MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

VIETNAM FORESTRY UNIVERSITY

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STUDENT THESIS

SOME BIOLOGICAL CHARACTERISTICS OF THE FAMILY MAGNOLIACEAE FROM YEN TU NATIONAL FOREST, QUANG NINH PROVINCE

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Abstract

A study of the family Magnoliaceae in Yen Tu National Forest, Quang Ninh province was made from the data of field work survey. There are 7 species, belonging to 3 genera of the Magnoliaceae were found. Among them 5 species are naturally distributed (*Michelia mediocris Dandy*; *Michelia balansae* Dandy, *Michelia foveolata* Merrill ex Dandy *Magnolia quangninhensis* Q.N. Vu, *Manglietia conifer* Dandy) and 2 planted species (*Michelia alba* L., *Michelia champaca* L.*)*. Therein, *Magnolia quangninhensis* Q.N. Vu is the new species for the Science. Based on morphology and the characteristic of each species, I was established Classification Key to Genera and species of 7 species in family Magnoliaceae. This study was defined the distribution; main forest types which species are located; evaluated the situation of 5 naturally species at study site. And also provided some recommendations for conservation, development the species of family Magnoliaceae from Yen Tu National forest, Quang Ninh province.

Keys: *Magnoliaceae, Michelia, Magnolia, Manglietia,* Yen Tu National Forest, , Classification Key.

I. INTRODUCTION

The variety of plant have long been known by more than 250 000 vascular plant species, the abundance and richness of plant have promoted and enriched the life on Earth from ancient to now. With a mission protect this abundance of plant, the national forest was established and conserved by the regulations of local government in each country. In Germany, there are 14 natural areas known as national parks. With 9134.31 square kilometers, the German national parks account for about 2.6% of the country. In the US, there are 58 national parks formally, many of which were over 100 years old. Yellowstone National Park in Wyoming, Montana and Idaho was founded in 1872 as the first national park in the world. Austria, there are 6 national parks with a total area of 2,356 square kilometers, accounting for about 2.8% the area of this country.

In Vietnam, the good news in June 8/2015, there are 31 National Parks with a total area of national parks around 10350.74 km² (620.10 km² of which is sea level), accounting approximately 2.93% of the land territory (Follow "Information about existing and recommended which areas protected in Vietnam, Vietnam Bird Life"). One of them is the Yen Tu National Forest, with a total natural area is 2783.0 hectares, located in Thuong Yen Cong Commune, Dong Phuong Commune, Uong Bi city, Quang Ninh province, far from Ha Long city 40 km, 150 km from Hanoi capital.

Yen Tu National Forest has the ecosystems very unique, the biological diversity is richness with alot of genetic resources of plant and rare animal and standard samples of forest ecosystems of the Northeast-Vietnam. This place also is one of the scenic spots, tourist attractions, and traditional festivals of the whole country; simultaneously is a Vietnam Buddhist Center. To reevaluate the existing plant resources of this region, as the basis for building Relics. August 2010, Sub Institute Forest Inventory and Planning of North West in cooperation with Department of forest plants, Forestry University open the enumerate addition survey to evaluate the plant resources. Based on the survey results, according to the standard classification of vegetation cover by Dr. Thai Van Trung, Yen Tu National has two main forest types: Forest evergreen tropical rainy season, this forest type distribution at elevations below 700 m; Dense evergreen forest subtropical, low mountain distributed at 700 m - 1068 m. With 5 forest status and 11 forest types of major plants not including those of IIA and IIB forest status. The plant species typical of this region are: *Erythrophleum fordii, Sindora tonkinensis, Vatica odorata, Dacrydium pierrei, Phyllostachys* spp., *Magnolia* spp., *Piper betle, Aegiceras corniculatum terrestrial.* This is also the plant species specific to region of Quang Ninh and the Northeast Vietnam.

The family Magnoliaceae is one of the important groups in flowering plants not only in studies of plant evolution and biogeography but also in their values. Most species of this family are woody trees, and some are shrubs characterized by an androecium of numerous spirally arranged stamens, a gynoecium with many simple carpels spirally arranged on an elongated axis and separated tepals. Most species of Magnoliaceae are used for wood and landscape, and some are used for medicine.

The family consists of 12 genera and 230 species with a peculiar distribution with an eastern center comprising the Indo-Malayan region, S. China, Japan and Australia to the south and western center in N. E. United States and southwards to Brazil and W. Indies. It is absent in Africa and Europe. But fossil remains were discovered in Tertiary deposits in the Artie Circle, Greenland, Europe and Central N. America. In Vietnam, at least ca. 50 species of Magnoliaceae was currently recorded (Vu, Q.N., 2014), but there are few studies focussed on the limited area such as national park or nature reserve to recognize the species composition and also to propose the solutions for conservation and development of species.

During the field trip course of BZ 224 – Plant Identification and several times traveling, I realized that Yen Tu, a National Forest located in Quang Ninh Province and not far from my home town, has special ecosystem and high biological diversity with rare plant and animal genetic resources and standard samples of forest ecosystems of the Northeast-Vietnam. It also is one of the scenic spots, tourist attractions, traditional festivals of the country and the world; and is a Vietnam Buddhist Centre. In those times, I also found that there are many trees with big white flower, fragrant smell and beautiful shape. My teachers showed that they are species of the family Magnoliaceae and I loved them from those times.

By literature review, I know that there are many studies and publications on Magnoliaceae on the world with some aspects, such as: taxonomy, phylogeny, anatomy, ontogeny, karyology, molecule, etc. In Vietnam, there are some publications mentioned mainly on taxonomy as informing the newly records of some taxon of the family. Some other also mentioned on biological characteristics of specific species, such as: Vu et al. (2013) in the study "Some biological and ecological characteristics of *Manglietia sapaensis* N.H.Xia & Q.N. Vu at the Hoang Lien National Park, Lao Cai Province" showed that *Manglietia sapaensis* is narrowly distributed naturally from 2,017-2,581m alt. (Núi Xẻ - Fanxipan path), in which topography is dismembered strongly, containing numerous high peaks with high slopes. Total 37 species are occurring in the high tree composition, from which 18 species are listed in plant composition. *Manglietia sapaensis* only participates the plant composition from 2,234-2,400m alt. and it plays an important role in these plant communities. Of the total 6

accompany species, 5 request species are *Myrsine semiserrata*, *Betula alnoides*, *Castanopsis sp.*, *Cornus hongkongensis*, *Michelia aeana* and *Litsea cubeba*. Average density of *Manglietia sapaensis* is 150-250 trees/ha on 2,300 - 2,400m alt. It is able to be regenerated by both seeds and shoots, but the first is dominant. In the regeneration layer, average density is from 3,680-10,000 individuals/ha and that of *Manglietia sapaensis* is from 160-400 individuals/ha. Result indicated that *Manglietia sapaensis* is best regenerated from 2,300 to 2,400m alt. and this can be applied on natural regeneration methods to reforestation of this species in Hoang Lien National Park.

Vu, Q.N., H.H. Nguyen & P.T. Nguyen (2014) in "Some biological characteristics of *Alcimandra cathcartii* Hook.f. & Thomson at the Hoang Lien National Park, Lao Cai Province" showed that *A. cathcartii* is distributed from alttitude of 2.000 - 2.600 m, along the path from Tram Ton to Fanxipan peak of the Hoang Lien National Park. In forest community, *A. cathcartii* is dominant and plays an important role in plant composition. It often occurs with some relative species like *Elaeocarpus griffithii, Castanopsis phansipanensis, Rhododendron sinofalconeri, Machilus odoratissima* and *Rhodoleia championii*. The density of *A. cathcartii* in the forest is quite high, ca. 200 - 250 trees/ha. *A. cathcartii* can regenerate from both seeds and stump shoots, but usually in seeds and rather good, ca. 560 - 2.720 saplings/ha.

Truong Van Phu (2014), "Some Characteristics Of The Family *Magnoliaceae* From *Bat Dai Son Nature Reserve*, Quan Ba District, Ha Giang Province", informed that there are 7 species belonging to 2 genera of the Magnoliaceae found in Bat Dai Son Nature Reserve, Quan Ba District, Ha Giang province, and those are: *Manglietia phuthoensis* Dandy; *Manglieatia longirostrata* (D.X. Li & R.Z. Zhou) Q.N. Vu; *Manglietia megaphylla* (Hu & W.C. Cheng); *Michelia balansae* Dandy; *Michelia fulva* (Chang et B.L. Chen), Q.N. Vu; *Michelia citrata* Q.N. Vu & N.H. Xia; *Michelia foveolata* Merrill ex Dandy. Therein, 3 species are new recorded for Flora of Vietnam, those are: *Manglieatia longirostrata* (D.X. Li & R.Z. Zhou) Q.N. Vu, *Manglietia megaphylla* Hu & W.C. Cheng, *Michelia citrata* Q. N. Vu & N. H. Xia. Specimens for all species were collected by him from the field survey.

In Yen Tu National Park, I know that there are some studies on plants or flora there, but no study was focussed on the family Magnoliaceae. Hence, I choose the subject "***Some Biological Characteristics of the Family Magnoliaceae from Yen Tu National Forest, Quang Ninh Province***" to improve understanding and suggesting the course of forest conservation and sustainable development of this family in the research area.

II. LITERATURE REVIEW

Research on the diversity and characteristics of the family Magnoliaceae

2.1. In the world.

The family Magnoliaceae is a primitive family plays an important role for science, as a key to formation of the concept about flower of Angiospermae species. Besides, most of the species in the family have potential use in the ornamental plants because their flowers are very fragrant, also use as medicines and seeds as a spice. Therefore, the Family Magnoliaceae species has been used and studied for a long time ago. In the years 650 BC, the Chinese monks planted *Magnolia Denudata* as an ornamental in the temple because of the pure white flowers and its fragrance (Callaway, 1994).

1703, Charles Plumier (1946 – 1704) has announced a new species (*Magnolia plumierii)* in West Indian species on "*Plantarum Americanarum Genera 38*" to recognize the scientific merits for the French botanist – Pierre Magnol (1638 – 1715), a professor of medicinal plants concurrently as director of the botanical garden in Montpellier, France. Then the name *Magnolia* was the Swedish botanist Carolus Linnaeus (Caroli Linnaei) (1707-1788) used in his "*Genera Plantarum I, 1937*" to describe for species in North America (*Magnolia glauca*), was later standardize the name *Magnolia Virginiana* L. That was the *Magnolia* official name appears and later was the name of family Magnoliaceae.

Subsequently, Linnaeus (1753) in "Species Plantarum" was mentioned 8 species belonging to 3 genera: *Liridenron* L. (*L. tulipifera* L), *Magnolia* L. *(M.virginiana* L., *M. foetida* L., *M. grisea* L., *M. tripetala* L., *M. acuminate* L.) and *Michelia* L. (*M. chamaca* L.).

Joannis De Loureiro (1790) continued describe 3 new species from Macau, China in "*Flora Cochichinensis": Liriodendron liliifera. L. figo and L, coco.*

Aug. Pyramo De Candolle (1824) in "*Prodromus Systematis Naturalis"* made the system for Magnoliaceae with 2 tribes, 9 generas as follows:

Ord. III. Magnoliaceae

Tribe I. Illicieae

1. *Illicium* L.
2. *Temus* Molina
3. *Drimys* J.R. Forst & G. Forst

Sect. I. *Eudrymis* DC.

Sect. II. *Wintera* DC.

4. *Tasmannia* R. Br. Ex DC.

Tribe II. Magnoliaeae

5. *Mayna* Aubl.

6. *Michelia* L. (*M. champaca, M. kisopa, M. doltsopa, tsiampaca, M. velutina, M. rufinervis, M. parviflora)*

7. *Magnolia* L.

Sect. I. *Magnoliastrum* DC. *(M. grandiflora, M. mexigana, M. glauca, M. umbrella, M. auriculata, M. pyramidata, M. macrophilla, M. cordata)*

Sect. II. *Gwillimia* Rottler ex DC. *(M. yulan, M. Kobus, M. obovata, M. fuscata, M. pumila, M. inodora, M?. coco, M?. figo)*

8. *Talauma* Juss. *(T. plumieri* (Sw.) DC.).

9. *Liriodendron* L. *(L. tulipifera)*

Spach (1839) in "*Histoire Naturelle Végétaux: Phanérogames VII"* has proposed new system for family Magnoliaceae, while 4 new genera (*Lirianthe, Liriopsis, Tulipastrum, Yulania)* as follows:

Magnoliaceae

I. Tribe Illicieae DC.

Section I. (Subtribe) Winterineae Spach

Section II. (Subtribe) Illicineae Spach

II. Tribe Magnolieae DC

Section I. (Subtribe) Magnolieae Spach

1. *Talauma* Juss.

Sect. I. *Hilariana* Spach

Sect. II. *Blumiana* Spach

2. *Aromadenron* Blume

3. *Manglietia* Blume

4. *Michelia* L.

5. *Liriopsis* Spach

6. *Yulania* Spach

Sect. I. *Theorhodon* Spach

Sect. II. *Aromanthe* Spach

Sect. III. *Rytidospermum* Spach

Sect. IV. *Tuliparia* Spach

7. *Magnolia* L.

8. *Tulipastrum* Spach

9. *Lirinanthe* Spach

Section II. (Subtribe) Liriodendrineae Spach

10. *Liridendron* (L.) DC. 1845, Siebold and Zuccarinii established more genera *Buergeria* Siebold & Zucc. Bentham and Hooker (1862) in "*Genera Plantarum"* has continued to use the system with the traditional genera following:

Ordo IV. Magnoliaceae

Tribe I. Wintereae

1. *Drimys* J. R. Forst. & G. Forst.

2. *Ilicium* L.

Tribe II. Magnolieae

3. *Talatuma* Juss. (*Buergeria, Aronmadendron, Blumea)*

4. *Mahnolia* L. (*Liriopsis , Yulania, Tulipastrum, and Lirianthe - Sphenocarpus*

5. *Manglietia* Blume

6. *Michelia* L.

7. *Liriodendron* L.

Tribe III. Schizandreae

8. *Schizandra* Desf. *(Sphaerostema)*

9. *Kadsura* Juss.

D. H. Baillon (1866) in "*RECUEL PÉRIODIQUE D'OBSERVATIONS BOTANIQUES: Ménoire sur la Famille des Magnolicées"* said that the sign to separate the genus Magnolia, Manglietia, Michelia and talauma is too weak, so he proposed the new system includes two genera as follows:

1. *Magnolia* L.

Sect. *Eumagnolia (Yulania. Lirianthe, Tulipastrum)*

Sect. *Talauma (Blumea, Buergeria, Aromsdendron)*

Sect. *Manglietia*

Sect. *Liriopsis (micheliopsis)*

Sect. *Michelia*

2. *Liriodendron* L.

Followed by a period wide application the system about family Magnoliaceae of Dandy during the first half of the 20th century, beginning in his works in 1927 "*The Genera of Magnoliaceae".* Where he described 4 new genus were: *Alcimandra, Pachylarna, Kmeria, Elmerrillia* and restore a genera *Aromadendron* by Blume (1825). Then, Dandy (1964, 1974)

continued accept two genus *Paramichelia* H. H. Hu (1940) and *Tsoongiodendron* W. Y. Chun (1963) and proposed the family Magnoliaceae system with twelfth genus: *Manglietia* Blume, *Magnolia* L. (incl. *Parakmeria* Hu & Cheng, 1951), *Talauma* Juss., *Alcimandra* Dandy, *Aromadendron* Blume, *Pachylarnax* Dandy, *Kmeria* Dandy, *Elmerrillia* Dandy, *Michelia* L., *Paramichelia* Hu, *Tsongiodendron* Chun and *Liriodendron* L. This pattern of Dandy was the foundation for many of the world's botanists describe, propose taxon and different systems such as: Hu et W. C. Cheng (1951) and *Woonyoungia* Law (1997), Z. X. Yu (1994) with *Sinomanglietia.*

In "*Notes on Magnoliaceae IV"* of Richard B. Figlar & Nooteboom (2004), two authors had shortened all of the taxa in subfamily Magnolioideae solely on – *Magnolia* with three genus: *Magnolia* (8 sections and 7 subsections), *Yulania* (2 sections and 6 subsections) and *Gynopodium* (2 sections). This new system of Figlar and Nooteboom (2004) has faced alot of objection from the botanists, especially Chinese researchers and some researcher of Korea.

Beside work about the system, the countries also develop the plant magazines (including photo color) and specialist books such as: *The familily Magnoliaceae in China (2008), specialist about the family Magnoliaceae of Thailand (2009),* etc.

In recent years, a series of research on molecular and systems arising advent such as: Qiu et al. 1995a,b; Azuma et al. 1999, 2000, 2001, 2004; Ueda et al. 2000; Shi et al. 2000; Kim et al. 2001a,b; Wang et al. 2006; Nie et al. 2008, ect. Has provided various aspects of the relationship between taxon in the family, however the result still limited cause of "supporting values" is low, the tree species are basal group in Magnoliaceae.

Xia Nian – He (2012) proposed a new system for Magnoliaceae base on many data of molecular and different morphological. Among this system, the author divided to sixteen genus in the family Magnoliaceae. *Manglietia* Blume N. H. Xia (2 sections: *Manglietia* and *Coniferae* N. H. Xia).

2.2. In Vietnam.

Some works of the botanist foreigners can mention: Loureiro (1790), Finet and Gagnepain (1906, 1907), Chevalier (1918), Dandy (1927, 1928, 1929, 1930), Gagnepain (1938, 1939).

Joannis De Loureiro (1790), a missionary and naturalist the Portuguese. He had many works on plant in southern Vietnam and the first work is "*Flora Cochinchenensis".* In which was recorded 4 species belonging 2 genus, that is: *Liriodendron lilifera, L. figo, L. coco* and *Michelia champaca (*later identified as *Magnolia lilifera, Michelia figo, Magnolia coco* and *Michelia champaca).*

Finet and Gagnepain (1906, 1907) in "*Flore de L'Asie Orienrale"* and *"Flore Générale de L'Indo – Chine"* were recognize 4 species: *Michellia champaca, M. figo, Magnolia pumila, Manglietia glauca* and described 2 new species: *Talauma fistulsa, Michelia baviensis* for the Vietnam flora.

Chevalier (1918) were continuing describe 2 new species from the sample have been collected in Vietnam are: *Talauma gioi* and *Michelia Tonkinensis.* Therefore, he also confirmed the distribution of 4 species of which have been published by other authors before.

Dandy (1927, 1928, 1929, 1930), who has spent lot of effort contribute to human science and the world systems of G, described many new species to the world. While 16 new species are described based on samples taken from Vietnam. There are: *Alcimandra cathcartii (Comb.nov.), Ttalauma nhatrangensis, Magnolia annamesis, M. clemensorum, M. nana, M. talaumoides, Manglietia chevalierii, M. conifer, M. rufibarbata, Michelia aenea, M. balansae (comb.nov.), M. chapensis, M. floribundavar. Tonlinensis (var.nov.), M. fulgens, M. hypolampra, M. masticate, M. mediocris, M. subulifera, M. tignifera,* and *Pachylarnax praecalva.*

Gagnepain (1938, 1939) has described 2 new species for science from the Vietnam's sample taken: *Manglietia blaoensis* and *Michelia braianensis;* 2 news: *Magnolia annamensis* Dandy var. *affinis* and *Magnolia eriostepta* Dandy var. *poilanei.* In this work, he was conducted and recorded the family Magnoliaceae in Vietnam is 39 species, 3 family

The research works by Vietnamese authors are still limited. However can mention two most prominent authors are: Pham Hoang Ho (1991, 1999) and Nguyen Tien Ban (2003). In the "*Vietnam plants"* work of Pham Hoang Ho (1991, 1999), 50 species belong 8 genus were recognized accompanied by a short description of the species. Nguyen Tien Ban with "*Checklist of Plant Species of Vietnam: Angiosperm II"* have listed 46 species and 3 family, 9 genera.

In addition to two research works, some species in the family also mention in some other works as: "*Vietnam forest trees"* of Vu Van Dung (1994); *"Plants commonly found in Vietnam",* Vo Van Chi et al. (1971); *"Indigenous trees in the South Vietnam",* Tran Hop (1997), etc. These works are written as the resource tree, without specializing in classification or system.

Thus, have many researches on the family Magnoliaceae in Vietnam, but up to now we have a few depth research about classification system, only stop at the statistics and describe species. So the result of this research will be contribute more about classification, systems as well as the conservation of the family Magnoliaceae species at Vietnam in particular area like Yen Tu and the world in general.

III. STUDY GOAL, OBJECTIVES, SITE DESCRIPTION, SCOPE OF THE STUDY AND METHODOLOGY

3.1. GOALS, OBJECTIVES AND SITE DESCRIPTION

3.1.1. Goals

To provide information biological characteristics of family Magnoliaceae as the basis for proposed some solutions idea to conserve and develop forest sustainable development in Yen Tu National Forest, Quang Ninh Province.

3.1.2. Objectives

- To identify species composition of the family Magnoliaceae at the Yen Tu National Forest;

- To identify some basic biological characteristics of the species (Including: distribution characteristics, morphology, phenology, regeneration, species accompany);

- To establish the classification keys to genera and species with full morphological description;

- To propose some solutions for conservation and development of this family the Yen Tu National Forest.

3.1.3. Site Description

This research subjects only investigate some basic characteristics: the composition and distribution; morphological characteristics, classification of species on the Family Magnoliacea. Just investigate the basic characteristics about the structure and regeneration of selected species in Yen Tu National Forests. And this research conducted at the core zone of Yen Tu national forest, Quang Ninh Province.

3.2. SCOPE OF THE STUDY

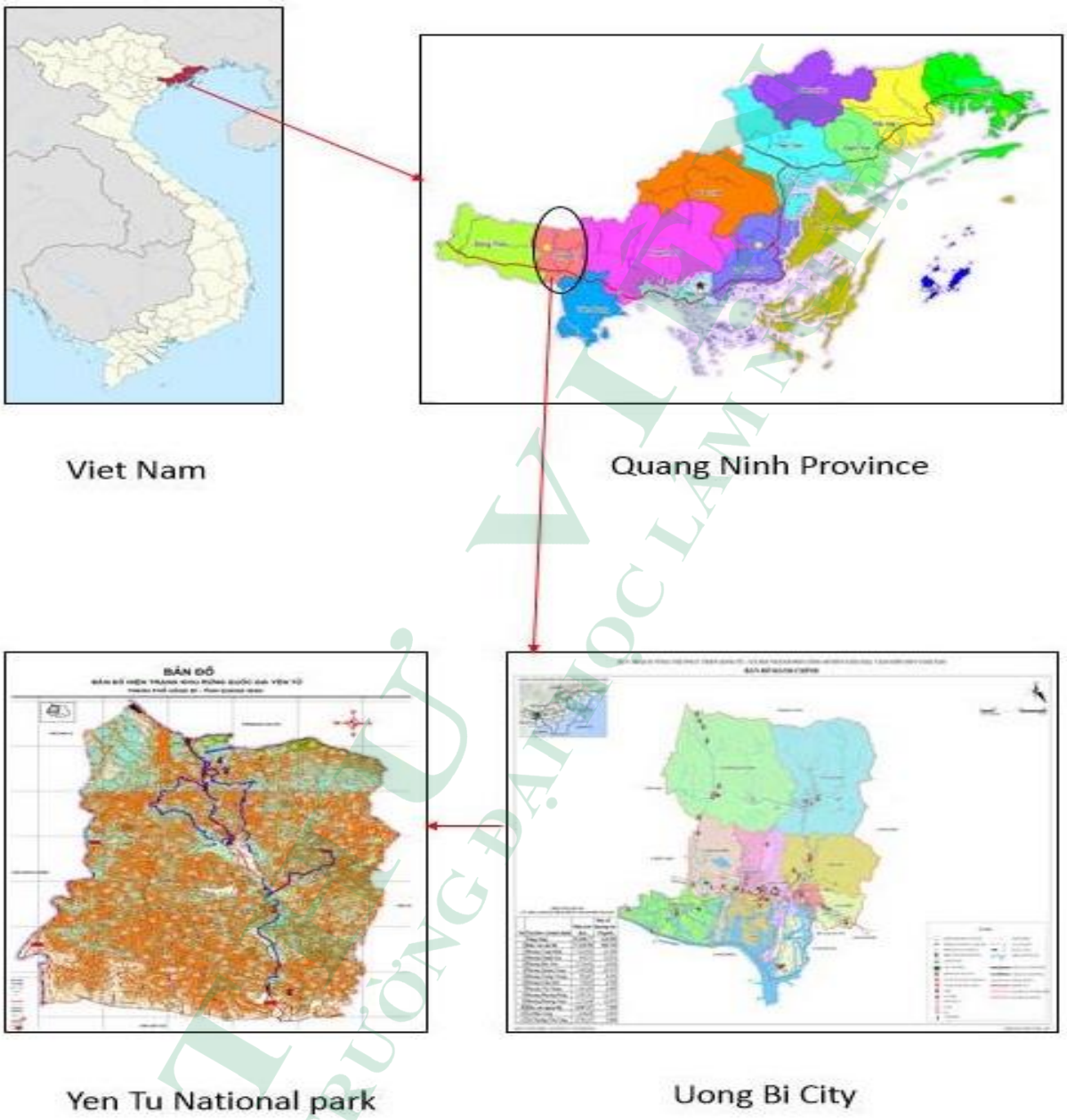


Figure 3.1: Map of Yen Tu National Forest, Quang Ninh Province

3.2.1. Location

Figure 3.2: The sign of Yen Tu National Forest

Yen Tu National Forest located in the northwest of Uong Bi city, about 20 km from the city center, in the Thuong Yen Cong commune, Phuong Dong precinct belong to Uong Bi city and a part Trang Luong commune - Dong Trieu district.

- Having the coordinates geographically at:

- From 210 05 'to 21 009' Northern latitude
- From 106 043 'to 106 045' East Longitue

- Administrative boundaries:

- North borders Tay Yen Tu Nature Reserve (Son Dong District - Bac Giang Province).
- East borders Yen Thuong commune.
- West borders Trang Luong commune (Dong Hong Thai commune (Dong Trieu district.
- The South is the Phuong Dong precinct - Uong Bi city.

3.2.2. Boundaries, acreage and topographic

Yen Tu National Forest is transferred from SUF (special use forest), with a total area of forest land is: 2947.5 hectares (According to Decision 4903 / QD-People's Committee of Quang Ninh. In 2010, the Prime Minister has written 537 / TTg-KTN, April 2, 2010, to the Ministry of Agriculture and Rural Development and the People's Committee of Quang Ninh province "On transforming SUF , Uong Bi, Quang Ninh to the , Quang province "; the boundary redefine the been reviewed. The results redefine the boundaries, forest area and special-use forest land of Yen Tu area is 2730.9 ha. Divided into two zones (Zone A and Zone B), in which forest area and forestry land are 2730.9 hectares, 52.1 hectares of land outside the forest. Overall the topographic of Yen Tu National Forest is fragmented very strongly,

high slope. So that it is the upstream of some main streams such as: Giai Oan, Cay Tram, Bai Dau, Bai Tam…

- Zone A: 2517.6 ha, focusing on national forest area and relics spots. The system is bounded by three mountain ranges: the mountains in the north from the peak 660m to the 908 m and two sub mountain ranges from north - South include: The system western mountains from the top 660 m towards the Cay Tram stream. The eastern mountain ranges from the peak 908 m towards Bai Dau stream) holding the entire Cay Tram stream, Giai Oan stream and Bai Dau stream. The highest peak is 1,068 m - Yen Tu peak (where Dong Pagoda), the lowest point is Nam Mau field 50 m. The topography is lower from north to south has created majestic landscape for the scenic Yen Tu. However) the topography is quite strong fragmentation) the average slope from 20-250) where> 400. It is also a disadvantage for managing the erosion.

- Zone B: 265.4 ha, including the area along both sides street belong to Phuong Dong precinct Phuong Dong precinct from the Suoi Tam temple to the adjacent Nam Mau fields (which has been identified and on the field markers). With most of the topography is hill and low mountains, the highest peak 312m, the boundaries is Phuong Dong precinct and Hong Thai Dong Commune - Dong Trieu district, the lowest point is Cua Ngan dam 40m, the average slope from 15-200m, in some places > 350m.

3.2.3. Geology, climate and hydrology

Yen Tu forest geological geology located in the area of Dong Trieu arc, with the main rocks such as sandstone rocks, flinty crush rocks and ancient alluvial.

The climate of Yen Tu NF following basic characteristics:

- Each year there are two seasons: the first season is winter cold and also dry from November to April next year; in hot weather, humid and rainy from May to October.

- Average temperature per year is 23.4 degrees C. The prevailing wind here is the Northeast and Southeast winds: The Northeast monsoon (the intensity of wind usually quite large, combined with low air humidity) started from November to April the following year.

- Average annual rainfall is 1,785 mm, the rainfall concentrated in June, July, August accounting for about 80% of annual rainfall; most rainfall in August.

- Humidity average area per year 81%.

- Evaporation per year is 1289 mm.

- In the dry season, the rainfall accounted for low rate of 10-20%, with long dry years 2 to 3 months to make up the heat, making the dry scrub, grass, trees wither then it is easy wildfires happens.

3.2.4. Natural resources

- The forest land is 2.145 ha occupy 80% area, belonging 1,736 ha of natural forest (occupy 80.9% of forest land and 64.6% of total area)

- The bare land: 331 ha occupy 12.3% of total area

- The area for business and agricultural production have only occupy 4.9% of total area

- The other areas for building, road, stream… occupy 49 ha and occupy 2,8 % of total area.

3.2.5. Economic - Social conditions

Yen Tu National Forest are fully located in Thuong Yen Cong Village, Uong bi city, with total population approximately 4.321 of people, 932 households, 8 hamlets; but there are only 4 hamlets that directly impacted to the forest: Khe Su 1, Khe Su 2, Nam Mau 1, Nam Mau 2 with total 2.049 of people, 482 households. In addition, there are 130 peoples that are frequently live in the historical relic's zones, including:

- There are 18 peoples in the informatics army

- There are 57 peoples in The management board's staffs

- There are 52 people in the Tung Lam tourism company

At the Yen Tu National Forest, there are 6 ethnics of people that co-existence: Dao, Hoa, Kinh, Tay, San Chi, Cao lan. The Dao ethnics take 52.4 % of total population here, the growth rate is 2%. The main jobs of local communities here is plowing (on the Nam Mau field) with the personal area is 460m^2/person. In recent years, the "forest garden" model, the fruit garden or tourism activities are actively participate by local peoples.

In general, the daily's life here are stable however the agricultural capacity have not developed, the total rice yield reach only 4.5 tons per year. The local products that derive from the Agriculture also play only a minor part and have not met the annual tourism demand. The services also have not developed.

In Yen Tu National Forest, the local people have contributed to the forest managements as well as the restoration. The fruit garden models bring many benefits for the local people here and may people can take 20-30 million VND per year base on it.

3.3. METHODOLOGY

❖ *Preparation*

- Prepare tools: measuring tapes, compass, nylon tape, callipers, camera, laptop, GPS...;

- Prepare personal tools need for the field trip to research;

- Prepare document and maps related to natural conditions, social, economic in Yen Tu national forest;

- Collect the documentaries that related to the family Magnoliaceae at Yen Tu national forest.

3.3.1. First instance investigation

Conducting identify on the map the area to investigate. The aim is to:

- Identify the research areas where have the species of family Magnoliaceae distributed;

- Identify transect preliminary investigation as to ensure passing the representative forests, where have the species of family Magnoliaceae distributed.

3.3.2. Morphological research and specimens collection

- Identify the study area where species of family Magnoliaceae are distributed based on map of Yen Tu National Forest by asking the rangers and local people;

- Establish the paths on the forest to inventory species and collect specimens as well as distribution information. These paths will go as detail as possible through Yen Tu National Forest;

- Observe the morphological description and determine the size of the parts: the stem, bark, branch, leaf, flower, fruit and seeds of the tree (the tree to be observed must reach a certain maturity level, currently exist in natural forest).

- Taking specimens for comparison with the previous specimen or species with similar morphology to determine the accuracy of this species (Nguyen Nghia Thin 1997, 2007).

Results note in *Table 1: field data sheet (Appendices 7.1)*.

3.3.3. Method to investigate the phenology (biological characteristics)

Methods of observation, description, track directly at the field: direct observation by eyes the phenology in the course of the investigation. Note the variation of parts (stems, buds, flowers, fruits) of the species. Method to investigate the phenology practiced following the Vietnam Forestry University (1966) and Nguyen Nghia Thin (2007), combining with other documents: the time to practice in the field is limited, so cannot track all of reproduce period of species. Therefore, we need to collect the researched documents about phenology and combine with data collected in the field to make the accuracy results.

Collected results are representing in *Table 02: Investigate the phenology of trees (Appendices 7.1)*.

Methods to research the distribution of the species

- The transect lines are arranged to go through the most basic types of terrain of the area and spread evenly in the national forest. The investigation follows the mountainside, the path way of local people, according to the car roads, tourist roads, along the main stream. On the investigation start observations to identify species and statistical indicators about species needs investigation. About the unidentified name, collect the sample to the evaluation later.

- The transect lines survey, we selected 10 transect lines for Yen Tu NF as follows:

Line I: from the cable car station 1 (Giai Oan temple) follow the walkway to Hoa Yen Pagoda 1800 m long.

Line II: From One Roof temple to Bao Sai temple 900m long.

Line III: Walk from Hoa Yen Pagoda to Golden waterfall: 500m long.

Line IV: Going from Hoa Yen pagoda to Van Tieu pagoda, Dong pagoda: 1200 m long.

Line V: From An Ki Sinh to bordering of Tay Yen Tu Nature Reserve long 600m.

Line VI: From Hoa Yen Pagoda to Am Duoc Sinh: 800m long.

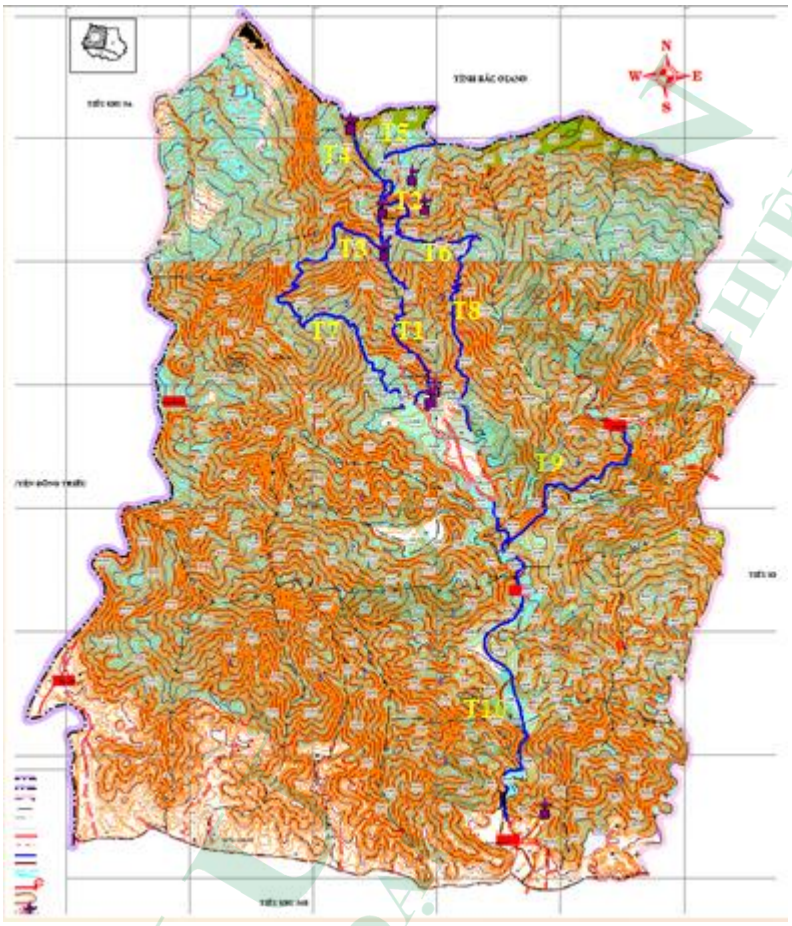
Line VII: From the cable car station 1 to Golden waterfall: 3000 m long.

Line VIII: From Giai Oan car station to to Am Duoc: 2000 m long.

Line IX: Walk from Ha Kieu slope to guard stations 2: 1700 m long.

Line X: Walk from Giai Oan car station to to guard stations 1, Truc Lam Zen Monastery - Yen Tu: 4000 m long.

Figure 3.3: Map of 10 transects selected to research the family Magnoliacae in Yen Tu National Forest



Information of objects on the transect lines, put in the *Table 03: Research the distribution of the species by transect lines (Appendices 7.1).*

3.3.4. Method to investigation of tree regeneration

Tree regeneration was investigated from seedling stage to tree regeneration stage that have diameter D1.3 < 6cm. Choosing mature trees and then investigates follow transects and counts all seedlings in and out of the canopy of this tree.

Note:

- Good tree is the tree have straight stem, have the top of tree, growth good, and no disease.

- Bad tree is twisted tree, without top tree, lower growth, and get disease.

- Normal tree is residual tree.

Data put in the *Table 04: Investigation of regeneration tree (Appendices 7.1).*

3.3.5. Method to identify the accompany species

Choosing the mature Magnolia tree and then identify six species closest to this Magnolia tree (Thomasius, 1973).

Data result put in the *Table 05: Investigate accompany species (Appendices 7.1).*

3.3.6. Interview Survey Method

Interviewing some rangers and elderly the local people, who known more about forest and had many years exposure in the forest. Also choose some people know more about to become a guide on the forest guide, determine the trees or take sampling species. In addition could be known about name of the species to have more information for species identification step.....

Hiring the local people or rangers guide into the forest, combining interview the guide, along with the identification of trees as well as the use and the distribution of them.

3.3.7. Analysis methods

3.3.7.1. Method to build classification key

Classification keys were built by Dichotomus Key system (Singh, 2010; Vu Quang Nam, 2014). The important classification of characteristics and signs of each species are chose based on the results of research morphological characteristics and phenology. Pictures about species will be taking and collecting to serve for process to build Classification Key.

3.3.8.1. Proposal for conservation and development

Based on information of distribution, rare level, regeneration, etc.

IV. RESULT AND DISCUSSION

4.1. Species composition of the family Magnoliaceae at the Yen Tu National Forest

From the field investigation and taxonomic work, the total 7 species of the family Magnoliaceae from Yen Tu National Forest are found, of which 5 species are naturally distributed and 2 species are cultivated. One species belongs to the genus *Magnolia* L. and it also is idenficated as a new species for the Science (*Magnolia quangninhensis* Q.N. Vu); one species belongs to the genus *Manglietia* Bulme (*Manglietia conifer* Dandy) and five species belong to the genus *Michelia* L. (*Michelia balansae* (Aug. DC.) Dandy; *M. foveolata* Merr. ex Dandy; *M. mediocris* Dandy; *M. alba* Candolle; *M. champaca* L). The more detail as Vietnamese name and local name are shown as the table 4.1 following.

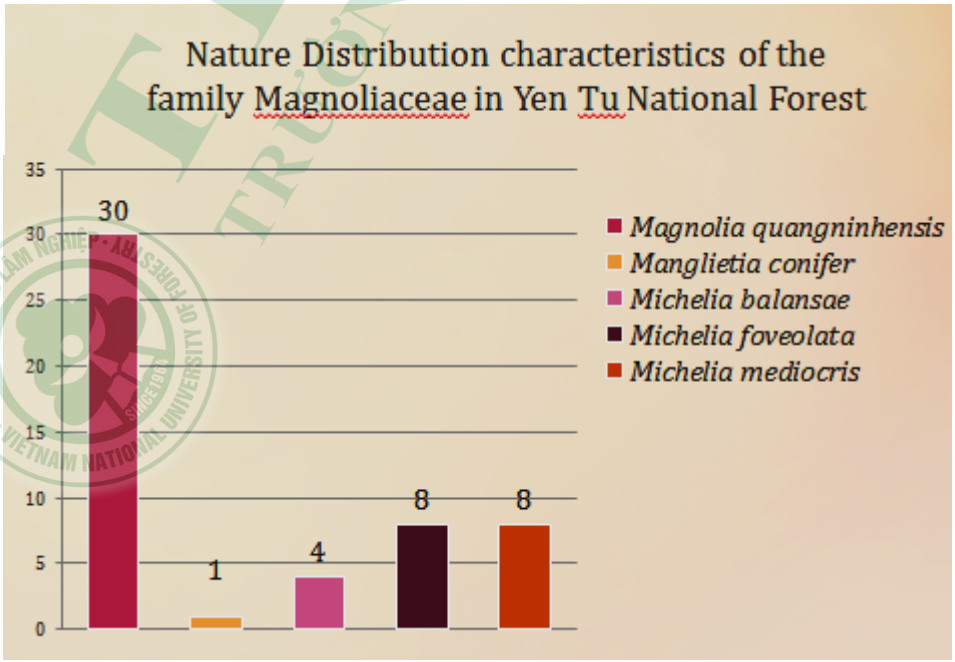
Table 4.1. Species composition of family Magnoliaceae at Yen Tu National Forest.

No.	Vietnamese name	Local name	Latin name
1	Dạ hợp quảng ninh	Hoa trứng gà	*Magnolia quangninhensis* Q.N. Vu
2	Mỡ ba vì	Vàng tâm	*Manglietia conifera* Dandy
3	Giổi bà/Giổi lông	Giổi long	*Michelia balansae* (Aug. DC.) Dandy
4	Giổi lá láng	Giổi xanh	*Michelia foveolata* Merr. ex Dandy
5	Giổi xanh	Giổi	*Michelia mediocris* Dandy
6	Ngọc lan hoa trắng	Ngọc lan hoa trắng	*Michelia alba* Candolle
7	Ngọc lan hoa vàng	Ngọc lan hoa vàng	*Michelia champaca* L.

4.2. Some basic biological characteristics of the species

4.2.1. Distribution characteristics in Yen Tu National Forest:

Figure 4.2.1:



Following the result collecting from the field of **Table 4.2: The nature distributed status of Magnoliaceae species** in appendix and the **Figure 4.2.1: Nature distribution characteristics of the family Magnoliaceae in Yen Tu National Forest** , we can see that:

- *Magnolia quangninhensis* is the most species found on 10 survey transects with 30/51 trees were found and take 60% per total tree were found. They are mainly distribute along the main stream with the elevation is 300-500m (transect number 1, 2, 3, 6, 7, 9, 10); some tree be found in higher elevation 500-600m (transect number 4, 5), but not have too much and grown with low quality of tree (often no top tree).
- *Michelia mediocris* mainly distributed 200-400m, lower area: Giai Oan car station, guard stations 1 and Truc Lam Zen Monastery - Yen Tu – Transect number 1. This tree species growth quite good in lower elevation of Yen Tu national forest, with high elevation almost no see this tree.
- *Michelia foveolata* takes 16% of total tree were found, mainly distribute from 600-900m, in transect number 4, 5, 6; near the area of Dong pagoda and the bordering of Tay Yen Tu Nature Reserve. With lower elevation, under 500m we cannot see any tree. But in the field we found 4/8 trees without top of tree, the main reason is affect by northeasterly winds by trend and mist wet most of season during the year so it's hard to growth and develop as well as damage the process of flowering and fruiting. (*Data collect by interview method*)
- *Michelia balansae* usually focus on the elevation from 300-400m. 3 tree were found near the Gold waterfall, of the total number of all trees found 4 trees in 10 survey transects. 4 trees take 8% per total tree were found. The big tree is not much, following **Table 4.2** we can see the diameter of tree found only 12, 14.8, 15, 18 cm. With transect number 4, 5, 6, the high elevation transect (above 500m), we didn't found this *Michelia balansae* tree.
- On 10 survey transects, we found only 1 *Manglietia conifer* Dandy tree, with the elevation is 490m, in the transect number 2: One Roof temple to Bao Sai temple. This tree in behind the Bao Sai temple. Even this tree grown with not bad quality but we still need to concern about seriously.
- Besides that, we found 2 species were: *Michelia alba* Candolle and *Michelia champaca* L. being raised and breed in the nursery of Yen Tu National Forest.

4.2.2. Some characteristics of biology and ecology:

4.2.2.1. Magnolia quangninhensis Q.N. Vu, *sp.nov.*

a. Morphology

Small timber tree, 3-5 m high, branching a lot in stems and smooth. Oval leaves 15-17cm long and 5cm wide, pointed both ends, above side leaf are glossy green and underside are light green, thick, crunchy, vein on both sides; petiole 8-15mm

Single flower grow in terminal, light green then white, with large curved carpophore, hairless, 6 flower petals; many stamen and carpel, ovoid, bisexual flowers, fragrant.

b. Distribution

Magnolia quangninhensis is the new species, which haven't much information about.

- In Yen Tu National Forest, *Magnolia quangninhensis* founded in most of survey transects: 1, 2, 3, 6, 7, 8, 9, 10 (under 600m); suitable with the live condition along the main stream and the lower elevation.

c. Ecology

- Flowering on May – June, flowers bloom about a half of month. Fruit season on September-October.
- Regeneration capacity and accompany species

Table 4.2.2.1. The nature regeneration of *Magnolia quangninhensis* in the survey transects

No.	Survey transects	Find the species in transect	Number of regeneration trees follow the height HVN (cm)			Quality			Note
			< 50	50 - 100	>100	Good	Bad	Normal	In or out of canopy
1		2		•			•		Out
2		2			•	•			Out
3		3			•			•	Out
4		3	•				•		In
5		3	•			•			In
6		5			•	•			Out
Number	5	3							
Rate (%)	100	60	33.3	16.7	50	50	33.3	16.7	

- Through the survey results show that *Magnolia quangninhensis* naturally regenerated are very good, most detected tree found in 3/5 transect (accounting 60%), the tree with good quality account 50% and 33.3% bad quality with the tree height 50 and < 50cm (because of this tree is too young so if have some small affect, so this tree also can hurt and get bad quality). But with the tree have over 1m tall accounting for 50% of the total regeneration trees found is really good for *Magnolia sp.* species in Yen Tu national forest. Most of regeneration trees found aren't in under canopy cover of mother tree, cause by the seeds of this species is very light and wind is an advantage for dispersal seeds.
- Accompany species: Thông tre lá dài (*Podocarpus neriifolius),* Lan Hoàng Thảo hoa vàng (*Dendrobium chrysanthum),* Mã tiền dây (*Strychnos umbellata),* Kim giao *(Nageia fleuryi),* Thiên tuế (*Cycas balansae),* Vạn tuế (*Cycas revoluta)*

d. <u>Value, Status and conservation</u>

Fragrant flower for scented tea and decorations (often use in Buddhist ceremonies). Different parts of the plant such as leaves and stems are used as medicine (rheumatic pain; also used to cook water for women after childbirth).

Because of the topographic of Yen Tu National Forest is fragmented very strongly so it has formed a lot of streams, including some main streams such as: Giai Oan, Cay Tram, Bai Dau, Bai Tam… In addition the weather condition in Yen Tu national forest most of time is mist. All the above conditions are very suitable for *Magnolia quangninhensis* (preferred to live along to stream and the wet areas). Basing on the data from interview and from result of research we can see that with elevation under 500m, the *Magnolia quangninhensis* tree grow very well and above 600m, the growth is slow down and easy to get wind affect (break the top of tree).

According to *IUCN Red List criteria* (IUCN, 2001) - IUCN Red List category, *Magnolia quangninhhesis* is known only from one locality and the population size is very small (less than 50 mature individuals), it is assessed here as Critically Endangered (CR). Furthermore, *Magnolia quangninhensis* is the new species and not have much research about. Now this species are abusive and exploitation for economic purposes without law to protect this new species.


Figure 4.2.2.1.a: Lead shape of Magnolia quangninhensis

Figure 4.2.2.1.b: Fruit of *Magnolia quangninhensis*

Figure 4.2.2.1.c: Trunk of *Magnolia quangninhensis*


Figure 4.2.2.1.d: Two color of *Magnolia quangninhensis* flowers in Yen Tu National Forest

4.2.2.2. Manglietia conifera Dandy

a. Morphology

A large evergreen tree, 20-25m tall and 20-50cm in diameter. Truck straight, cylindrical. Crown conical. Bark silvery-grey, with many minute lenticels. Inner bark white, fragrant. Twigs with many leaf scars. Leaves simple, alternate. Lamina ovate or oval, apex cuspidate or obtuse, base cuneate; dark green, shining above, pale beneath. Petiole slender, long, with a small scar from cadicous stipule. Flower bisexual, large, yellowish-white, solitary at the tip of the branches Calyx and corolla indistinct; perianth 9 – lobed, in 3 whorls. Stamens many. Carpels numerous, concrescent on a long stalk forming an ovate mass.

Fruit compound, cylindrical, formed by many follicles, the follicle without mucron, dehiscing along the ventral suture of the carpel. Seeds 5-6 in each follicle. Red coloured, shining and strongly smelling.

b. Distribution

This species has a natural ecology mixed evergreen forest on the hills or in the valley (humid place). In China noted wild life forms appeared at high altitude 700 - 1300 m and in South China (Guangdong, Guangxi, Yunnan, Guizhou, Hunan)

Geographic allocation range mainly in Vietnam (Lao Cai, Vinh Phuc, Ha Tay (old), Quang Ninh, Tuyen Quang, Thanh Hoa, Nghe An, Lam Dong).

In Yen Tu Nation Forest, we only found one *Manglietia conifer* tree with the elevation is 490m, in the transect number 2: One Roof temple to Bao Sai temple. This tree in behind the Bao Sai temple.

c. Ecology

- Light - demanding and fast - growing tree, suitable in high rainfall areas with fertile and well-drained soils. Natural and coppice-regeneration are good. Flowering in January, fruiting from July to August.

- Regeneration capacity and accompany species

Table 4.2.2.2. The nature regeneration of *Manglietia conifer* in the survey transects

No.	Survey transects	Find the species in transect	Number of regeneration trees follow the height HVN (cm)			Quality			Note
			< 50	50 - 100	>100	Good	Bad	Normal	In or out of canopy
Number	5								
Rate (%)	100	0.0	0	0	0	0	0	0	

- Through the survey results show that *Manglietia conifer* Dandy naturally regenerated are not good. On 5 survey transects none tree were found and no regeneration tree found in under canopy cover of mother tree.

- Accompany species: Sồi phảng (*Lithocarpus cerebrinus),* Chò đãi (*Carya sinensis*), Sến mật (*Madhuca pasquieri)*, Thiên tuế balansa (*Cycas balansae*), Thông nhựa (*Pinus merkusii),* Bách vàng (*Xanthocyparis vietnamensis).*

e. <u>Value, Status and conservation</u>

Widely distributed throughout North of Vietnam. This species has been exploited for its timber and they are planting like an industrial tree. it is principally threatened by forest fragmentation and conversion of habitat to agricultural use in sub-montane, upland and some montane forests in non-limestone regions. Where it occurs in the interface between agriculture and montane forest, the forest is liable to degradation. For this species, adequately administered reserves that contain large areas of undisturbed forest may be the only long-term solution. Conservation is urgently required

Figure 4.2.2.2.a: Trunk and shape of canopy Manglietia conifer

Figure 4.2.2.2.b: Fruit and leaf shape of *Manglietia conifer*

4.2.2.3. *Michelia balansae* (Aug. DC.) Dandy

a. <u>Morphology:</u>

Trees, 7-10 m tall, to 60 cm in diam. Bark gray to grayish brown, not fissured. Young twigs, buds, petioles, leaf blade abaxial surfaces, flower buds, gynoecium and brachyblasts densely brown or reddish tomentose or appressed fine tomentose. Stipules densely pubescent, free from the petioles. Petiole 1.5-3 cm long, base flattened, adaxially furrowed; leaf blade oblong-elliptic to obovate-elliptic to broadly elliptic 13-20(-28) x 5-10 cm, abaxially veins evidently prominent and brown tomentose, adaxially subglabrous; base broadly cuneate, apex abruptly acute; secondary veins 10-15 on each side of midvein with ends arc0hing upward and becoming reticulate. Brachyblast 1-1.2 cm long, with 1-2 spathaceous bracts. Flowers fragrant; tepals 6, subequal, white and/or pale greenish, obovate-elliptic, glabrous, 3.5-3.7 x 1.3-1.5 cm; inner ones oblanceolate, smaller and narrower; stamens 1-1.5 cm long, connective exserted and forming a mucro; anthers 8-10 mm long; gynoecium ovoid, ca. 8 mm long, gynophore 4-6 mm long; gynoecium ovoid. Fruiting gynophore 3-7 cm long; fruit 4-12 cm long; mature carpels ellipsoid-ovoid, obovoid, or cylindric, 2-5 x 1.3-2.0 cm, apex with a reflexed 3-5 mm long beak. Seeds ellipsoid, 10-15 x 5-10 mm, testa bright red.

b. Distribution:

- *Michelia balansae* is distributed in Cao Bang, Ha Giang, Quảng Ninh, Hanoi, Hoa Binh, Lao Cai, Nghe An, Ninh Binh, Phu Tho, Quang Binh, Quang Tri, Son La, Thai Nguyen, Thanh Hoa, Tuyen Quang, Vinh Phuc, Yen Bai Provinces. Also in China (S Fujian, S and SW Guangdong, S Guangxi, Guizhou, Hainan, S Yunnan). Evergreen broad-leaved forest, on moist sandy soil, at 200-1100 m alt.

- In Yen Tu National Forest: *Michelia balansae* is naturally distributed from 300 - 800m alt., but usually focus on a height of 400m alt.. The big tree is not much, just left the woody tree. Through investigation encounter, this species usually focus on growing with *Magnolia conifera* on the mountains slopes and high peaks where the land is still good and quite thick.

c. Ecology:

- Ecology: Flowing in April - May, fruit in September - October. This species is one kind of shade tolerant tree, grow scattered in the forest moist, where soil have rich in nutrients.
- Regeneration capacity and accompany species:

Table 4.2.2.3. The nature regeneration of *Michelia balansae* in the survey transects

No.	Survey transects	Find the species in transect	Number of regeneration trees follow the height HVN (cm)			Quality			Note
			< 50	50 - 100	>100	Good	Bad	Normal	In or out of canopy
1		2			•		•		Out
Number	3	1							
Rate (%)	100	33.3	0	0	100	0	100		

- Through the survey results show that *Michelia balansae* naturally regenerated is not quite good. On 3 survey transects, only 1 tree is found without top, so this tree get bad quality of tree. No regeneration tree is found in under canopy cover of mother tree.
- Accompany species: Sưa (*Dalbergia tonkinensis*), Dẻ gai đỏ (*Castanopsis hystrix)*, Sồi đá lá mác (*Lithocarpus balansae)*, Hoàng đằng (*Fibraurea tinctoria)*, Kim giao (*Nageia fleuryi)*, Lan phi điệp vàng (*Dendrobium chrysanthum*.

d. <u>Value, Status and conservation</u>

Using wood, smell good, less affect by termite, using in building houses, making furniture, making art crafts. The seed is also used as a spice.

In the field, only found 4 trees in 10 survey transects with very small diameter. Showing that *Michelia balansae* grow not good in Yen Tu national forest's weather condition, I asked some forester that: "Do they find any seed of this species when they go to forest?", and they said that: "Long time they no see this species seed, in many year ago they often take this seed species use as a spice but long time they didn't see anymore". That's why only found 1 regeneration tree in 3 survey transects in Yen Tu National Forest and with bad quality (without top of tree).

Moreover in many places the forests are destroyed very serious (which includes *Michelia balansae* tree in), at some point where reside of this species as Dong Tam (Yen Bai), Chan Mong (Phu Tho), Yen Cat (Thanh Hoa). The timber tree are exploited everywhere. Conservation is urgently required.

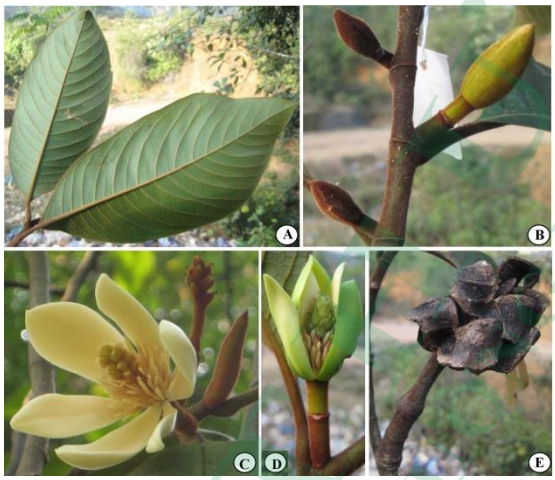


Figure 4.2.2.3.a: Leaf, bub, flower of *Michelia balansae*

Figure 4.2.2.3.b: Seed inside fruit of *Michelia balansae*

4.2.2.4. Michelia foveolata Merr. ex Dandy

a. Morphology:

Trees, to 30 m tall, to 80 cm (DBH). Bark pale gray to dark gray. Young twigs, buds, petioles, leaf blade abaxial surfaces, and brachyblasts densely reddish brown, brown, or white tomentulose. Petiole 1.5-3 cm, without a stipular scar.

Leaf blade oblong-elliptic, elliptic-ovate, or narrowly ovate, 17-23 × 6-11 cm, thickly leathery, abaxially coppery to gray tomentulose, adaxially deep green and glossy, secondary veins 16-26, ends slender, divaricate, and netted near margin, reticulate veins dense, base broadly cuneate, obtuse, or subcaudate and usually asymmetrical, apex acuminate to shortly acuminate.

Brachyblasts ca. 5 mm in diam., with 3 or 4 bract scars. Petals 9-12, pale yellowish green, base purplish; outer 3 petals broadly obovate, 6-7 cm; petals of middle and inner whorls obovate, narrower and smaller. Stamens ca. 50, 2.5-3 cm; filaments dark purple, 7-10 mm; anthers 1.5-2 cm. Gynophore 1.7-2 cm, silvery tomentulose; gynoecium 2-3 cm; carpels ca. 5 mm; ovaries narrowly ovoid, ca. 3 mm, adnate to torus at base; ovules ca. 8 per carpel. Fruit 7-20 cm; mature carpels long ellipsoid, 1-2.4 cm.

b. Distribution

China: Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Yunnan.

Vietnam: Tuyen Quang (Nam Duong, Na Hang), Ha Giang (Quan Ba), Vinh Phuc (Tam Dao), Thanh Hoa (Ben En), Quang Binh (Phong Nha – Ke Bang), Quang Nam (Ngoc Linh).

In Yen Tu national forest, only distribute in the high elevation from above 500m. Near from Dong pagoda and the bordering of Tay Yen Tu Nature Reserve

c. Ecology

- Prefer deep, fertile and well-drained soils, developed from granite or limestone. Shade-tolerant and medium-growing tree. Nature regeneration under dense forest-cover, but seedling and saplings are rarely found under the shade of mother tree. Flowering in March-April, fruit in October-November.

- Regeneration capacity and accompany species

Table 4.2.2.4. The nature regeneration of *Michelia foveolata* in the survey transects

No.	Survey transects	Find the species in transect	Number of regeneration trees follow the height HVN (cm)			Quality			Note
			< 50	50 - 100	>100	Good	Bad	Normal	In or out of canopy
1		2			•	•			Out
2		2			•			•	Out
Number	3	1							
Rate (%)	100	33.3	0	0	100	50	0	50	

- Through the survey results show that *Michelia foveloata* naturally regenerated are relatively good, all detected tree have over 1m tall accounting for 100% of the total regeneration trees found and with 50% good quality tree, 50% normal quality tree. A part lead to the poor regeneration of this species is due to weather conditions in Yen Tu national forest is inconsistent with this species. No regeneration trees found in under canopy cover of mother tree.
- Accompany species: Thông nhựa (*Pinus merkusii),* Thông tre lá ngắn (*Podocarpus pilgeri*), Lệ Dương (*Aeginetia indica),* Kim giao *(Nageia fleuryi),* Bách vàng (*Xanthocyparis vietnamensis),* Hoàng đàn giả (*Dacrydium elatum).*

d. <u>Value, Status and conservation</u>

Used for timber. Habitat has been badly degraded and now grows scatter throughout North and Middle of Vietnam. The major threats are fragmentation of habitat, forest fire, illegal logging and low regeneration rates also have a significant impact upon their population size which if disturbed have difficulty responding quickly and hence may become locally extirpated. Because, in this area, local people live in the mountain and they cut the forest for farming.

The current status in Yen Tu National Forest is 4/8 tree were found without top of tree, by interview method I asked some ranger, local people about this situation and the main

reason is affect by northeasterly winds by trend and mist wet most of season during the year so it's hard to growth and development as well as damage the process of flowering and fruiting. Conservation is urgently required.

Figure 4.2.2.4.a: Trunk of *Michelia Foveolata*

Source: faunaandfloraofvietnam.blogspot.com

Figure 4.2.2.4.b: Flower of Michelia Foveolata

4.2.2.5. Michelia mediocris Dandy

a. <u>Morphology</u>

Big tree, to 25 m tall, to 90 cm DBH. Bark greyish brown. Young twigs and young leaf blades greyish white appressed pubescent. Buds reddish brown, pendulous, apex acute. Petiole 1.5-3 cm, without a stipular scar. leaf blade rhomboid-elliptic, 6-13 × 3-5 cm, thinly leathery, abaxially greyish white appressed puberulous, adaxially glabrous, secondary veins 10-15 on each side of midvein, slender, and inconspicuous, reticulate veins dense, base cuneate to broadly cuneate, apex shortly acuminate. Spathaceous bracts 3.

Flower buds ellipsoid, 10-15 × 5-9 mm, densely brownish yellow to greyish white appressed puberulous. Tepals 9, white, spoon-shaped, 1.8-2.2 × 0.5-0.8 cm. Stamens 1-1.5

cm; connective exserted and forming a 3-4 mm long tip; anthers 0.8-1.4 cm. Gynophore 3-5 mm, densely silvery appressed puberulous; gynoecium cylindric, ca. 1 cm; carpels 7-14; ovules 4 or 5 per carpel.

Fruit have yellow and blackish brown when matured, 2-3.5 cm; mature carpels obovoid, ellipsoid, or globose, 1-2 cm, slightly compressed, white lenticellate, apex with an obtuse beak. Seeds 5-8 × ca. 5 mm; testa bright red.

b. Distribution

China: Guangdong, Guangxi, Hainan, S Hunan

Vietnam: the northern mountainous province, Thanh Hoa, Nghe An, Ha Tinh, Gia Lai, Kon Tum, Binh Dinh. Elevation 800m run down

In Yen Tu National Forest, *Michelia mediocris* mainly distributed 200-400m, lower area: Giai Oan car station, guard stations 1 and Truc Lam Zen Monastery - Yen Tu.

c. Ecology

- Flowering on March-April, fruits season from August to October. Photophilic plant, grows well in areas with sandy clays. Frequent see in tropical seasonal rainforest and subtropical.
- Regeneration capacity and accompany species

Table 4.2.2.5. The nature regeneration of *Michelia mediocris* in the survey transects

No.	Survey transects	Find the species in transect	Number of regeneration trees follow the height HVN (cm)			Quality			Note
			< 50	50 - 100	>100	Good	Bad	Normal	In or out of canopy
1		1		•		•			Out
2		1			•	•			Out
3		3			•	•			Out
Number	4	2							
Rate (%)	100	50	0	33.3	66.7	100	0	0	

- Through the survey results show that *Michelia mediocris* naturally regenerated are quite good in low elevation, with 100% detected tree are good quality and 66.7% have the height more than 100cm. The trees were found in the survey transect accounting

2/4 transect line (50%). No regeneration trees found in under canopy cover of mother tree.

- Accompany species: Lan Kim Tuyến *(Quercus platycalyx),* Thông nhựa (*Pinus merkusii),* Trà hoa gilbert (*Camellia gilbertii),* Kim giao *(Nageia fleuryi),* Thiên tuế (*Cycas balansae),* Lan phi điệp vàng (*Dendrobium chrysanthum.*

d. Value, Status and conservation

Using for timber for construction and with high quality of wood use for furniture. Scented seeds, used as a spice. Bark and seeds are used for medicinal purposes (fever and abdominal pain.)

The *Michelia mediocris* tree growth quite good in lower elevation of Yen Tu national forest, with high elevation almost no see this tree and 1 trees were found in 700m elevation with bad quality – no top of tree, affected by northeasterly wind and mist in high elevation.

Michelia mediocris is a species with high economic value and also has value in medicine. Nowadays this species are hunted and cut down a lot because of its value. Also the distribution of this species, narrowed day by day and the number of individuals is decrease by serious way. Conservation is urgently required.

Source: faunaandfloraofvietnam.blogspot.com

Figure 4.2.2.5.a: Flower of Michelia mediocris

Figure 4.2.2.5.b: Fruit and Seed of Michelia mediocris

4.2.2.6. *Michelia alba* Candolle

a. Morphology

A medium woody tree, 18-20m tall and 30-40cm in diameter. Truck straight, cylindrical, bark silvery-grey. Shoot and bud have a thin cover by white soft fur.

Simple leaves, alternate. Lamina ovate or oval, 15-20cm length, apex cuspidate or obtuse, base cuneate; dark green, shining above, pale beneath. Petiole 1.5-3cm long, with a small scar from cadicous stipule.

Flower in leaf axil, white, fragrant, perianth 9 – 15 petals, and many stamens. Hard to become fruit.

Big Fruit ovate or oval, formed by many big follicles and scattered, each follicle have 1-8 oval seed.

b. Distribution

Widely distributed throughout the country with a humid tropical climate and propagated as ornamental plants in Asia. Particularly in the tropics and subtropics in Southeast Asia and China because the flowers smell fragrant. Some essential oils can be extracted from its flowers.

Michelia alba was imported into Vietnam from the mid-19th century, grows well in areas where the average rainfall from 1000 to 2000 mm / year. Widely planted in South Vietnam Delta. Due to trees have fragrant flowers, beautiful leaves and shade trees so it be planted widely in most of the big cities in our country. Especially in schools, parks or temples and pagodas.

c. Ecology

Light - demanding and fast - growing tree, suitable in sandy, loamy, moist, and slightly acidic soils. Natural and coppice-regeneration are good.

Flowering from April to September, fruiting in October.

d. Value, Status and conservation

The timber tree use for construction and make furniture. Fragrant flower for an ornament tree and decorations (often use in Buddhist ceremonies or the special day of some countries). In addition to making ornament, whole stems, leaves and flowers of *Michelia alba* can be used in medicine (swelling, coughing, gastrointestinal disorders, etc.).

In Yen Tu National Forest, *Michelia alba* are being raised and breed in the nursery. In fact that, through 10 natural surveyed transects in the field were not found any *Michelia alba* trees grow naturally on.

Figure 4.2.2.6.a. Flower of *Michelia alba*

Source: 2008 Derek Ramsey

Figure 4.2.2.6.b. Fruit of *Michelia alba*

4.2.2.7. *Michelia champaca* L.

a. Morphology

Evergreen tree, 25-30m tall and 70-80cm in diameter. Truck straight, cylindrical, bark silvery-grey. Shoot, petiole and browse covered with soft pale yellow fur.

Single leaves, separate. Lamina oval shaped pointed or oval long, 10-20cm length, 4-9 cm wide, apex cuspidate or obtuse, base cuneate; dark green, shining above, pale beneath. Petiole 2-4cm long.

Flower in leaf axil, orange, fragrant, perianth 15-20 petals, stamen with central column zone about 3mm long. Dual fruit, 7-15cm long, reverse ovate, each follicle have 2-4 seeds.

b. Distribution

Michelia champaca widely grown in the evergreen forests, mountainous areas, low, medium, and high mountains of Asia with a humid tropical climate.

Vietnam: grows naturally in the Dak Lak and Dong Nai, and was planted as an ornamental very popular in large cities, temples and the relics.

c. Ecology

Neutral tree and fast - growing, suitable in acidic sandy loam soil, thickness layer, loamy, moist. Where have slightly sloping, valleys, foothills, or relatively flat areas, along streams, riparian wetlands. Natural and coppice-regeneration are medium.

Flowering in July and August.

d. Value, Status and conservation

The timber tree use for construction and make furniture. Fragrant flower for an ornament tree and decorations (often use in Buddhist ceremonies or the special day of some countries).

Additionally *Michelia champaca* tree is also used in cosmetic industry and pharmaceutical. Traditional medicine in Asia, juice or decoction of the flowers used to treat

gastrointestinal disorders, vomiting, and fever. Flower soaked in oil used on skin treatment of headache, eye pain, rhinitis, sinusitis, arthritis, gout, dizziness, inflammation. Besides, *Michelia champaca* flowers express graceful, noble. Leaves used to treat the swelling, tree roots cooling effect. In India, *Michelia champaca* flower is used to treat stomach cancer.

In Yen Tu National Forest, *Michelia champaca* are being raised and breed in the nursery. In fact that, through 10 natural surveyed transects in the field were not found any *Michelia champaca* trees grow naturally on.

Figure 4.2.2.7.a. Leaf, Flower and Fruit of *Michelia champaca*

Source: M – Gilson (a biology scientist)

Source: faunaandfloraofvietnam.blogspot.com

Figure 4.2.2.7.b. Flower of Michelia champaca

Source: M – Gilson (a biology scientist)

Figure 4.2.2.7.c. Fruit of Michelia champaca

4.3. Classification Key

Classification keys built according to "Dichotomous key". The important characteristics and identify signs of each species are collected according to studies about morphological and phonological. Results of survey show that Yen Tu National Forest has 7 species belonging to the family Magnoliaceace.

"There are 7 key characters used to construct the taxonomic keys to 8 representative genera (*Liriodendron, Michelia, Manglietia, Magnolia, Alcimandra, Kmeria, Parakmeria, Pachylarnax*) of the family Magnoliaceae from Vietnam, and those are: Leaf form, young leaf in bud, sexual flower, position for producing flower, gynophore of flower, number of ovules per carpel, and how to open mature carpels" (Vu Quang Nam, 2014).

In this key, flower position is chosen to separate the genus *Michelia* from *Magnolia and Manglietia*. The number of ovules is to divide the genus *Magnolia* and *Manglietia*. In the genus *Michelia*, characters of the color of young parts, the number of tepals, and adnate or free stipule are chosen to separate species. The key to genera and species are presented as follow:

KEY TO SPECIES

1A: Flower axillary…….. *Michelia*

2A: Young parts brown or reddish hairs

3A: Tepals 6…….. *Michelia balansae*

3B: Tepals 9-12…….. *Michelia foveolata*

2B: Young parts pubescent, later pubecent or glabrous

4A: Stipule free to the petiole…… *Michelia mediocris*

4B: Stipule adnate to the petiole……..

5A. Tepals white, stipular scar nearly reaching ½ of petiole *Michelia alba*

5B. Tepals yellow, stipular scar from ½ to apex of petiole *Michelia champaca*

1B: Flowers Terminal

6A: Ovules 2 per carpel…….. *Magnolia quangninhensis*

6B: Ovules 4 to many per carpel…… *Manglietia conifera*

4.4. Recommandation for Conservation

- *In-situ conservation*

The family Magnoliaece species at Yen Tu national forest are not only play an important in scientific research but cultural values as well.

+ We need to specially concern about *Michelia mediocris* Dandy and *Michelia foveolata* in the high 700m above, by using and applying new technology, new protecting in forestry to repair the top of the trees; that were broken by nature affect (northeast monsoon and rime) . In-situ conservation on the way to go Dong pagoda, design some shield for tree to prevent the rime or limit the impacts on the *Michelia mediocris* Dandy and *Michelia foveolata* trees.

+ Applying technology and traditional method for developing regenerate trees, replacement crop on the dead tree, and special care about the tree in the high elevation near the Tay Yen Tu nature reserve and near Dong pagoda. Need to build the nurseries, improve seed quality ad expanding to serve for conservation and restoration

+ Limit the human activities such as: take seed, wood for economic value or flower to serve some ceremonies; to keep the natural distributed zone for regeneration of Magnolia species. Prohibit local people from cultivation on these area and illegal exploitations

+ Combine with local government, authorities, local people, forest protection force for purpose of patrol, controlling

+ Propaganda to raise awareness and the important of conservation, raising awareness about strict protection zone, banning the extraction and impacting to growth and development also the possibility of natural regeneration of species in family Magnoliaceace at Yen Tu national forest

+ Guide the instruction of local laws, rules about conservation species in Magnolieace construction revealed mailboxes to stop and hand out the people who act of illegal deforestation.

+ With the fact conditions, we can conduct natural regeneration under the tree mother as well as expand the area of distribution and regeneration capacity of the species. At the ripe fruit season can be obtained and when conditions is suitable, we can bear seed on forest land after cultivating land. Under the canopy where the species usually distributed, ensuring temperature, moist, light to regenerated trees can grow and develop well in the nature condition.

+ Need more further scientific researches about each species in family Magnoliaceae in Yen Tu national forest, to further research on distribution zone, ecology, capacity regeneration. Especially for *Magnolia coco*, cause of this species is the new species and it also

has many use for medicine, but only has very few research on its characteristics, use and detail about this species.

- *Ex-situ Conservation*

Nowadays, there are some instructions, technical processes which are needed to incentive applied into reality also incorporated with local knowledge for some species in Magnoliaece to develop the distribution of species. However, next time we can add some contents for suitable includes:

+ Seed selection techniques:

• The Authorities should have clearly guidance and practical in seed selection that suitable for specific characteristics and strength of local community to expand and develop in the large scale. Especially, we consider about the species which are limited in nature and poor nature regeneration.

• We need to build nurseries, seed quality and expanding to serve for conservation and reforestation. Some species has advanced technologies about breed required quickly referred training. If there is no research about improving breed of species, we need urgently practice research to conduct for conservation.

• Techniques of Cultivation:

+ Summarizing experiences and advanced technologies in planting species in Magnoliaceae family to make lessons and widespread to all relevant people.

+ Continuing to build instructions, technical progresses in planting for species in Magnoliaceae to develop in different ecology areas.

+ Continuing to study solutions and models in planting for Magnolia coco (under canopy).

+ Developing agro- forestry extension, compliment and training to improve technical cultivation. Propaganda to raise and change your mind from exhausted exploit to sustainable harvesting, from destroying exploitation to exploit regeneration and sustainable business.

+ Continuing research the impacts of other species in Magnoliaceae under nature forest, setting out some suitable solutions, avoiding impact to soil and losing habitat of fauna in forest.

V. CONCLUSION, REMAINING ISSUES AND RECOMMENDATION

5.1. Conclusion

The result of the research show that the Family Magnoliaceae are natural distributed in vary of elevation from 300 - 800 m with 7 species, belonging to 3 genera of the Magnoliaceae were found from my survey on the field: *Magnolia quangninhensis* Q.N.Vu, *Manglietia conifer* Dandy, *Michelia blansae* (Aug. DC.) Dandy, *Michelia foveolata* (Merr. ex Dandy), *Michelia mediocris* Dandy, *Michelia alba* Candolle, *Michelia champaca* L. (Among that have 2 planted species are *Michelia alba* Candolle, *Michelia champaca* L.). This research has added a new species for the list of plants of Yen Tu National Forest and the family Magnoliaceae in Vietnam too.

This is *Magnolia quangninhensis*, the most species found on 10 survey transects with 30/51 trees were found and take 60%. They are mainly distribute along the main stream and from 300-500m; some tree be found in higher elevations 500-600, but not have too much; mixed with Thông tre lá dài (*Podocarpus neriifolius)*, Lan Hoàng Thảo hoa vàng (*Dendrobium chrysanthum)*, Mã tiền dây (*Strychnos umbellata)*, Kim giao *(Nageia fleuryi)*, Thiên tuế (*Cycas balansae)*, Vạn tuế (*Cycas revoluta)*. The regenerated are very good, accounting 60% per 5 survey transect; the tree with good quality account 50% and 33.3% bad quality with the tree height 50 and < 50cm; tree have over 1m tall accounting for 50% of the total regeneration trees found

Besides that, there are 2 species: *Michelia alba* L. and *Michelia champaca* L. being raised and breed in the nursery of Yen Tu National Forest.

This research also defined the distribution, main forest types, which species are located; evaluated the situation of 7 species at study site.

Based on morphology of each species, I was established Classification Key to Genera and species of 7 species of family Magnoliaceae from Yen Tu National Forest.

Provided some recommendations for conservation and development the species of family Magnoliaceae and other species in Yen Tu National Forest.

5.2. Remaining issues

- Research stage some species in Family Magnoliaecae did not match in the period of flowering and seed production, so unable to obtain samples of flowers and seeds of the species had research on

- Not yet deep research of the ecology, behavior of individuals and populations of species in family Magnoliacae, due to the short time researching.

- This research study just stop at species composition, conservation status and silvicultural characteristics of 7 species in family Magnoliacae in study description that are not going deeper into the technical for breeding and planting and developing of this species

5.3. Recommendation

Management board of Yen Tu historical relics and Yen Tu National Forest and other relevant authorities need to promote the conservation benefits for significant species and encourage protection the family of Magnoliaceae and other populations by the local community at Yen Tu National Forest.

Quang Ninh Department of Science and Technology and management board of Yen Tu historical relics and Yen Tu National Forest need to collaborate with local communities and other scientific institutions to design and plan a project to further assess conservation status and promote conservation benefits for protecting species the Family Magnoliaceae have high conservation value. The aim of such a project would be to protect genetic resources in Yen Tu National Forest.

An understanding of the social-economic value of many of the discovered species of Magnoliaceae within local communities is limited. Therefore, Some suggested on-ground conservation directly involving the participation of local communities include establishing seed banks, collecting seed, establishing nurseries to propagate important economic species and establishing tree protection programs.

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VII. APPENDICES

Table 4.2: The nature distributed status of Magnoliaceae species

Transect name	Length (m)	No	Latin name	Vietnamese name	D 1.3	Elevation (m)	Note
1. The cable car station 1 to Hoa Yen Pagoda	1800	1	*Magnolia quangninhensis*	Dạ hợp quảng ninh	12,2	400	
		2	*Magnolia quangninhensis*	Dạ hợp quảng ninh	15,1	410	
2. One Roof temple to Bao Sai temple	900	3	*Magnolia quangninhensis*	Dạ hợp quảng ninh	8,1	500	
		4	*Magnolia quangninhensis*	Dạ hợp quảng ninh	5,5	500	
		5	*Magnolia quangninhensis*	Dạ hợp quảng ninh	17	480	
		6	*Magnolia quangninhensis*	Dạ hợp quảng ninh	15,3	480	
		7	*Manglietia conifera*	Mỡ ba vì	21.3	490	
3. Hoa Yen Pagoda to gold waterfall	500	8	*Michelia balansae*	Giổi Bà/Giổi Lông	12	470	
		9	*Magnolia quangninhensis*	Dạ hợp quảng ninh	10	480	
		10	*Magnolia quangninhensis*	Dạ hợp quảng ninh	6,5	420	
		11	*Magnolia quangninhensis*	Dạ hợp quảng ninh	8,5	400	
		12	*Magnolia quangninhensis*	Dạ hợp quảng ninh	7	370	
		13	*Michelia foveolata*	Giổi lá láng	17,2	700	
		14	*Michelia*	Giổi lá láng	25	850	Withou

4. Hoa Yen pagoda to Van Tieu pagoda, Dong pagoda	1200		*foveolata*				t top tree
		15	*Michelia foveolata*	Giổi lá láng	15,3	770	Without top tree
		16	*Magnolia quangninhensis*	Dạ hợp quảng ninh	21	800	
		17	*Magnolia quangninhensis*	Dạ hợp quảng ninh	17	800	
		18	*Michelia foveolata*	Giổi lá láng	20,8	800	Without top tree
		19	*Michelia foveolata*	Giổi lá láng	15,6	900	
5. An Ki Sinh to bordering of Tay Yen Tu Nature Reserve	600	20	*Michelia foveolata*	Giổi lá láng	15,7	500	
		21	*Michelia foveolata*	Giổi lá láng	7,6	600	
		22	*Magnolia quangninhensis*	Dạ hợp quảng ninh	7,3	680	
		23	*Michelia mediocris Dandy*	Giổi xanh	8,9	700	Without top tree
		24	*Magnolia quangninhensis*	Dạ hợp quảng ninh	9,1	720	Without top tree
		25	*Magnolia quangninhensis*	Dạ hợp quảng ninh	5	850	
6. Hoa Yen Pagoda to Am Duoc Sinh	800	26	*Magnolia quangninhensis*	Dạ hợp quảng ninh	6,3	480	
		27	*Magnolia quangninhensis*	Dạ hợp quảng ninh	6	500	
		28	*Michelia foveolata*	Giổi lá láng	10,5	535	Without top tree

		29	*Magnolia quangninhensis*	Dạ hợp quảng ninh	15	550	
7. The cable car station 1 to Golden waterfall	3000	30	*Magnolia quangninhensis*	Dạ hợp quảng ninh	14	350	
		31	*Magnolia quangninhensis*	Dạ hợp quảng ninh	10,5	380	
		32	*Michelia balansae*	Giổi Bà/Giổi Lông	15	340	
		33	*Michelia balansae*	Giổi Bà/Giổi Lông	18	350	Without top tree
		34	*Magnolia quangninhensis*	Dạ hợp quảng ninh	8	400	
		35	*Magnolia quangninhensis*	Dạ hợp quảng ninh	15	400	Without top tree
8. Giai Oan car station to to Am Duoc	2000	36	*Magnolia quangninhensis*	Dạ hợp quảng ninh	16,7	300	
		37	*Magnolia quangninhensis*	Dạ hợp quảng ninh	18,7	300	
		38	*Michelia mediocris Dandy*	Giổi xanh	10,7	400	
		39	*Michelia mediocris Dandy*	Giổi xanh	15	350	
		40	*Michelia mediocris Dandy*	Giổi xanh	16,2	380	
9. Ha Kieu slope to guard stations 2	1700	41	*Magnolia quangninhensis*	Dạ hợp quảng ninh	15,3	300	
		42	*Magnolia quangninhensis*	Dạ hợp quảng ninh	9,7	400	
		43	*Michelia*	Giổi	14,8	380	

			balansae	Bà/Giổi Lông			
10. Giai Oan car station to to guard stations 1, Truc Lam Zen Monastery - Yen Tu	4000	44	*Magnolia quangninhensis*	Dạ hợp quảng ninh	18	250	
		45	*Magnolia quangninhensis*	Dạ hợp quảng ninh	15.2	250	
		46	*Magnolia quangninhensis*	Dạ hợp quảng ninh	16.5	250	
		47	*Magnolia quangninhensis*	Dạ hợp quảng ninh	19.1	250	
		48	*Michelia mediocris Dandy*	Giổi xanh	12.2	250	
		49	*Michelia mediocris Dandy*	Giổi xanh	15.6	250	
		50	*Michelia mediocris Dandy*	Giổi xanh	14.3	230	
		51	*Michelia mediocris Dandy*	Giổi xanh	15.8	230	
Nursery of Yen Tu National Forest		52	*Michelia alba*	Ngọc lan hoa trắng			planted tree
		53	*Michelia champaca*	Ngọc lan hoa vàng			planted tree

7.1. Tables to collecting data in the field

Table 1: Field Data Sheet

Species name: .....; Family name:.....	
Field No.:	Habitat & Ecology:
Locality:	
Co-ordinate:	
Altitude:	
Collectors:	Collected date:

Common name:.....

Local name:.....

Place to growth: .....

Shape of canopy:.....

Branches:.....

Trunk:.....

DBH: .....

Leaf: .....

Flower: .....

Fruit: .....

Use: .....

Other characteristics: .....

Table 02: Investigate the phenology of trees

Number: ..... Writer: .....

Latin name: ..... Family: .....

Location:..... Outside characteristics (height, DBH): .....

Conditions of growing place: .....

Tracking date	Month												Weather conditions	Phenology	Notes
	1	2	3	4	5	6	7	8	9	10	11	12			

Notations: (-) starting time; (x) prosperous time; (O) ending time.

Table 03: Research the distribution of the species by transect lines

Date: ……..; Survey place:……..

Investigator:…….…… Name of tree species: .....

No.	Name	Coordinate	Elevation (m)	Height (m)		D1.3	Note
				HVN	HDC		
1							
2							
3							
4							
5							
6							

Table 04: Investigation of regeneration tree.

No.	Survey transects	Number of regeneration trees follow the height HVN (cm)			Quality			Note
		< 50	50 - 100	>100	Good	Bad	Normal	In or out of canopy
1								
2								
3								
4								
Number								
Rate (%)								

Table 05: Investigate accompany species

No: ..... Place: ..... Investigator:.....

Date: .....; Altitude:.....

Co-odination: .....

Magnolia tree	D1.3 (cm)	Hvn (m)	No. accompany species	Distance to Magnolia tree (m)	Name of species	D1.3	Hi	Quality
1			1					
			2					
			3					
			4					
			5					
			6					

7.2. Figure in the field

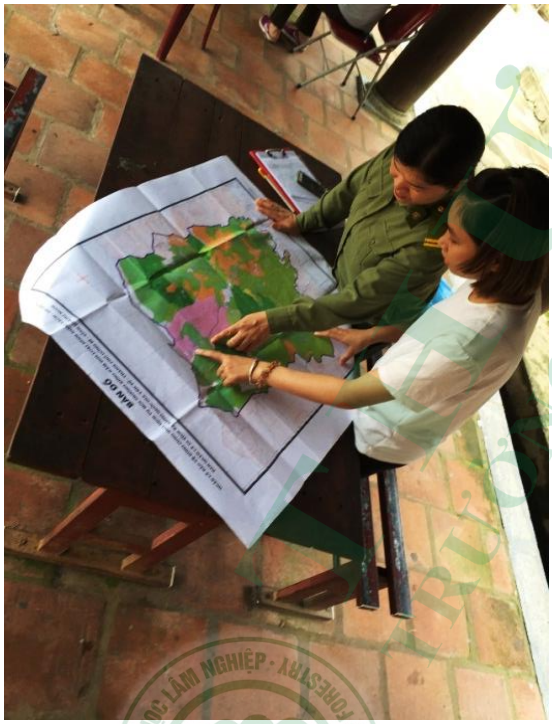
F1. ***Magnolia quangninhensis* Q.N. Vu, *sp.nov.***

F2. Transect 4: Hoa Yen pagoda to Van Tieu pagoda, Dong pagoda

F3. The nursery garden of Yen Tu National Forest

F4. *Michelia alba* in Yen Tu's rusery garden

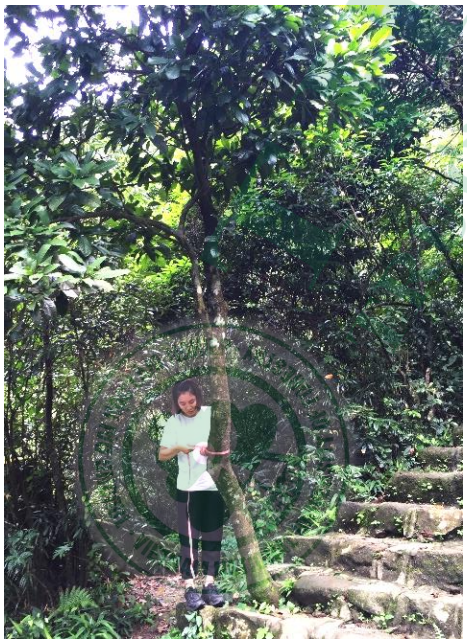
F5. The landscape and the weather condition of Yen Tu National Forest



F6.a. Some images in collecting data process on the Yen Tu National Forest








F6.b. Some images in collecting data process on the Yen Tu National Forest.