

CAMELLIA HOABINHENSIS (THEACEAE: SECT. CHRYSANTHA), A NEW YELLOW-FLOWERED SPECIES FROM NORTHERN VIETNAM

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Article history

Received: May 14th, 2023

Received in revised form: July 7th, 2023 | Accepted: September 7th, 2023

Available online: December 13th, 2023

Abstract

A new species, *Camellia hoabinhensis* (section *Chrysantha*, *Theaceae*), is described and illustrated based on specimens collected from a lowland forest on limestone hills in Hoa Binh Province, northern Vietnam. The species is characterized by its small habit to 4.5 m tall, large flowers 9.0–9.5 cm in diameter with 18–19 light yellow petals, and hairy filaments, ovaries, and styles. A comparison of the new species with similar species, *C. euphobia*, *C. impressinervis*, *C. phanii*, and *C. velutina*, is provided. The IUCN conservation status of the proposed species is Data Deficient (DD).

Keywords: *Camellia*; *Chrysantha*; Flora; Indochina; Plant taxonomy.

DOI: [http://doi.org/10.37569/DalatUniversity.14.1.1143\(2024\)](http://doi.org/10.37569/DalatUniversity.14.1.1143(2024))

Article type: (peer-reviewed) Full-length research article

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1. INTRODUCTION

Camellia L. is the largest genus of the Theaceae, comprising around 250 species with more than 700 published names (International Plant Names Index, 2021; World Flora Online, 2021). China and Vietnam are known as areas rich in *Camellia* species, in which 95 (54 endemic) and 97 (76 endemic) species are recorded, respectively (Chang & Bartholomew, 1984; Keng, 1962; Le et al., 2020; Ming & Bartholomew, 2007; Orel & Curry, 2015; Pham-Hoang, 1999; Prince, 2007; Prince & Parks, 2001; Stevens et al., 2004). Among the species, approximately 20 yellow-flowered species of *Camellia* belonging to sect. *Chrysantha* Hung T. Chang (1979) have been recorded (Chang, 1979; Hakoda et al., 2007; Le & Luong, 2016; Le et al., 2020; Pham et al., 2019; Tran, 2002; Tran & Luong, 2013). This section's members are still increasing due to the recent discovery of some new species including *C. velutina* V. T. Pham, V. D. Luong & Aver. (Pham et al., 2019). Typical characteristics of sect. *Chrysantha* are distinct pedicels, small floral bracts, yellow flowers, three carpels of gynoecium, and separate styles (Chang, 1979; Chang & Bartholomew, 1984; Hakoda et al., 2007; Le & Luong, 2016; Ming & Bartholomew, 2007; Pham et al., 2019).

In this study, we describe a new species of yellow-flowered *Camellia* sect. *Chrysantha*, *C. hoabinhensis* V. D. Luong, Tran & V. T. Pham, found during our field survey in Hoa Binh Province in 2019.

2. MATERIALS AND METHODS

The field survey was conducted in Hoa Binh Province, northern Vietnam, in November 2019. Specimens were collected from the wild, and photographs were taken. Collecting and fixing specimens followed the usual procedures for botanical specimens (Liesner, 1995; Maden, 1970). To examine the validity of the new species, we consulted taxonomic literature (e.g., Hakoda et al., 2007; Ming & Bartholomew, 2007; Nguyễn et al., 2020; Orel & Curry, 2015; Pham-Hoang, 1999; Pham et al., 2019) and compared the collected specimens with herbarium specimens deposited at DLU, FOF, FU, KAG, and HNU, and with digitized images from virtual herbaria on the web, including A, BR, E, GH, GZU, HUH, K, L, LE, and P (acronyms according to Thiers, 2015).

3. RESULTS

Camellia hoabinhensis belongs to *Camellia* sect. *Chrysantha* based on morphological analysis. The new species is most similar to *C. velutina* V. T. Pham, V. D. Luong & Aver. (2019: 144), *C. impressinervis* Hung T. Chang & S. Ye Liang (1979: 72), and *C. euphlebia* Merr. ex Sealy (1949: 216), but differs in having larger flowers, more petals, longer stamens and styles, ovaries that are hairy in the upper parts, and styles that are sparsely pubescent at the base. Moreover, *C. hoabinhensis* differs from *C. velutina* in having bracteoles that are smaller and pubescent, from *C. impressinervis* in having glabrous leaves and pubescent bracteoles, sepals, and filaments, and from *C. euphlebia* in having fewer bracteoles and pubescent petals.

3.1. Taxonomic treatment

Camellia hoabinhensis V. D. Luong, Tran & V. T. Pham, *sp. nov.* (Figures 1, 2).

Description: Small tree, 4.5 m tall, 6.5 cm DBH, bark brownish gray. Young twigs brown, glabrous. Leaves alternate, petiole 1.0–1.2 cm long, glabrous, blade elliptic to broadly elliptic, 19.5–23.0 × 10.0–10.5 cm, thickly coriaceous, glabrous on both surfaces, adaxial surfaces dark green, glossy, abaxial surfaces light green, apices shortly acuminate, margins serrulate, bases broadly cuneate or rounded, midribs sunken adaxially, prominent abaxially, lateral veins 8–12 pairs, sunken adaxially, prominent abaxially, tertiary veins scalariform-reticulate, prominent abaxially. Flowers light yellow, 9.0–9.5 cm in diam., terminal, pedicels 1.0–1.2 cm long, glabrous, bracteoles 2–4, scale-like, narrowly semi-orbicular, 1.0–1.3 × 3.0–3.5 mm, pubescent on both surfaces. Sepals 4–5, semi-orbicular, adaxial sides slightly concave, dark yellow, 1.1–2.0 × 0.5–1.6 cm, persistent, pubescent on both surfaces, apices rounded. Petals 18–19 in 3 whorled, light yellow, pubescent on both surfaces, recurved in anthesis, petals in the outer whorls 4, elliptic, 1.6–3.5 × 2.3–3.0 cm, those of the middle whorls 8–9, broadly elliptic, 4.0–5.8 × 2.7–3.5 cm, those of the inner whorls 5–7, narrowly elliptic, 4.5–5.2 × 2.0–2.7 cm. Androecium adnate with petals, stamens numerous in 4–5 whorled, 3.5–4.3 cm long, light yellow, connate 1–1.4 cm from the base, inner filaments glabrous, outer filaments pubescent, anthers dark yellow, oblong, approximately 2.5 × 1.5 mm. Gynoecium 3 (–4) carpels, ovaries conical, 3.0 × 4.0 mm, tomentose, styles 3(–4), 3.5–3.8 cm long, free to the base, sparsely pubescent at base, stigma heads approximately 0.4 mm wide. Fruit and seeds not seen.

Distribution, habitat, and ecology: Vietnam, Hoa Binh Province. This species is currently known only from the type locality. *Camellia hoabinhensis* grows in evergreen forests on limestone hills at elevations of approximately 500 m. It flowers from November to January of the following year.

Typus: Vietnam. Hoa Binh Province, Yen Thuy District, Da Phuc Commune, evergreen forest on limestone hills, 20°27'54.3"N 105°33'33.2"E, 500 m elevation, 22 November 2019, *Ninh & Diep 191101* (holotype HNU!).

Etymology: The species epithet refers to Hoa Binh Province, the province where the new species was collected.

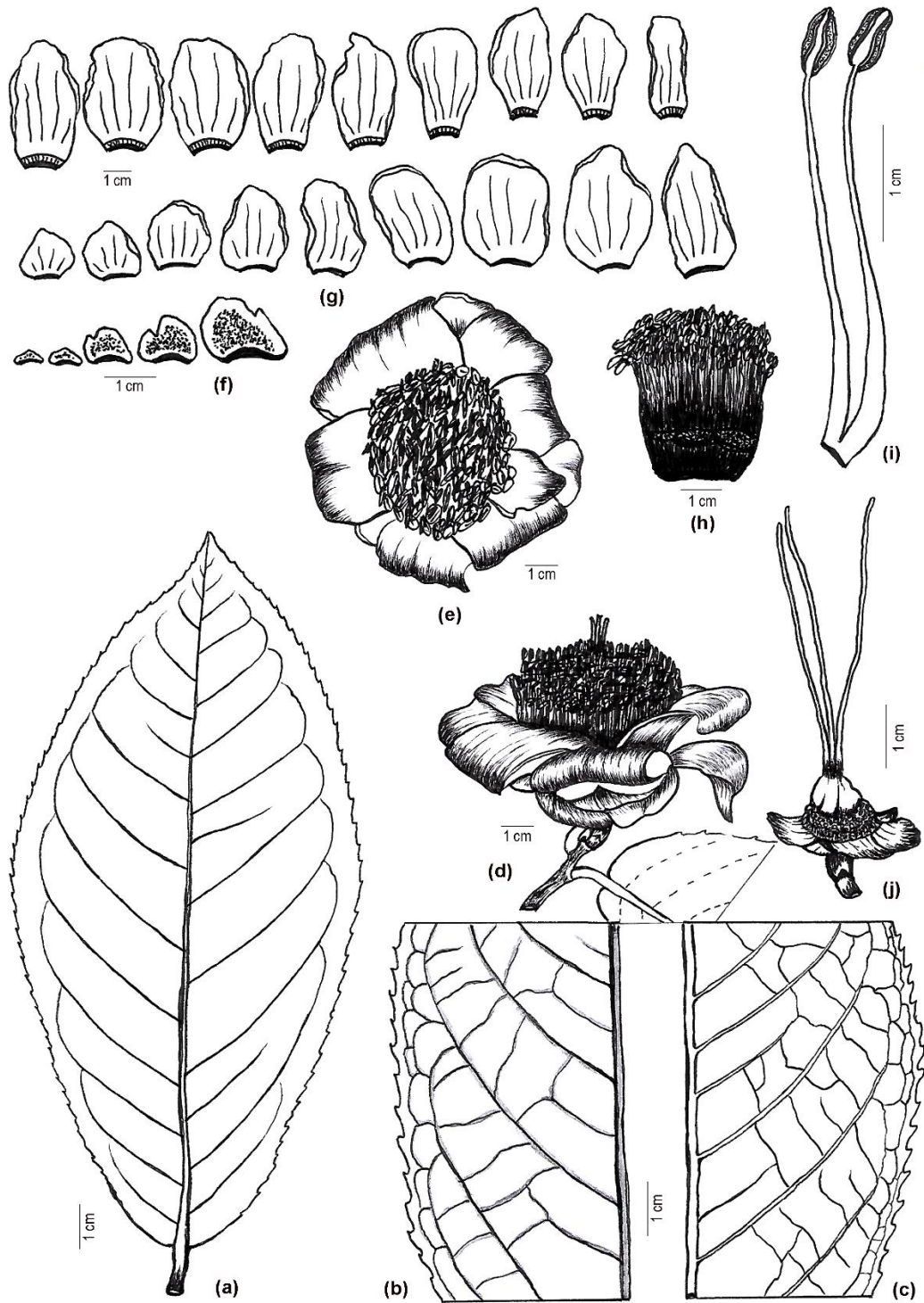


Figure 1. *Camellia hoabinhensis* V. D. Luong, Tran & V. T. Pham

Notes: (a) Leaf, adaxial side; (b, c) Leaf venation detail, adaxial (left) and abaxial (right) side; (d) Flower (lateral view); (e) Flower (front view); (f) Sepals, adaxial side; (g) Petals, adaxial side; (h) Androecium; (i) Stamens; (j) Gynoecium, lateral view.

Source: Drawn by Luong Van Dung from the holotype.



Figure 2. *Camellia hoabinhensis* V. D. Luong, Tran & V. T. Pham (fresh specimens)

Notes: (a, b) Leaves, adaxial (left) and abaxial (right); (c, d) Flowers, front and lateral views;

(e) Sepals, adaxial side; (f) Petals, adaxial side; (g, h) Androecium, outer and inner views;

(i) Stamens; (j) Gynoecium, lateral view.

Source: Photos and color plate prepared by Tran Ninh.

3.2. Comparison of *Camellia hoabinhensis* with closely related species

Camellia hoabinhensis is similar to *C. velutina*, *C. impressinervis*, and *C. euphlebica* in plant size, leaf shape, and yellow flowers. However, it can be easily

distinguished from these species by its larger flowers, many petals, longer stamens, and by being tomentose at ovaries and bases of the styles. In addition, *C. hoabinhensis* differs from *C. velutina* in having smaller and pubescent bracteoles; from *C. impressinervis* in having glabrous leaves (vs. pubescent abaxially) and pubescent bracteoles, sepals, and filaments (only for outer ones); and from *C. euphlebia* in having fewer bracteoles (2–4 in *C. hoabinhensis* vs. (7–)8 in *C. euphlebia*), and pubescent petals (vs. glabrous). A detailed comparison between *C. hoabinhensis*, *C. velutina*, *C. impressinervis*, and *C. euphlebia* is given in Table 1. Moreover, *Camellia hoabinhensis* may resemble *C. phanii* Hakoda & Ninh (2007: 54; 2016: 119) but differs in its elliptic-to-broadly elliptic leaf blades (vs. oblong or oblong-ovate in *C. phanii*), larger flowers (9.0–9.5 cm in diam. in *C. hoabinhensis* vs. 4.0–6.0 cm in diam. in *C. phanii*), longer stamens (3.5–4.3 cm long in *C. hoabinhensis* vs. 1.5–2.3 cm long in *C. phanii*), glabrous inner filaments (vs. pubescent at the base), longer styles (3.5–3.8 cm long in *C. hoabinhensis* vs. 2.2–2.5 cm long in *C. phanii*), and by being tomentose (vs. glabrous) in the upper part of the ovary.

Table 1. Morphological comparison of *Camellia hoabinhensis*, *C. velutina*, *C. impressinervis*, and *C. euphlebia*

Characteristic	<i>C. hoabinhensis</i>	<i>C. velutina</i>	<i>C. impressinervis</i>	<i>C. euphlebia</i>
Leaf blade size (cm)	19.5–23.0 × 10.0–10.5	15.0–22.0 × 5.0–11.0	12.0–18.0(–22.0) × 3.0–8.5	(11.0–)14.0–20.0(–25.0) × (4.5–)5.0–8.0(–15.0)
Hairiness of leaf blade	glabrous on both surfaces	glabrous on both surfaces	glabrous adaxially, sparsely pubescent abaxially	glabrous on both surfaces
Hairiness of petiole	glabrous	glabrous	pubescent	glabrous
Flower diam. (cm)	9.0–9.5	5.0–6.5	approx. 5.0	5.0–6.0
Number of bracteoles	2–4	2(–3)	5 or 6	(7–)8
Bracteole size (mm)	1.0–1.3 × 3.0–3.5	3.0–5.0 × 2.0–4.0	1.0–2.5 × approx. 1.5	1.0–3.0 × 3.0–5.0
Hairiness of bracteole	pubescent on both sides	abaxially velutinous	glabrous	N/A
Number of sepals	4–5	5	5	5
Sepal size (cm)	1.1–2.0 × 0.5–1.6	0.3–1.1 × 0.5–1.7	0.6–1.0 × approx. 1.0	0.4–0.5 × 0.5–0.7
Hairiness of sepals	pubescent on both surfaces	abaxially velutinous	glabrous	abaxially glabrous, adaxially sericeous
Number of petals	18–19	10(–11)	11 or 12	7–9
Shape of petals	narrowly elliptic to broadly elliptic	ovate to broadly ovate	obovate	suborbicular, broadly obovate to obovate-elliptic

Sources: Chang (1979); Ming and Bartholomew (2007); Pham et al. (2019).

Table 1. Morphological comparison of *Camellia hoabinhensis*, *C. velutina*, *C. impressinervis*, and *C. euphlebia* (cont.)

Characteristic	<i>C. hoabinhensis</i>	<i>C. velutina</i>	<i>C. impressinervis</i>	<i>C. euphlebia</i>
Petal size (cm)	1.6–5.8 × 2.0–3.5	1.2–4.5 × 1.5–3.0	approx. 3.0 × 1.5–1.8	2.5–4.0 × 1.0–2.5
Hairiness of petals	pubescent on both surfaces	velutinous on both surfaces	N/A	glabrous
Stamen length (cm)	3.5–4.3	1.5–2.5	approx. 2.0	2.0–3.5
Hairiness on filament	inner filaments glabrous, outer filaments pubescent	glabrous	glabrous	glabrous
Hairiness of ovary	tomentose	glabrous	glabrous	glabrous
Hairiness of style	sparsely pubescent at base	glabrous	glabrous	N/A

Sources: Chang (1979); Ming and Bartholomew (2007); Pham et al. (2019).

3.3. IUCN CONSERVATION STATUS

In our field survey, only one population of *C. hoabinhensis* was found, consisting of 15 flowering individuals, from which we collected the above specimens. During our search, no other herbarium specimens or information about its distribution or habitat were found. We consider the data to be inadequate for risk assessment. The species can be listed as Data Deficient (DD) according to the IUCN Red List 2019 criteria (IUCN, 2019). The habitat of *C. hoabinhensis* is not included in a protected area and has been highly impacted by large-scale deforestation for forest-farming activities. We urgently need additional investigation to accurately know the locations of populations and the total number of individuals of *C. hoabinhensis* in the area.

4. DISCUSSION

Vietnam has a high diversity of *Camellia*, and many new species of *Camellia* have been discovered in Vietnam in recent years. Among the 97 recorded species in the country, nearly 50 were published in the two last decades (Le et al., 2020). However, we still need to increase our knowledge of this genus. This ongoing research should prove to be significant in furthering our knowledge of species diversity and the need for habitat protection for *Camellia* species in Vietnam. Moreover, yellow-flowered camellias have been recognized as having potential value for use in medicine and pharmaceuticals. Recent studies have shown that the chemical constituents of some species of yellow-flowered *Camellia* have anticancer, antioxidant, and antibacterial activities (Ge et al., 2019; Lin et al., 2013; Song et al., 2011). Therefore, this study offers opportunities for further medical and pharmaceutical studies.

5. CONCLUSION

A new species, *Camellia hoabinhensis*, was discovered and described through fieldwork and subsequent taxonomic study. This species is characterized by its large yellow flowers. However, its habitat in the limestone forest of Yen Thuy District is not protected and is severely impacted by human activities such as logging and forest farming. The new species is also at risk from *Camellia* enthusiasts who collect specimens from the wild for horticultural purposes because of its large, attractive flowers. Further studies of the systematic evolution and potential medicinal properties of this species would be valuable.

ACKNOWLEDGMENTS

The authors would like to thank Mr. Bui Phi Diep for his assistance in the fieldwork.

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