

# Camellia vanlangensis (Theaceae, Sect. Archecamellia), a new yellow-flowered species from Vietnam

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ABSTRACT: A new plant species, *Camellia vanlangensis*, belonging to the *Archecamellia* section is described from Thanh Hoa Province, northern Vietnam. It grows up to 8 m tall and has big golden yellow flowers up to 8 cm wide. The flower is a solitary, subterminal, cup-shaped, with glabrous pedicel, 5–6 persistent bracteoles, 9–10 persistent orange-green sepals, and 10–11 petals. It has 130–150 stamens in 5 whorls, glabrous 3–5-loculed ovary, 3–5 distinct styles, 5-rigged and apex sunken of capsule. A detailed comparison between new species and two close related species, *C. impressinervis* and *C. calcicola*, is provided. Preliminary IUCN conservation status of this species is assigned as Critically Endangered (CR).

KEY WORDS: Camellia calcicola, Camellia impressinervis, endangered species, flora, plant taxonomy, Van Lang, yellow flowers.

#### INTRODUCTION

The genus Camellia L. (1753) holds the distinction of being the largest genus within the Theaceae family, with over 300 accepted species and more than 750 published names according to the Plants of the World Online < https://powo.science.kew.org/>. Notably, China and Vietnam are considered to be the areas with the highest abundance of Camellia species. There are 161 Camellia species recorded in China (including 54 endemics) and 97 species recorded in Vietnam (including 76 endemics) (Phạm, 1999; Prince, 2007; Ming and Bartholomew, 2007; Orel and Curry, 2015; Le et al., 2020; Pang et al., 2022). Recent research has identified over 30 unique species of Camellia that produce yellow blooms and are native to Vietnam (Ninh, 2002; Hakoda et al., 2007; Tran and Luong, 2013; Le and Luong, 2016; Pham et al., 2019; Do et al., 2019; Le et al., 2020; Nguyễn et al., 2020).

During our recent explorations in Thanh Hoa Province, we discovered a unique *Camellia* species with yellow flowers in a primary forest. After examining the specimens, we found that it belongs to Sect. *Archecamellia* Sealy due to its morphological characteristics. Sect. *Archecamellia* is distinguished by its axillary or subterminal flowers, which are solitary or rarely paired and medium in size, thick and erect pedicels, 5–10 persistent bracteoles, persistent sepals, yellow or pale yellow corolla (rarely red), inner petals basal connate and adnate to the androecium, stamens in 3–5 whorls with filiform, puberulent or glabrous filaments, and basal 1/2 of outer whorl connate into a tube, sunken or 3–5-lobed ovary apex, 3–5 distinct styles, and sunken capsule apex (Sealy, 1958; Ming and Bartholomew, 2007). The

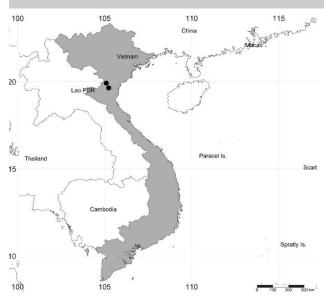
Camellia plants in the Thanh Hoa Province have unique characteristics that have not been observed in any other known species. As a result, we have classified and introduced this newfound species as *C. vanlangensis* V.D. Luong & V.T. Pham.

### **MATERIAL AND METHODS**

In 2021, a field survey was conducted in Thanh Hoa Province, northern Vietnam (Fig. 1). The specimens and images were acquired and fixed using the accepted practices for botanical specimens from the wild (Liesner, 1995; Maden, 1970). To ensure the validity of the new species, we consulted the relevant taxonomic literature (Sealy, 1958; Pham, 1999; Ninh, 2002; Prince, 2007; Ming and Bartholomew, 2007; Hakoda et al. 2007; Tran and Luong, 2013; Orel and Curry, 2015; Le and Luong, 2016; Pham et al., 2019; Do et al., 2019; Nguyễn et al., 2020; Le et al., 2020). We compared them with herbarium specimens deposited at DLU, HNU, and VASF and digitized images from virtual herbaria on the web, including A, GH, HUH, BR, E, GZU, K, L, LE, P (acronyms according to Thiers, accessed 2023). Plant terminology followed by Harris and Harris (1994). The specimens were deposited at DLU and VAFS, and the new scientific name followed the International Code of Nomenclature for algae, fungi, and plants (Turland et al., 2018). GeoCAT was used to analyze the species' Extent of Occurrence and Area of Occupancy, and the conservation status was assessed based on IUCN Standards and Petitions Subcommittee criteria (Bachman et al., 2011; IUCN, 2019).

Vol. 68, No. 4





**Fig. 1.** Distribution of *Camellia vanlangensis* V.D. Luong & V.T. Pham in Vietnam (closed circle).

### TAXONOMIC TREATMENT

Camellia vanlangensis V.D. Luong & V.T. Pham, sp. nov. Figs. 2–4

*Type*: VIETNAM, Thanh Hoa Province: Lang Chanh District, Giao An Commune, primary closed evergreen broad-leaved mixed with bamboo forest with highly impacted, around point 20°03′23.4″N, 105°14′46.6″E, at elevation 800 m, 26 October 2021, *Trinh Ngoc Bon and Pham Binh Nguyen Bon211101* (holotype: DLU; isotype: VAFS); 26 August 2022, *Pham Van The and Pham Binh Nguyen PVT1033* (paratype: VAFS).

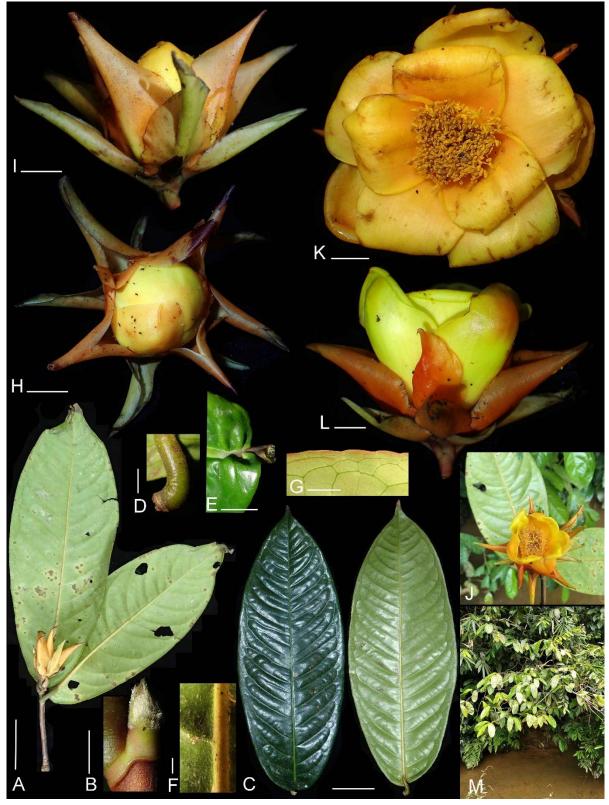
*Diagnosis:* The new species most differs from *Camellia impressinervis* Hung T.Chang & S.Ye Liang (1979) with its cordate leaves base (*vs.* rounded to obtuse), more secondary leaf veins (16–22 *vs.* 9–11 pairs), longer sepals (3.5–4.3 *vs.* 0.1–1.0 cm), and larger capsules 4–5 *vs.* 3 cm. It's most distinct from *C. calcicola* T.L.Ming (1993) by its sparse tomentose on leaves (*vs.* glabrous in adaxial and pubescent in abaxial surfaces), longer sepals (3.5–4.3 *vs.* 0.9–1.4 cm), glabrous petals and filaments (*vs.* pubescent), and glabrous ovary and style (*vs.* pubescent).

**Description:** Evergreen tree, 5–8 m tall, trunk ca. 15 cm in diam. at base, with sparse and wide canopy, bark dark green with large white-grey patches, young branches ca. 0.5 cm in diam., red, later dark green, sparsely tomentose, terminal buds small, conical, ca. 0.3 cm in diam., outside surface white hirsute. **Leaves** petioles stout, curved, 15–19 mm long, 4–5 mm in diam., red and hirsute when young, dark green and sparsely tomentose when old, blades thinly leathery, elliptic to oblong-elliptic, 25–33 cm long, 7.5–12.5 cm wide, adaxial surface glabrous, shiny and dark green, abaxial surface pale green, sparsely tomentose, apex acuminate, base cordate, plicate, margin entire to slightly serrulate, slightly revolute, secondary

veins not reaching to the margins, distinct on both surfaces, adaxially sunken, abaxially prominent, midrib red and pubescent abaxially when young, yellow-green and sparsely tomentose when old, secondary veins 16–22 pairs. Flower buds bright yellow, elliptic, ca. 3.5 cm long, 2.5 cm in diam. Flowers solitary, subterminal, cupshaped, 5-8 cm in diam., golden yellow, pedicels ca. 1 cm long, 0.3 cm in diam., covered with bracteoles and sepals, glabrous. Bracteoles 5-6, sometimes dried in flower buds stage, persistent, variable in size and shape, suborbicular, deltoid, ovate, broadly elliptic, smallest one ca. 0.6 cm long and 0.7 cm wide, biggest one 3.2 cm long and 1.0 cm wide, dark-green to light green, orange or orange-red, concave, adaxial surface almost glabrous except for base, abaxial surface sparsely tomentulose, base rounded, apex acute, margins ciliate, involute. Sepals 9-10, sometimes dried in flower buds stage, persistent, deltoid, ovate to elliptic, 3.5–4.3 cm long, 1.0– 3.0 cm wide, orange-green to orange-red, concave, adaxial surface almost glabrous except for base, abaxial surface sparsely tomentulose, apex acute, margins ciliate, strongly involute. **Petals** 10–11, orbicular to broadly obovate, 2.8– 4.3 cm long, 1.8-3.1 cm wide, glabrous on both sides, united with androecium at 0.8–1.4 cm from the base, shiny, concave, apex round. Androecium glabrous, stamens 130–150, 5 whorls, filaments 25–37 mm long, ca. 0.6 mm in diam., outer ones basally connate into a tube for 19-23 mm long from base, anthers 2.6–4.0 mm long, 1 mm wide, golden yellow. **Gynoecium** glabrous, yellow, ovary 3–5loculed, conical, angled, 3.6–4.6 mm long, 4.0–5.5 mm in diam., styles 3–5, free from base, 25–28 mm long. Capsule subglobose, 4-5 cm in diam., surface rough, distinctly 5rigged, sunken at apex. Seed 1 in each locule, subglobose or globose-trigonous, 2-2.3 cm in diam., more or less smooth, dark brown, glabrous.

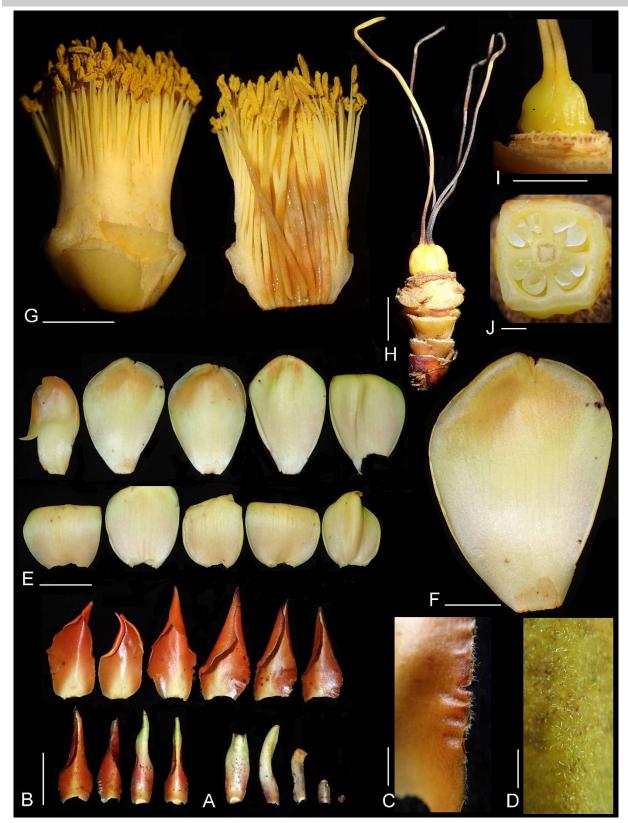
Distribution, habita, and phenology: Camellia vanlangensis was found in a primary evergreen broadleaved mixed with bamboo forest and highly impacted at elevation around 800 m in Lang Chanh and Nhu Xuan Districts, Thanh Hoa Province (Fig. 1). It grows along stream valley or a shady place on the slope of a mountain with many outcrop rocks. In this area, it grows with Angiopteris sp. (Marattiaceae), Asplenium nidus (Aspleniaceae), Cyathea sp. (Cyatheaceae), Tectaria decurrens, Tectaria sp. (Tectariaceae), Musa sp. (Musaceae), Leea sp. (Vitaceae), Homalomena sp. (Araceae), Arenga sp. (Arecaceae), Costus (Costaceae), *Pollia* sp., *Commelina* sp. (Commelinaceae), Trevesia sp. (Araliaceae), Curculigo sp. (Hypoxidaceae), Xanthophytum sp. (Rubiaceae), Aglaonema sp., Pothos sp., Rhaphidophora sp. (Araceae), Garcinia sp. (Clusiaceae), Alpinia sp. (Zingiberaceae), Saurauia sp. (Actinidiaceae), Piper sp. (Piperaceae), Phoebe sp. (Lauraceae), Liparis sp. (Orchidaceae), Hopea chinensis (Dipterocarpaceae). Flowering in October to December, fruiting in December to August of next year.





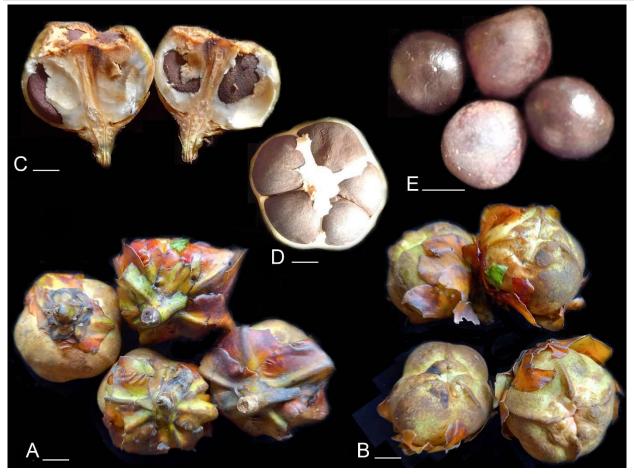
**Fig. 2.** *Camellia vanlangensis* V.D. Luong & V.T. Pham and its natural habitat **A**. Branch with flower bud; **B**. Vegetative bud; **C**. Adaxial (left) and abaxial (right) leaf surfaces; **D**. Petiole; **E**. Leaf base; **F**. Part of abaxial leaf surface showing sparsely tomentose; **G**. Leaf blade margin; **H**. Flower bud (top view); **I**. Flower bud (lateral view); **J**. Flowering branch; **K**. Flower (top view); **L**. Flower (lateral view); **M**. Habitat. Scale bars: A, C = 5 cm; B, D, G = 0.5 cm; E, H, I, K, L = 1 cm; F = 1 mm. Photos by N.B. Trinh and B.N. Pham, design by V.T. Pham (*Trinh Ngoc Bon and Pham Binh Nguyen Bon 211101*).





**Fig. 3.** Floral parts of *Camellia vanlangensis* V.D. Luong & V.T. Pham **A.** Bracteoles; **B.** Sepals; **C–D.** Part of adaxial (left) and abaxial (right) sepal surfaces; **E.** Petals (adaxial surface); **F.** Close up of a petal (adaxial surface); **G.** Outer view (left) and inner view (right) of androecium; **H.** Gynoecium attached on receptacle; **I.** Ovary (lateral view); **J.** Ovary (cross-section). Scale bars: A, B, E = 2 cm; C, D, H, I = 0.5 cm; F, G = 1 cm; J = 1 mm. Photos by N.B. Trinh, design by V.T. Pham (*Trinh Ngoc Bon and Pham Binh Nguyen Bon 211101*).





**Fig. 4.** Fruits and seeds of *Camellia vanlangensis* V.D. Luong & V.T. Pham **A.** Fruits (bottom view); **B.** Fruits (top view); **C.** Fruits (longitudinal section); **D.** Disected fruit with five seeds inside; **E.** Seeds. Scale bars: A–E = 1 cm. Photos by B.N. Pham, design by V.T. Pham (*Pham Van The and Pham Binh Nguyen PVT1033*).

*Etymology*: The epithet "vanlangensis" refers to an ancient name of Vietnam, Van Lang.

Proposed Vietnamese name: Trà hoa vàng Văn Lang IUCN Conservation status: Currently, Camellia vanlangensis is known from two populations in Thanh Hoa Province. One of which is in Lang Chanh District where the type specimens were collected. The other one was recorded by local people with video evidence in Nhu Xuan District (Fig. 1). Its habitats do not belong to any protected area and are severely fragmented by farming, selected timber cutting, firewood and collecting nontimber forest products. It also is seriously threatened by Camellia enthusiasts. Based on the criteria from the IUCN Standards and Petitions Subcommittee (2019), the extent of occurrence (EOO) is less than 1 km² and the area of occupancy (AOO) is 8,000 km². This falls under the Critically Endangered (CR) with B1ab(i-iv) + B2ab(i-iv).

**Remarks:** In the Sect. Archecamellia, the characteristic of ovary indumentum is one of the key characters for species identification (Ming and Bartholomew, 2007). There are about 23 species in this section including 13 species in Vietnam and nine species in China (Gagnepain,

1943; Pham, 1999; Ming and Bartholomew, 2007; Orel and Curry, 2015; Do et al., 2019; Zhao, 2019; Nguyễn et al., 2020; Nguyen et al., 2023). In general, the new species, Camellia vanlangensis is different from the following species in the section by its glabrous ovary (vs. the following species are tomentose): C. cattienensis Orel (2012), C. chrysanthoides Hung T.Chang (1979), C. granthamiana Sealy (1956), C. maianhii Curry, VD Luong & ND Do in Nguyen et al. (2023), C. megasepala Hung T.Chang & Trin Ninh in Chang (1996), C. micrantha S.Ye Liang & Y.C.Zhong (1988), C. pukhangensis, and C. puhoatensis (Gagnepain, 1943; Ming and Bartholomew, 2007; Orel and Wilson, 2011; Zhao, 2019; Do et al., 2019; Nguyễn et al., 2020; Nguyen et al., 2023). At the same time, the new species stands out from other species in the section due to its striking golden yellow flowers. While, the following species typically exhibit red, white, or yellowish-white colorings: C. amplexicaulis (Pit.) Cohen-Stuart (1916), C. indochinensis Merr. (1939), C. krempfii (Gagnep.) Sealy (1949), and *C. lucii* Orel & Curry (2015) (Gagnepain, 1943; Pham, 1999; Ming and Bartholomew, 2007; Nguyen et al., 2023).

Taiwania Vol. 68, No. 4



Table 1. Morphological characteristic comparison of *Camellia vanlangensis*, *C. impressinervis* and *C. calcicola* (Gagnepain, 1943; Ming and Zhang, 1993; Ming and Bartholomew, 2007; Do et al., 2019)

Characters	C. vanlangensis	C. impressinervis	C. calcicola
Leaf			
Indumentum	sparsely tomentose in abaxial surfaces	sparsely hair in abaxial surfaces	glabrous in adaxial and pubescent in abaxial surfaces
Base	cordate	rounded to obtuse	cordate
Margins	entire to slightly serrulate	strong serrulate	sharply serrate
No. of secondary veins (pairs)	16–22	9–11	16–20
Flower			
Sepal length (cm)	3.5-4.3	0.1–1.0	0.9–1.4
Sepal indumentum	abaxial surface sparsely tomentulose	glabrous in both sides	pubescent on both sides
Petal indumentum	glabrous on both sides	-	pubescent on both sides
Petal size (cm)	2.8-4.3 × 1.8-3.1	1.3–3.0 × 0.9–1.8	0.9-1.4 × 0.7-1.0
Androecium			
Filament indumentum	glabrous	glabrous	pubescent at the base of inner filaments
Gynoecium			
Ovary locule	3–5	3	3
Ovary indumentum	glabrous	glabrous	pubescent
Style number	3–5	3	3
Style indumentum	glabrous	-	pubescent at the lower part
Capsule			
Diameter (cm)	4–5	3	-

In addition, Camellia vanlangensis is distinguished from the following species in the section by characteristics of its young branches, petioles, and the abaxial surfaces of their leaves are sparsely tomentose covered (vs. glabrous surfaces for those parts): C. aurea Hung T.Chang (1979), C. euphlebia Merr. ex Sealy (1949), C. fascicularis Hung T.Chang (1991), C. flavida Hung T.Chang (1981), C. huana T.L.Ming & W.J.Zhang (1993), C. petelotii (Merr.) Sealy (1949), C. pingguoensis D.Fang (1980), C. pleurocarpa, C. rostrata S.X.Yang & S.F.Chai (2020) (Gagnepain, 1943; Phạm, 1999; Ming and Bartholomew, 2007; Liu et al., 2020).

On the other hand, the new species is most similar to Camellia impressinervis and C. calcicola in young branches and petioles tomentose, more or less the same the size of flowers, large and numerous bracteoles and sepals, and numerous of filaments. However, the new species can be distinguished from C. impressinervis by the following characteristics: leaves base cordate (vs. rounded to obtuse), leaves margins entire to slightly serrulate (vs. strong serrulate), more number of secondary leaves veins (16-22 vs. 9-11 pairs), longer sepals (3.5-4.3 vs. 0.1-1.0 cm), sparsely tomentulose in abaxial surface of sepals (vs. glabrous in both sides), and larger capsules (4–5 vs. 3 cm). Meanwhile, the new species can be separated from C. calcicola in abaxial surfaces of leaves sparsely tomentose (vs. glabrous in adaxial and pubescent in abaxial surfaces), entire to slightly serrulate of leaves margins (vs. sharply serrate), longer sepals (3.5– 4.3 vs. 0.9-1.4 cm), abaxial surface of sepals sparsely tomentulose (vs. pubescent on both sides), glabrous on both sides of petals (vs. pubescent on both sides), larger petals (2.8–4.3  $\times$  1.8–3.1 vs. 0.9–1.4  $\times$  0.7–1.0 cm), glabrous filaments (vs. pubescent at the base of inner filaments), glabrous ovary (vs. pubescent), and glabrous style (vs. pubescent at the lower part). A thorough comparison between the new species, *C. impressinervis* and *C. calcicola* is presented in Table 1.

## **ACKNOWLEDGMENTS**

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