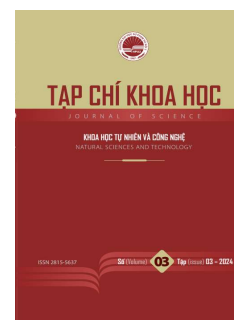




HPU2 Journal of Sciences: Natural Sciences and Technology

Journal homepage: <https://sj.hpu2.edu.vn>



Article type: Research article

Some data about endangered and rare plant species in Me Linh Station for Biodiversity, Vinh Phuc province

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Abstract

Me Linh Station for Biodiversity has an area of 170.3 hectares, near Tam Dao National Park. Although the area is not large, it has with high biodiversity and rich flora, including many rare and threatened plant species. So, this place not only preserves biodiversity but also organizes research and educational activities to protect biodiversity and the environment. Some research projects have been done on species diversity, ecosystem diversity, and forest biomass... This study identifies 38 endangered and rare plant species. Among them, 20 species in *Vietnam Red Data Book 2007*; 20 species belong to *Decree No. 84/2021/ND-CP*; 16 species belong to *Appendix II of CITES (2024)*, and 4 species belong to IUCN (2024). Simultaneously, this study added summary information about the conservation status, life forms, geographical factors, and uses of 38 plant endangered and rare species in Me Linh Station for Biodiversity, Vinh Phuc province.

Keywords: Endangered plant, rare plant, life forms, geographical factors, uses, Me Linh Station for Biodiversity

1. Introduction

Me Linh Station for Biodiversity has an area of 170.3 hectares, near Tam Dao National Park. This place not only preserves biodiversity but also organizes research and educational activities to protect biodiversity and the environment. According to statistics, the flora here currently has 852 plant

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<https://doi.org/10.56764/hpu2.jos.2024.3.3.52-59>

Received date: 16-9-2024 ; Revised date: 08-10-2024 ; Accepted date: 05-11-2024

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species, which are endangered and rare. These plant species play an essential role in nature and are of great value to humans, requiring in-depth research and updating their current status. Up to now, there has been some of research on species diversity. A study by S. C. Kim, N. V. Sinh, and D. V. Hai describes some of the typical plant species in this area, including some endangered and rare plant species [1]. D. V. Hai, N. T. Cuong, R. K. Choudhary, Z. Lin, and Y. Deng discovered and announced *Cosmianthemum melinhense* - a new species from the Me Linh Station for Biodiversity [2]. However, in-depth research on endangered and rare plant species has not been mentioned. Therefore, we have research endangered and rare plant species here to provide a database to protect biodiversity and the environment.

2. Research methods

To research endangered and rare species in Me Linh Station for Biodiversity, we used a method described by N. N. Thin in references [3] and [4]. This method is based on the characteristics of plant organs, especially the reproductive organs.

2.1. Study area and sample collection

The study area was in Me Linh Station for Biodiversity; data collection was carried out during field trips to sample, photograph, observe, and to record the characteristics of specimens in their living state, observing their distribution, habitat, and other characteristic.

2.2. Classification

Specimens were analyzed from whole to detail, from outside to inside where the analysis was combined with the description. Then, the monographs were used to classify. The species names were identified by using a comparative morphological method based on P. H. Ho's works [5]–[7] and Flora of Vietnam [8]–[11]. The nomenclature of species was accorded to Flora of Vietnam and Checklist of plant species of Vietnam [12]–[14]; the species names were updated according to The Plant list [15].

2.3. Conservation status assessment

The conservation status assessment was based on the classification of the Vietnam Red Book part II – Plants [16], Decree no. 03/VBHN-BTNMT [17], Decree no. 84/2021/ND-CP [18], CITES [19], and IUCN [20].

2.4. Life form and geographical element classification

Life forms (biological spectrum) were based on the division scale of Raunkiaer [21], geographical factors [22], and plant resources in T. M. Hoi's work [23].

3. Results and discussion

3.1. Conservation value of plant species in the Me Linh Station for Biodiversity

We have been determined 38 endangered and rare plant species in Me Linh Station for Biodiversity, Table 1. In Table 1, the life form was denoted base on the Raunkiaer's work [21]. Ph (Phanerophytes) includes Mg (Megaphanerophytes: over 30 meters high), Me (Mesophanerophytes: from 8 to 30 meters high), Mi (Microphanerophytes: from 2 to 8 meters high), and Na (*Nanaphanerophytes*: from 0.5 to 2 meters high). Some abbreviations including Ch (Chamerophytes), Hm (Hemicryptophytes), Cr (Cryptophytes), Ep (Epiphytes phanerophytes), and Lp (Lianes phanerophytes).

Table 1. Comprehensive checklist of endangered and rare plant species in Me Linh Station for Biodiversity

TT	Science names	Vietnam names	Life form	Geographical element	Uses	Conservation value			
						National		International	
						Red data book	Decree 84	IUCN	CITES
POLYPODIOPHYTA									
1. Cyatheaceae									
1.	<i>Cyathea gigantea</i> (Wall. ex Hook) Holttum	Ráng gỗ nhãn	Mi	19	Or, M		IIA		Pl.II
2. Dicksoniaceae									
2.	<i>Cibotium barometz</i> (L.) J. Sm.	Lông cu li	Ch	29	Or, M		IIA		Pl.II
3. Polypodiaceae									
3.	<i>Drynaria bonii</i> Chr.	Cốt toái bò	Ep	18	M	VU	IIA		
MAGNOLIOPHYTA DICOTYLEDONEAE									
4. Anacardiaceae									
4.	<i>Gluta laccifera</i> (Pierre) Ding Hou	Son huyết	Mg	17	W, L	VU			
5. Annonaceae									
5.	<i>Goniothalamus takhtajanii</i> Ban	Giác để tam đảo	Mi	16	W	CR			
6. Apocynaceae									
6.	<i>Rauwolfia verticillata</i> (Lour.) Baill.	Ba gác vòng	Mi	17	M	VU			
7. Aristolochiaceae									
7.	<i>Asarum glabrum</i> Merr.	Hoà tiên	Hm	17	M	VU			
8. Burseraceae									
8.	<i>Canarium pimela</i> K. D. Koenig	Trám đen	Me	18	W, F, M	VU			
9. Campanulaceae									
9.	<i>Codonopsis javanica</i> (Blume) Hook. f.	Đẳng sâm	Lp	33	M	VU	IIA		
10. Fabaceae									
10.	<i>Dalbergia assamica</i> Benth.	Cọ khẹt	Me	17	W, M				Pl.II
11.	<i>Dalbergia rimosa</i> Roxb.	Trắc dây	Lp	21	M		IIA		Pl.II
11. Fagaceae									
12.	<i>Castanopsis ferox</i> (Roxb.) Spach	Dẻ gai	Me	17	W	VU			
13.	<i>Castanopsis tessellata</i> Hick. & A. Cam.	Cà ôi lá đa	Me	17	W	VU			
12. Lauraceae									
14.	<i>Cinnadenia paniculata</i> (Hook.f.)Kosterm.	Kháo xanh	Me	33	W, E	VU		VU	
13. Menispermaceae									
15.	<i>Stephania dielsiana</i> Y. C. Wu	Củ dôm	Lp	18	M	VU	IIA		
16.	<i>Stephania longa</i> Lour.	Lưỡi tiền	Ch	17	M		IIA		
17.	<i>Stephania rotunda</i> Lour.	Bình vôi	Cr	21	M		IIA		
18.	<i>Tinospora sagittata</i> (Oliv.) Gagnep.	Củ gió	Ch	13	M	VU			

TT	Science names	Vietnam names	Life form	Geographical element	Uses	Conservation value			
						National		International	
						Red data book	Decree 84	IUCN	CITES
14. Myrsinaceae									
19.	<i>Ardisia silvestris</i> Pit.	Lá khô	Hm	16	M	VU			
20.	<i>Embelia parviflora</i> Wall. ex A. DC.	Thiên lý hương	Ch	25	M	VU			
15. Opiliaceae									
21.	<i>Melientha suavis</i> Pierre	Rau sắng	Mi	17	V	VU			
16. Sapotaceae									
22.	<i>Madhuca pasquieri</i> (Dubard) H. J. Lam	Sến mật	Mg	13	W, Oil, M	VU		EN	
17. Schisandraceae									
23.	<i>Kadsura coccinea</i> (Lem.) A. C. Smith	Nấm com	Lp	17	M		IIA		
18. Thymelaeaceae									
24.	<i>Aquilaria crassna</i> Pierre ex Lecomte	Trâm hương	Mi	17	W, M, E	EN		CR	Pl.II
19. Tiliaceae									
25.	<i>Colona poilanei</i> Gagnep.	Cọ mai nháp lá nhỏ	Me	13	W			NT	
MONOTYLEDONEAE									
20. Convallariaceae									
26.	<i>Disporopsis longifolia</i> Craib.	Hoàng tinh hoa	Cr	21	M	VU	IIA		
21. Asparagaceae									
27.	<i>Peliosanthes teta</i> Andr.	Sâm cau	Cr	21	M	VU	IIA		
22. Orchidaceae									
28.	<i>Anoectochilus brevilabris</i> Lindl.	Giải thù ba răng	Cr	18	Or, M	EN	IA		Pl. II
29.	<i>Bulbophyllum concinnum</i> Hook. f.	Câu diệp xinh	Hm	21	Or		IIA		Pl. II
30.	<i>Bulbophyllum fischeri</i> Seidenf.	Long gamble	Hm	21	Or		IIA		Pl. II
31.	<i>Dendrobium nobile</i> Lindl.	Thạch hộc	Ep	25	Or, M		IIA		Pl. II
32.	<i>Epipogium roseum</i> (D. Don) Lindl.	Thượng lan	Cr	17	Or		IIA		Pl. II
33.	<i>Geodorum densiflorum</i> (Lamk.) Schlecht.	Địa kim hoa dày	Cr	21	Or		IIA		Pl. II
34.	<i>Goodyera foliosa</i> (Lindl.) Benth. ex C. B. Clarke	Hảo lan lá	Cr	21	Or		IIA		Pl. II
35.	<i>Tainia viridifusca</i> (Hook.) Benth.	Tài lan xanh nâu	Cr	13	Or, M		IIA		Pl. II
36.	<i>Thrixspermum centipeda</i> Lour.	Bạch điềm	Ep	23	Or		IIA		Pl. II
37.	<i>Thrixspermum formosanum</i> (Hayata) Schlecht.	Mao tử đài loan	Ep	33	Or		IIA		Pl. II
38.	<i>Trichotosia pulvinata</i> (Lindl.) Kraenzl.	Mao lan gói	Ep	21	Or		IIA		Pl. II

Also, in Table 1, the geographical element was numbered based on L. T. Chan's work [22] as follows:

- 13. Bacbo endemic
- 16. Vietnam endemic
- 17. Indochina endemic
- 18. Southern China endemic
- 19. Hainam, Taiwan, Philippines element
- 21. India element
- 23. Indonesia, Malaysia element
- 25. Topical Asia element
- 29. Asia element
- 33. Unknown element

CR (Critically Endangered), EN (Endangered), VU (Vulnerable), and NT (Near Threatened) were marked based on Vietnam Red Data Book [16] and IUCN [20].

In Table 1, column Decree 84, IA and IIA notes are correspond to the appendixes of the Governments Decree No. 84/2021/ND-CP [17]. Appendix IA lists species threatened with extinction, prohibited from export, import, re-export, introduction from the sea and transit of natural specimens for commercial purposes. Appendix IIA lists species that, although currently not threatened with extinction, may become so without control of export, import, re-export, introduction from the sea and transit of natural specimens thereof for commercial purposes. In the CITIES column, the notations were based on CITES [19], in which Appendix I lists species threatened with extinction, prohibited from export, import, re-export, introduction from the sea, and transit of natural specimens for commercial purposes and Appendix II lists species that, although currently not threatened with extinction, may become so without control of export, import, re-export, introduction from the sea and transit of natural specimens thereof for commercial purposes. The “Uses” column was based on T. M. Hoi's work [13] with following notations: F (Fruit), Or (ornamental plant), Oil (fatty oils), W (woods), L (latex), E (essentials), M (medicines), and V (vegetable) respectively.

Table 1 shows that 38 endangered and rare plant species belong to 2 phyla, 22 families in Me Linh Station for Biodiversity. Among them, Magnoliophyta accounts for the majority with 19 families (accounting for 86.36%), 35 species (accounting for 92.1%); in there, 22 species belong to the Magnoliopsida (accounting for 57,89% of the total number of species), and 13 species belong to the Liliopsida (accounting for 34.21% of the total number of species); Polypodiophyta has three species belong to 3 families (Table 2).

Table 2. Distribution of taxa in phyla

Phyla	Family		Genus		Species	
	Quantity	Rate (%)	Quantity	Rate (%)	Quantity	Rate (%)
POLYPODIOPHYTA	3	13.64	3		3	
MAGNOLIOPHYTA	19	86.36	29	90.63	35	92.1
Magnoliopsida	16		18		22	57,89
Liliopsida	3	13.64	11	34.76	13	43.21
Total	22	100	32	100	38	100

The family with the most species is Orchidaceae, with 11 species (accounting for 28.95% of the total number of species); next is the Menispermaceae with 4 species (accounting for 10.53% of the total number of species); Fabaceae, Fagaceae and Myrsinaceae, each family has 2 species (accounting

for 5.26% of the total number of species); 17 remaining families, each family has 1 species (accounting for 2.63% of the total number of species).

At the national level: Among 38 endangered and rare plant species in Me Linh Station for Biodiversity, there are 20 species in *Vietnam Red Data Book 2007*. Among them, *Goniothalamus takhtajanii* Ban is at a very critical level (CR), 3 species are endangered (EN), and 16 are vulnerable (VU).

Belongs to Government Decree No. 84/2021/ND-CP, there are 20 species; among them, 1 species (*Anoectochilus brevilabris* Lindl.) in appendix IA and 19 species in appendix IIA.

At the international level: Among 38 endangered and rare plant species in Me Linh Station for Biodiversity, 4 species in IUCN (2024); among them, *Aquilaria crassna* is at a very critical level (CR) *Madhuca pasquieri* is at an Endangered (EN), *Cinnadenia paniculata* is at a Vulnerable (VU), and *Colona poilanei* is at a Near Threatened (NT).

Belongs to Appendix II of CITES (2024), there are 16 species whose trade must be controlled to avoid being threatened with extinction.

3.2. Geographical element of endangered and rare plant species in the Me Linh Station for Biodiversity

Me Linh Station's endangered and rare plant species belong to 10 geographical elements. Among them, the Indochina endemic has the highest number of species with 11 species (accounting for 28.94%); next is the Indian element, which has 9 species (23.68%); Bacbo endemic and Southern China endemic there are 4 species together (each element accounts for 10.52%); Vietnam endemic and Topical Asia element there are 2 species together (each element accounts for 5.26%); Hainan, Taiwan, Philippines element; Indonesia, Malaysia element; Asia element there is 1 species together (each element accounts for 2.63%). Further, there are 3 species whose geographical factors cannot be determined (accounting for 7.89% of the total species).

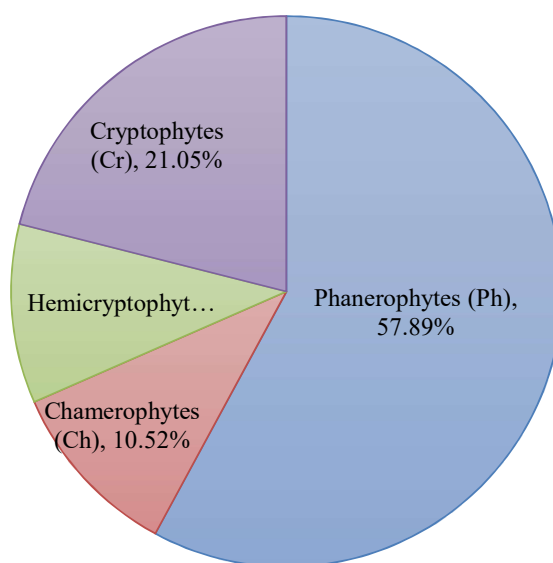


Figure 1. Life forms of endangered and rare plant species.

3.3. Life forms of endangered and rare plant species in the Me Linh Station for Biodiversity

For biodiversity, 38 endangered and rare plant species in Me Linh Station belong to 4 main life forms. Include: Phanerophytes (Ph) dominates with 22 species (accounting for 57.89%. Among them, *Megaphanerophytes* – Mg with 2 species, *Mesophanerophytes* – Me with 6 species, *Microphanerophytes* – Mi with 5 species, *Nanaphanerophytes* – Na with 9species); Chamerophytes (Ch) and Hemicryptophytes (Hm) there are with 4 species together (each group accounting for 10.52%); Cryptophytes (Cr) with 8 species (accounting for 21.05%), Figure 1.

3.4. Usage value of endangered and rare plant species in Me Linh Station for Biodiversity

Besides their conservation value, endangered and rare plant species in Me Linh Station are also used for many different purposes, including 8 groups of uses indicated below in Figure 2.

Medicinal value (M): This is the biggest, with 23 species (accounting for 60.52%). Some species have high value, such as *Aquilaria crassna*, *Asarum labrum*, *Codonopsis javanica*, and *Stephania rotunda*.

Ornamental plants (O): with 13 species (accounting for 34.21%). Most of them belong to Orchidaceae. Among them, some species have high value and beautiful flowers, such as *Anoectochilus breviaris*, and *Dendrobium nobile*.

Timber trees (W): with 9 species (accounting for 23.68%). Some species have high value, especially *Madhuca pasquieri*, which is considered one of the four best types of wood.

Essential oils plants (E): with 2 species, *Cinnadenia paniculata* and *Aquilaria crassna* (accounting for 5.26%). Among them, essential oils of *Aquilaria crassna* are especially famous and valuable.

In addition, there is also 1 species for fruit (*Canarium pimela*), 1 species of fatty oil (*Madhuca pasquieri*), 1 species of latex (*Gluta laccifera*), 1 species for famous delicious vegetables (*Melientha suavis*).



Figure 2. Usage value of endangered and rare plant species.

4. Conclusion

In the Me Linh Station for Biodiversity has 38 endangered and rare plant species. 20 species in Vietnam Red Data Book 2007; 20 species belong to Decree No. 84/2021/ND-CP; 16 species belong to Appendix II of CITES (2024), and 4 species belong to IUCN (2024). Endangered and rare plant species in the Me Linh Station are divided into 4 main groups of life forms and 10 geographical elements (not to mention 3 unidentified species). All of them have been used for many different purposes, with 8 groups of uses, many of which have great economic value.

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