

BIODIVERSITY AND USING VALUE OF SOME SPECIES OF MAGNOLIACEAE IN SON LA PROVINCE OF VIETNAM

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ARTICLE INFO	ABSTRACT
Received: 30/12/2021	Within the framework of the research program on species of the family Magnoliaceae Juss. containing essential oils in Vietnam, we have conducted a field survey using routine investigation method and assessed the biodiversity of some Magnoliaceae species in some areas of Son La province. A total of nine species of Magnoliaceae family were sampled in districts of Moc Chau and Van Ho, and one species distributed in Yen Chau district was referenced from previous document. Out of the total of 10 species, 3 species (<i>Magnolia clemensiorum</i> , <i>Magnolia fistulosa</i> , and <i>Michelia sonlaensis</i>) are endemic to Vietnam, 4 species have been assessed as endangered at different levels in Vietnam (<i>Magnolia balansae</i> and <i>Magnolia dandyi</i>) and at the global level (<i>Magnolia chevalieri</i> and <i>Michelia sonlaensis</i>) requiring a conservation plan to maintain biodiversity. All 10 studied species of the Magnoliaceae family have valuable timber, some species are grown as ornamental plants due to their fragrant and beautiful flowers, and some species are used as medicines to treat a number of diseases in traditional medicine. By hydrodistillation, all 9 species collected in Moc Chau and Van Ho districts were determined to contain essential oils in their branches, leaves, and fruits.
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ĐA DẠNG SINH HỌC VÀ GIÁ TRỊ SỬ DỤNG CỦA MỘT SỐ LOÀI THUỘC HỌ NGỌC LAN (MAGNOLIACEAE) TẠI TỈNH SƠN LA, VIỆT NAM

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THÔNG TIN BÀI BÁO	TÓM TẮT
Ngày nhận bài: 30/12/2021	Trong khuôn khổ chương trình nghiên cứu các loài thuộc họ Ngọc lan (Magnoliaceae Juss.) chứa tinh dầu tại Việt Nam, chúng tôi đã tiến hành điều tra bằng phương pháp theo tuyến và đánh giá đa dạng sinh học một số loài thuộc họ Ngọc lan tại một số khu vực thuộc tỉnh Sơn La. Tổng số 9 loài thuộc họ Ngọc lan đã được thu mẫu tại huyện Mộc Châu và huyện Vân Hồ, và 1 loài phân bố ở huyện Yên Châu được tham khảo từ tài liệu trước đây. Trong tổng số 10 loài, có 3 loài (<i>Magnolia clemensiorum</i> , <i>Magnolia fistulosa</i> , và <i>Michelia sonlaensis</i>) là loài đặc hữu của Việt Nam, 4 loài đã được đánh giá ở tình trạng nguy cấp ở các mức khác nhau tại Việt Nam (<i>Magnolia balansae</i> và <i>Magnolia dandyi</i>) và ở cấp độ toàn cầu (<i>Magnolia chevalieri</i> và <i>Michelia sonlaensis</i>) cần có phương án bảo tồn duy trì đa dạng sinh học. Cả 10 loài thuộc họ Ngọc lan được nghiên cứu có giá trị cho gỗ, một số loài được trồng làm cây cảnh do có hoa thơm và đẹp, một số loài có tác dụng làm thuốc chữa một số bệnh trong y học cổ truyền. Bằng phương pháp chưng cất tinh dầu lõi cuốn hơi nước, cả 9 loài thu mẫu ở huyện Mộc Châu và huyện Vân Hồ đã được xác định có chứa tinh dầu trong các bộ phận cành, lá, quả của chúng.
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TỪ KHÓA

Tình trạng bảo tồn
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1. Introduction

Magnoliaceae Juss. is one of the most primitive groups of flowering plants in the Angiospermae, having an important role in the study of plant evolution, biogeography, climate change, morphology, and paleontology [1], [2]. Magnoliaceae is characterized by primitive features such as numerous, loose and undifferentiated or poorly differentiated perianth, and spiral arrangement on elongated flower bases. The species in the family are trees or shrubs. Leaves staggered, entire, evergreen, sometimes deciduous, stipules enclosing green shoots. Flowers are large, hermaphrodites, diverse in color, fragrance, convex flower base on which the composition of flowers is present. The double fruit consists of many follicles arranging in panicles. Magnoliaceae is an important family with many species that have been reported possessing valuable uses such as: fragrant ornament, high quality wood, spices, medicines and essential oil products [3]-[6]. Beside the famous commercial product of essential oil of *Magnolia champaca* (L.) Baill. ex Pierre, the essential oils of many Magnoliaceae species have antibacterial and medicinal effects [7]-[14].

In the world, Magnoliaceae has more than 300 species [15], belonging to 17 genera [16] or 2 genera [17], [18], they are distributed mainly in Southeast Asia, Central America, East and North America, Mexico, West India and some surrounding areas. Currently, the hierarchical arrangement of taxa, especially the existence of genera belonging to the family Magnoliaceae in taxonomic systems is still a matter of debate because it depends on historical circumstances, views and opinions, and the approach of each taxonomist group [1], [16]-[19]

Son La is a province in the Northwest mountainous region with high biodiversity of plant and animal species with a number of Nature Reserves such as: Cópia (Thuan Chau district), Sop Cóp (Sop Cóp and Song Ma district), Ta Xua (Bac Yen district), Xuan Nha (Van Ho district), Muong La (Muong La district). Currently, the published works on the distribution of Magnoliaceae species in Son La are very limited, except for the publication of new *Michelia sonlaensis* species for the world in 2019 [20].

In the research program to evaluate the plant resources containing essential oils of some species of the Magnoliaceae family in general and *Magnolia* genus in particular in Vietnam, we conducted a survey to assess the distribution status and use value of 9 species of Magnoliaceae in some areas of Son La province, contributing to the scientific basis for the assessment of biodiversity, use value and conservation orientation of rare and endangered species.

2. Materials and Methods

Investigation and survey on the distribution of species of the family Magnoliaceae in Moc Chau district and Van Ho district by using the Methods of plant research of Nguyen Nghia Thin [21]. The number of individuals of each species was determined in each study area on the survey route.

The scientific names of species of the family Magnoliaceae were identified by the method of comparing morphological characteristics, using specialized documents such as: An Illustrated Flora of Vietnam [22], Checklist of Plant Species of Vietnam [23], Popular plant dictionary [24], Flora of China [16], The Magnoliaceae of Thailand [17], Vietnamese medicinal plant dictionary [25], and published works on newly discovered Magnoliaceae species in Vietnam [1], [19], [20], [26], [27].

The conservation status of Magnoliaceae species was evaluated using the following documents: The Red List of Magnoliaceae [2], Taxonomic Revision of the family Magnoliaceae from Vietnam [19] *Michelia sonlaensis* Q. N. Vu, sp. nov. (Magnoliaceae) from northern Vietnam [20], Vietnam Red Data Book [28], Guidelines for Using the IUCN Red List Categories and Criteria [29], The IUCN Red List of Threatened Species in 2021 [30].

Essential oils from samples of twigs, leaves and fruits of species of the Magnoliaceae collected at different areas were obtained by hydrodistillation using a Clevenger-type apparatus

according to the Vietnam Pharmacopoeia V [31]. The essential oil content was calculated based on the absolute dry weight of the sample (v/w).

3. Results and Discussion

3.1. Distribution of some species of Magnoliaceae in Son La province

In total, 10 species of Magnoliaceae family were investigated in three districts of Son La province: Moc Chau, Van Ho, and Yen Chau (Table 1). Among those, *Michelia sonlaensis* information was found in the previous literature by other authors with about less than 250 individuals in Yen Chau district [20].

Magnolia championii Benth. was the species having the highest individual diversity that grow wild in the investigation areas in Moc Chau district recorded during our field trips, with 22 individuals totally, among them there was a small regeneration plant. *Magnolia fistulosa* (Finet & Gagnep.) Dandy was the second-ranked species in terms of number of individuals investigated in Son La province with 5 individuals recorded in Moc Chau district and one individual recorded in Van Ho district. The other investigated species were recorded from 1 to 4 individuals at the study areas (Table 1).

Of nine investigated species of Magnoliaceae in the study areas, 7 species were recorded in Moc Chau district, 4 species were recorded in Van Ho district and 1 species was recorded in Yen Chau district. Among them, six species including *Magnolia championii*, *M. chevalieri*, *M. clemensiorum*, *M. conifera*, *M. fistulosa*, and *Michelia tonkinensis* were first recorded in Son La province (Table 1).

Table 1. Distribution of some species of Magnoliaceae in Son La Province

N°	Latin name	Local name	Investigation site in Son La Province	N° of individuals	Distribution according to other documents
1	<i>Magnolia balansae</i> A. DC. (syn. <i>Michelia balansae</i> (A.DC.) Dandy)	Giôi bà, Giôi lông	Xuan Nha Special Use Forest, Moc Chau district.	1	Cao Bang, Ha Giang, Ha Noi, 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; China ^{a,b,c}
2	<i>Magnolia championii</i> Benth. (syn. <i>Lirianthe championii</i> (Beth.) N. H. Xia & C. Y. Wu)	Dạ hợp hồng kông	Chieng Son commune, Moc Chau district	22	Ha Tinh, Hai Phong, Nghe An, Quang Binh, Quang Ninh, Thua Thien Hue; China ^{c,d}
3	<i>Magnolia chevalieri</i> (Dandy) V.S.Kumar (syn. <i>Manglietia chevalieri</i> Dandy)	Giôi chevalieri, Mỡ phú thọ	Chieng Yen commune, Van Ho district.	4	Gia Lai, Ha Tinh, Hoa Binh, Khanh Hoa, Lam Dong, Lao Cai, Nghe An, Ninh Thuan, Phu Tho, Thanh Hoa, Tuyen Quang, Vinh Phuc, Yen Bai; China, Laos ^{a,b,c}
4	<i>Magnolia clemensiorum</i> Dandy (syn. <i>Lirianthe clemensiorum</i> (Dandy) N. H. Xia & Q. N. Vu)	Dạ hợp clemens	Chieng Yen commune, Van Ho district	1	Da Nang, Nghe An ^{a,b,c}
5	<i>Magnolia conifera</i> (Dandy) V.S.Kumar (syn. <i>Manglietia conifera</i> Dandy)	Mỡ ba vì	Xuan Nha Special Use Forest, Moc Chau district.	2	Cao Bang, Ha Giang, Ha Noi, Hoa Binh, Lam Dong, Lao Cai, Quang Ninh, Quy Nhon, Tuyen Quang, Vinh Phuc, Yen Bai;

N°	Latin name	Local name	Investigation site in Son La Province	N° of individuals	Distribution according to other documents
6	<i>Magnolia dandyi</i> Gagnep. (syn. <i>Manglietia dandyi</i> (Gagn.) Dandy)	Dạ hợp dandy, Vàng tâm	Chieng Son commune, Moc Chau district.	1	China, Laos ^{a,b,c} Ha Giang, Ha Tinh, Lao Cai, Nghe An, Quang Binh, Son La, Thanh Hoa, Tuyen Quang, Vinh Phuc, Yen Bai; Laos ^{a,b,c}
7	<i>Magnolia fistulosa</i> (Finet & Gagnep.) Dandy (syn. <i>Lirianthe fistulosa</i> (Finet & Gagnep.) N.H.Xia & C.Y.Wu)	Dạ hợp hoa óng, Dạ hợp bông	Chieng Yen commune, Van Ho district. Chieng Son commune, Moc Chau district.	1 5	Da Nang, Ha Noi, Hoa Binh, Khanh Hoa, Nghe An, Kon Tum, Thua Thien Hue ^{b,c}
8	<i>Magnolia foveolata</i> (Merr. ex Dandy) Figlar (syn. <i>Michelia foveolata</i> Merr. ex Dandy)	Giôi lá láng	Xuan Nha Special Use Forest, Moc Chau district.	1	Gia Lai, Phu Tho, Son La, Tuyen Quang, Lao Cai, Yen Bai, Quang Ninh, Ha Noi, Nghe An, Ha Tinh, Kon Tum, Thua Thien-Hue, Thanh Hoa, Da Nang, Vinh Phuc; China ^{a,b,c}
9	<i>Michelia tonkinensis</i> A.Chev.	Giôi bắc bộ	Chieng Yen commune, Van Ho district. Chieng Son commune, Moc Chau district.	1 2	Ha Tinh, Nghe An, Ninh Binh, Phu Tho, Quang Tri, Thanh Hoa, Thua Thien Hue, Tuyen Quang, Yen Bai; China ^{a,b,c,e}
10	<i>Michelia sonlaensis</i> Q.N. Vu ^f	Giôi son la	Muong Lum municipality, Yen Chau district.	< 250	Son La ^f

Note: ^a[22]; ^b[23]; ^c[19]; ^d[26]; ^e[32], ^f[20].

3.2. Conservation status and values of some species of Magnoliaceae in Son La province

Among 10 species of Magnoliaceae family recorded with distribution in Son La province, 3 species including *M. clemensiorum*, *M. fistulosa*, and *M. sonlaensis* are endemic to Vietnam (Table 2). So far, the distribution of these species in other countries in the world has not been recorded.

There are 2 species of Magnoliaceae family including: *M. balansae*, and *M. dandyi* assessed at Vulnerable (VU) class in Vietnam and need to be conserved [28].

At the global level, evaluations at different time points have shown that 1 species of the Magnoliaceae family in this study (*M. chevalieri*) has been listed in the Endangered (EN) class according to the IUCN (International Union for Conservation of Nature) criteria that needs conservation attention [2], [29].

In addition, *M. sonlaensis* with the number of mature individuals estimated to be less than 250 [20] was assessed as Endangered (EN) according to Guidelines for Using the IUCN Red List Categories and Criteria [29].

Species are assessed to be threatened at different levels, possibly due to scattered distribution, reduction of distribution area, loss of habitat quality, habitat destruction for the purpose of expanding agricultural land, low ability of natural regeneration and heavy logging, etc. Through actual investigation and based on relevant documents, it is necessary to have an expanded and more complete assessment and review from botanical experts, conservationists and related agencies to add one globally endangered species (*M. chevalieri*) and one species (*M. sonlaensis*)

assessed by the authors as endangered in their publication [20] into the Vietnam Red Data Book to adopt policies and measures to conserve and avoid the extinction of these species in the wild, causing a decline in plant biodiversity.

Table 2. Conservation status and values of some species of Magnoliaceae in Son La province

N°	Latin name	Conservation status	Value	Concentration of essential oil
1	<i>M. balansae</i>	VU ^a	E, EO, T	0.023-0.064%, n=3
2	<i>M. championii</i>	-	EO, T	0.010-0.061%, n=2
3	<i>M. chevalieri</i>	EN ^{b,c}	EO, T	0.038-0.562%, n=6
4	<i>M. clemensiorum</i>	Endemic ^d	EO, T	0.026-0.137%, n=2
5	<i>M. conifera</i>	-	EO, F, M, O, T	0.137-0.465%, n=5
6	<i>M. dandyi</i>	VU ^a	EO, F, T	0.174-0.486%, n=2
7	<i>M. fistulosa</i>	Endemic ^d	EO, T	0.035-0.395%, n=8
8	<i>M. foveolata</i>	-	EO, M, T	0.034-0.090%, n=2
9	<i>M. tonkinensis</i>	-	E, EO, F, T	0.060-1.148%, n=4
10	<i>M. sonlaensis</i> ^e	EN ^e , Endemic ^e	T	-

Note: E: Eatable, EO: Essential oil, F: Forest, M: Medicine, O: Ornamental, T: Timber; ^a[28]; ^b[2]; ^c[30]; ^d[19]; ^e[20].

All of 10 species of the Magnoliaceae family in this study are valued for good or medium quality wood (T= Timber) used in construction and furniture making; one species (*M. conifera*) is grown as ornamental plant (O= Ornamental) for its fragrant and beautiful flowers; two species (*M. balansae* and *M. tonkinensis*) have seeds used as spicy (E = Eatable); two species (*M. conifera* and *M. foveolata*) have medicinal effects in traditional medicine (M = Medicine) [22], [23], [25]. Three species (*M. conifera*, *M. dandyi*, *M. tonkinensis*) of ecological value on the list of tree species are prioritized for afforestation programs [33] (Table 2).

Besides, the results of essential oil hydrodistillation from 34 samples including the branches, leaves, and fruits of 9 species of Magnoliaceae family in the present study showed that they are all essential oil bearing plant species (EO = Essential oil). The essential oil contents of these samples ranged from 0.01 - 1.148% calculated on dry weight basis (v/w) (Table 2). These species are potential resources for application in the cosmetic industry, flavoring, perfumery, especially the species with high essential oil contents.

4. Conclusion

The investigated areas in Moc Chau district found higher number of species belonging to Magnoliaceae family (7 species) than the investigated areas in Van Ho district (4 species). In Yen Chau district, only one species (*M. sonlaensis*) was recorded according to the previous report. Among ten species of Magnoliaceae family investigated in three districts of Son La province, *Magnolia championii* Benth. was the species having the highest individual diversity with 21 mature individuals and one small regeneration plant. Six species (*Magnolia championii*, *M. chevalieri*, *M. clemensiorum*, *M. conifera*, *M. fistulosa*, and *Michelia tonkinensis*) were first recorded in Son La province. Three species (*M. clemensiorum*, *M. fistulosa*, and *M. sonlaensis*) are endemic to Vietnam. The conservation status of four species has been assessed at classes of VU (*M. balansae*, and *M. dandyi*) in Vietnam, and EN (*M. chevalieri* and *M. sonlaensis*) globally. Using values of the investigated species are mainly for their wood (timber), ornamental, spicy (eatable), medicine, ecology, and 9 species were determined containing essential oil. It is necessary to have an expanded and more complete assessment and review from relevant individuals and organizations to add one or two globally endangered species mentioned above to the Vietnam Red Data Book in order to have policies and measures to protect them, avoiding the extinction of these species in the wild.

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