Two new species of *Camellia* (Theaceae) from Vietnam

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**ABSTRACT:** Two new species of *Camellia* (Theaceae) are described from Vietnam: *Camellia vuquangensis* Luong, Tran & L. T. Nguyen and *Camellia hatinhensis* Luong, Tran & L. T. Nguyen. The new taxa were collected from Vu Quang National Park in the center of Vietnam. The new finds are morphologically dissimilar to all known Camellia species. Recent Camellia discoveries have increased the number of species recorded in Vietnam from 50 to 75, making Vietnam a center of diversity and a crucial area for more research into the diversity and distributions of *Camellia*.

**Keywords:** *Camellia*, Ha Tinh, new species, Vietnam, Vu Quang

*Camellia* is the largest genus of the Theaceae, with an estimated 120 to 300 species (Chang and Bartholomew, 1984; Ming and Bartholomew, 2007). According to Sealy (1958), Chang and Bartholomew (1984), Gao et al. (2005), Ming and Bartholomew (2007), about 80% of these species are found in China and others are found in Cambodia, Indonesia, Japan, Laos PDR., Philippines, Thailand, and Vietnam.

In Vietnam, about 50 species of *Camellia* were recognized prior to the mid-2000’s (Ho, 1999; Ninh, 2002). However, in recent years additional species of *Camellia* have been discovered and described from Vietnam, increasing the total to 75 species and making Vietnam the centre of *Camellia* diversity (Orel and Wilson, 2010, 2012; Ninh and Dung, 2012, 2013; Orel et al., 2012, 2013, 2014a, 2014b; Luu et al., 2015; Ninh and Ninh, 2015; Dung et al., 2016; Ninh and Dung, 2016).

Vu Quang National Park with about 1,678 species of vascular plants, 94 species of mammals, 315 species of birds, 58 species of reptiles, and 31 species of amphibians, indicating that Vu Quang National Park is one of the centers of biodiversity for Vietnam (Vu Quang National Park Management Board, 2014). During a field trip in 2016 to survey *Camellia* in the Vu Quang National Park, we collected two species of *Camellia*. Careful examination of the morphological characters indicated and more than 300 dried specimens kept in the following herbaria were also examined: VAFS, DLU, HN, VNM as well as digitized plant specimen images available on the web of Muséum National d’Histoire Naturelle (https://science.mnhn.fr/) and Chinese Virtual Herbarium (http://www.cvh.org.cn/) that did not match any described species.

**Taxonomic Treatment**

1. *Camellia vuquangensis* Luong, Tran & L. T. Nguyen, *sp. nov.* (Figs. 1, 2).—**TYPE:** VIETNAM. Ha Tinh province, Vu Quang district, 21 Aug 2017 (fl), Luong Van Dung, Tran

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Fig. 1. *Camellia vuquangensis* Luong, Tran & L. T. Nguyen. A. Leaf, adaxial surface. B. Venation detail of leaf (abaxial surface). C. Venation of leaf (adaxial surface). D. Flower, lateral view. E. Flower, top view. F. Perules (inner surfaces shown). G. Petals (inner surfaces). H. Stamens. I. Pedicel and gynoecium (other floral parts removed) (drawn by Luong Van Dung).
Ninh, Nguyen Thi Lieu, Do Cong Thuan, Thai Canh Toan, Le Van Toan, Hoang Van Huan VN.0358 (holotype: DLU, Isotype: VAFS).

Shrub, 3–4 m tall, young branches and leaves light violet and pubescent. Leaves stalked; blade thick and coriaceous, oblong, 12–23 cm long and 4–7 cm wide, glabrous above, hirsute below, the apex acuminate to long caudate, the base auriculate with some teeth, the margins sharply serrulate, the midribs sunken above and protruding below with 17 to 22 pairs of lateral veins, sunken above and protruding below the main leaf surface; the petioles 8–10 mm long, hirsute. Flowers 1 or 2, positioned on the terminal or axillary of branches, 8–9.5 cm in diameter, shortly pedicellate. Perules 6 or 7, scale shaped to nearly rounded, 0.4–2.2 cm high, 0.4–1.6 cm wide, pubescent on both sides, ciliate margins. Petals 13 or 14, elliptic, obovate, ob lanceolate, entire, light yellow, 2.5–6.0 cm long, 1.5–2.5 cm wide, emarginated, glabrous on inner surfaces, pubescent central region of outer surfaces, united.

Fig. 2. Camellia vuquangensis Luong, Tran & L. T. Nguyen. A. Branches. B. Flower bud. C. Flower, lateral view. D. Flower, top view.
with outermost filaments 0.6–1.8 cm at the base. Androecium over 290 stamens, in 6 or 7 circles, light yellow, 3.5–4.5 cm long, pubescent to 1/2 from the base, outer filaments united for 2–2.4 mm from the base and form a short cup. Ovary cylindrical, 3-locular, 5–6 mm long, pubescent; styles 3, free to the base, 1–1.3 cm long, pubescent to 1/2 from the base. Capsule not seen.

**Distribution and phenology:** This species was found in the forest of Vu Quang International Park, Vu Quang district, Ha Tinh province, at the elevation of 50–100 m. Blooming season: Spring, August to September.

**Etymology:** The specific epithet of the new species refers to the location of discovery, Vu Quang National Park, Vietnam.

**IUCN Red List category:** The Area of Occupancy (AOO) for *C. vuquangensis* is estimated to be less than 1 km², as extensive surveys in the wider region have not located this species elsewhere. Despite a further search of the area around the type locality, only eight additional mature trees were found. The total known population of the species is fewer than 50 individuals, and it would be qualified as Critically Endangered (CR) under criterion D (IUCN, 2011).

**Taxonomic remarks:** This species most closely resembles *Camellia dilinhensis* of sect. *Obvoidae* Tran et Luong (Ninh and Dung, 2013) as the leaf is elliptic oblong; flowers are yellow and are either solitary or a pair at the ends of branches; ovary 3-locular, cylindrical, pubescent; style 3, free. Thus based on morphological similarity, this species should be assigned to sect. *Obvoidae* Tran et Luong. The main similarities and differences between *Camellia vuquangensis* with *Camellia dilinhensis* are summarized in Table 1.

### Table 1. Morphological comparison between *C. vuquangensis* with *C. dilinhensis*.

| Characters          | *Camellia vuquangensis* | *Camellia dilinhensis* |
|---------------------|-------------------------|------------------------|
| Leaf blade shape    | Oblong                  | Oblong elliptic or elliptic, glabrous |
| Leaf size           | 12–23 cm long and 4–7 cm wide | 16–24.5 cm long, 5.5–9.5 cm wide |
| Leaf apex           | Acuminate to long caudate | Acuminate |
| Leaf base           | Auriculate with some teeth | Cuneate |
| Petiole             | 8–10 mm long, hirsute   | 1–1.9 cm long, glabrous |
| Flowers             | 1 or 2, terminal or axillary | 1 to 3 in each group in axillary |
| Flower diameter (cm)| 8–9.5                   | 3.5–3.7                |
| Pedicel             | Absent                  | 5–7 mm long, glabrous |
| Petal number        | 13 or 14                | 8 or 9                 |
| Petal shape         | Elliptic, obovate, oblongolate | Nearly rounded to elliptic |
| Petal size          | 2.5–6.0 cm high, 1.5–2.5 cm wide | 1.5–1.7 cm long, 1.2–1.4 cm wide |
| Petal hairiness     | Pubescent on middle outer surfaces | Glabrous on both sides |
| Stamens             | 290 stamens, 5 or 6 circles | 350 stamens, 4 or 5 circles |
| Filaments           | 3.5–4.5 cm long, pubescent to 1/2 from the base | 5–9 mm long, glabrous |
| Style               | 3, free to the base, 1–1.3 cm long, pubescent to 1/2 from the base | 3, free to the base, 5 mm long, pubescent |

2. *Camellia hatinhensis* Luong, Tran & L. T. Nguyen, *sp. nov.* (Figs. 3, 4).—**TYPE:** VIETNAM. Ha Tinh province, Vu Quang district, 27 Aug 2017, Luong Van Dung, Tran Ninh, Nguyen Thi Lieu. Do Cong Thuan, Nguyen Viet Hung. VN.0354 (holotype, isotype: DLU).

Shrubs or small trees, 4–6 m tall, young branches villous becoming glabrous with age. Leaves stalked; blade thick and coriaceous, oblong, 11–15 cm long and 3–5 cm wide, glabrous above, villous below, the apex acuminate to long caudate; the base broadly cuneate or nearly rounded, the midribs sunken above and protruding below main leaf, 10 to 14 pairs of lateral veins sunken above and protruding below the main leaf, the margins serrulate or serrate; petals 1–1.3 mm long, villous. Flowers solitary at branch apices, white, 8–9 cm in diameter, the pedicel absent. Perules 9 or 10, nearly rounded, 0.4–2.3 cm high, 0.3–2.1 cm wide, pubescent on both sides, persistent, margins ciliate. Petals 10 or 11, elliptical, nearly rounded, obovate, retic, 2.7–4.8 cm long, 2.3–4.5 cm wide, pubescent on both sides, united with
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Fig. 3. *Camellia hatinhensis* Luong, Tran & L. T. Nguyen. A. Leaf, adaxial surface. B. Venation detail of leaf (abaxial surface). C. Venation of leaf (adaxial surface). D. Flower bud. E. Flower, top view. F. Perules (inner surfaces shown). G. Petals (inner surfaces). H. Perules and gynoecium. I. Stamens. J. Capsule with persisting styles. K. Pericarp. L. Seeds (drawn by Luong Van Dung).
outermost filaments 0.5–1.3 cm at the base. Androecium over 300 stamens, in 6 or 7 circles, 3–3.5 cm long, pubescent, outer filaments united from the base and forming a short cup, united 1.3–1.6 cm at the base. Ovary nearly rounded, 3-locular, tomentose, 0.5 cm long, 0.4 cm wide; styles 3, free to the base, 3–3.3 cm long, tomentose. Fruits globose, pubescent, 3.5–4 cm in diameter, 3-locular, with 1 or 2 seeds in each locule, columella abortive. Seeds cuneate or semiglobose, 1.6–1.9 cm high, 1.1–1.4 cm wide, glabrous.

**Distribution and phenology:** This species was found in the forest of Vu Quang National Park, Vu Quang district, Ha Tinh province, at the elevation over 100 m. Flowering: August to September; Fruiting: October to November.

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

**IUCN Red List category:** The AOO for *C. hatinhensis* is estimated to be less than 1 km². Despite a further search of the area around the type locality and other forests in the vicinity, only eight additional mature trees were found. The total known population of the species is fewer than 50 individuals, and it would be qualified as CR under criterion D (IUCN, 2011).
**Table 2.** Morphological comparison between *C. hatinhensis* with *C. gauchowensis*, *C. oleifera*, *C. sasanqua*, and *C. vietnamensis*.

| Characters               | *C. hatinhensis* | *C. gauchowensis* | *C. oleifera* | *C. sasanqua* | *C. vietnamensis* |
|--------------------------|------------------|-------------------|---------------|----------------|-------------------|
| Young shoots             | Villous          | Villous           | Glabrous to villous | Villous         | Villous          |
| Leaf blade shape         | Oblong           | Elliptic to mostly obovate | Elliptic to broadly elliptic | Elliptical     | Elliptic to ovate, rarely obovate |
| Leaf size                | 11–15 cm long, 3–5 cm wide | 6.8–9.0 cm long, 2.9–5.0 cm wide | 4.0–11.7 cm long, 1.4–5.1 cm wide | 2.6–6.3 cm long, 0.9–3.2 cm wide | 5.4–13.1 cm long, 2.7–6.7 cm wide |
| Leaf apex                | Acuminate to long caudate | Acute to obtuse or short acuminate | Acute to short acuminate | Acute or variously acuminate to occasionally cuspidate | Acute to mostly short acuminate |
| Leaf base                | Broadly cuneate or nearly rounded | Cuneate | Cuneate to mostly rounded | Cuneate | Cuneate to mostly rounded |
| Upper surface            | Glabrous | Smooth, midrib densely puberulent | Smooth, midrib moderately puberulent | Smooth, hirsutulous along the midrib | Smooth, the midrib puberulent |
| Lower surface            | Villous | Midrib villous | Rarely with few hairs, midrib sparsely villous or glabrous | Smooth, with a few hairs along the midrib | Smooth, midrib glabrous to villous |
| Petiole                  | 1–1.3 mm long, villous | 5–10 mm long, puberulent | 3–6 mm long, villous | 4–6 mm long, villous | 5–12 mm long, puberulent |
| Flower diameter          | 8–9 cm | 6.0–7.5 cm | 5.5–7.0 cm | 5.0–7.6 cm | 7.5–13.9 cm |
| Perules                  | 9 or 10, persistent, pubescent on both sides | 10 to 12, deciduous | 8, deciduous, outside heavily pubescent, inside glabrous | 8 to 10, deciduous, more or less pubescent on the outside, inside glabrous | 9 or 10, deciduous, outside pubescent, inside glabrous |
| Petal number             | 10 or 11 | 7 or 8 | 7 or 8 | 7 or 8 | 8 to 10 |
| Petal shape              | Elliptic, nearly rounded, obovate, united with outermost filaments | Obovate, cleft at the tip, nearly free at the base with little or no fusion to the staminal column | Obovate to obcordate, cleft at tip, fused with the staminal column | Oblanceolate to obovate, cleft at the tip, petals free | Obcordate, cleft at tip, petals free |
| Petal size               | 2.7–4.8 cm long, 2.3–4.5 cm wide | 3.0–3.8 cm long, 1.5–2.6 cm wide | 3.2–3.9 cm long, 1.5–2.4 cm wide | 3.0–3.7 cm long, 1.4–2.4 cm wide | 3.9–7.5 cm long, 3.0–4.9 cm wide |
| Androecium hairiness     | Pubescent | Glabrous | Glabrous | Glabrous | Glabrous |
| Androecium length        | 3–3.5 cm | 1.0–1.2 cm | 1.8 cm | 1.1–1.6 cm | 1.2–2.0 cm |
| Gynoecium length         | 3.5–3.8 cm | 1.0 cm | 1.2–1.6 cm | 1.1–1.5 cm | 1.2–2.0 cm |
| Style                    | 3, tomentose, free to the base | 3 to 5, glabrous, free at the base | 3 to 5, glabrous, fused 1/2 from the base | 3, glabrous, styles, range from fused 1/4 to 2/3 from the base | 3 to 5, glabrous, free or fused up to 1/2 from the base |
**Taxonomic remarks:** *Camellia hatinhensis* possesses some morphological characteristics common to the species *C. gauchowensis* Chang, *C. oleifera* Abel; *C. sasanqua* Thunb. and *C. vietnamensis* Huang ex Hu (Gao et al., 2005) belonging to Section *Oleifera* Hung T. Chang (Chang and Bartholomew, 1984). All these species have terminal flowers which are sessile and white; bracteoles and sepals are not differentiated, coriaceous; ovaries 3-locular; styles 3–5. Therefore the species should be classified into Sect. *Oleifera* Hung T. Chang. The main similarities and differences between *C. hatinhensis* with *C. gauchowensis*, *C. oleifera*, *C. sasanqua*, and *C. vietnamensis* are summarized in Table 2.

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**Conflict of Interest**

Authors declare that there is no conflict of interest.

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