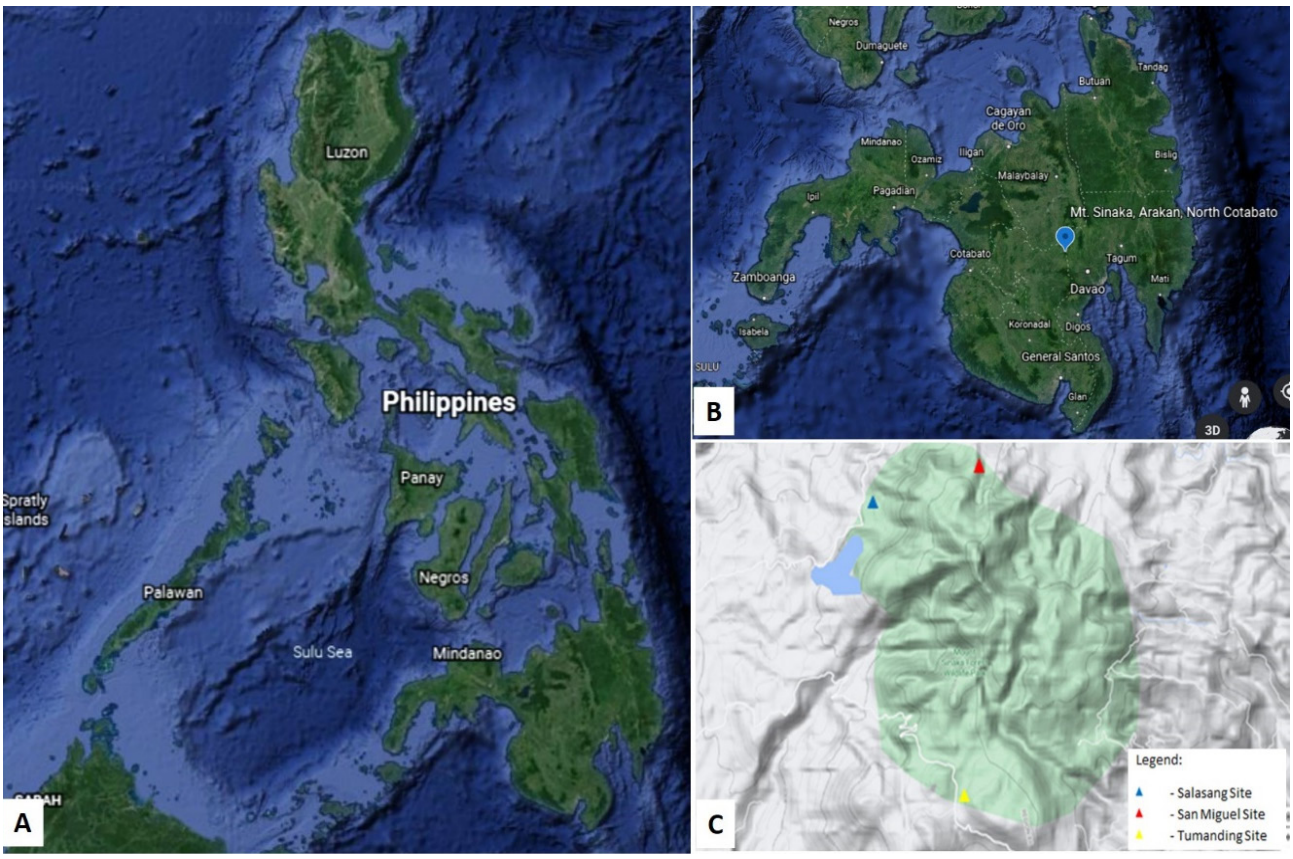

Figure 1. Location map of Mt. Sinaka. A. Map of the Philippines, B. Map of Mindanao Island and C. Sampling routes in Mt. Sinaka.

Table 1. Checklist of ferns and lycophytes in Mt. Sinaka, Arakan, North Cotabato, Southern Philippines. (Growth forms: AR – arborescent; HL –holoepipythic; HE – hemiepiphytic; LI – lithophytic; TE – terrestrial.)

Species	Growth forms	Tumanding	San Miguel	Salasang	Collection No.
Lycopodiaceae					
1. *Huperzia miniata* (Spring) Trev.	TE/LI		/		
2. *Lycopodiella cernua* (L.) Pic. Serm.	TE	/	/		0353
3. *Phlegmariurus banayanicus* (Herter) A.R.Field & Bostock	HL		/	/	0325/0770/0300/0787
4. *P. pinifolius* (Trevis.) Kiew	HL		/		0281
5. *P. salvinioides* (Herter) Ching	HL	/	/	/	0306/0053/0782
6. *P. squarrosus* (G.Forst.) Á.Löve & D.Löve	HL	/			
7. *P. verticillatus* (L.f.) A.R.Field & Testo	HL		/		0326

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Selaginellaceae					
8. *Selaginella biformis* A. Braun ex Kuhn	TE/LI	/	/		
9. *S. cupressina* (Willd.) Spring	TE	/	/	/	0072/0563
10. *S. denticulata* Spring	TE			/	0574/0806/0777
11. *S. doederleinii* Hieron.	TE	/		/	0560/0182
12. *S. elmeri* Hieron.	TE	/			
13. *S. engleri* Hieron.	TE			/	0563/0555/0559
14. *S. involvens* (Sw.) Spring	HL	/	/	/	0806 /0328
15. *S. gastrophylla* Warb.	TE			/	0709/0563
16. *S. negrosensis* Hieron.	TE	/	/	/	0309/0561
17. *S. remotifolia* Spring	TE	/		/	0074/0160
18. *S.* sp. 1	TE		/		0308
19. *S.* sp. 2	TE			/	
Aspleniaceae					
20. *Asplenium affine* Sw.	HL		/	/	0562/0567/0289
21. *A. apoense* Copel.	HL	/	/		0067
22. *A. caudatum* G. Forst.	TE/LI	/	/		
23. *A. nidus* L.	HL	/	/	/	0317
24. *A. normale* D. Don	TE		/	/	0341/0342/0565
25. *A. persicifolium* J.Sm. ex Mett.	HL			/	0684
26. *A. splendens* Kunze	HL	/			
27. *A. tenerum* G. Forst.	HL	/	/		0680
28. *A.thunbergii* Kunze	HL	/	/	/	0679
29. *A. unilaterale* Lam.	TE/LI	/			0166
30. *A. vittaeforme* Cav.	HL	/			
31. *Hymenoaspleniu m excisium* (C.Presl) S.Linds	HL	/		/	0572
Athyriaceae					
32. *Athyrium punticaule* (Blume) T. Moore	TE	/	/		0173
33. *Diplazium altum* (Copel.) C. Chr.	TE	/			0183
34. *D. cordifolium* Blume	TE			/	0774
35. *D. davaoense* Copel.	TE	/	/		0283

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36. *D. lomariaceum* (Christ) M.G.Price	TE		/	/	0307
37. *D. pallidum* T. Moore.	TE	/	/	/	0297/0077
38. *D. sorzogonense* (C.Presl) C.Presl	TE	/	/	/	0069/0349/0776/0661/0768
Blechnaceae					
39. *Blechnum orientale* L.	TE	/			
Cyatheaceae					
40. *Alsophila commutata* Mett.	AR		/		
41. *A. elmeri* Copel.	AR		/		
42. *A. fuliginosa* Christ	AR	/	/	/	0164/0554
43. *A. lurida* (Blume) Hook.	AR		/	/	
44. *Sphaeropteris elmeri* R.M. Tryon	AR	/	/	/	0165
45. *S. glauca* (Blume) R.M. Tryon	AR	/			
46. *S. polypoda* R.M. Tryon	AR		/		
47. *S. tripinnata* R.M. Tryon	AR	/	/	/	0804
Davalliaceae					
48. *Davallia denticulata* (Burm.f.) Mett. ex Kuhn	HL	/	/		
49. *D. heterophylla* Sm.	HL		/		0356
50. *D.hymenophylloides* (Blume) Kuhn	HL	/		/	0079/0660/0683/0789/0781
51. *D. repens* (L. f.) Kuhn	HL	/	/		0170/0329
52. *D.solida* (G. Forst.) Sw.	HL	/	/	/	0355
53. *D. trichomanoides* Blume	HL	/		/	0167
Dennstaedtiaceae					
54. *Histiopteris incisa* (Thunb.) J. Sm.	HL		/		
55. *Microlepia matthewii* Christ	HL	/	/		0275
56. *Pteridium aquilinum* (L.) Kuhn	HL	/	/		

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Dicksoniaceae					
57. *Calochlaena javanica* (Blume) M.D.Turner & R.A.White	TE	/	/		
58. *Dicksonia mollis* Holttum	AR	/	/		
Diplaziopsidaceae					
59. *Diplaziopsis javanica* (Blume) C. Chr.	TE	/		/	0303/0576
Dipteridaceae					
60. *Dipteris conjugata* Reinw.	TE		/		0344
Dryopteridaceae					
61. *Acrophorus nodosus* C.Presl	TE		/	/	0322
62. *Arachniodes caudifolia* Ching & Y.T. Hsieh	TE			/	0579/0564
63. *Bolbitis heteroclita* (C.Presl) Ching	TE/LI	/		/	0553
64. *Ctenitis* sp.	TE		/		0286
65. *Dryopteris nodosa* (C.Presl)	TE			/	0772
66. *D. sparsa* (D.Don) Kuntze	TE		/	/	0340/0681/0771
67. *Elaphoglossum blumeanum* (Fée) J.Sm.	HL		/		
68. *E. callifolium* (Blume) T. Moore	HL		/		0313
69. *E. luzonicum* (Copel.)	HL			/	0710
70. *E. petiolatum* (Sw.) Urb.	HL	/	/		0177
71. *Pleocnemia irregularis* (C.Presl) Holttum	HL		/		
72. *Polystichum elmeri* Copel.	HL	/	/	/	0337
73. *P. puncticulatum* Alderw.	TE		/	/	0338
Gleicheniaceae					
74. *Dicranopteris linearis* (Burm.) Underw.	TE	/	/		0352
75. *Diplopterygium longissimum* (Blume) Nakai	HE	/			

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76. *Gleichenia curanii* Copel.	TE		/		0304
77. *G. truncata* (Willd.) Spreng.	TE	/			
78. *Sticherus hirtus* (Blume) Ching	TE		/	/	0779/0351
79. *S. loheri* (Christ) Copel.	TE	/	/	/	0305
Hymenophyllaceae					
80. *Abrodictyum cumingii* C.Presl	TE	/	/	/	0052/0650/0569
81. *A. obscurum* (Blume) Ebihara & K. Iwats.	TE	/	/	/	0066/0324/0805/0064
82. *Callistopteris apiifolia* (C.Presl) Copel.	TE	/	/	/	0648/0662/0323/0057
83. *Cephalomanes javanicum* (Blume) Bosch	TE			/	0658
84. *Hymenophyllum acanthoides* (Bosch) Rosenst.	HL	/	/		0062/0327
85. *H. inaequale* (Poir.) Desv.	HL			/	0659/0160
86. *H. pallidum* (Blume) Ebihara & K.Iwats	HL		/		0347
87. *H. serrulatum* C.Chr.	HL	/	/	/	0061/0650/0277
88. *Hymenophyllum* sp.	HL		/	/	0775/0262
Hypodematiaceae					
89. *Leucostegia immersa* Wall. ex C. Presl	TE	/	/		0336
Lindsaeaceae					
90. *Lindsaea apoensis* Copel.	HL	/	/		0063/0330
91. *L. hamiguitanensis* D.N.Karger & V.B.Amoroso	TE		/		0280
92. *Odontosoria chinensis* (L.) J. Sm.	TE	/			
93. *Tapeinidium acuminatum* K.U.Kramer	TE	/		/	0794/0256/0785
94. *T. gracile* (Blume) v.A.v.R.	TE	/			0068
95. *T. luzonicum* (Hook.) K.U.Kramer	TE	/	/	/	0773/0231
96. *T. pinnatum* (Cav.) C. Chr.	TE		/	/	0657/0339

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Marattiaceae					
97. *Angiopteris evecta* (G.Forst.) Hoffm.	TE			/	
98. *A. palmiformis* (Cav.) C. Chr.	TE	/	/		
Nephrolepidaceae					
99. *Nephrolepis biserrata* (Sw.) Schott	HL	/	/		
100. *N. cordifolia* (L.) C. Presl	HL	/	/		
101. *N. falcata* (Cav.) C. Chr.	HL				
Oleandraceae					
102. *Oleandra neriiformis* Cav.	HE	/	/		0059/0350
Ophioglossaceae					
103. *Botrichyum daucifolium* Wall. ex Hook. & Grev.	TE	/			0176/0685
104. *Ophioderma intermedium* (Hook.) Nishida	TE		/		0278
105. *O. pendula* (L.) C.Presl	HL	/	/	/	0078/0312
Osmundaceae					
106. *Plenasium banksiifolium* (C.Presl) C.Presl	TE	/	/		0302/0204
Polypodiaceae					
107. *Aglaomorpha cornucopia* (Copel.) M.C. Roos	HL	/	/		0284
108. *A. heraclea* (Kunze) Copel.	HL	/	/		0310
109. *A. pilosa* (J.Sm. ex Kunze) Copel.	HL			/	
110. *Calymmodon gracilis* (Fée) Copel.	HL		/	/	0348
111. *Goniophlebium benguetense* (Copel.) Copel.	HE	/			
112. *G. persicifolium* (Desv.) Bedd.	HL	/	/	/	0168/0783/0333
113. *G. pseudoconnatum* Copel.	HE			/	0780
114. *Grammitis* sp.1	TE	/	/	/	0055
115. *G.* sp.2	TE		/		

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116. *Lecanopteris deparioides* (Ces.) Baker	HL	/	/		0171
117. *Lepisorus accedens* (Blume)	HL		/		0276
118. *L. spicatus* (L.f.) Li Wang	HL			/	0682/0712
119. *Leptochilus macrophyllus* (Blume) Noot.	HL	/	/	/	0566/0257
120. *Loxogramme avenia* (Blume) C.Presl	HL	/	/		0296/0184
121. *Microsorum commutatum* Copel.	HL	/			
122. *M. congregatifolium* (Alderw.) Holttum	TE/LI	/		/	0686/0705
123. *M. punctatum* (L.) Copel.	HL		/		0291
124. *Oreogrammitis* sp.	HL		/		0279
125. *Prosaptia celebica* (Blume) Tagawa & K.Iwats.	HL			/	0633
126. *P.* sp.1	HL		/		
127. *Pyrrosia sphaerosticha* (Mett.) Ching	HL	/			0162
128. *Radiogrammitis* sp.	HL		/	/	
129. *Scleroglossum pusillum* (Blume) Alderw.	HL	/	/	/	0169/0315
130. *Selliguea albidosquamata* Parris	HL	/	/		0179/0298
131. *S. elmeri* (Copel.) Ching	HL	/			0335/0253
132. *S. triloba* (Houtt.) M.G.Price	HL			/	
133. *S. taeniata* (Sw.) Parris	HL	/	/	/	0332
134. *Tomophyllum subsecundodissectum* (Zoll.) Parris	HL			/	0649
Pteridaceae					
135. *Antrophyum latifolium* Blume	HL	/			0073
136. *A. sessilifolium* (Cav.) Spreng.	HL		/		0159/0294/0316
137. *A. callifolium* Blume	HL			/	

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138. *Dryopteris sparsa* (D.Don) Kuntze	TE/LI		/	/	0340/0681/771
139. *Haplopteris alternans* (Copel.) S.Linds. & C.W.Chen	HL	/	/	/	0314/0180
140. *H. ensiformis* (Sw.) E.H.Crane	HL	/	/	/	0314/0791/0788
141. *H. scolopendrina (*Bory)C. Presl	HL		/	/	0784
142. *Pteris* sp.1	TE			/	
143. *P. mertensioides* Willd.	TE		/		0293
144. *P. schlechteri* Brause	TE	/	/		
145. *P. tripartita* Sw.	TE	/		/	0706
146. *Syngramma alismifolia* (C. Presl) J. Sm.	TE	/	/		0070/0334
147. *S. wallichii* Bedd.	TE			/	0793
148. *Taenitis blechnoides* (Willd.) Sw.	TE	/	/		0181/0295
Saccolomataceae					
149. *Orthiopteris campylura* (Kunze) Copel.	TE	/			0161
Tectariaceae					
150. *Tectaria angulata* (Willd.) Copel.	TE		/		0288
151. *T. athyriorosa* M.G.Price	TE		/	/	0292
152. *T. decurrens* (C.Presl) Copel.	TE			/	0357
153. *T. sulitii* Copel.	TE	/			
154. *T. weberi* Copel.	LI		/		0354/0358
Thelypteridaceae					
155. *Chingia ferox* (Blume) Holttum	TE	/			
156. *Christella dentata* (Forssk.) Brownsey & Jermy	TE	/		/	
157. *C.* sp.	TE		/		0318
158. *Pronephrium nitidum* Holttum	TE	/			0255
159. *P.* sp.	TE		/		0076
160. *P. xiphioides* (Chr.) Holttum	TE		/		0299
161. *Sphaerostephanos* cf. *semimetralis*	TE		/		0290
162. *S. unitus* (L.) Holttum	TE	/	/	/	0058
163. *S.* sp.	TE	/	/		0285
Total		**94**	**107**	**78**	

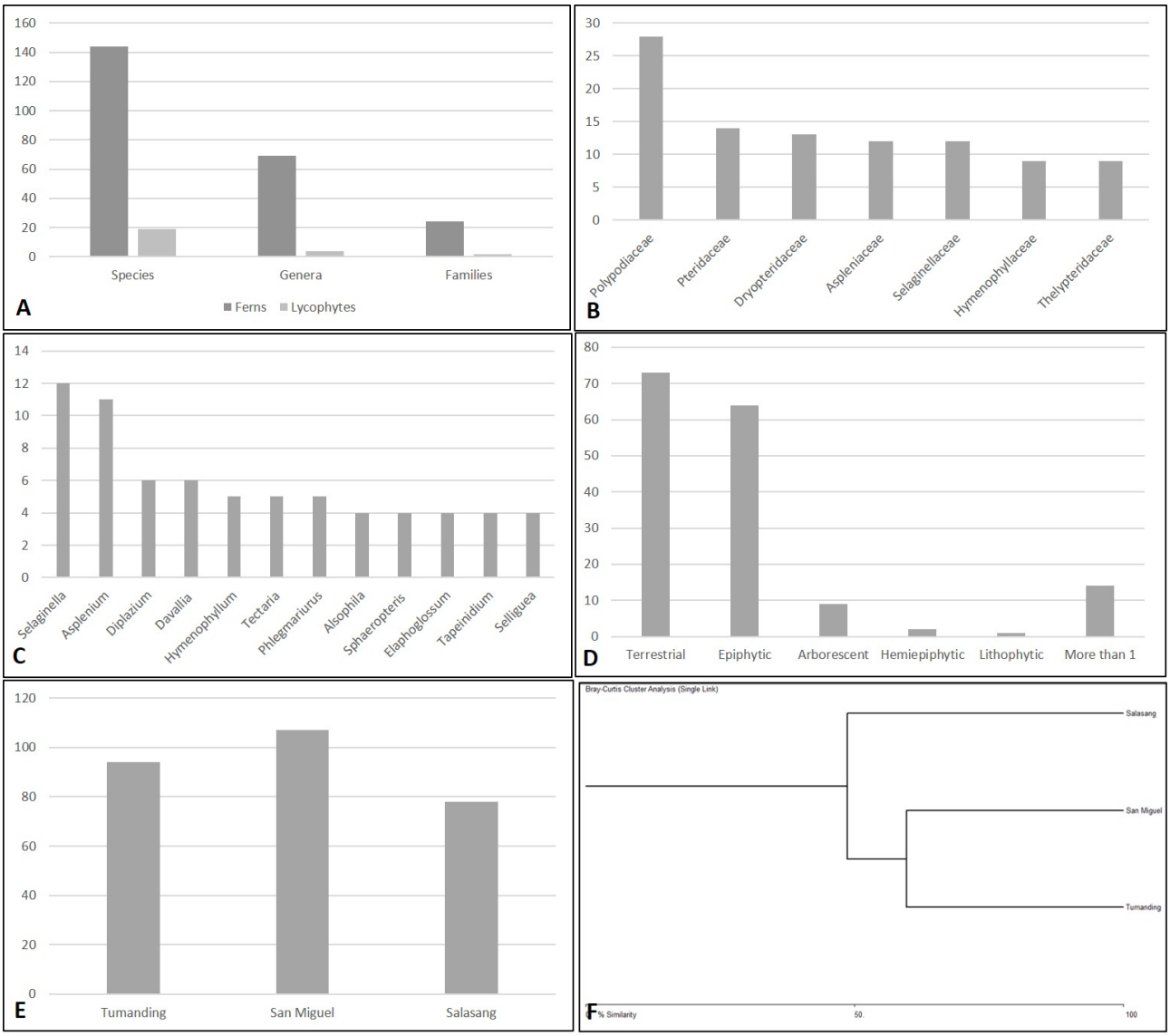

Figure 2. Numbers of ferns and lycophytes in Mt. Sinaka by classes, families, genera, and growth forms. A. Proportion of families, genera, and species of Lycopodiopsida and Polypodiopsida. B. Seven most diverse families of ferns. C. = D. Number of species per growth forms. E. Total number of species per site. F. Similarity between sites.

species richness constitutes about 15% and 29% of the total number of pteridophyte species in the Philippines and Mindanao island, respectively.

The families of ferns and lycophytes recorded in Mt. Sinaka are also the same families of ferns found in the different mountain ecosystems in Mindanao but differ in species richness (Amoroso *et al*., 2009, 2012, 2018; Coritico *et al*., 2020). Kessler *et al*. (2010) stated that species richness is greatly affected on the size of the area sampled, climatic condition, soil type, and geographical location. Even human activities such as the conversion of forests to agricultural lands and pollution (Amoroso *et al*., 2016) and accessibility of the mountain (Coritico *et al*., 2017) could be a factor. The richness of ferns and lycophytes in Mt. Sinaka might be influenced by its neighboring mountain ranges like Mt. Apo in the eastern side and Marilog Forest Reserve in western side. More than 50% of the species recorded in Mt. Sinaka are also found in Mt. Apo Range, Marilog Forest Reserve and other mountain ranges in Mindanao (Amoroso *et al*., 2016; Coritico *et al*., 2020).

Majority of the growth forms were terrestrial having 73 species, (44.78%) – followed by epiphytes (64 spp., 39.26%), arborescent (tree ferns) (9 spp., 5.52%), hemi-epiphyte (2 spp., 1.22%) and lithophytic (1 sp., 0.61%) – and other species were observed to have more than

one growth forms (14 spp., 8.58%) (Figure 2D). The growth forms showed that the ferns and lycophytes in the area are mostly terrestrial and epiphytes. Terrestrial species of pteridophytes are important part of the ground vegetation in many forest. As a matter of fact, they composed two-thirds of the ground flora and one-third are epiphytes (Schuettpelz and Pryer, 2009; Dubuisson *et al*., 2009).

Species Similarity Between Sites

Barangay Salasang has the highest elevation (1609 masl) among the three sites. An abundance of terrestrial and epiphytic ferns, lycophytes, bryophytes, and other understory plants were observed in this area.

Barangay Tumanding is closely related to Barangay San Miguel with about 60% similarity of the species and it is attributed to the same elevational gradient and forest type present which is the montane rainforest. The low species richness observed in Barangay Tumanding is due to the massive illegal logging activity in the area. Reforestation was also evident, where *Swietenia macrophylla* King, *Pterocarpus indicus* Willd. and other trees are flourishing in the area. On the other hand, Barangay San Miguel has the highest number of species recorded. Part of the area has unique pitcher plant sanctuary where different species of Nepenthes are found *viz*., *Nepenthes truncata* Macfarl., *N. surigaoensis* Elmer, *N. mindanaoensis* Sh.Kurata, *N. alata* Blanco. This barangay also organized Bantay Kalikasan or forest guards to protect and conserve the biological resources in the area. The ultramafic soil resembles that of Mt. Hamiguitan in Davao Oriental. Both terrestrial and lithophytic lycophytes (*Lycopodiela cernua* (L.) Pic. Serm. and *Huperzia miniata* (Spring) Trev. were also recorded in the said sanctuary. However, the lowland forest of these three sites has been converted into agricultural ecosystem such as banana, palm oil, coffee, corn and vegetables like cabbage, but there are still remnants of indigenous tree and other plant species in these areas.

Endemism and Conservation Status

There are 13 endemic species recorded in Mt. Sinaka. Of these, 11 are broadly Philippine endemics and 2 are Mindanao endemic. This is about 5% of the total endemic species found in the country. The broadly distributed Philippine endemic species are *Asplenium apoense* Copel., *Alsophila fuliginosa* Christ, *Polystichum elmeri* Copel., *Lindsaea apoensis* Copel., *Aglaomorpha cornucopia* (Copel.) M.C.Roos, *Selliguea elmeri* (Copel.) Ching, *Tectaria athyriosora* M.G.Price, *Pronephrium xiphioides* (Chr.) Holttum, *Phlegmariurus banayanicus* (Herter) A.R.Field & Bostock, *Selaginella negrosensis* Hieron., and *Selaginella elmeri* Hieron. The Mindanao endemic species are *Lindsaea hamiguitanensis* D.N. Karger & V.B. Amoroso and *Tectaria weberi* Copel.. *L. hamiguitanensis* was discovered in Mt. Hamiguitan Range Wildlife Sanctuary in 2012 and has recently been documented in Mt. Tago and Mt. Pantaron Range in Bukidnon, Central Mindanao (Coritico and Amoroso, 2020) while *T. weberi* was previously recorded only in Mt. Hilong-Hilong, Butuan Province (Copeland, 1912) (Table 2).

The mountain range is prone to over-collection and exploitation of floral resources, as a source of income of the settlers residing in the foot of the mountain. A total of 19 threatened species recorded, 7 species are endangered, 9 are vulnerable and 3 as other threatened species. The endangered species include *Sphaeropteris glauca* (Blume) R.M. Tryon, *S. lepifera* (J. Sm. ex Hook.) R.M. Tryon, *Dicksonia mollis* Holttum, *Ophioderma pendula* C.Presl, *Lecanopteris deparioides* (Cesati) Baker, *Phlegmariurus salvinioides* (Herter) Ching, *Phlegmariurus squarrosus* (G.Forst.) Á.Löve & D.Löve (Table 2; Figure 3). These ferns and lycophytes particularly the tree ferns are commonly harvested in Mt. Sinaka and sold along the highways going to Davao City for a very minimal price. Habitat destruction through logging, shifting cultivation, land use/land cover change, environmental pollution, invasive species, and over-exploitation of forest resources are considered the major threats to biodiversity (Catibog-Sinha and Heaney, 2006; Monastersky, 2014; Coritico and Amoroso, 2020). Thus, it is strongly recommended that these remaining species will be given a high priority for protection and conservation.

CONCLUSIONS

Species inventory revealed a total of 163 species of ferns and lycophytes belonging to 73 genera under 26 families. With these, 144 are ferns and 19 are lycophytes. Nineteen threatened species recorded, 7 species are endangered, 9 are vulnerable and 3 as Other Threatened Species. Eleven species are broadly Philippine endemic while two Mindanao endemic species are recorded. Majority of the growth forms are terrestrial (44.78%) and epiphytic (39.26%). The status of the species found in the area demands an immediate protection and conservation in order to preserve the remaining important species. Continuous comprehensive inventory of the species and policy enactment is recommended in order to realize the LGU's desire in declaring Mt. Sinaka as a critical habitat or a local conservation area.

Table 2. Conservation status of ferns and lycophytes in Mt. Sinaka, Arakan, North Cotabato. Conservation status: CR – critically endangered, EN – endangered, VU – vulnerable, OTS – other threatened species. Endemism: PE – Philippine Endemic, ME – Mindanao Endemic

Family	Species	DENR DAO-2017	Endemism
Lycopodiaceae	1. *Phlegmariurus salvinioides*	EN	-
	2. *P. squarrosus*	EN	-
	3. *P. banayanicus*	-	PE
Selaginellaceae	4. *Selaginella negrosensis*	-	PE
	5. *S. elmeri*	-	PE
Aspleniaceae	6. *Asplenium vittaeforme*	VU	-
	7. *A. apoense*	-	PE
Blechnaceae	8. *Oceaniopteris egregia*	VU	-
Cyatheaceae	9. *Alsophila fuliginosa*	VU	PE
	10. *Sphaeropteris elmeri*	VU	-
	11. *S. glauca*	EN	-
	12. *S. lepifera*	EN	-
Davalliaceae	13. *Davallia solida*	OTS	-
Dicksoniaceae	14. *Dicksonia mollis*	EN	-
Dryopteridaceae	15. *Polystichum elmeri*	-	PE
Lindsaeaceae	16. *Lindsaea apoensis*	-	PE
	17. *L. hamiguitanensis*	VU	ME
Marattiaceae	18. *Angiopteris evecta*	OTS	-
Ophiglossaceae	19. *Ophioderma pendula*	EN	-
	20. *Botrychium daucifolium*	VU	-
Osmundaceae	21. *Plenasium banksiifolium*	OTS	-
Polypodiaceae	22. *Lecanopteris deparioides*	EN	-
	23. *Aglaomorpha cornucopia*	VU	PE
	24. *A. heraclea*	VU	-
	25. *Aglaomorpha pilosa*	VU	-
	26. *Selliguea elmeri*	-	PE
Tectariaceae	27. *Tectaria athyriosora*	-	PE

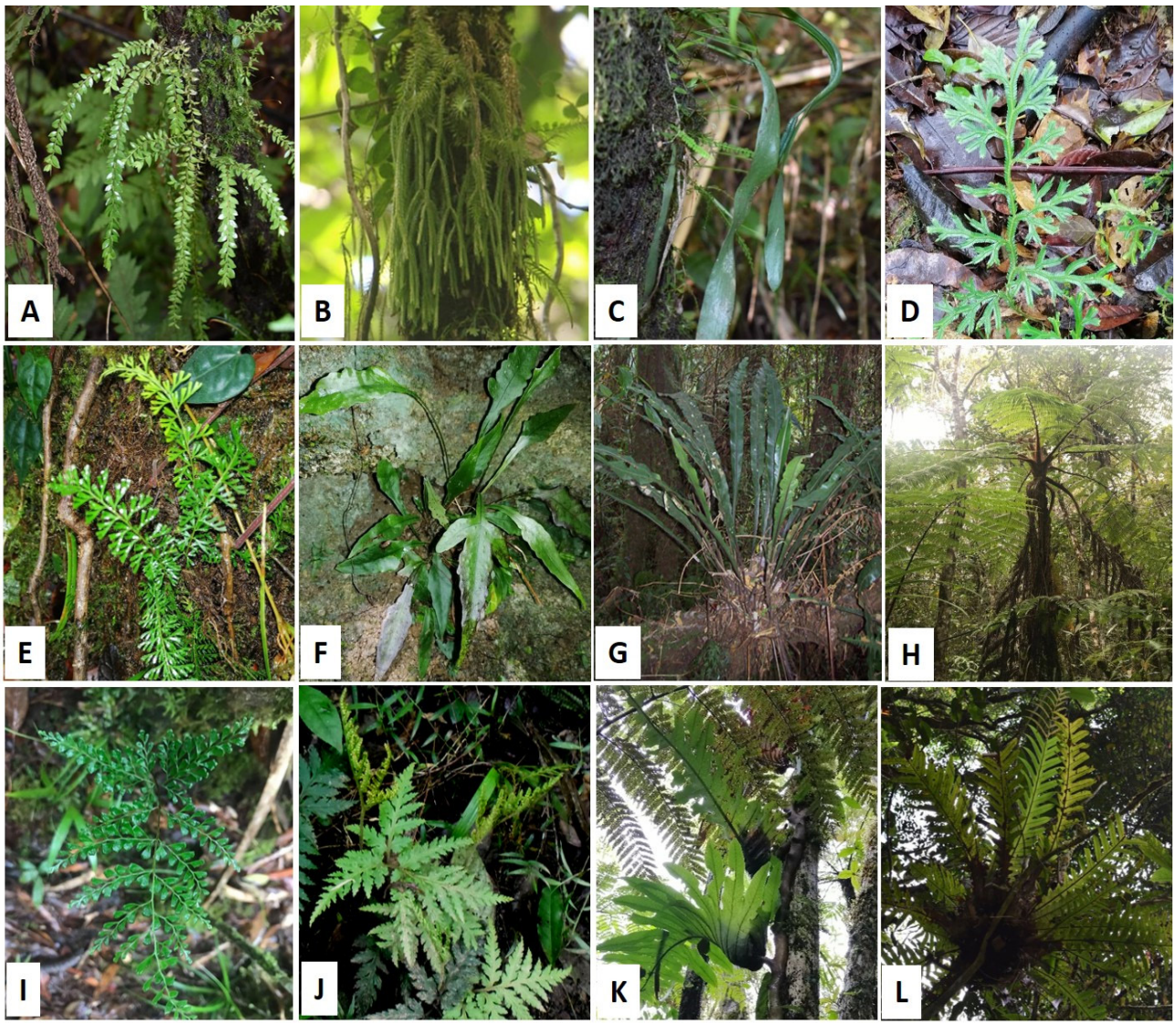

Figure 3. Some ferns and lycophytes in Mt. Sinaka, Arakan, North Cotabato. A. *Phlegmariurus salvinioides*, B. *Phlegmariurus squarrosus*, C. *Ophioderma pendula*, D. *Selaginella negrosensis*, E. *Lindsaea apoensis*, F. *Tectaria weberi*, G. *Asplenium vittaeforme*, H. *Sphaeropteris elmeri*, I. *Lindsaea hamiguitanensis*, J. *Botrychium daucifolium*, K. *Aglaomorpha cornucopia*, L. *Aglaomorpha heraclea*.

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