



## *Camellia tuyenquangensis* (Theaceae), a new species from Vietnam

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**ABSTRACT:** *Camellia tuyenquangensis* (Theaceae), a new yellow species of camellia from the Chiem Hoa district of the Tuyen Quang province in Vietnam, is described and illustrated. *Camellia tuyenquangensis* is similar to *Camellia luongii* but different from the latter species in several morphological features: leaves oblong-ovate to narrow elliptic; flowers 1–2; bracteoles glabrous on both sides; sepal margins ciliate; style cleft one half of the length. The morphological data provisionally support its placement in *Camellia* sect. *Chrysantha* Chang.

**Keywords:** *Camellia*, new species, Theaceae, Vietnam

Vietnam is located on the Indochina peninsula in Southeast Asia. It has a tropical monsoon climate, with humidity averaging at 84 percent throughout the year. Three quarters of Vietnam's territory are made up of low mountains and hilly regions. Therefore, the natural conditions of Vietnam have been identified as favorable for *Camellia* species. The wild *Camellia* were discovered in many parts of Vietnam's territory, stretching from north to south. The colors of their flowers are white, pink, red, and yellow. Of them, the yellow *Camellia* are rare and have the considerable economic potential for its colorful beauty.

In the world, the number of species in *Camellia* genus was estimated to be from 120 to 300 (Sealy, 1958; Chang and Bartholomew 1984; Ming and Bartholomew 2007) and this genus is the largest genus of the Theaceae. Recently, many additional new species of *Camellia* have been discovered and described from Vietnam (Ninh et al., 2012; Orel et al., 2012, 2014; Ninh and Dung, 2013; Orel and Curry 2014; Ninh and Ninh, 2015; Luong et al., 2016).

A total number of Vietnamese yellow *Camellia* species recorded until now is about 40 species (Ninh and Dung, 2016).

Mostly, the yellow *Camellia* of Vietnam are rare and highly endemic, however, they are not so many in individual numbers and narrowly distributed. Many yellow *Camellia* species in northern Vietnam are being exploited to eradicate in the wild.

Based on several our surveys in the last two years, many yellow *Camellia* samples were obtained in the north Vietnam. Among them, a number of individuals recorded from Chiem Hoa district, Tuyen Quang province are distinctive. After analyzing and comparing the morphological characteristics with close species, we assert that it is a new species, named as *Camellia tuyenquangensis*.

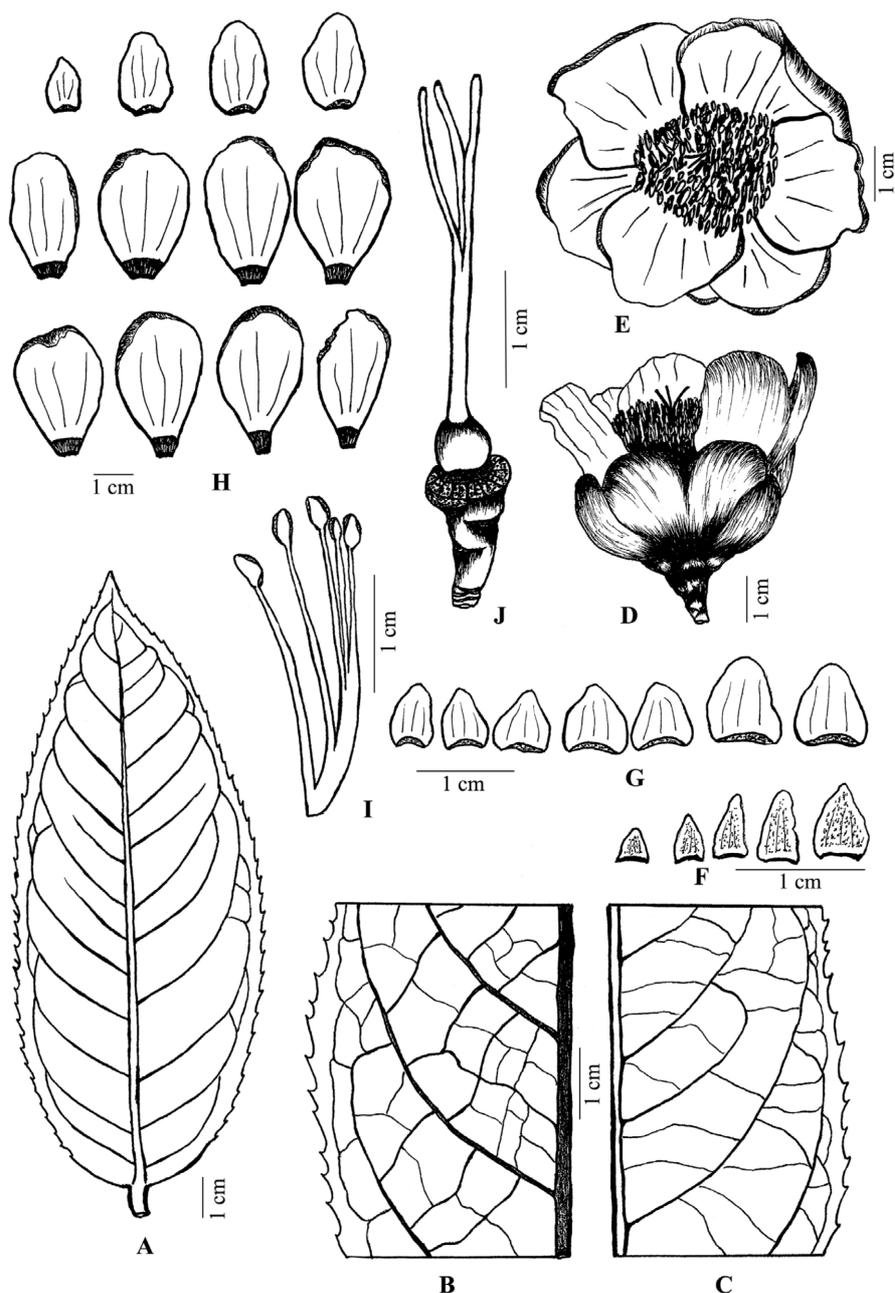
### Taxonomic Treatment

*Camellia tuyenquangensis* D. V. Luong, N. N. H. Le & N. Tran, sp. nov. (Figs. 1, 2).

**TYPE:** VIETNAM. Tuyen Quang province: Chiem Hoa district, 25 Oct 2016 (fl), *Luong Van Dung 161101* (holotype, DLU; isotype, SING).

Shrub, 5–6 m tall; young branches light brown, glabrous;

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**Fig. 1.** *Camellia tuyenquangensis* D. V. Luong, N. N. H. Le & N. Tran. **A.** Leaf, adaxial view. **B.** Venation detail of leaf (abaxial surface). **C.** Venation of leaf (adaxial surface). **D.** Flower, side view with some petals removed. **E.** Flower, top view. **F.** Bracteoles (inner surfaces shown). **G.** Sepals (inner surfaces). **H.** Petals (inner surfaces), outer whorl in top row, followed by middle and inner whorls. **I.** Stamens. **J.** Pedicel and gynoecium (other floral parts removed). Drawn by Dung Van Luong.

old branches white-grey. Leaves simple, alternate; petioles 10–15 mm long, glabrous; blades thick and coriaceous, oblong-ovate to narrow elliptic, 14–18 cm long, 5–8 cm wide, apex acute or acuminate, bases rounded, margins serrate and sometime serrulate at the upper part, adaxial surface green, glabrous and not shining, abaxial surface yellowish green and glabrous, lateral veins 9–11 pairs, sunken adaxially, protruding

abaxially. Flowers 1 or 2, terminal or axillary, 5.5–6.0 cm in diam.; pedicels 10 mm long, glabrous. Bracteoles 4–5, broadly triangular, overlapping, margins ciliate, glabrous on both sides, 3–6 mm long and 2.5–4 mm wide. Sepals 7, spiral, broadly triangular or elliptic, 7–11 mm long and 4.5–9 mm wide, margins ciliate, glabrous on both sides. Petals 12, yellow, glabrous, lateral veins 9–11 pairs, sunken adaxially, protruding abaxially. Flowers 1 or 2, terminal or axillary, 5.5–6.0 cm in diam.; pedicels 10 mm long, glabrous. Bracteoles 4–5, broadly triangular, overlapping, margins ciliate, glabrous on both sides, 3–6 mm long and 2.5–4 mm wide. Sepals 7, spiral, broadly triangular or elliptic, 7–11 mm long and 4.5–9 mm wide, margins ciliate, glabrous on both sides. Petals 12, yellow, arranged in 3 whorls; the outer whorl 4, elliptic, 17–30 mm



**Fig. 2.** *Camellia tuyenquangensis* D. V. Luong, N. N. H. Le & N. Tran. **A.** Leafy branch. **B.** Flower, top view. **C.** Pedicel, part of androecium and gynoecium revealed after removing other floral parts (Photos: Dung Van Luong).

long, 13–20 mm wide, the middle whorl 4, elliptic, obovate, 38–45 mm long, 23–33 mm wide, the inner whorl 4, basally connate for 5–6 mm, obovate, elliptic, 42–45 mm, 24–30 mm wide, glabrous on both sides. Stamens 250, in 4–5 whorls, outer whorl connate for 10–14 mm at the base, adnate to petal bases, anthers yellow, 2–2.5 mm; filaments glabrous, 25–30 mm long. Ovaries 3-locular, ovoid, 5 mm long, 5 mm wide, glabrous; styles 30 mm long, 3-cleft to middle or 3-cleft half the length of style. Fruit not seen.

**Etymology:** The specific epithet of the new species refers to the location of discovery, Tuyen Quang province, Vietnam.

**Distribution and phenology:** This species was found in the forest of Chiem Hoa district, Tuyen Quang province, at the elevations of 500–800 m. It was collected with the flowers in October. No mature capsules or seeds were evident. It grows mixed with other species such as: *Caryodaphnopsis tonkinensis*, *Litsea dilleniifolia*, *Fernandoa collignonii*, *Bursera tonkinensis*, *Diospyros mollis*, and *Phoebe macrocrpa*, etc.

### IUCN Red List category

The Area of Occupancy (AOO) for *C. tuyenquangensis* is

estimated to be less than 1 km<sup>2</sup>. Despite a thorough survey of the area around the type locality, only eight additional mature trees were found. The total known population of the species is consisted of fewer than 50 individuals, and it would be qualified as Critically Endangered (CR) under criterion D (IUCN, 2011).

**Notes:** This is one of very few yellow *Camellia* species in the world that have a gynoecium with cleft styles. This is known in just five other species, including *Camellia capitata* Orel, Curry and Luu, *C. luteopallida* Luong, Nguyen and Luu, *C. oconoriana* Orel, Curry and Luu, *C. pubipetala* Wan and Huang and *C. luongii* Tran and Le. Comparison of these species with *C. tuyenquangensis* is shown in Table 1.

*Camellia tuyenquangensis* is most similar to *C. luongii*, but different from those characters as leaves oblong-ovate to narrow elliptic; flowers 1–2; bracteoles glabrous on both sides; sepals margins ciliate; style cleft 1/2 the length.

In having yellow flowers with a 3-carpellate ovary, *C. tuyenquangensis* generally resembles many other yellow *Camellia* species that are placed in sections *Arhecamellia*, *Bidoupia*, *Capitata*, *Chrysantha*, *Corallinae*, *Obovoidea*, *Piquetia*, and *Thea*. However, *Camellia tuyenquangensis*

**Table 1.** Morphological comparison of *Camellia tuyenquangensis* with *C. capitata*, *C. luteopallida*, *C. pubipetala* and *C. luongii* (data partly based on Luong et al. 2016, Ninh and Ninh 2015, Orel et al. 2014, Chang and Bartholomew 1984).

Characters	<i>C. tuyenquangensis</i>	<i>C. capitata</i>	<i>C. luteopallida</i>	<i>C. pubipetala</i>	<i>C. luongii</i>
Young branches, hairiness	Glabrous	Pubescent	Glabrous	Densely hirsute	Glabrous
Leaf blade, shape	Narrow-ovate, sometimes elliptic	Elliptic to ovate, sometimes obovate	Elliptic to ovate	Elliptic	Broad elliptic, elliptic to narrow elliptic
Leaf apex, shape	Acute or acuminate	Cuspidate, acute on smaller leaves	Cuspidate or acuminate	Caudate, rarely abruptly acuminate, apiculate	Acuminate
Leaf base, shape	Rounded	Obtuse, subcordate, acute in less developed leaves	Obtuse or cuneate	Rounded to cuneate	Rounded to cuneate
Leaf blade, hairiness	Glabrous both sides	Glabrous above, finely and sparsely hairy below	Glabrous both sides	Glabrous above, densely villous below	Glabrous both sides
Petiole, hairiness	Glabrous	Finely white hairy	Glabrous	Densely hirsute	Glabrous
Flowers, number and position	1–2, terminal or axillary	Clusters of 9–12(–14), terminal	1 or rarely 2, terminal	1, seldom 2, terminal or axillary	1, terminal or axillary
Pedicel, length	10 mm	(sessile)	(subsessile)	(subsessile)	15 mm
Bracteoles and sepals, hairiness	Glabrous on both sides, margins ciliate	Finely tomentose, also hairy on margins	Hairy on both sides	Outer surfaces puberulent, margins short ciliate	Outer surface glabrous; white, minutely and scattered ciliolate; inner surface with finely white puberulous, sometime glabrous
Petals, hairiness	Glabrous on both sides, margins hairless	Glabrous on both sides	Dense appressed brown hairs on both sides	Outside puberulent	Glabrous on both sides
Filaments, hairiness	Glabrous	Glabrous	Sparsely hairy at base	Puberulent	Glabrous
Ovary, hairiness, locules and shape	Glabrous, 3-locular, ovoid	Glabrous, 3-locular; roughly triangular, ridged	Glabrous, 3-locular, ovoid, 3-lobed	Densely puberulent, 3–4-locular, subglobose	Glabrous, 3-locular, ovoid
Style, hairiness, extent to which cleft	Glabrous, 3-cleft, clefts c. 1/2 style length	Glabrous, 3-cleft, clefts c. 4/5 style length	Dense white appressed hairs, 3-cleft, clefts c. 4/5 style length	Puberulent, 3–4-cleft, clefts c. 1/3 style length	Glabrous, 3, free to the base

shares most morphological characteristics with *Camellia* section *Chrysantha* Chang (Chang and Bartholomew, 1984), including medium to large yellow pedicellate flowers, 5 bracts, 7 persistent sepals, 12 petals, stamens in 4 whorls with basally connate filaments in the outer whorl and free filaments in the inner whorls, a 3-locular glabrous ovary, and styles cleft into 3 parts. The flowers of *Camellia tuyenquangensis* differ from other species in section *Chrysantha* only in having both axillary and terminal (not strictly axillary) flowers and 4–5 (not 5–7) bracteoles.

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### Literature Cited

- Chang, H. T and B. Bartholomew. 1984. *Camellias*. B.T. Bastford Ltd., London, 211 pp.
- IUCN. 2011. International union for conservation of nature, red list categories and criteria, ver. 3.1. Retrieved Mar. 2, 2011, available from <http://www.iucnredlist.org>.
- Luong, V. D., H. T. Luu, T. Q. T. Nguyen and Q. D. Nguyen. 2016. *Camellia luteopallida* (Theaceae), a new species from Vietnam. *Annales Botanici Fennici* 53: 135–138.
- Ming, T. L. and B. Bartholomew. 2007. Theaceae. In *Flora of China*. Vol. 12. Hippocastanaceae through Theaceae. Wu, Z.-Y. and P. H. Raven. (eds.), Science Press, Beijing and Missouri Botanical Garden Press, St. Louis, MO. Pp. 366–478.
- Ninh, L. N. H and L. V. Dung. 2016. General information about the Yellow *Camellia* species in Vietnam. In *Proceedings of Dali International Camellia Congress*. International Camellia Society, Dali, Yunnan, China.
- Ninh, T., N. Hakoda and L. V. Dung. 2012. A new species of yellow *Camellia* (sect. *Piquetia*) from Vietnam. *International Camellia Journal* 44: 161–162.
- Ninh, T. and L. V. Dung. 2013. *Camellia dilinhensis*: A new yellow species from Vietnam. *International Camellia Journal* 45: 87–89.
- Ninh, T. and L. N. H. Ninh. 2015. A new yellow *Camellia* species from North of Vietnam. *International Camellia Journal* 47: 36–39.
- Orel, G., P. G. Wilson, A. S. Curry and L. H. Truong. 2012. *Camellia inusitata* (Theaceae), a new species forming a new section (*Bidoupia*) from Vietnam. *Edinburgh Journal of Botany* 69: 347–355.
- Orel, G. and A. S. Curry. 2014. A new species of *Camellia* section *Dalatia* (Theaceae) from Vietnam. *Telopea* 17: 99–105.
- Orel, G., P. G. Wilson, A. S. Curry and L. H. Truong. 2014. Four new species and two new sections of *Camellia* (Theaceae) from Vietnam. *Novon* 23: 307–318.
- Sealy, J. R. 1958. A Revision of the Genus *Camellia*. Royal Horticulture Society, London, 239 pp.