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Flora of the Research Forest in Yen Tu, Quang Ninh

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Abstract. The vascular flora of the Research Forest in Yen Tu, Quang Ninh was assessed between 2005 and 2006. In the area under review, 721 species belonging to 425 genera and 154 families were identified. Among these species, these are 9 Lycopodiophyta, 34 Polypodiophyta, 8 Gymnospermae and 670 Angiospermae species (577 Dicotyledonae, 93 Monocotyledonae). The richest 3 families are Euphorbiaceae with 52 (7.2%) species, Asteraceae with 30 (4.2%) species and Moraceae with 30 (4.2%) species. The richest genus is *Ficus* L., (22 species) followed by *Syzygium* Gaertn., (8 species) and *Dioscorea* L., (7 species). When the flora of the area is analysed by Raunkiaer's life form system, the results are as follows: phanerophytes 596 (82.7%), chamaephytes 20 (2.8%), hemicryptophytes 15 (2.1%), cryptophytes 37 (5.1%), therophytes 37 (5.1%), and unknown 16 (2.2%) species, respectively.

Keywords: Vascular plant, Flora, Yen Tu, Quang Ninh Research Forest.

1. Introduction

This research was carried out to determine the flora of the Research Forest in Yen Tu, Quang Ninh. The vegetation of the area has been extensively destroyed by anthropogenic effects and, therefore, plants try to survive under unsuitable conditions. On the other hand, there are not publish in here. Therefore, new report should be prepared for the conservation of plant species.

The Research Area is located within the borders of the North by Son Dong district (Bac Giang province), in the East by Vang Danh village, in the West by Trang Luong, Dong Trieu district, and in South by Dong Thi, Uong Bi district (Quang Ninh province). It is about 2686 ha in size, and is located at latitudes 21°05' - 21°09' N, and longitudes 106°43' - 108°45' E.

Yen Tu, Quang Ninh Research Forest is covered two mainly mountain chains toward to North from 660m peak to 908m peak and two junior mountain chains toward North-South. West is from 660m peak to Vang Tan stream, and East is from 908m peak to Bai Dau stream. Altitude in the study area ranges from 50m Nam Mau plain to 1068m Yen Tu peak. The study area consist three mainly stream systems as Vang Tan, Giai Oan and Bai Dau.

Geology

The geological structure of the research area mostly consists of aged calcareous rocks, paleo-allvium and sand gravel. There are 4 large soil groups in the study area as follows:

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Yellow ferallitic soil developed in sandstone in low areas; yellow ferallitic soil developed in stone gravel belong to hill areas; yellow-red soil developed in paleoalluvium; cultivated soil in Nam Mau plain, due to the climate, topography and differences in the main substance.

Climate

The typical climate of the region is clearly two seasons. It characterized by hot, humidity and rainy summer which starts from May to October, meanwhile cool and dry winter which starts from November to April of the next year. The temperature decreases gradually and the rain increases towards the upper parts of the mountains. This characteristic is observed clearly at 680 - 800m altitude. The temperature on the area rarely falls below 0^{o}C. The annual average precipitation rate is 1785mm. The maximum and minimum precipitations were 2700mm and 1423mm, respectively. The climatic data for this area are based on observations made by the Region Meteorology Station. Meanwhile, the annual mean temperature is 23.4^{o}C. The maximum mean temperature is 33.4^{o}C, in June. The minimum mean temperature is 14^{o}C, in December. However, the temperature also falls down 5^{o}C or lower, sometime. The annual average maximum and minimum humid rate is 86% and 62%, respectively.

2. Materials and methods

The research material consists of some 2015 plant specimens collected from the research area. Efforts were made to collect both flowering and fruiting specimens. The specimens were prepared according to established herbarium techniques. Subsequently, the Flora of Vietnam [1-4] and the other related floras [5-9] and monographs [10-12] were used in the identification of the specimens.

Moreover, some of the specimens were compared with the type specimens which have been keeping at the Herbarium of Forest University and National University of Hanoi (HNU) during the study period between 2005 and 2006. Some other specimens were determined by expert, Vu Van Can (Forest Inventory and Planning institute). The most of the plant specimens are kept at the Herbarium of University Forest and other are kept at the Herbarium of National University of Hanoi (HNU). The flora list and authors were corrected and given according to the order in [4,13,14].

3. Results and discussion

This study was carried out with approximately 2015 vascular plant specimens collected between 2005 and 2006. As a result of the identification of the plant specimens, 154 families, 425 genera, and 721 species were determined. Nine of the 721 species belonging to the Lycopodiophyta and 34 are Polypodiophyta and the other 678 belonging to the spermaphyte plant. Eight species are Gymnospermae and the others 670 are Angiospermae, (Table 1).

The dispersion of the plant taxa belonging to Angiospermae that were defined in the study area according to the large taxonomical groups is shown in Table 2. The Dicotyledonae group are contained by 577 (86.0%) of species, 340 (85.0%) of genus and 110 (83.0%) of family, meanwhile the Monocotyledonae are included by 93 (14.0%) of species, 58 (15.0%) of genus and 23 (17.0%) of family, respectively in the study area.

Table 1. The dispertion of taxa into large taxonomic groups

Divisions	Number of families		Number of genera		Number of species	
	No	%	No	%	No	%
Lycopodiophyta	2	1.3	2	0.5	9	1.2
Polypodiophyta	15	9.7	19	4.5	34	4.7
Gymnospermae	4	2.6	6	1.4	8	1.1
Angiospermae	133	86.4	398	93.6	670	93.0
Total	154	100	425	100	721	100

Table 2. The distribution of the species according to the class of Angiospermae

Class	Number of families		Number of genera		Number of species	
	No	%	No	%	No	%
Dicotyledoneae	110	83	340	85	577	86
Monocotyledoneae	23	17	58	15	93	14
Total	133	100	398	100	670	100

As can be seen from Table 3, with 596 (82.7%) of the species are phanerophytes, 20 (2.8%) are chamaephytes, 37 (5.1%) are cryptophytes, 15 (2.1%) are hemicryptophytes, 37 (5.1%) are therophytes, and 16 (2.2%) are unknown, respectively. The level of phanerophyte species is dominate in area study, others groups are relatively high. Although the average rainfall per year is 1785mm, most of the rain falls in August, September and November. The weather is hot, humid and rainy from the beginning of May until the end of October, as a whole. For this reason, it is normal for the life-forms to be distributed as they [15].

Table 3. Life-forms

Order	Life-form	Species number	Rates (%)
1	Phanerophytes	596	82.7
2	Chamaephytes	20	2.8
3	Cryptophytes	37	5.1
4	Hemicryptophytes	15	2.1
5	Therophytes	37	5.1
6	Unknown	16	2.2
Total		721	100

The family Euphorbiaceae is the largest in the study area with 52 (7.2%) species. The next largest is Asteraceae and Moraceae, represented as the same by 30 (4.2%) species, followed by Rubiaceae with 28 (3.9%) species, Lauraceae with 25 (3.5%) species, Fabaceae with 23 (3.2%) species, Poaceae with 20 (2.8%) species, Caesalpiniaceae with 18 (2.5%) species, Fagaceae with 15 (2.1%) species and Verbenaceae with 13 (1.8%) species. The Euphorbiaceae are the largest family here, because they are one of the largest families in Vietnam. The Asteraceae family is the second largest family in this area, partly because they are the largest family in the world as well as in Vietnam and partly because of the large number of wild chrysanthenum plants growing in cultivated areas.

The 10 largest families according to number of species in this study and the studies mentioned above are compared in Table 4.

Table 4. The richest families within the areas being compared

Order	Family	Studies performed (species)			
		Yen Tu	Cat Ba	Huu Lung	Vietnam
1	Euphorbiaceae	52	50	31	425
2	Asteraceae	30	25	20	325
3	Moraceae	30	30	17	-
4	Rubiaceae	28	30	30	400
5	Lauraceae	25	20	14	246
6	Fabaceae	23	30	14	470
7	Poaceae	20	35	17	400
8	Caesalpiniaceae	18	-	-	-
9	Fagaceae	15	14	-	-
10	Verbenaceae	13	18	14	-
11	Acanthaceae	-	-	-	217
12	Cyperaceae	-	-	-	303
13	Orchidaceae	-	-	18	800
14	Apocynaceae	-	15	13	170

The order of the largest families varies only slightly between studies. In the studies of the Yen Tu area, the Acanthaceae, Cyperaceae, Orchidaceae, and Apocynaceae families are not listed as one of the 10 largest families although they are one the 10 largest in Vietnam as a whole. Meanwhile, the family Euphorbiaceae is the largest family in the studies carried out in Yen Tu, Cat Ba and Huu Lung areas and is one the 10 largest in Vietnam as a whole. The family Asteraceae is the 2nd largest family in the studies carried out in Yen Tu and Huu Lung and is the 6th largest in Cat Ba. In contrast, in the studies of the Yen Tu, Huu Lung and Cat Ba areas, the family Moraceae is listed as one of the 10 largest families although is not one of the 10 largest in Vietnam as a whole. The Moraceae family is 3rd in the list from the Yen Tu, Cat Ba, and 5th in the list from Huu Lung area. Although this appears to be a significant divergence from the general distribution of Vietnam flora, the family Moraceae is, in fact, one of the 10 largest families in East-North region of Vietnam. As the same Caesalpiniaceae, Fagaceae, and Verbenaceae occupied 8th, 9th, 10th, in Yen Tu area, respectively. But they are not listed one of the 10 largest in Vietnam as a whole. It could be explained by differences in the habitats of the study area. The other position in the lists is occupied by Rubiaceae, Lauraceae, Fabaceae and Poaceae families. This result was expected because they are one of the 10 largest families in Vietnam as a whole.

The genera containing the highest number of species in this study and the other studies are listed in Table 5. The 10 genera containing the highest number of species vary significantly. However, each list includes contains between 4 and 8 of the 10 genera containing the highest number of species. The genera *Blumea* DC., *Desmodium* Desv., *Calamus* L., *Smilax* L., *Polygonum* L., *Elaeocarpus* L., *Sauropus* Blume, *Mallotus* Lour., which are not among the 10 largest genera, are also included in the lists. The genus *Calamus* L., *Cinnamomum* Schaeff., *Smilax* L., occupy 6th, 8th, 10th position in Yen Tu, respectively, but it is not listed as one of the 10 largest genera in the studies compared. This discrepancy can be explained by differences in the habitats of the study areas. As the same, the genus *Lithocarpus* Blume was ranked 6th in Yen Tu area and *Ardisia* Sw., was ranked 4th in Huu Lung area. They are one of 10 largest genera in Vietnam, but they are not occupied in other compared. This discrepancy also can be explained by differences in the habitats of the study areas.

Table 5. The richest genera in the studies compared

Order	Genera/Family	Studies performed (species)			
		Yen Tu	Cat Ba	Huu Lung	Vietnam
1	Ficus (Moraceae)	22	12	10	97
2	Syzygium (Myrtaceae)	8	-	6	60
3	Dioscorea (Dioscoreaceae)	7	8	5	39
4	Blumea (Asteraceae)	6	4	-	33
5	Desmodium (Fabaceae)	6	5	8	29
6	Calamus (Poaceae)	6	-	-	18
7	Lithocarpus (Fagaceae)	6	-	9	112
8	Cinnamomum (Lauraceae)	6	-	-	44
9	Litsea (Lauraceae)	6	6	7	46
10	Smilax (Smilacaceae)	6	-	-	29
11	Polygonum (Polygonaceae)	-	6	-	36
12	Elaeocarpus (Elaeocarpaceae)	-	6	-	39
13	Mallotus (Euphorbiaceae)	-	5	6	39
14	Ardisia (Myrsinaceae)	-	-	7	101
15	Diospyros (Ebenaceae)	-	-	7	75
16	Sauropus (Euphorbiaceae)	-	5	-	23
17	Phyllanthus (Euphorbiaceae)	-	5	6	48

The research area is a designated protection area and is located in one of the centres of plant diversity in Northern Vietnam. The aim of this study, now that its total flora has been assessed, is to help the general population understand the importance of botanical and environmental assessment and also to the biodiversity conservation.

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Kết quả nghiên cứu bước đầu về hệ thực vật tại rừng đặc dụng Yên Tử, Quảng Ninh

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Rừng đặc dụng Yên Tử, Quảng Ninh cách thành phố Hạ Long khoảng 40Km và Hà Nội 150Km. Rừng ở đây được bao bởi hệ giông chính Yên Tử về phía Bắc từ đỉnh 660m đến đỉnh 908m và hai giông phụ theo hướng Bắc Nam. Đỉnh cao nhất là Yên Tử với độ cao 1068m và thấp nhất là Cách đồng năm mẫu 50m.

Hệ thực vật tại rừng đặc dụng Yên Tử, Quảng Ninh đã được tiến hành nghiên cứu từ năm 2005-2006. Kết quả ban đầu thu được bao gồm 4 ngành với 721 loài thuộc 425 chi và 154 họ. Sự phân bố các taxon như sau: ngành Thông đất có 9 loài, tiếp đến ngành Dương xỉ với 34 loài, ngành Hạt trần chiếm 8 loài và ngành Hạt kín chiếm số lượng loài lớn nhất với 670 loài (bao gồm 577 loài thuộc lớp Hai là mầm và 93 loài thuộc lớp Một lá mầm). Khi đánh giá 10 họ giàu loài thì 3 họ có số loài lớn nhất là: họ Thầu dầu với 52 (7,2%), tiếp đến 2 họ Cúc và Dâu tằm có số loài bằng nhau chiếm 30 (4,2%). Ba chi giàu loài nhất trong số 10 chi giàu loài đã được xác định, chi *Ficus* L. (22 loài), tiếp đến chi *Syzygium* Gaertn., (8 loài) và *Dioscorea* L., (7 loài). Phân tích dạng sống đã áp dụng theo Raunkiaer, kết quả thu được gồm nhóm chồi trên (Ph) chiếm 596 (82,7%), chồi sát đất (Ch) với 20 (2,8%), chồi nửa ẩn (Hm) gồm 15 (2,1%), chồi ẩn (Cr) chiếm 37 (5,1%), cây một năm (Th) có 37 (5,1%) và chưa xác định (Unk) chiếm 16 (2,2%) loài.