

## TAXONOMY OF THE GENUS *Paris* L. (Melanthiaceae) IN VIETNAM

Nguyen Quynh Nga\*, Pham Thanh Huyen, Phan Van Truong, Hoang Van Toan

National Institute of Medicinal Materials

**ABSTRACT:** *Paris* L. is a small genus distributed widely in Eurasia. In Vietnam *Paris* occur in evergreen broad-leaved forests in some mountainous areas of the North and the Central highlands. Due to over-exploitation as well as habitat loss, populations of some *Paris* species are seriously declining. This genus has not been studied extensively in Vietnam. The aim of this study was to define the morphological characteristics of the genus *Paris* in Vietnam. Morphological description, dichotomous key for identification, ecology and distributions of the genus in Vietnam are reported. The results show that this genus in Vietnam comprises 8 species and 2 varieties, possessing unilocular ovary with parietal placenta.

**Keywords:** Melanthiaceae, *Paris*, identification key, morphological description, Vietnam.

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\*Corresponding author: nguyenguynhnga@hotmail.com.

### INTRODUCTION

The genus *Paris* L. (Melanthiaceae), which is locally known as *Bay lá một hoa* or *Trong lau*, is a small genus distributed in evergreen broad-leaved forests of some mountainous areas in the North and the Central highlands of Vietnam. Originally this genus comprised 5 species in Vietnam [3]. Then, Do (2007) [1] recorded 6 species after a first extensive study. However, ovaries of those species in her work were erroneously described as multilocular with axile placentation instead of unilocular with parietal placentation, as mentioned in the original description as well as other relevant works [2, 6]. Recently, 2 more new species i.e. *P. cronquistii* (Takht.) H. Li and *P. xichouensis* (H. Li) Y. H. Ji, H. Li & Z. K. Zhou. [4, 5] have been recorded and the total number of *Paris* species in Vietnam is now 8 species with 2 varieties. The aim of this study is to define the morphological characteristics and to construct taxonomic key of the genus *Paris* in Vietnam.

### MATERIALS AND METHODS

Fresh samples of the genus *Paris* were collected from the field in the Northern and Central Vietnam, 76 voucher specimens were deposited in the herbarium of the National Institute of Medicinal Materials (NIMM).

Morphological characters of all collected samples were analyzed and taxonomic key was prepared with reference to the relevant documents [1, 2, 6].

### RESULTS AND DISCUSSION

***Paris* L. - Báy lá một hoa (Trọng lâu)**

L. 1753. Sp. Pl. 367; J. Hutch. 1959. Fam. Fl. Pl. ed. 2.2: 615; F. T. Wang & al. in F. T. Wang & T. Tang, 1978. Fl. Reip. Pop. Sin. 15: 86-96; Takht. 1983. Brittonia, 35: 255-270; H. Li 1984. Act. Bot. Yunn. 6(4): 351-362; id. 1986. Bull. Bot. Res. 6910: 109-144; id. 1986. Guihaia, 6(3): 187-192; N. T. Ban & N. T. Do, 1992. Journ. Biol. 14 (4): 5; N. T. Do, 1992. Journ. Pharm. 6: 10; id. 1995. Journ. Biol. 17(4, special vol); 128; Takht. 1996. Div. Class. Fl. Pl. 485; Tamura in Kubitzki, 1998. Fam. Gen. Vasc. Pl. 3: 450; S. Liang & V. G. Soukup in Z. Y. Wu & P. H. Raven, 2000. Fl. China, 24: 88-95; N. T. Do, 2007. Fl. Viet. 6: 10.

Type: *Paris quadrifolia* L.

Herbs perennial, terrestrial part 0.5-2 m, erect, solitary, unbranched. Rhizome horizontal, cylindrical, grow underground, send out roots and shoots from their nodes. Leaves 4 to many, in a terminal whorl, petiolate; lanceolate, ovate to obovate; green, abaxially with or without purple

blotches; papery or leathery, glabrous; main veins 3-7 with anastomosing veinlets; apex acute to acuminate; base cuneate obtuse, truncate to cordate. Flowers bisexual, solitary, developing from the top of stem, pedunculate. Peduncle 10-80 cm. Tepals in 2 whorls, free. Outer tepals 3-6(8) nearly as many as leaf and inner tepal number; the number of outer tepals may vary within a species; green to yellow-green; ovate to lanceolate; apex acute to acuminate. Inner tepals 3-6 (7-8), the number of inner tepals may vary among species, nearly as many as leaf and outer tepal number; longer, equal or slightly shorter or much shorter than the outer ones; green, yellow-green or dark purple; linear or spatulate, apex acute; reflexed-bent backward or not. Stamens in

1-2 whorls, nearly 2-3 times as many as the number of leaves, outer and inner tepals. The number of stamens may vary among species. Filaments shorter or equal to anthers. Free portion of connective transversely ellipsoid to subglose or cylindrical with apex rounded or acuminate. Ovary subglobose or ellipsoid, shallowly or deeply ribbed, horizontal cross section square to polygon with convex or concave sides; transverse rim blue violet, violet, purple to red orange; unilocular with parietal placenta; ovules numerous, arranged along placentas. Style nearly equal to or shorter than stigma, stigma lobes 3-7(8). Fruit capsule, loculicidal, many seeded. Seed subglobose or ellipsoid, aril fleshy.

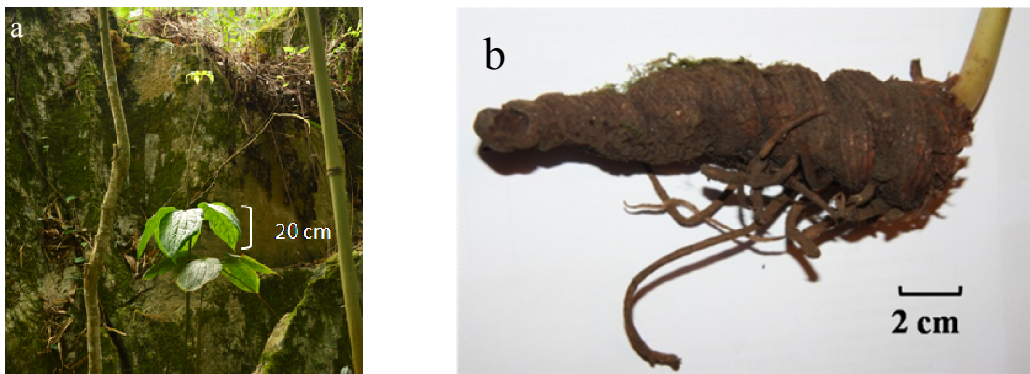
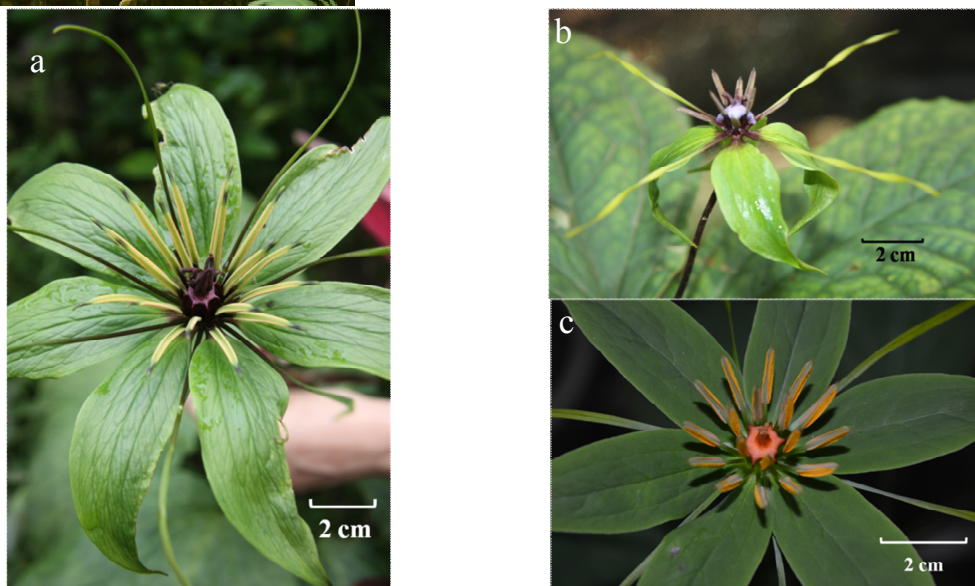


Figure 1. (a) Habit and (b) rhizome of *P. xichouensis* (H. Li) Y. H. Ji, H. Li & Z. K. Zhou



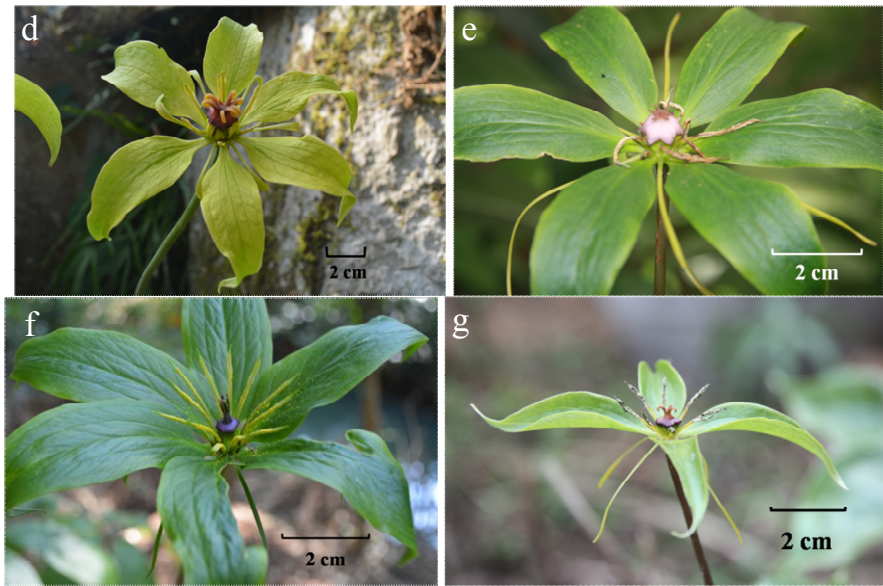


Figure 2. Flowers of some *Paris* species

a. *P. dunniana* H. Lév. ; b. *P. vietnamensis* (Takht) H. Li; c. *P. cronquistii* (Takht.) H. Li; d. *P. xichouensis* (H. Li) Y. H. Ji, H. Li & Z. K. Zhou; e. *P. polyphylla* var. *yunnanensis*; f. *P. polyphylla* var. *chinensis* (Franch.) H. Hara; g. *P. caobangensis* Y. H. Ji, H. Li & Z. K. Zhou

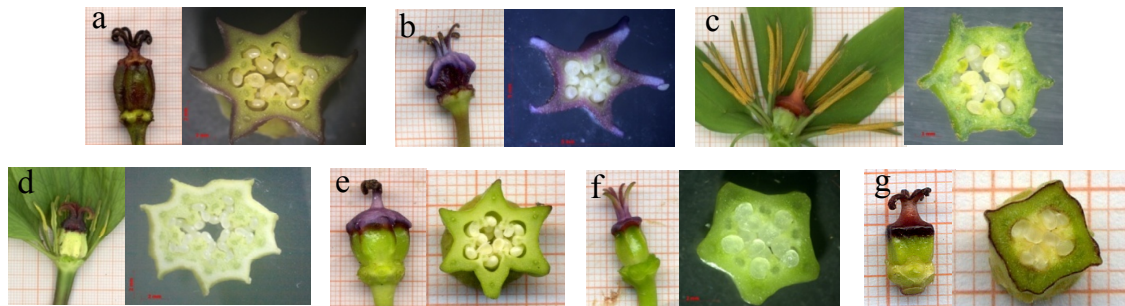


Figure 3. Gynoecium (left) and ovary horizontal cross section (right) of some *Paris* species  
a. *P. dunniana* H.Lév. ; b. *P. vietnamensis* (Takht) H.Li; c. *P. cronquistii* (Takht.) H.Li; d. *P. xichouensis* (H.Li) Y.H.Ji, H.Li & Z.K.Zhou; e. *P. polyphylla* var. *yunnanensis*; f. *P. polyphylla* var. *chinensis* (Franch.) H.Hara; g. *P. caobangensis* Y.H.Ji, H.Li & Z.K.Zhou



Figure 4. a. Young capsule of *P. xichouensis* (H.Li) Y.H.Ji, H.Li & Z.K.Zhou; b. Dehiscent capsule of *P. polyphylla* var. *chinensis* (Franch.) H.Hara

**Distribution, ecology and medicinal uses of Paris species in Vietnam**

*Ecology:* Paris species mostly grow on moist soil, near stream, limestone slopes or under the canopy in evergreen forests; elevation 600-1,500 m. Fl. April-June, fr. July-November.

*Distribution:* Distribution of Paris species in Vietnam is shown in Fig. 5.

*P. caobangensis* Y. H. Ji, H. Li & Z. K. Zhou: Lao Cai prov. (Sa Pa), Cao Bang (Nguyen Binh); *P. cronquistii* (Takht.) H. Li: Ha Giang prov. (Dong Van); *P. delavayi* Franch.: Lao Cai prov. (Sa Pa), Ha Giang prov. (Dong Van), Cao Bang prov. (Nguyen Binh), Vinh Phuc prov. (Tam Dao).; *P. dunniana* H. Lév.: Lao Cai prov. (Sa Pa), Vinh Phuc prov. (Tam Dao), Ninh Binh prov. (Cuc Phuong), Kon Tum (Kon Plong).; *P. fargesii* Franch.: Ha Noi (Ba Vi), Thanh Hoa prov. (Quan Hoa, Ba Thuoc); *P. polyphylla* var. *yunnanensis* (Franch.) Hand.-Mazz.: Lai Chau prov. (Phong Tho), Ha Noi (Ba Vi), Thanh Hoa prov. (Ba Thuoc); *P. polyphylla* var. *chinensis* (Franch.) H. Hara: Lao Cai prov. (Sa Pa), Yen Bai (Nghia Lo), Dien

Bien prov. (Tuan Giao), Phu Tho prov. (Thanh Son), Ha Noi (Ba Vi), Hoa Binh prov. (Luong Son, Mai Chau), Ninh Binh prov. (Cuc Phuong), Nghe An prov. (Con Cuong), Quang Nam prov. (Nam Giang), Quang Binh prov. (Bo Trach), Kon Tum prov. (Kon Plong); *P. vietnamensis* (Takht.) H.Li: Ha Giang prov. (Hoang Su Phi, Xin Man), Lao Cai prov. (Sa Pa), Lai Chau prov. (Phong Tho), Vinh Phuc prov. (Tam Dao), Lam Dong prov. (Lac Duong); *P. xichouensis* (H. Li) Y. H. Ji, H. Li & Z. K. Zhou: Ha Giang prov. (Dong Van) (picture 5).

*Medicinal uses:* In traditional medicine, rhizomes of Paris are valuable. They have been used to treat many diseases such as fever, malaria, snake bites, pimples, inflammation of the mammary gland, tuberculosis and asthma [8].

However, due to over-exploitation as well as habitat loss, populations of some Paris species are seriously declining. For example, *P. cronquistii* (Takht.) H. Li and *P. xichouensis* (H.Li) Y. H. Ji, H. Li & Z. K. Zhou occur only in the narrow areas in Ha Giang province.

Table 1. Comparison of some morphological characters among Paris species in Vietnam

N <sup>o</sup>	Morphological characters Species	Leave	Inner tepal	Free portion of anther connective	Ovary	Style and stigma
1	<i>P. caobangensis</i> Y. H. Ji, H. Li & Z. K. Zhou	Abaxially without purple blotches	Yellow green, linear, shorter than outer one	Cylindric, apex acuminate, 2-2.5 mm	4-5 ribbed, horizontal cross section (HS) convex polygon	Style conspicuous, equal to stigma
2	<i>P. cronquistii</i> (Takht.) H. Li	Abaxially with purple blotches	Yellow green, linear, longer than outer one	Cylindrical, apex acuminate, 1.5-2 mm	5-6 ribbed, HS concave polygon	Style conspicuous, equal to stigma
3	<i>P. delavayi</i> Franch.	Abaxially without purple blotches	Purple, linear, shorter than outer one	Cylindrical, apex acuminate, 3-4 mm	4-5 ribbed HS concave polygon	Style conspicuous, equal to stigma
4	<i>P. dunniana</i> H. Lév.	Abaxially without purple blotches	Green, linear, longer than outer one	Cylindrical, apex acuminate, 4.0-4.5 mm	6-8 ribbed, HS concave polygon	Style conspicuous, shorter than stigma
5	<i>P. fargesii</i> Franch.	Abaxially without purple blotches	Yellow green, linear, shorter than outer one	Transversely ellipsoid, subglobose; 1.0-2.0 mm	4-5 ribbed HS concave polygon	Style inconspicuous
6	<i>P. polyphylla</i> Sm.	Abaxially	Yellow green to	Cylindrical,	5-7 ribbed,	Style



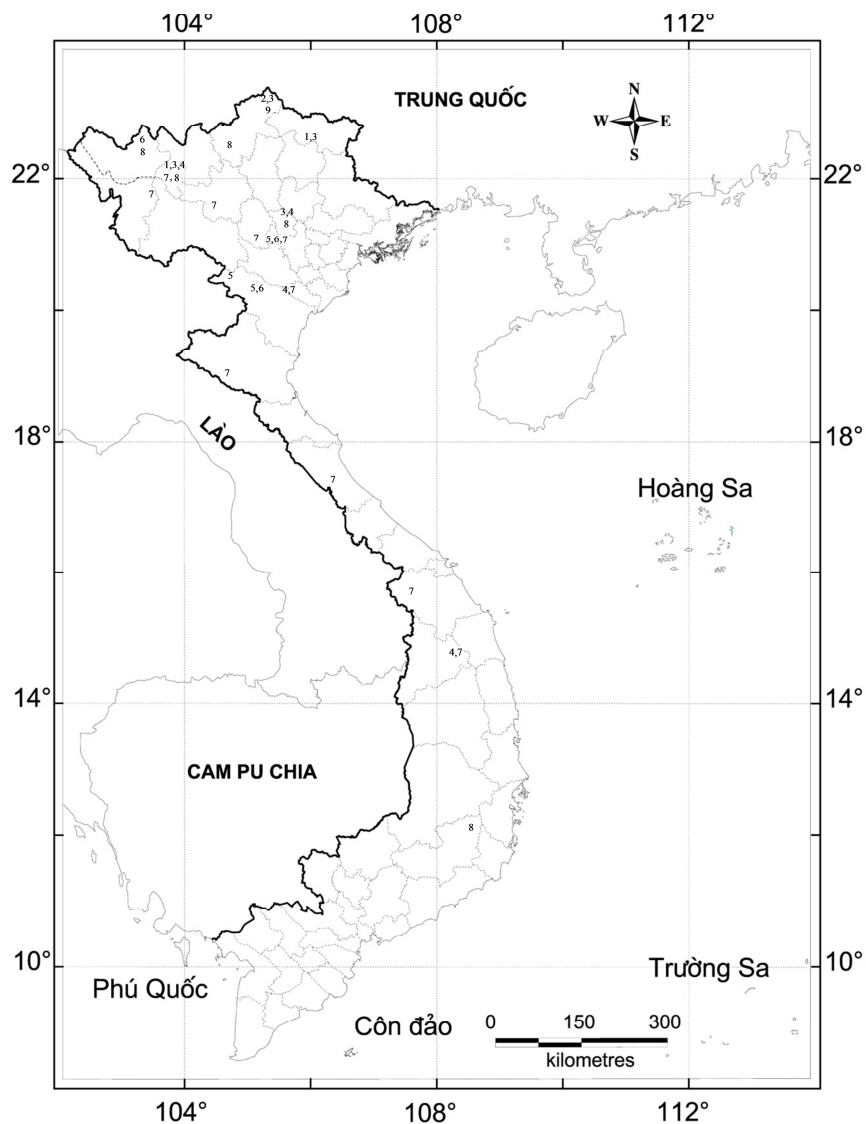
		without purple blotches	green, linear, shorter than (or nearly equal to) outer one, reflexed or not reflexed	apex acuminate, 1.0-2.5 mm	HS concave polygon	conspicuous, equal or shorter than stigma
	<i>P. polyphylla</i> var. <i>yunnanensis</i> (Franch.) Hand.-Mazz.	Abaxially without purple blotches	Yellow green, linear, shorter than (or nearly equal to) outer one, not reflexed	Cylindrical, apex acuminate, 1.0-1.5 mm	5-7 ribbed, HS concave polygon	Style conspicuous, equal to stigma
	<i>P. polyphylla</i> var. <i>chinensis</i> (Franch.) H. Hara	Abaxially without purple blotches	Green, linear, shorter than outer one, reflexed	Cylindrical, apex acuminate, 1.5-2.5 mm	5-7 ribbed, HS concave polygon	Style conspicuous, equal or shorter than stigma
7	<i>P. vietnamensis</i> (Takht) H. Li	Abaxially without purple blotches	Yellow green, linear, longer than outer one	Cylindrical, apex acuminate, 1.0-1.5 mm	4-6 deeply ribbed, HS star-shaped	Style inconspicuous
8	<i>P. xichouensis</i> (H. Li) Y. H. Ji, H. Li & Z. K. Zhou	Abaxially without purple blotches	Yellow green spatulate, shorter than outer one	Cylindrical, apex rounded, 2.0-2.5 mm	6-8 ribbed, HS concave polygon	Style inconspicuous

#### Identification key for the genus *Paris* L. in Vietnam

Based on the personal observation and the

identification key of Li [2] and Liang & Soukup [6], a taxonomic key was constructed for the genus *Paris* L. in Vietnam. It is presented hereunder:

- 1A. Free portion of anther connective transversely ellipsoid, subglobose..... 1. *P. fagersii*  
 1B. Free portion of anther connective cylindrical with apex rounded or acuminate  
 2A. Inner tepals (4-11 cm) longer than outer tepals (2-7 cm)  
 3A. Ovary deeply ribbed, style inconspicuous.....2. *P. vietnamensis*  
 3B. Ovary ribbed, style conspicuous  
 4A. Leaves without purple blotches. Style (2-3 mm) shorter than stigma (6-8 mm)....3. *P. dunniana*  
 4B. Leave abaxially with purple blotches. Style and stigma nearly equal in length (2.5-3.5 mm).....4. *P. cronquistii*  
 2B. Inner tepals (2.5-7.5 cm) shorter or nearly as long as outer tepals (5-9 cm)  
 5A. Free portion of anther connective apex rounded, inner tepals spatulate.....5. *P. xichouensis*  
 5B. Free portion of anther connective apex acuminate, inner tepals linear  
 6A. Inner tepal purple to dark purple, free portion of anther connective 3-4 mm.....6. *P. delavayii*  
 6B. Inner tepal green, yellow green, free portion of anther connective 1-2.5 mm  
 7A. Ovary 4-5 ribbed, horizontal cross section convex polygon.....7. *P. caobangensis*  
 7B. Ovary 5-7 ribbed, horizontal cross section of ovary concave polygon.....8. *P. polyphylla*  
 8A. Inner tepals slightly shorter or as long as outer tepals, not reflexed..... 9. *P. polyphylla* var. *yunnanensis*  
 8B. Inner tepals much shorter than outer tepals, reflexed.....10. *P. polyphylla* var. *chinensis*



Picture 5. Distribution of *Paris* species in Vietnam

1. *P. caobangensis* Y. H. Ji, H. Li & Z. K. Zhou; 2. *P. cronquistii* (Takht.) H. Li; 3. *P. delavayi* Franch.; 4. *P. dunniana* H. Lév.; 5. *P. fargesii* Franch.; 6. *P. polyphylla* var. *yunnanensis* (Franch.) Hand.-Mazz.; 7. *P. polyphylla* var. *chinensis* (Franch.) H. Hara; 8. *P. vietnamensis* (Takht) H.Li; 9. *P. xichouensis* (H. Li) Y. H. Ji, H. Li & Z. K. Zhou

## CONCLUSIONS

Morphological analysis of this study showed that all 8 species with 2 varieties of the genus *Paris* in Vietnam possess unilocular ovary with parietal placenta. Based on the characteristics of inner and outer tepal, free portion of connective apex, stamen, style and ovary, an identification

key for the species of the genus *Paris* in Vietnam is constructed. Information of ecology, distributions and their uses are also reported additionally.

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(Melanthiaceae) in Vietnam using morphological characteristics and PCR-RFLP markers" supported by National Institute of Medicinal Materials.

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## NGHIÊN CỨU ĐẶC ĐIỂM HÌNH THÁI CỦA CHI *Paris* L. (Melanthiaceae) Ở VIỆT NAM

Nguyễn Quỳnh Nga, Phạm Thanh Huyền, Phan Văn Trường, Hoàng Văn Toán

Khoa Tài nguyên dược liệu, Viện Dược liệu

#### TÓM TẮT

*Paris* L., thuộc họ Melanthiaceae, là một chi nhỏ, phân bố chủ yếu ở vùng núi cao từ các tỉnh phía Bắc cho đến Tây Nguyên. Nhiều loài thuộc chi *Paris* là những cây thuốc có giá trị, tuy nhiên, việc chặt phá rừng đã làm thu hẹp môi trường sống, cùng với tình trạng thu gom bán bất hợp pháp trong những năm gần đây đã làm suy giảm nguồn dược liệu quý này. Cho đến nay, các công trình nghiên cứu về đặc điểm hình thái của chi *Paris* (Bảy lá một hoa) ở Việt Nam vẫn chưa đầy đủ. Trong nghiên cứu này, chúng tôi đã mô tả đặc điểm hình thái và xây dựng khóa định loại cho 8 loài và 2 thứ thuộc chi *Paris* ở Việt Nam; bài báo còn cung cấp một số thông tin về đặc điểm sinh thái, phân bố và giá trị sử dụng. Dựa vào các đặc điểm hình thái có thể kết luận các loài thuộc chi *Paris* ở Việt Nam đã thống kê được đều thuộc nhóm bầu 1 ô, noãn dính bên.

*Từ khóa:* Melanthiaceae, *Paris*, đặc điểm hình thái, khóa định loại, Việt Nam.

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