DIVERSITY OF FLOWERING PLANTS IN GAO GIONG ECOTOURISM AREA, CAO LANH DISTRICT, DONG THAP PROVINCE

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Abstract

The study was conducted to assess the diversity of flowering plants (Magnoliophyta) in Gao Giong ecotourism area, Cao Lanh district, Dong Thap provine, through field surveys and plant sampling collection in typical habitats. The results recorded 89 families, 249 genera and 337 species. Taxa belonging to Magnoliopsida (Dicotyledonae) are more diversified than Liliopsida (Monocotyledonae) with 240 species, 174 genera and 68 families. Families of most species members are Poaceae, Fabaceae, Asteraceae, Cyperaceae and Amanrathaceae. Genera of most diverse species are Cyperus, Ficus, Ipomoea, Nymphaea and Alternanthera. The flora has 5 main types of stem forms: woody plants, herbs, shrubs, vines and parasitic plants in which herbaceous plants dominate with 192 species. Value used of plants has been 10 main groups. Among these, medicinal plants have most diversity with 205 species (60.83%). Gao Giong ecotourism area has 2 endangered species listed in Vietnam's Red Book (2007) of Oryza rufipogon and Elaeocarpus hygrophilus.

Keywords: *Diversity, ecotourism area, Gao Giong, Magnoliophyta, species, stem form.*

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ĐA DẠNG THỰC VẬT CÓ HOA Ở KHU DU LỊCH SINH THÁI GÁO GIỒNG, HUYỆN CAO LÃNH, TỈNH ĐỒNG THÁP

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Tóm tắt

Nghiên cứu được thực hiện nhằm đánh giá đa dạng thực vật có hoa (ngành Ngọc lan) ở khu du lịch sinh thái Gáo Giồng, huyện Cao Lãnh, tỉnh Đồng Tháp qua các chuyến đi khảo sát thực địa và thu thập mẫu vật trên các sinh cảnh điển hình. Kết quả nghiên cứu đã ghi nhận được 337 loài thực vật, 249 chi, 89 họ và 2 lớp thuộc ngành Magnoliophyta. Các taxa thuộc lớp Ngọc lan Magnoliopsida (lớp Hai lá mầm) đa dạng hơn lớp Loa kèn Liliopsida (lớp Một lá mầm) với 240 loài, 174 chi, 68 họ. Các họ có số lượng loài nhiều nhất là: Poaceae, Fabaceae, Asteraceae, Cyperaceae và Amaranthaceae. Các chi đa dạng nhất gồm: Cyperus, Ficus, Ipomoea, Nymphaea, Alternanthera. Hệ thực vật nơi đây có 5 dạng thân: cây gỗ, cây thảo, cây bụi, dây leo và cây kí sinh, trong đó dạng cây thảo chiếm ưu thế với 192 loài. Giá trị sử dụng của thực vật có hoa được chia làm 10 nhóm chính, trong đó nhóm cây làm thuốc là đa dạng nhất với 205 loài (60,83%). Khu du lịch sinh thái Gáo Giồng có 2 loài thực vật có hoa có nguy cơ tuyệt chủng theo Sách Đỏ Việt Nam (2007) là Oryza rufipogon và Elaeocarpus hygrophilus.

Từ khóa: *Dạng thân, đa dạng, Gáo Giồng, khu du lịch sinh thái, loài, thực vật có hoa.*

1. Introduction

Gao Giong ecotourism area is known as a "Miniature of Dong Thap Muoi" with primeval *Melaleuca* forests, seasonal floodplain meadows and the largest herbaceous area. *Melaleuca* forests here not only play the role of regulating the flow of floods and creating fresh air for the whole area but also the habitat of many species of plants and animals typical of the Plain of Reeds. Many species are listed in the Vietnam's Red Data Book (2007).

Gao Giong ecotourism area has an inland wetland ecosystem characterized by an evergreen broadleaved forest, one of the important sites for biodiversity conservation of the wetland ecosystem of the Dong Thap province. In addition to ecological value, Gao Giong is also rich in culture, science, and natural resources. Diverse Gao Giong flora creates a unique natural landscape, attracting visitors for exploration.

Le et al. (2010) and Vo et al. (2013) comfirmed 199 species, 163 genera, 76 families. These species comprise one species of Bryophyta (non-vascular plant), seven of Polypodiophya, one of Gynospermatophyta, and 190 of Angiospermatophyta in Gao Giong ecotourism area. Meanwhile, Pham (2018) identified 326 vascular plant species belonging to 245 genera, 89 families in three divisions: Polypodiophyta (nine species), Cycadophyta (one species) and Magnoliophyta (316 species) in this area.

This study continues to evaluate species composition diversity of flowering plants in Gao Giong ecotourism, Cao Lanh district, Dong Thap province and compares the results with previous studies by Le et al. (2010), Vo et al. (2013), Pham (2018) to supplement the list of species composition, contribute to the work sustainable exploitation, conservation of local resources, as well as maintenance of regional climate.

2. Subjects and methods

2.1. Research subjects

Flowering plants are from Gao Giong ecotourism area, Cao Lanh district, Dong Thap province.

2.2. Research methodology

2.2.1. Field research methods

Conducted 6 field trips to survey, record data, observe, describe, record local names, tree characteristics and sample photographs.

Support tools include small magnifiers, cameras, notebooks, pencils, ballpoint pens.

Research method (Nguyen, 2008), specifically: Set up 40 standard plots with dimensions of 20 x 20 m randomly along investigation routes passing through different habitats typical of the study area.

For evaluating the taxa diversity in the Magnoliophyta phylum: Statistics on the number of species, genera, families, and subclasses from low to high, based on the established list of flora, calculating the percentage of taxa for its diversity.

For assessing diversity of stem forms: Based on the concept of stem form of E. Warming (1901): the stem form component is a collection of plant groups, despite differences in classification systems, all have the ability to adapt to certain living conditions, have similarities in structure, physiological function and biological behavior (Vu, 2000). From the statistical data of the main stem types in the list of flowering plants in the research area, calculate the percentage of species belonging to each stem type compared to the total number of species identified.

2.2.2. Laboratory methodology

Collectively and selectively inherit documents, scientific works related to the research project to synthesize information, apply to the analysis, and interpret the results.

Determining the scientific name of plants by morphological methods used by: "*An Illustated Flora of Vietnam"* (Pham, 1999, 2003); "*Useful plants in Vietnam"* (Vo & Tran, 2001, 2002); "*Dictionary of common plant"* (Vo, 2003, 2004); "*Vietnamese plant's names refenence book"* (Vo, 2007); "*Flora of Vietnam, Cyperaceae"* (Nguyen, 2002); "*Flora of Vietnam, Asteraceae"* (Le, 2007).

The scientific names of species and plant families under the latest updated specialized taxonomy websites: Plant of the World Online (2024): https://powo.science.kew.org/ and Plant Identifier (2024): https://identify.plantnet.org/.

List of flowering plants species composition sorted according to Takhtajan classification system (2009).

3. Results

3.1. Species richness and taxonomic diversity

Drawing on flowering plants from the research

site, we have identified 337 species, 249 genera, 89 families, 11 subclasses of 2 classes.

Compared with the number of flowering plant species in Gao Giong ecotourism area surveyed by Le et al. (2010) and Vo et al. (2013) discovered 190 species, we have discovered and added 147 species of flowering plants not included in the list of floral species (2010, 2013) in here.

Compared with the results by Pham (2018) recorded 316 flowering plants species, we added 21 species (Table 1) of flowering plants not included in the list of floral species (2018) in Gao Giong ecotourism area.

Table 1. List of species added the list of flowering plants species composition in Gao Giong ecotourism area (2018)

Ordinal number	Families	Species
1	Piperaceae	*Piper betle* L.*
2	Saururaceae	*Houttuynia cordata* Thunb.*
3	Menispermaceae	*Tiliacora triandra* (Colebr.) Diels*
4	Menispermaceae	*Cyclea barbata* Miers
5	Amaranthaceae	*Alternanthera bettzickiana* (Regel) G. Nicholson*
6	Amaranthaceae	*Amaranthus spinosus* L.
7	Amaranthaceae	*Celosia argentea* L.*
8	Amaranthaceae	*Gomphrena celosioides* Mart.
9	Amaranthaceae	*Gomphrena globosa* L.*
10	Nyctaginaceae	*Boerhavia erecta* L.
11	Leeaceae	*Leea rubra* Blume
12	Fabaceae	*Vigna adenantha* (G.Mey.) A. Delgado
13	Moringaceae	*Moringa oleifera* Lam.*
14	Asteraceae	*Praxelis clematidae* (Griseb.) R.M.King & H.Rob.
15	Asteraceae	*Tagetes erecta* L.*
16	Asteraceae	*Tridax procumbens* L.
17	Asteraceae	*Gymnanthemum amygdalinum* (Delile) Sch.Bip.*
18	Acanthaceae	*Asystasia chelonoides* Nees
19	Poaceae	*Isachne globosa* (Thunb.) Kuntze
20	Poaceae	*Paspalum scrobiculatum* L.
21	Poaceae	*Setaria sphacelata* (Schumach.) Stapf & C.E. Hubb. ex Moss

Among of 21 species added to the list by Pham (2018), 9 species (*) were cultivated for ornamental, food, and medicinal purposes, while 12 species grew wild due to environmental changes, ecotourism activities, and climate change.

A total of 337 species recorded were 181 species of natural wilderness and 156 species are planted for landscaping and shade create the ecosystem and diversity of the Dong Thap Muoi wetlands.

Magnoliopsida had the highest number of taxa at all stages, with 240 species, 174 genera and 68 families. Liliopsida, 97 species, 75 genera and 21 families (Table 2).

Table 2. Rate distribution of taxa in Magnoliophyta

Class	Families		Genera		Species	
	Taxa	%	Taxa	%	Taxa	%
Total	89	100	249	100	337	100
Magnoliopsida	68	76.40	174	69.88	240	71.22
Liliopsida	21	23.60	75	30.12	97	28.78
Magnoliopsida/ Liliopsida	3.24		2.32		2.47	

3.1.1. Diverse classification

The distribution of taxa in the subclasses were also different (Table 3). The subclass Rosidae number of taxa at the highest and most abundant levels with 65 species, 50 genera, 19 families.

Table 3. Taxa ratios in the subclasses

Subclass	Families		Genera		Species	
	Taxa	%	Taxa	%	Taxa	%
Magnoliidae	6	6.74	7	2.81	14	4.15
Ranunculidae	2	2.25	2	0.80	4	1.19
Caryophyllidae	6	6.74	15	6.02	27	8.01
Dilleniidae	19	21.35	38	15.26	53	15.73
Rosidae	19	21.35	50	20.08	65	19.29
Asteridae	3	3.37	22	8.84	24	7.12
Lamiidae	13	14.61	40	16.06	53	15.73
Alismatidae	6	6.74	14	5.62	16	4.75
Liliidae	5	5.62	10	4.02	11	3.26
Arecidae	1	1.12	6	2.41	6	1.78
Commelinidae	9	10.11	45	18.07	64	18.99

3.1.2. Diverse families

The species surveyed were 337 species distributed in 89 families. However, the proportion of species in the families is not uniform, we had statistically five most diverse families, such as: Poaceae (38 species); Fabaceae (27 species); Asteraceae (21 species); Cyperaceae (14 species); Amaranthaceae (13 species). Of these, the richest is Poaceae.

3.1.3. Diverse genera

Of the 249 genera recorded, 5 genera the most diverse (5 to 9 species) with 33 species. The richest genera were *Cyperus* (9 species), both *Ficus* and *Ipomoea* genera are the second rich genera (7 species), ranked the third both *Nymphaea* and *Alternanthera* genera (5 species).

3.2. The variety of stem forms

The flowering plants in Gao Giong were of five types: Trees, herbaceous plants, shrubs, vines and parasitic shrubs; data are presented in Table 4.

Table 4. The variety of stem forms of flowering plants in Gao Giong ecotourism area

Stem forms	Herbaceous plants	Trees	Shrubs	Vines	Parasitic shrubs	Total taxa
Taxa	192	80	34	28	3	337
Percentage stem form (%)	56.97	23.74	10.09	8.31	0.89	100

As seen from Table 4, the dominant stem form of flowering plants (Magnoliophyta) is the herbaceous (with 192 species, accounting for 56.97%), followed by the trees (80 species, accounting for 23.74%), the third shrubs (34 species, accounting for 10.09%), fourth vines (28 species, accounting for 8.31%) and the last parasite shrubs (3 species, accounting for 0.89%). So, the results were shown that the flora had the characteristics of a tropical flora. This reflected the marsh flora consisting of tall water-tolerant grasses, occasional trees and shrubs living in an environment that was often flooded, nutrient-poor soil, acidic and dry in the dry season.

3.3. Diversity of plant resources

3.3.1. Diverse in value for use

Based on the documents: "Vietnam's Herbal Plants and Remedies" (Do, 2004); "Useful plants in Vietnam" (Vo & Tran, 2001, 2002); "Dictionary of common plant" (Vo, 2003, 2004); "Dictionary of Medicinal plant in Vietnam" (Vo, 2012); "List

of medicinal plants in Vietnam" (The Institute of Medicine, 2016), we have listed 10 utility group, the results are presented in Table 5.

Group of medicinal plants: There are 205 species of medicinal plants, accounting for 60.83% of total species, including medicinal plants such as *Annona glabra*, *Cassytha filiformis*, *Piper betle*, *Houttuynia cordata*, *Glinus oppositifolius, Portulaca oleracea*, *Achyranthes aspera*, *Gomphrena celosioides*, *Phyllanthus amarus, Cayratia trifolia*, *Heliotropium indicum*, *Scoparia dulcis*, *Gmelina asiatica* and so on. These are the species used by local people to treat diseases such as cardiovascular disease, hypertension, kidney disease, otolaryngology, liver disease, rhinitis and healing, insomnia, gynaecological disesase, etc.

Groups of ornamental plants: There are 120 species, accounting for 35.61% of total species recorded here. The main species such as: *Argyreia nervosa*, *Ruellia simplex*, *Tecoma stans*, *Helianthus annuus*, *Allamanda cathartica*, *Catharanthus roseus*, *Adenium obesum*, *Nelumbo nucifera*, *Combretum indicum*, *Terminalia catappa, Cosmos sulphureus*, *Nymphaea pubescens*, *N. rubra*, *N. nouchali*, *Bougainvillea brasiliensis*, *Mirabilis jalapa*, *Ixora coccinea*, *Arachis pintoi*, *Cassia fistula*, *C. grandis*, and more.

Group of edible plants: There are 101 species, accounting for 29.97% of the total species of the study area, including: *Emilia sonchifolia, Grangea maderaspatana, Sphaeranthus indicus*, *Capsicum frutescens*, *Ipomoea batatas*, *Citrus maxima*, *Spondias mombin*, *Malpighia glabra*, *Dimocarpus longan*, *Leucocasia gigantea*, *Dioscorea alata*, *Ananas comosus*, *Hellenia speciosa*, *Curcuma longa*, *Zingiber officinale*, *Cymbopogon citratus*, *Saccharum officinarum* and so on.

The other tree groups take a small percentage.

3.3.2. The value of genetic resources

According to the Vietnam's Red Data Book (2007), of the 337 species of flowering plants recorded in the Gao Giong ecotourism area, two species were classified as species needing conservation at the "Vulnerable - VU" level: *Oryza rufipogon* Griff. and *Elaeocarpus hygrophilus* Kurz.

Table 5. Value of use of flowering plants in Gao Giong ecotourism area

Ordinal number	Value of use	Taxa	%
1	Group of medicinal plants	205	60.83
2	Group of ornamental plants	120	35.61
3	Group of edible plants	101	29.97
4	Group of plants for animal feed	39	11.57
5	Group of trees for organic fertilizer, soil improvement	35	10.39
6	Group of trees for wood and firewood	30	8.90
7	Group of essential oil plants	25	7.42
8	Group of making handicrafts plants	12	3.56
9	Group of fiber-producing plants	6	1.78
10	Group of fatty oil plants	5	1.48

4. Conclusions

The composition of flowering plants in Gao Giong ecotourism area, Cao Lanh district, Dong Thap province is 337 species, 249 genera, 89 families, 11 subclasses of 2 classes in Magnoliophyta. The Magnoliopsida taxa are the most diverse with 240 species, 174 genera, and 68 families. Families in terms of their taxa number rank as follows: Poaceae, Fabaceae, Asteraceae, Cyperaceae and Amaranthaceae. The genera most diverse are *Cyperus, Ficus, Ipomoea, Nymphaea* and *Alternanthera*. Two species of plant threatened with extinction have been identified in the Vietnam's Red Data Book (2007): *Oryza rufipogon* Griff. and *Elaeocarpus hygrophilus* Kurz.

The flowering plants are five types of stem forms, in which herbaceous plants dominate with 192 species. The value of vegetation is divided into 10 main groups such as medicinal plants (205 species), ornamental plants (120 species), edible plants (101 species) and so on.

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