

## *CAMELLIA OCONORIANA* (THEACEAE), A NEW SPECIES FROM VIETNAM

G. OREL<sup>1</sup>, P. G. WILSON<sup>1</sup>, A. S. CURRY<sup>1</sup> & LUU HONG TRUONG<sup>2</sup>

The new species *Camellia oconoriana* Orel, Curry & Luu (Theaceae), endemic to Lam Dong Province, Vietnam, is described and illustrated. It is compared to *Camellia* species in sections *Archaecamellia*, *Stereocarpus*, *Piquetia* and *Chrysantha*. Morphological evidence supports a transitional placement in *Camellia* sect. *Chrysantha* ser. *Chrysanthae*.

*Keywords.* *Camellia*, Lam Dong, new species, Theaceae, Vietnam.

### INTRODUCTION

The genus *Camellia* L. (Theaceae) has 119 to 280 species (Gao *et al.*, 2005), the large range in estimated number of species due to very different taxonomic opinions. It should also be noted that the taxonomy of the genus *Camellia*, represented by the three taxonomic systems of Sealy (1958), Chang & Bartholomew (1984) and Ming & Bartholomew (2007), is in disarray and at best can be considered to be provisional and unsatisfactory (Chapman & Wang, 2002). Further, although Gao *et al.* (2005) follow the outline of Chang's taxonomic system (Chang & Bartholomew, 1984), their sectional taxonomic treatment of the genus and the assignment of species to individual *Camellia* sections is not the same. These dissimilarities are sometimes rather substantial (e.g. in *Camellia* sect. *Archaecamellia*) and thus for all practicable purposes the taxonomic system of Gao *et al.* (2005) may be considered to be a fourth taxonomic treatment of the genus.

To accommodate the diverse morphological characteristics of *Camellia oconoriana* we elected to base the new species on the taxonomic treatment of Chang & Bartholomew (1984). The salient morphological characteristics of the new species warrant a transitional placement into *Camellia* sect. *Chrysantha* ser. *Chrysanthae* (Chang, 1981).

Historically only a relatively small number of *Camellia* species were considered to be native to the southern mountain regions of Vietnam. The northern parts of Vietnam (e.g. the Tam Dao National Park and the adjacent geographical areas which are relatively close to the Chinese border) were traditionally considered to be the major centres of distribution of Vietnamese *Camellia* species (Sealy, 1958; Chang & Bartholomew, 1984;

<sup>1</sup> Royal Botanic Gardens, Mrs Macquaries Road, Sydney, NSW 2000, Australia. E-mail: george.orel@rbgsyd.nsw.gov.au and peter.wilson@rbgsyd.nsw.gov.au

<sup>2</sup> Southern Institute of Ecology, Vietnam Academy of Science and Technology, 1 Mac Dinh Chi, District 1, Ho Chi Minh City, Vietnam. E-mail: hongtruongluu@yahoo.com

Gao *et al.*, 2005). Recent systematic exploration carried out by a team of scientists on the Da Lat Plateau and the Lang Biang Massif (1999–2012) resulted in the discovery of several new *Camellia* taxa, some of which have already been published (Orel, 2006; Orel & Wilson, 2010a, 2010b, 2012). The discovery of another new species, *Camellia oconoriana*, in the south of the country not only confirms the floral richness of this geographical area but further establishes it as an important centre of Theaceae genetic diversity and the possible northern boundary of the hypothesised area of origin for genus *Camellia* (Orel & Marchant, 2006).

#### SPECIES DESCRIPTION

***Camellia oconoriana* Orel, Curry & Luu, sp. nov. Fig. 1.**

Apud species sect. *Chrysanthae* combinatione characterum sequentium distinguitur: folia magna, anguste elliptica; flores semper axillares; sepala duo comparate magna; petala straminea marginibus carneolis tinctis; bases styliorum persistentes. – Type: Vietnam, Lam Dong Prov., unnamed mountain c.120 km south-west from the City of Da Lat, 22 xi 2010, *Orel & Curry* 0720 (holo NSW; iso VNM).

Perennial, medium to large evergreen shrub to 7.5 m high; sometimes multi-stemmed, sparsely branched, upright habit; juvenile branches glabrous, green towards the terminals, grey proximally; semi-mature branches entirely light grey, leaf scars not prominent; adult branches and trunk shiny, light grey, rather rough, no striations present. *Petiole* falcate, slightly twisted, round, thick, of the same colour as the leaf, primary vein continues as a shallow channel on the adaxial side of the petiole, 20–25(–30) mm long, 4–5(–7) mm wide, up to 4 mm thick, attached to branches at 45–80° angle. *Axillary leaf buds* rudimentary, dull, brown to light brown, slightly falcate, with sharp apex, 4–5 mm long; terminal buds slender, thin, narrow, distinctly and unevenly falcate, with sharp, soft apex, up to 10 mm long, 1–3 mm wide. *Leaves*: juvenile leaves very narrow elliptic, margins without serrations, slightly undulate, soft and pendulous, dull, of soft lilac colour, midrib also dull, but brightly lilac-pink; mature leaves very narrowly elliptic to narrowly elliptic, irregularly, shallowly and sparsely serrate, unevenly undulate, 30–36.5 cm long, 8–8.5 cm wide; slightly coriaceous; leaf apex cuspidate to acuminate; base obtuse, acute on smaller leaves; adaxial leaf surface glabrous, mid green, shiny, lighter green and shiny below; primary venation 4–7(–9) mm wide proximally, less than 1 mm wide distally, abaxially prominent, adaxially less so; secondary venation shallow, brochidodromous, with up to 24 pairs of veins adaxially sunken, abaxially prominent; tertiary veins indistinct, sparse, craspedodromous, at almost right angles to the secondary venation, evenly distributed, adaxially and abaxially marginally sunken, areolation indistinct, meshes unevenly triangular/tetragonal and of relatively inconstant size, maximum areole dimension 10 × 5 mm, but typically less (Hickey, 1979). *Bracts* persistent, distinctly differentiated from sepals, pliable, not woody, arranged in 2 whorls of (–) 3 and 3 respectively; the outer whorl, bracts unevenly triangular with rounded apex, slightly concave,

proximally slightly overlapping, soft, green with randomly distributed brown, corky areas, sparsely and very shortly hairy on adaxial surfaces, keel and striations lacking, margins thin, undulate, tightly appressed to the inner whorl, 10–12 mm long, 9–10 mm wide; the inner whorl, bracts unevenly triangular with rounded apex, slightly concave, proximally slightly overlapping, soft and entirely green, glabrous, keel and striations lacking, margins thin, undulate, 12–14 mm long, 10–11 mm wide. *Flowers* pedicellate, pedicel slightly variable in shape, 30–40 mm long, distally up to 6 mm wide, pendulous, glabrous, light green to pink, with 1–3 small bracteoles, 1–2 mm long, 1–2 mm wide; flowers always axillary, solitary or in twos; flower buds pendulous, globose to ovate with blunt apex, yellow with green and light pink areas; adult flowers 50–60 mm diameter, light to mid yellow, with dark pink-lilac to purple blush on the petal margins, fleshy, waxy, rigid, petal margins partially folded; developing flowers narrowly oblongoid in lateral section, senescing flowers cream to almost white. *Petals* arranged in two, basally joined whorls which form a shallow cup, fully mature and senescing petals widely reflexed; the outer whorl of (2–)3 petals, concave, roughly obovate, proximally overlapping, rather asymmetric, sometimes emarginate, margins sometimes translucent, striations absent, 25–30 mm long, 20–25 mm wide; the inner whorl of 3 petals, concave, roughly obovate, not overlapping, rather asymmetric, sometimes emarginate, margins sometimes translucent, striations absent, 25–30 mm long, 15–20 mm wide. *Sepals* 2, large, distinctly recognisable, rigid but not woody, strongly concave, glabrous, of yellow-green colour, with pink randomly distributed pigmentation, 20–23(–25) mm long, 18–20 mm wide. *Stamens* numerous (300–350), in a circular formation, 30–35 mm diameter; filaments thin, of variable thickness, glabrous, yellow, slightly shiny, 16–18 mm long, outer filaments proximally fused for c.6 mm forming a circular, ring-like structure of intensely orange colour; anthers dorsifixed, narrow, c.2 mm long, 1 mm or less wide, dark yellow to orange, later yellow-brown to brown, with a single dark brown-black line joining the distal and proximal ends. *Style* compound, 3–5-parted, finely hairy proximally, glabrous distally, light yellow to white, proximally fused for 4–5 mm, 14–15 mm long; stigmas indistinct, also light yellow to white. *Ovary* superior, 4–5-carpellate, unevenly rotund, finely and densely tomentose; ovary c.7 mm long, 5–6 mm wide. *Fruit*: juvenile fruit capsules light green and shiny; mature fruit mid brown, not shiny, unevenly round, distinctly oblate, style remnants persistent, 4–5-lobed, with chambers that are not always bi-locular, 4–5.5 cm diameter, c.2.5 cm deep.

*Distribution and habitat.* *Camellia oconoriana* occurs in a mountainous, tall, wet, subtropical rainforest, where it forms part of a dense understorey layer, enduring low light and high humidity conditions in nutrient-poor soils. It is known only from the type collection from the lower slopes of an unnamed mountain in Lam Dong Province, Vietnam. The species provenance details are withheld for conservation reasons.

*Phenology.* Collected in flower in November. Fruiting and seeding in February to March.

*IUCN Red List Category.* The type specimen was collected from a population of some 10 adult plants which covered an area of less than 1 km<sup>2</sup>. Juvenile plants or seedlings

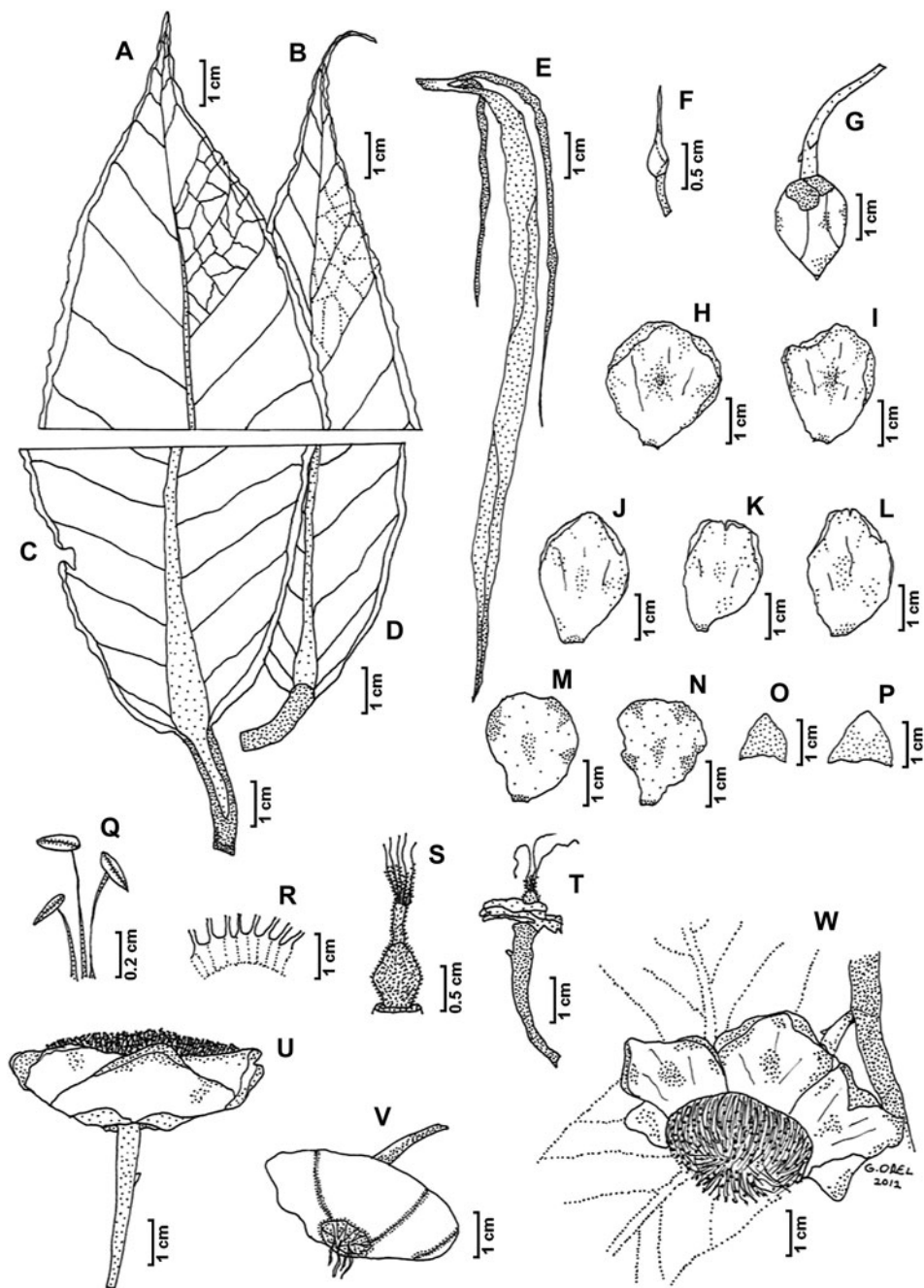


FIG. 1. *Camellia oconoriana* Orel, Curry & Luu. A, adult leaf, apex, primary, secondary and tertiary venation, adaxial view; B, adult leaf, apex, primary, secondary and tertiary venation, abaxial view; C, adult leaf, leaf base and petiole, adaxial view; D, adult leaf, leaf base and petiole, abaxial view; E, juvenile leaves at differing stages of development; F, apical leaf bud; G, flower

were not found. Despite a detailed search of the area around the type locality only one population was discovered. Given this situation, we consider the IUCN category of Critically Endangered (CR D) to be appropriate (IUCN, 2011).

*Etymology.* The specific epithet honours Geoffrey and Rachel O'Connor, long-time members of the New South Wales Camellia Research Society, Sydney and supporters and benefactors of scientific research in Australia.

#### DISCUSSION

Taxonomic treatments of *Camellia* are generally based on one of the systems of Sealy (1958), Chang & Bartholomew (1984) or Gao *et al.* (2005). Therefore, we examined the classification systems of these authors in some detail to determine the taxonomic position of the new species. To accommodate the diverse morphological characteristics of *Camellia oconoriana* we found the sectional treatment of Chang (1981) and the species concepts of Chang & Bartholomew (1984) to be the most practical.

*Camellia oconoriana* possesses a number of morphological characteristics common to species of *Camellia* sections *Archaecamellia* Sealy, *Stereocarpus* (Pierre) Sealy, *Piquetia* (Pierre) Sealy and *Chrysantha* H.T.Chang (Sealy, 1958; Chang, 1981; Chang & Bartholomew, 1984; Ho, 1991; Richards *et al.*, 2002; Tran, 2002; Gao *et al.*, 2005; Orel, 2006; Ming & Bartholomew, 2007) and, in some cases, *C. oconoriana* exhibits morphological traits belonging to more than one section (Table 1). However, the possession of 5–7 bracts, connate filaments that fuse into a short tube or ring, 3–5-parted styles and pubescent ovaries place *Camellia oconoriana* closer to, but not firmly within, *Camellia* sect. *Chrysantha* H.T.Chang where we provisionally place it pending further research (see Table 1). As *Camellia oconoriana* does not exhibit any profound novelties in basic *Camellia* floral morphology it was not considered appropriate to establish a new *Camellia* section, either within the taxonomic system of Sealy (1958), or in that of Chang & Bartholomew (1984).

*Camellia oconoriana* possesses a number of morphological characteristics in common with particular species of the above-mentioned sections of *Camellia*, so we selected the following species, which have traits similar to those of *C. oconoriana*: *Camellia krempfii* (Gagnep.) Sealy, *C. pleurocarpa* (Gagnep.) Sealy, *C. euphlebia* Merr. ex Sealy and *C. petelotii* Merr. ex Sealy (section *Archaecamellia*) (Sealy, 1958), *C. dormoyana* (Pierre) Sealy (section *Stereocarpus*) (Sealy, 1958), *C. piquetiana* (Pierre) Sealy and *C. dongnaiensis* Orel (section *Piquetia*) (Sealy, 1958; Orel, 2006) and *C. nitidissima* Chi, *C. impressinervis* H.T.Chang & S.Y.Liang, *C. flava* (Pit.) Sealy and

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bud; H & I, petals of the outer whorl; J, K & L, petals of the inner whorl; M & N, sepals; O & P, bracts; Q, anthers; R, filaments forming a ring-like structure; S, gynoeceium; T, spent flower with senescing styles; U, developing flower, lateral view; V, adult fruit capsule with persisting styles; W, branchlet with a flower and leaves. Drawn by G. Orel from the holotype, *Orel & Curry* 0720.

TABLE 1. Comparison of selected morphological characters of *Camellia* sections *Archaeacameilia*, *Stereocarpus*, *Piqueta* and *Chrysantha*

Section	Leaf size (cm)	Leaf shape	Pedicel	No. of bracts	No. of petals	Filaments	Styles	Ovary
<i>Archaeacameilia</i> Sealy	10–20(–31) × 3.8(–6)–7.5	Oblong to oval- elliptic to oblong-elliptic	Stout, distally wide	(–6), 11–16	8–14	Free above petal union, fleshy cup	3 or 5, free	Glabrous or pubescent
<i>Stereocarpus</i> (Pierre) Sealy	11–18(–25) × 5.5–8	Oval or oblong or ovate	Sessile or almost sessile	2–4	12	United with petals, free above	1, 5(–6), lobulate	Glabrous
<i>Piqueta</i> (Pierre) Sealy	29–42 × 9.5–12.5	Oblong to elliptic, or narrowly obovate	Stout, distally wide	(–3), 8–10	7–8 (or more)	United at the base, then free	5 or 6, free to base, or compound and 6-parted	Densely pubescent
<i>Chrysantha</i> H.T.Chang	Up to 22 × 8.5	Oblong, ovate, elliptic	Variable	5–7	8–12	Free or connate, short tube	3–5-parted, free	Glabrous or pubescent

Data from Sealy (1958), Chang (1981), Chang & Bartholomew (1984), Richards *et al.* (2002), Gao *et al.* (2005), Orel (2006) and Ming & Bartholomew (2007).

TABLE 2A. Interspecific morphological comparison of *Camellia oconoriana* with the selected member species from sections *Archaeacamellia* Sealy, *Stereocarpus* (Pierre) Sealy, *Piqueta* (Pierre) Sealy and *Chrysantha* H.T.Chang

Taxon	Flower colour	No. of petals	Degree and type of filament attachment
<i>C. krempfii</i> (Gagnep.) Sealy	White	10	Outer filaments united for 7–8 mm, forming a fleshy cup
<i>C. pleurocarpa</i> (Gagnep.) Sealy	Not seen	Not seen	Not seen
<i>C. euphlebia</i> Merr. ex Sealy	Yellow	8–9	Outer filaments united for 1.6–1.7 mm, forming a fleshy cup
<i>C. petelotii</i> Merr. ex Sealy	Yellow	14	Outer filaments united for 1.3 mm, forming a fleshy cup
<i>C. dormoyana</i> (Pierre) Sealy	White or yellowish	5–6	Filaments basally connate
<i>C. piquetiana</i> (Pierre) Sealy	Pink, suffused with purple	8 or more	United with petals and one another for 3–5 mm
<i>C. dongnaiensis</i> Orel	Yellow-apricot, pink margins	8	Filaments fused in bottom third
<i>C. nitidissima</i> Chi	Yellow	8–12	Basally fused
<i>C. impressinervis</i> H.T.Chang & S.Y.Liang	Yellow	11–12	Outer filaments united for 5 mm, forming a fleshy cup
<i>C. flava</i> (Pit.) Sealy	Yellow	10–13	Filaments fused into a column up to 9 mm long
<i>C. pubipetala</i> Wan & S.Z.Huang	Yellow	9–13	Outer filaments united for 1.4 mm, adnate with petals
<i>C. oconoriana</i> Orel, Curry & Luu	Light to mid yellow, with dark pink-lilac to purple blush	5–6	Proximally fused for c.6 mm, forming a bright orange, ring-like structure

Data from Pitard (1910), Sealy (1958), Chang & Bartholomew (1984), Ho (1991), Richards *et al.* (2002), Gao *et al.* (2005), Orel (2006) and Ming & Bartholomew (2007).

TABLE 2B. Interspecific morphological comparison of *Camellia oconoriana* with the selected member species from sections *Archaeacamellia* Sealy, *Stereocarpus* (Pierre) Sealy, *Piqueta* (Pierre) Sealy and *Chrysantha* H.T.Chang (continued)

Taxon	Ovary	Styles	Style morphology	Capsule shape
<i>C. krenpfii</i> (Gagnep.) Sealy	Ovoid-globose	5-parted	Free to base	Not seen
<i>C. pleurocarpa</i> (Gagnep.) Sealy	Not seen	5, persistent	Free	Oblate
<i>C. euphlebia</i> Merr. ex Sealy	Ovoid	3-parted	Free	Oblate, 3-coccal
<i>C. petelotii</i> Merr. ex Sealy	Globose	3	Free to base	Oblate
<i>C. dormoyana</i> (Pierre) Sealy	Globose, strongly lobed	5-parted	Fused, but apically 5-cleft	Depressed, globose
<i>C. piquetiana</i> (Pierre) Sealy	Discoïd, lobulate	3-5(-6)	Free to the swollen base (joined for 2 mm)	Flattened, globose, discoïd*
<i>C. dongnaiensis</i> Orel	Conical, evenly rounded	6	Compound, basally fused at the very bottom	Oblate*
<i>C. nitidissima</i> Chi	Globose	3-4	Free to base	Triangular, oblate
<i>C. impressinervis</i> H.T.Chang & S.Y.Liang	Globose	2-3	Free	Oblate or bi-coccate
<i>C. flava</i> (Pit.) Sealy	Globose	5	Free	Globose
<i>C. pubipetala</i> Wan & S.Z.Huang	Sub-globose	3-4	Cleft apically for 1-1.5 cm	Oblate
<i>C. oconoriana</i> Orel, Curry & Luu	Unevenly rotund	3-5	Compound, basally fused for 4-5 mm	Unevenly round, oblate

Data from Pitard (1910), Sealy (1958), Chang & Bartholomew (1984), Ho (1991), Richards *et al.* (2002), Gao *et al.* (2005), Orel (2006) and Ming & Bartholomew (2007).

\*G. Orel – unpublished data, 2009.



*C. pubipetala* Wan & S.Z.Huang (section *Chrysantha*) (Gao *et al.*, 2005). Tables 2a and 2b show a comparison of selected morphological characters of *Camellia oconoriana* and these 11 species. Flower colour (mostly yellow), the arrangement of the filaments (basally united and forming a ring or fleshy cup) and the shape of the seed capsules (mostly globose or obovate) seem to be the main morphological traits that these species have in common. However, the tables also show that *Camellia oconoriana* is well distinguished from these other species, particularly in the bright orange, ring-like base of the androecium, and the unevenly shaped ovaries and capsules.

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