

AN UPDATED CHECKLIST AND COMMENTS FOR SECTION *PIQUETIA* (*CAMELLIA*, THEACEAE)

Roman Vasilyevich Doudkin^{a, b}, Nong Van Duy^c, Vu Kim Cong^c, Tran Thai Vinh^c,
H'Yon Nie Bing^c, Dang Thi Tham^c, Quach Van Hoi^{a, c,*}

^a*Institute of High Technologies and Advanced Materials, Far Eastern Federal University,
Vladivostok, Russia*

^b*Botanical Garden-Institute FEB RAS, Vladivostok, Russia*

^c*Tay Nguyen Institute of Scientific Research, Vietnam Academy of Science and Technology,
Lam Dong, Vietnam*

*Corresponding author's email: quachvanhoi@gmail.com

Article history

Received: March 14th, 2023

Received in revised form (1st): May 5th, 2023 | Received in revised form (2nd): May 23rd, 2023

Accepted: June 9th, 2023

Available online: June 30th, 2023

Abstract

New Camellia species in section Piquetia have recently been discovered. It is necessary to enumerate the number of species and update the specific characteristics of this section. Based on the study of more than 30 pieces of literature and a large number of specimens, a total of 15 species belonging to section Piquetia, including two new species, are identified. A taxonomic key to all species is provided, and typical characteristics of the section are also discussed. Information on the distribution, ecology, and conservation status of each species, as well as notes on the differences between closely related species, is also provided.

Keywords: *Camellia*; Endemic; Reclassification; Section *Piquetia*; Taxonomic key.

DOI: [https://doi.org/10.37569/DalatUniversity.13.2.1124\(2023\)](https://doi.org/10.37569/DalatUniversity.13.2.1124(2023))

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

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1. INTRODUCTION

Piquetia (Pierre) Sealy is a section of the genus *Camellia* L. (Theaceae). This section is mentioned in L. Pierre's book (Pierre, 1887) with only one species of *Thea piquetiana* Pierre ex Laness, which was later transferred to *Camellia piquetiana* (Pierre) Sealy by Sealy (1958). Laness may have mentioned the species *Thea piquetia* before Pierre but provided no information to place this species in section *Piquetia*. The section was characterized by persistent sepals; oblong anthers; raised receptacle; carpels 5–6 partly free and biovulated; fruit dehiscent; thin, leathery pericarp; and a very thick columella. Later, J. R. Sealy (Sealy, 1958) also drew upon the characteristics of *C. piquetiana* to establish section *Piquetia* with characteristics such as “flower borne on short (8-mm-long) shoots in the axils of the leaves, usually 3–5 flowers on a shoot but sometimes 1 only; flowers pedicellate, nodding; pedicel very stout, thickened upwards; bracteoles 2–3, persistent; sepals 5, persistent; petals 8 or more; stamens free above the union with the petals, puberulous inside; gynoecium densely hairy; style 5 (or 6), free.” Although sect. *Piquetia* was placed into the subgenus *Procamellia* (Chang & Bartholomew, 1984; Ninh, 2002) or into the subgenus *Thea* (Linnaeus) Hung T. Chang (Ming & Bartholomew, 2007; Nguyen, 2017; Quach et al., 2021c, 2021d; Sealy, 1958), the section is still widely recognized, while several others have been modified. In particular, the number of *Camellia* species is continuously increasing due to many new species being discovered in recent years (e.g., Hoang et al., 2022; Ly et al., 2022; Quach et al., 2021a, 2021c, 2021d, 2022a; Truong et al., 2022). The number of species in this section is also constantly increasing, but they have not yet been counted. Moreover, a taxonomy key to classify them is required. The common characteristics of this section given by Pierre (1887) and Sealy (1958) are no longer consistent with many new species. We provide an updated checklist of sect. *Piquetia* in this study, bringing the total number of known sect. *Piquetia* species to 15. In addition, a new taxonomic key to the species of sect. *Piquetia* is given, and some common characteristics have been added.

2. MATERIALS AND METHODS

The updated checklist is based on a review of the scientific names of all species belonging to sect. *Piquetia*. A suite of specimens of species in sect. *Piquetia* were also examined from the following herbaria in Vietnam: DLU, HN, HNU, SGN, VNM, VNMN, and via online images from other herbaria (P, K, A, NY). The scientific names and nomenclature were checked according to the Shenzhen code of the International Association for Plant Taxonomy (Turland et al., 2018), together with online consultation from The Plant List (<http://www.theplantlist.org>), World Flora Online (<http://www.worldfloraonline.org>), Plants of the World Online (<https://powo.science.kew.org/>), and International Plant Names Index (<https://www.ipni.org>). Morphological characteristics were used to establish a taxonomic key to all species in this section.

3. RESULTS

Camellia sect. *Piquetia* (Pierre) Sealy, 1958, Rev. Gen. *Camellia*: 108. (Sealy, 1958).

≡ *Thea* sect. *Piquetia* Pierre, 1887, Fl. For. Conchinchine, II. Sub, pl. 119. (Pierre, 1887).

= *Camellia* sect. *Lecomtia* Orel, 2015, Pursuit of Hidden Camellias Vietnam China: 154. (Orel & Curry, 2015).

Typus: *Camellia piquetiana* (Pierre) Sealy, 1958, Rev. Gen. *Camellia*: 108 (Seally, 1958)

Leaf-blades oblong, narrow elliptic or narrow lanceolate, very large, usually more than 20 cm long; flower axillary or terminal, solitary or 2–5 clustered, pedicellate, nodding; pedicel stout or slender, 1.2–5.5 cm long, thickened upwards; bracteoles 2–4, persistent (except for *C. longii* and *C. proensis*); sepals 5, (rarely 3 in *C. dongnaiensis* and *C. campanulata*, sepals 6–7 in *C. hiepii*), persistent; stamens free above the union with the petals; gynoeceium densely hairy; style 5 or more, or 3–4 in *C. honbaensis*, 4 in *C. sonthaiensis*, free, or just united at the base; capsule depressed-globose; seeds 1–2 per locule.

A key to the species of *Camellia* section *Piquetia* worldwide

- 1a. Ovary 3(–4)-locular 2
- 1b. Ovary 5-locular or more 3
- 2a. Style united at the base, flower red to purplish red (7) *C. honbaensis*
- 2b. Style free to the base, flower light yellow (13) *C. sonthaiensis*
- 3a. Flower shape campanulate 4
- 3b. Flower shape cyanthiform, never campanulate 5
- 4a. Style united at the base 6
- 4b. Style free to the base 7
- 5a. Flower pink, red, purple 8
- 5b. Flower light yellow, or yellow with pink pigmentation on edges 9
- 6a. Petals 8; leaf base auriculate (3) *C. cattienensis*
- 6b. Petals 5–6; leaf base obtuse to rounded (9) *C. longii*
- 7a. Sepals 5; petals 20–22 (1) *C. annamensis*
- 7b. Sepals 3; petals 6 (2) *C. campanulata*
- 8a. Young branches pubescent 10
- 8b. Young branches glabrous (11) *C. piquetiana*
- 9a. Petals light yellow only 11
- 9b. Petals yellow with pink pigmentation on edges 12
- 10a. Leaf base subcordate or cordate (6) *C. hiepii*

- 10b. Leaf base broadly acute or obtuse(10) *C. phuongchiana*
 11a. Young branches pubescent(4) *C. dalatensis*
 11b. Young branches glabrous 13
 12a. Young branches pubescent; sepals 5–6 14
 12b. Young branches glabrous; sepals 3(5) *C. dongnaiensis*
 13a. Leaf base rounded or acute (12) *C. proensis*
 13b. Leaf base cordate (14) *C. sphanii*
 14a. Sepals and petals pubescent or tomentose on both sides (8) *C. langbianensis*
 14b. Sepals and petals glabrous inside(15) *C. vidalii*

A checklist of the species of *Camellia* section *Piquetia* worldwide

(1) *Camellia annamensis* N. S. Ly, V. D. Luong, N. D. Do, T. H. Le & T. L. Nguyen, 2022, *Taiwania* 67(2): 244, figs. 1, 2. (Ly et al., 2022).

Type: [Vietnam]. Nghe An Prov., Que Phong Dist., Dong Van Commune, Pu Hoat Nature Reserve, at elevation of 100 m, 15 Jan. 2019, *Do Ngoc Dai et al.*, DLHH-1028 (holotype DLU; isotypes P, VNM).

Specimens examined: *Do Ngoc Dai et al.*, DLHH-1028 (DLU, P, VNM); *Do Ngoc Dai & Nguyen Danh Hung*, DH 732 (VNM, DLU); *Nguyen Thi Lieu et al.*, VN 0373 (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia annamensis* was found at an elevation of 100 m in the Pu Hoat Nature Reserve, Dong Van Commune, Que Phong Dist., Nghe An Prov., and at an elevation of 497 m in the Xuan Lien Nature Reserve, Yen Nhan Commune, Thuong Xuan Dist., Thanh Hoa Prov. This species grows on hill slopes and along streams in less-disturbed secondary forests.

Conservation status: This species is provisionally assessed as Critically Endangered (CR) according to the IUCN Red List criteria (IUCN, 2019; Ly et al., 2022).

Note: According to Ly et al. (2022), *C. annamensis* was placed under sect. *Piquetia*. This species is most similar to *C. longii* Orel & Luu in the characters of general vegetative habit and the shape and color of sepals, petals, and stamens. It is easily distinguishable from *C. longii* by its mature leaves sparsely appressed puberulous abaxially, petioles sparsely appressed puberulous (vs. glabrous), sepals 5 (vs. 2–3), and petals 20–22 (vs. 5–6). *Camellia annamensis* is also similar to *C. dalatensis*, *C. sonthaiensis*, and *C. proensis* but is easily distinguished from them by having red flowers (vs. light-yellow flowers in the other three species).

(2) *Camellia campanulata* Orel, Curry & Luu, 2015, *Pursuit Hidden Camellias Vietnam China*: 154. (Orel & Curry, 2015).

Type: [Vietnam]. Binh Phuoc Prov., about 1.0 km from the Cambodian border, July 2011, *Luu Hong Truong, Nguyen Quoc Dat, G. Orel & A. S. Curry, 1257* (holotype VNM; isotype NSW).

Specimens examined: *Quach Van Hoi, Q201119* (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia campanulata* was found at an elevation of 327 m in an evergreen broad-leaved forest in Bu Gia Map National Park in Binh Phuoc Prov.

Conservation status: *Camellia campanulata* is assessed as Critically Endangered (CR) (Orel & Curry, 2015).

Note: *Camellia campanulata* was first recorded in the list of unpublished species (Orel & Curry, 2015), but it is an accepted name in Plants of the World Online. Orel and Curry (2015) established *Camellia* sect. *Lecomtia* Orel with only one species, *C. campanulata*. However, *C. campanulata* should be placed under sect. *Piquetia* because it possesses the following characteristics: leaf blades very large, 30–38 cm long, 7.5–9 cm wide; flower axillary or terminal, solitary, pedicellate, nodding; bracteoles 3–4, persistent; petals 6; stamens free; gynoeceum densely hairy; style 5-(or 6-)lobed, free to base. In particular, *C. campanulata* is closest to *C. longii* (in sect. *Piquetia*) in having young branches glabrous; leaf blade narrowly elliptic, 27–38 cm long and 7.5–12.5 cm wide, apex acute, base obtuse; mature flower campanulate, axillary or terminal, solitary; petals 5–6, concave; filaments glabrous, outer parts united with the petals and one another, 3–5 cm long; style 5(–6); and ovary 5-locular.

(3) *Camellia cattienensis* Orel, 2012, Kew Bull. 66(4): 566; Orel & Curry, 2015, Pursuit Hidden Camellias Vietnam China: 88. (Orel & Curry, 2015; Orel & Wilson, 2012).

Type: [Vietnam]. Lam Dong Prov., Cat Tien National Park, 19 Dec. 2007, *G. Orel et al., 0711* (holotype NSW; isotypes HN, NSW).

Specimens examined: *G. Orel et al., 0711* (HN).

Distribution and ecology: VIETNAM (endemic). *Camellia cattienensis* was found in low light and humid conditions on poor nutrient soils in evergreen broad-leaved forests in Cat Tien National Park, Cat Tien Dist., Lam Dong Prov.

Conservation status: *Camellia cattienensis* was discovered in Cat Tien National Park (Orel & Wilson, 2012). The number of individuals is unknown. This species is provisionally assessed as Data Deficient (DD) according to the IUCN Red List criteria (IUCN, 2019; Orel & Wilson, 2012).

Note: *Camellia cattienensis* possesses a number of morphological characteristics common to sect. *Piquetia*, such as leaf blades large, 35–36 cm long and 8.5–9 cm wide; flowers pedicellate, solitary; pedicel thickened upwards; petals 8; stamens free above and

basally united with the petals; gynoecium tomentose; style 5 (Sealy, 1958). Among the species in *Piquetia*, *C. cattienensis* resembles *C. longii* by possessing the morphological characteristics of young branches glabrous; leaf blades oblong to narrowly elliptic, very large, 27–36 cm long and 6–10.5 cm wide; flowers peduncle, campanulate, solitary; filaments glabrous, outer filaments united with the petals and one another; style 5, fused at the base; ovary 5-locular. This study proposes the placement of this species in the sect. *Piquetia* to be appropriate.

(4) *Camellia dalatensis* Luong, Tran & Hakoda, 2012, Int. Camellia J. 44: 161; Tran & Luong, 2012, VNU J. Sci. Nat. Sci. Technol. 28(2S): 35; Le, 2016, in: Li J-Y., Proc. Dali Int. Camellia Cong. Dali-Yunnan-China: 87, fig. 3; Beech et al., 2017, The Red List of Theaceae: 24. (Beech et al., 2017; Le, 2016; Ninh et al., 2012 ; Tran & Luong, 2012).

Type: [Vietnam]. Dalat Plateau, evergreen forest at an elevation of 1300 m, 8 Mar. 2012, *Ninh & Dung, 120301* (holotype and isotype HNU).

Specimens examined: *Ninh & Dung 120301* (HNU), *HN 22/7/2008* (DLU), *HN 17/1/2014* (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia dalatensis* was collected from an elevation of 1300 m in a valley of mixed evergreen broad-leaved and needle-leaved forest in Xuan Truong Commune, Dalat, Lam Dong Prov.

Conservation status: This species was assessed as Critically Endangered (CR) by Beech et al. (2017).

Note: According to Ninh et al. (2012), this species resembles *Camellia vidalii* Rosmann, but it differs in having densely hairy young branches, an abaxial surface of the lamina, and light-yellow petals.

(5) *Camellia dongnaiensis* Orel, 2006, Novon 16: 244, fig. 1; Orel & Curry, 2015, Pursuit Hidden Camellias Vietnam China: 72; Nguyen, 2017, Fl. Vietnam: 163, fig. 65; Beech et al., 2017, The Red List of Theaceae: 25. (Beech et al., 2017; Nguyen, 2017; Orel, 2006; Orel & Curry, 2015)

Type: [Vietnam]. Lam Dong Prov., unnamed tributary upstream of Dong Nai River, 17 Jan. 2004, *G. Orel et al., 21148* (holotype NSW; isotypes NSW, HN).

Specimens examined: *G. Orel et al., 21148* (HN).

Distribution and ecology: VIETNAM (endemic). This species was found along the Dong Nai River on the Dalat Plateau in Lam Dong Prov., southern Vietnam.

Conservation status: *Camellia dongnaiensis* is assessed as Critically Endangered (CR) by Beech et al. (2017).

Note: *Camellia dongnaiensis* resembles *C. vidalii* in having leaf blades narrowly obovate, 35–44 cm long, both surfaces glabrous; flowers axillary, 4–7.5 cm in diam.; pedicel 2.5–4.5 cm long, glabrous; petals 8–10, oval or pentagonal; ovary 5(or 6); style free, 5–6.

(6) *Camellia hiepii* V. S. Dang, Vuong, V. C. Nguyen & V. D. Luong, 2023, Kew Bull., in prep. (Nguyen et al., 2023).

Type: [Vietnam]. Dak Lak Prov., M'Drak Dist., Mt. Chu Mu, at elevations of 500 to 800 m, 20 Dec. 2020, *Nguyen Van Canh et al.*, DLU201220 (holotype and isotype DLU), DLU210506 (paratype DLU).

Specimens examined: *Nguyen Van Canh et al.*, DLU201220, DLU210506 (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia hiepii* was discovered in evergreen broadleaf forests on Mt. Chu Mu, M'Drak Dist., Dak Lak Prov., Central Highlands.

Conservation status: More than 200 mature individuals of *C. hiepii* are distributed over an area of about 300 ha. However, the habitat of this species is being affected by human activities. This species is provisionally assessed as Critically Endangered (CR) according to the IUCN Red List criteria (IUCN, 2019).

Note: The validity of *Camellia hiepii* as a new species is now under review. The characteristics of *C. hiepii* are leaf blades oblong, 22–60 cm long, 8–18 cm wide; flower solitary, axillary, pedicellate, nodding; bracteoles 2, persistent; sepals 6–7, persistent; petals 11–12, 2-whorled, inner petals united with outermost filaments; gynoecium superior; ovary 5–6(–8)-locular, tomentose; styles 5–6(–8) free, which indicate that *C. hiepii* is classified into sect. *Piquetia*. It is easily distinguishable from *C. dalatensis*, *C. dongnaiensis*, *C. langbianensis*, *C. proensis*, *C. sonthaiensis*, and *C. piquetiana* by having red flowers (vs. yellow or orange flowers in the first four species and vs. purplish flowers in *C. piquetiana*) and from *C. honbaensis* by its gynoecium 5–6(7–8)-locular (vs. 3-locular).

(7) *Camellia honbaensis* Luu, Q. D. Nguyen & G. Tran, 2018, Academia Journal of Biology 40(4): 23, fig. 1. (Luu et al., 2018).

Type: [Vietnam]. Khanh Hoa Prov., Hon Ba Nature Reserve, 12°06'41"N, 108°58'51"E at an elevation of 650 m, 22 Jan. 2015, *Luu Hong Truong & Tran Gioi Luu*, 1101 (holotype SGN, isotypes SGN, VNMN); *ibid.*, 8 April 2013, *Luu Hong Truong & Tran Gioi*, KH1140 (paratype SGN); *ibid.*, 24 Mar. 2014, *Luu Hong Truong & Tran Gioi*, KH1140b (paratype SGN).

Specimens examined: *Luu Hong Truong & Tran Gioi Luu*, 1101 (VNMN); *Luu Hong Truong & Tran Gioi*, KH1140 (SGN); *Luu Hong Truong & Tran Gioi*, KH1140b (SGN).

Distribution and ecology: VIETNAM (endemic). This species was found at an elevation of 650 m in an evergreen broad-leaved forest in the Hon Ba Nature Reserve and at Khanh Vinh Pass, Khanh Vinh Dist., Khanh Hoa Prov., Central Vietnam.

Conservation status: Only two populations are known in and around the Hon Ba Nature Reserve. The number of individuals and their status assessment is not known. This species is provisionally assessed as Data Deficient (DD) (IUCN, 2019).

Note: *Camellia honbaensis* is similar to *C. dongnaiensis* and *C. piquetiana* but differs in having style 3–4, connate at basal 1/5–1/3 part (vs. 5–6, free). In addition, it differs from *C. dongnaiensis* in having red flowers (vs. graduated yellow-apricot to intensely pink petals).

(8) *Camellia langbianensis* (Gagnep.) Phamhoang, 1991, Cayco Vietnam 1(1): 537; Pham-Hoang, 1999, An Illust. Fl. Vietnam V1: 432, fig. 1743; Ban, 2003, Checkl. Pl. Spec. Vietnam V2: 347; Nguyen, 2017, Fl. Vietnam: 271, fig. 111; Zhao et al., 2017, Phytotaxa 292(2): 173; Zhao, 2019, Phytotaxa 419(1): 103; Quach et al., 2021b, Phytotaxa 480(1): 86, figs. 1, 2. (Ban, 2003; Nguyen, 2017; Pham-Hoang, 1991; Pham-Hoang, 1999; Quach et al., 2021b; Zhao et al., 2017; Zhao, 2019).

≡ *Dankia langbianensis* Gagnepain, 1939, Notul. Syst.(Paris) 8:131; Gagnep., 1943, in Lecomte, Suppl. Fl. Indo-Chine 1:198-199 (Gagnepain, 1939, 1943).

Type: [Vietnam]. Lam Dong Prov., between B.-dle and Dankia Commune, Mt. Langbiang at elevations of 1200 to 1300 m, 26 Oct. 1930, *Poilane, 18648* [lectotype P designated by Zhao et al. (2017, p. 173), isolectotypes K, L, P].

Specimens examined: *Poilane, 18648* (P), *23790* (P), *24105* (P); *L. V. Dung et al. DL.170201, DL19010, DL190401* (DLU); *L. Averyanov et al., VH 3561* (HN).

Distribution and ecology: VIETNAM (endemic). *Camellia langbianensis* occurs only in Lam Dong and Ninh Thuan provinces. It grows in evergreen broad-leaved forests at elevations of 1100 to 1300 m.

Conservation status: This species is known from three populations in Lam Dong and Ninh Thuan provinces, and the total number of mature individuals is estimated at fewer than 200. It is assessed as Critically Endangered (CR) (Quach et al., 2021b).

Note: *Camellia langbianensis* was first published as *Dankia langbianensis* in the monotypic genus *Dankia* by Gagnepain (1939) who placed *D. langbianensis* as a member of the family Bixaceae. Pham-Hoang (1991) merged *Dankia* with *Camellia*. The descriptions of the flowers and fruit of *Dankia* are consistent with those of *Camellia* in having 5 sepals, numerous stamens, a capsule dehiscent with 5 valves, and a central placenta. Later, Zhao (2019) reduced *C. vidalii* to a synonym of *C. langbianensis*. However, it differs from *C. vidalii* in some morphological characters, such as pedicel sparsely pubescent (vs. glabrous), pubescent on both sides (vs. outside sparsely

pubescent, inside glabrous), and filament pubescent basally (vs. glabrous). Quach et al. (2021b) treated *C. langbianensis* as a member of the sect. *Piquetia*, and we follow their treatment.

(9) *Camellia longii* Orel & Luu, 2014, *Nordic J. Bot.* 32(1): 46; Orel & Curry, 2015, *Pursuit Hidden Camellias Vietnam China*: 113; Beech et al., 2017, *The Red List of Theaceae*: 27. (Beech et al., 2017; Orel & Curry, 2015; Orel et al., 2014).

Type: [Vietnam]. Lam Dong Prov., Cat Tien National Park, 10 Sep. 2009, *Vu Ngoc Long*, CT4 (holotype VNM, isotypes NSW, VNM).

Specimens examined: *Vu Ngoc Long*, CT4 (VNM); *Quach Van Hoi*, Q201119; *Nong Van Duy*, TN3/735 (DLU).

Distribution and ecology: VIETNAM (endemic). This species was found in the understory of an evergreen broad-leaved forest and a mixed broad-leaved and bamboo forest. It is distributed in Cat Tien National Park in Phuoc Cat Commune, Cat Tien District, Lam Dong Province, southern Vietnam.

Conservation status: *Camellia longii* is assessed as Endangered (EN) (Beech et al., 2017).

Note: *Camellia longii* resembles *C. cattienensis* and *C. campanulata* in many morphological characteristics, such as large leaves; large red flowers; style 5, free to the base; filaments glabrous. These three species may be conspecific, but further studies based on more collections and phylogenetic analysis are needed to reach a conclusion.

(10) *Camellia phuongchiana* Curry, V. H. Quach, T. T. Hoang & Q. C. Truong, 2022, *Brittonia* 74: 339, figs. 1, 2. (Quach et al., 2022b).

Type: [Vietnam]. Lam Dong Province, Di Linh District, Gung Re Commune, mixed evergreen broadleaf-bamboo forest, elevation 890–950 m, 14 March, 2021. *Quach Van Hoi & Hoang Thanh Truong*, VTN1705 (holotype and isotype DLU).

Specimens examined: *Quach Van Hoi*, *Hoang Thanh Truong*, VTN1705, Q210314 (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia phuongchiana* is known only from the type locality, where it is scattered along a stream and among rocks under the canopy of a mixed evergreen broadleaf-bamboo forest at elevations of 890 to 950 m.

Conservation status: The total number of mature individuals of the species is considered to be fewer than 30, and all are distributed in an area less than 1 km² (Quach et al., 2022b). It can be provisionally assessed as Critically Endangered (CR) according to IUCN categories and criteria (IUCN, 2019).

Note: *Camellia phuongchiana* belongs to sect. *Piquetia* by possessing the following characteristics: flowers borne in the axils of the leaves, solitary or 2(–3)-clustered, pedicellate, nodding; bracteoles 2–3, persistent; sepals 5, persistent; petals 8 or more; stamens free above the union with the petals; gynoecium densely hairy; and style 5, free. Morphologically, *C. phuongchiana* is close to *C. piquetiana* in sharing with it the characteristics of leaf blades oblong; petals densely pubescent on both surfaces; stamens shorter than styles; and ovaries with 5 locules. However, it differs from *C. piquetiana* in having a smaller leaf blade (20–)24–32(–35) cm long, 6–8 cm wide (vs. 29–42 cm long, 9.5–12.5 cm wide in *C. piquetiana*); petioles 1.8–2 cm long (vs. 0.8–1.0 cm long); pedicels (3.5–)4–5(–5.5) cm long (vs. 0.8–1.1 cm long); and petals 10–11, densely pubescent on both surfaces (vs. 8 or more, pubescent only on the back) (Quach et al., 2022b).

(11) *Camellia piquetiana* (Pierre) Sealy, 1958, Rev. Gen. Camellia: 108, fig. 52; Pham-Hoang, 1999, An Illust. Fl. Vietnam V1: 425, fig. 1716; Richard et al., 2003, Int. Camellia J. 35: 54; Ban, 2003, Checkl. Pl. Spec. Vietnam V2: 349; Nguyen, 2017, Fl. Vietnam: 165, fig. 66; Beech et al., 2017, The Red List of Theaceae: 30; Zhao et al., 2018, Phytotaxa 351(1): 94. (Ban, 2003; Beech et al., 2017; Nguyen, 2017; Pham-Hoang, 1999; Richards et al., 2003; Sealy, 1958; Zhao et al., 2018).

≡ *Thea piquetiana* Pierre, 1887, Fl. Forest. Cochinch. 8:t.119; Gagnep., 1943, in Lecomte, Suppl. Fl. Indo-Chine 1:320 (Gagnepain, 1943; Pierre, 1887).

Type: [Vietnam]. Dong Nai Province near Chiao Xhan in Bien Hoa Province, March 1877, *L. Pierre, 1708* (holotype P, isotype K).

Specimens examined: *Pierre, 1708* (P, K); *Quach Van Hoi, Q210403* (DLU).

Distribution and ecology: VIETNAM (endemic). *C. piquetiana* was found in an evergreen broad-leaved forest near Dong Nai River, Loc Bac Commune, Bao Lam Dist., Lam Dong Prov.; Deo Chuoi Pass, Madagui Town, Da Huoai Dist., Lam Dong Prov.; Di Linh Dist., Lam Dong Prov.; and Dong Nai Prov., southern Vietnam.

Conservation status: *Camellia piquetiana* is listed as Critically Endangered (CR) (Beech et al., 2017).

Note: *Camellia piquetiana* was described by Pierre in 1887 as a species of *Thea*, and Sealy transferred it to the genus *Camellia* in 1958. It is the type species of sect. *Piquetia* endemic to Vietnam. This species is distinctly characterized among sect. *Piquetia* species by purplish petals.

(12) *Camellia proensis* V. D. Luong, Doudkin & V. H. Quach, 2021, Phytotaxa 479(1): 137, figs. 1, 2. (Quach et al., 2021c).

Type: [Vietnam]. Lam Dong Prov., Don Duong Dist., Pro Commune, at elevations of 800 to 1100 m, 8 Mar. 2015, *Quach Van Hoi & Luong Van Dung, DUNG.150301* (holotype and isotypes DLU).

Specimens examined: *Quach Van Hoi & Luong Van Dung, DUNG.150301* (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia proensis* was found in Pro Commune, Don Duong District, and Ta Nang Commune, Duc Trong District, both in Lam Dong Province. This species is distributed at elevations between 800 and 1100 m along the sides of streams in evergreen broad-leaved forests.

Conservation status: Several field investigations were carried out, but only two populations of *C. proensis* are known in Lam Dong Province, southern Vietnam. About 100 mature individuals remain, and the habitat quality and area are declining due to deforestation. This species is assessed as Endangered (EN) here.

Note: *Camellia proensis* is distinguishable from *C. dongnaiensis*, *C. honbaensis*, *C. piquetiana*, and *C. longii* by its yellow flowers; from *C. dalatensis* by its glabrous twigs and leaves; and from *C. sonthaiensis* by its mature fruit depressed-globose, 4–5.5 cm high and 8.5–10 cm in diameter.

(13) *Camellia sonthaiensis* Luu, V. D. Luong, Q. D. Nguyen & T. Q. T. Nguyen, 2015, *Ann. Bot. Fennici* 52: 289; Le, 2016 in Li J-Y., *Proc. Dali Int. Camellia Cong. Dali-Yunnan-China*: 89; Nguyen, 2017, *Fl. Vietnam*: 184. (Nguyen, 2017; Le, 2016; Luu et al., 2015).

Type: [Vietnam]. Khanh Hoa Prov., Khanh Vinh Dist., Son Thai Commune, 12°13'09"N, 108°44'46"E, at an elevation of 900 m, 14 Apr. 2013, *Luong Van Dung, DL 13.04.01* (holotype DLU; isotypes DLU, SGN), *DL 13.04.02*, *DL 13.04.03*, *DL 13.04.04* (paratypes all DLU, SGN).

Specimens examined: *Luong Van Dung, DL 13.04.01, DL 13.04.02, DL 13.04.03, DL 13.04.04* (DLU); *Quach Van Hoi, Q201102* (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia sonthaiensis* was found in an evergreen broad-leaved forest on humid fertile soils along a mountain stream at Khanh Vinh Pass, Son Thai Commune, Khanh Vinh Dist., Khanh Hoa Prov.

Conservation status: Only two populations of *C. sonthaiensis* are known from Khanh Vinh Dist., Khanh Hoa Prov. The status of *C. sonthaiensis* should be provisionally assessed as Data Deficient (DD) according to the IUCN categories and criteria (IUCN, 2019).

Note: *Camellia sonthaiensis* is distinctly characterized by its narrowly lanceolate leaves and usually 4-locular ovary with 4 styles. It was placed in sect. *Piquetia* due to possessing 1–3 flowers borne on short shoots in the axils of the leaves, which are pedicellate and nodding, 2–3 persistent bracteoles, 5 persistent sepals, stamens free above the union with petals, and a densely hairy ovary.

(14) *Camellia sphanii* Q. C. Truong & V. S. Le, 2022, *Dalat Uni. J. Sci.* 12(3): 11, figs. 1, 2. (Truong et al., 2022).

Type: [Vietnam]. Lam Dong Prov., Don Duong Dist., D'ran Town, Hamasin Village, evergreen broadleaf forests at elevations of 1300 to 1500 m, 28 Jan. 2021, *Truong Quang Cuong, Le Van Son & Luong Van Dung, DL212801* (holotype DLU; isotypes DLU, VTN).

Specimens examined: *Truong Quang Cuong, Le Van Son & Luong Van Dung, DL212801* (DLU).

Distribution and ecology: VIETNAM (endemic). *Camellia sphamii* was found in an evergreen broad-leaved forest in Hamasin Village, D'ran Town, Don Duong Dist., Lam Dong Prov., southern Vietnam.

Conservation status: *Camellia sphamii* was found in only one population with fewer than 200 mature individuals in an area of 2 ha. It is assessed as Critically Endangered (CR) (Truong et al., 2022).

Note: *Camellia sphamii* was placed in sect. *Piquetia* due to possessing many morphological characteristics of the section. This species most closely resembles *C. dalatensis* and *C. proensis*, but it differs from *C. dalatensis* by having young branches and leaves glabrous (vs. hairy in *C. dalatensis*) and from *C. proensis* by having leaf blades cordate at the base (vs. rounded or acute at the base in *C. proensis*).

(15) *Camellia vidalii* Rosmann, 1999, *Adansonia* III, 21(2): 319; Rosmann, 2000, *Int. Camellia J.* 32: 66; Nguyen, 2017, *Fl. Vietnam*: 171, fig. 68; Zhao, 2019, *Phytotaxa* 419(1): 103; Quach et al., 2021, *Phytotaxa* 480(1): 90. (Nguyen, 2017; Quach et al., 2021b; Rosmann, 1999, 2000; Zhao, 2019).

Type: [Vietnam]. Lam Dong Prov., Bao Loc City, between Bien Hoa and Dalat at an elevation of 875 m, 8 Dec. 1998, *Rosmann, Caurier & Luc, 981* (holotype P); *ibid.*, *Rosmann, Caurier & Luc, 982, 983, 985, 986* (paratypes all P).

Specimens examined: *Rosmann, Caurier & Luc, 981, 982, 983, 985, 986* (P); *Quach Van Hoi Q210502* (DLU).

Distribution and ecology: VIETNAM (endemic). This species was found on a mountainside in an evergreen broad-leaved forest in B'Lao Commune, Bao Loc City, Lam Dong Prov.

Conservation status: The current status of this species has not yet been assessed. The total population of this species was observed to be fewer than 200 individuals in its type locality.

Note: Rosmann described *Camellia vidalii* in 1999 (Rosmann, 1999). He placed *C. vidalii* in section *Thea*. Afterwards, Nguyen (2017) placed *C. vidalii* in sect. *Archecamellia*. Morphologically, *C. vidalii* possesses a number of characteristics common to sect. *Piquetia*, such as large leaf blades 35–40 cm long and 6–8 cm wide; flowers pedicellate, nodding, borne in the axils of the leaves; bracteoles 2–3, persistent;

sepals 5; petals 9–10; and style 5 (or 6), free to the base. The characteristic of nodding flower is not found in section *Arhecamellia*. In particular, *C. vidalii* is closest to *C. langbianensis*, and Zhao (2019) suggested that *C. vidalii* is a synonym of *C. langbianensis*. It differs from *C. langbianensis* in having a glabrous pedicel (vs. sparsely pubescent), bracteoles outside sparsely pubescent and inside glabrous (vs. both sides pubescent), sepals outside pubescent only at apex and inside glabrous (vs. both sides pubescent), and glabrous filaments (vs. pubescent near base). Quach et al. (2021b) suggested placing *C. langbianensis* in section *Piquetia* as well as *C. vidalii*, which is most similar to *C. langbianensis*. Therefore, this study places *C. vidalii* in section *Piquetia*, as appropriate.

4. DISCUSSION

There is no firm knowledge of the number of species in sect. *Piquetia*. Based on previous classification keys, the number of species in the section has varied from 5 to 9 (Luu et al., 2015, 2018; Quach et al., 2021c; Truong et al., 2022). In this study, 15 species are recognized for the first time and introduced with a key to the species of this section, which includes one undescribed species, *C. hiepii*, and three species, *C. campanulata*, *C. cattienensis*, and *C. vidalii*, newly transferred to sect. *Piquetia*. These three species have nodding flowers, which are not found in section *Arhecamellia*. Considering that all species in sect. *Piquetia* are endemic to Vietnam (except *C. campanulata*, which occurs in the border area between Cambodia and Vietnam), sect. *Piquetia* itself is considered to be endemic to the country. In particular, all species are distributed in southern Vietnam (except for *C. annamensis* in central Vietnam). According to Orel (2006), *C. piquetia*, *C. dongnaiensis*, and *C. krempfii* have specific characteristics adapted to wet, low-light conditions under the evergreen canopy of subtropical rainforests. For example, the leaves have prominent apices and sunken adaxial venation, which enable the plants to channel excess moisture away and lower the likelihood of pathogen growth on their leaf laminae. The leaf size also promotes transpiration, and the leaves are soft and extremely pendulous, which prevents damage by large water drops that may fall from the high leaf canopy of the dominant vegetation. Orel and Marchant suggested that the *Camellia* species originated in southern Vietnam. The above characteristics are also outstanding characteristics of sect. *Piquetia*. A recent study by Quach et al. (2021d) shows that southern Vietnam is considered to be the second center of *Camellia* diversity in Vietnam, with the first center found in northern Vietnam.

This study emends the definition of the section, has gathered full information on the bibliography, distribution, ecology, and conservation status of each species, and has offered some comments on the relationship between similar species in section *Piquetia*. Sealy (1958) established sect. *Piquetia* based on a single species, *C. piquetiana*, which was described by Pierre (1887) as *Thea piquetia*. Many new species in section *Piquetia* have been discovered and published recently (Ly et al., 2022; Quach et al., 2021a, 2021c, 2021d, 2022b; Truong et al., 2022), and the number of species in sect. *Piquetia* has risen to 15. Overall, sect. *Piquetia* has several characteristics worthy of attention: leaf blade large, oblong, narrow elliptic or narrow lanceolate; style free to base or only basally united; and usually ovary 5-locular.

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