

Names of Assam tea: Their priority, typification and nomenclatural notes

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Abstract Various names have been used for Assam tea and they are typified here. The currently widely used name, *Camellia sinensis* var. *assamica*, is a combination based on *Thea viridis* var. *assamica*, not “*T. assamica*” because the latter was never validly published. Two earlier published names, *C. theifera* and *T. cochinchinensis*, and two later ones, *C. tenuistipa* and *T. yersinii*, may represent the same taxon and are treated as synonyms of *T. viridis* var. *assamica* because the latter has priority at the rank of variety and therefore is the correct name for Assam tea.

Keywords Assam tea; *Camellia sinensis* var. *assamica*; *Camellia tenuistipa*; *Camellia theifera*; *Thea cochinchinensis*; *Thea yersinii*

■ INTRODUCTION

Tea, *Camellia sinensis* (L.) Kuntze (Theaceae), is one of the most popular beverage sources in the world. Tea was firstly recorded and used by the Chinese more than two millennia ago (Fang, 1998; Lu & al., 2016). It has been recognized and subsequently enjoyed by people in the Western world for centuries in large part due to the efforts of the British East India Company (Jackson, 1870), whose botanists found and verified the occurrence of wild tea plants in Assam (Assam tea) in the second quarter of the 19th century (Anonymous, 1835; Griffith, 1838; Sealy, 1958).

Linnaeus (1753: 515) established the genus *Thea* L. for the species *T. sinensis* L. But he (Linnaeus, 1762: 734 & 735) subsequently replaced *T. sinensis* with *T. bohea* L., an illegitimate replacement name for *T. sinensis* (because Linnaeus, 1762, cited all the referenced illustrations of *T. sinensis* under *T. bohea*, this makes the latter nomenclaturally superfluous; Art. 6.11, 52.1 & 52.2[d] of the *ICN*; McNeill & al., 2012), and added *T. viridis* L. Since then, both *T. bohea* and *T. viridis* have been treated as the heterotypic synonyms of the same species (Sims, 1807; Seemann, 1859; Sealy, 1958; Chang, 1981, 1998; Chang & Bartholomew, 1984; Ming, 2000; Ming & Bartholomew, 2007). Similarly, *Thea* has been treated as a synonym of *Camellia* L. (Sweet, 1818) and Kuntze (1887) proposed the combination *C. sinensis*, which is the currently widely used scientific name of tea.

Assam tea and tea differ from each other mainly in characters of the leaf and occur naturally in different geographical areas (Sealy, 1958; Ming, 2000). They have been treated both as conspecific and as separate species. Seemann (1859: 349)

adopted a broad concept of tea under the name *T. chinensis* Sims to represent “only one species of the plant yielding the tea of commerce”, including tea and Assam tea. *Thea chinensis* is another illegitimate replacement name for *T. sinensis* because Sims (1807: t. 998) cited the latter as a synonym of the former, making *T. chinensis* nomenclaturally superfluous (Art. 6.11, 52.1 & 52.2[e]). This broad concept of tea was accepted by Dyer (1874) and Cohen-Stuart (1919) but they applied the name *C. theifera* Griff. to it. By contrast, Wight (1962) and Chang (1984, 1998) proposed that tea and Assam tea should be treated as two distinct species. Many researchers have, however, recognized Assam tea as a variety of *C. sinensis* (Sealy, 1958; Keng, 1972; Chang, 1981; Chang & Bartholomew, 1984; Hô, 1991; Ming, 1999, 2000; Ming & Bartholomew, 2007).

However, the currently widely used scientific name of Assam tea, “*C. sinensis* var. *assamica* (J.W.Mast.) Kitam.” has nomenclatural problems and two earlier published names may represent the same taxon. Therefore, the names of Assam tea are examined and typified here to clarify their nomenclatural status.

■ TYPIFICATION OF THE NAMES

Thea viridis var. *assamica*

Masters (1844: 63) introduced the name “*Thea assamica*” for Assam tea and this has been accepted as the “basonym” of *C. sinensis* var. *assamica* (Choisy) Kitam. (Sealy, 1958; Keng, 1972; Chang, 1981; Chang & Bartholomew, 1984; Hô, 1991; Ming, 1999, 2000; Ming & Bartholomew, 2007) and *C. assamica* (Choisy) Hung T.Chang (Chang, 1998) without previous

question. Both combinations are, however, actually based on another name and “*T. assamica*” was never validly published.

In the original publication, Masters (1844) described “Assam tea plant” using the name “*T. assamica*” but concluded that it “... is identical with *Thea viridis*, described in Rees’ Cyclopaedia ...” (Masters, 1844: 68). And at the end of his paper Masters (1844: 69) further explicitly stated that “... the trivial name ‘*Thea assamica*,’ is here used solely for the purpose of the better understanding of this paper; there being no peculiarity in the plant to authorize burdening science with a new name.” Therefore, Masters himself did not accept the name “*T. assamica*”. According to Art. 36.1(a), the name “*T. assamica*” was not validly published by Masters in 1844. However, Sealy (1958: 119) and Ming (2000: 133) indicated that another publication of Masters (1863) contained the name “*T. assamica*”. In this article Masters (1863), however, used the words “the Assam tea plant”, “the tea-plant as found in Assam” and “the Assam plant” to indicate what he meant but never mentioned the binary name “*T. assamica*”.

Choisy (1855: 155) adopted the name *T. viridis* to represent tea and cited “*T. assamica* H. Kew” in its synonymy. He (Choisy, 1855) probably learned the name “*T. assamica*” from the specimens deposited at K since he wrote “H. Kew”. But the name “*T. assamica*” recorded on the specimen sheets is not an effectively published name (Art. 30.1). Choisy (1855: 156) further divided *T. viridis* into three varieties based on the size of the leaves, including *T. viridis* var. *assamica* Choisy. The diagnosis of *T. viridis* var. *assamica* stated briefly: “feuilles longues de 4 à 8 pouces”, thereby distinguishing this variety from *T. viridis* var. *cantoniensis* (Lour.) Choisy (leaves 2–3 inches long) and *T. viridis* var. *vulgaris* Choisy (leaves 1–1.5 inches long) listed simultaneously. It was here, therefore, that *T. viridis* var. *assamica* was validly published as a new taxon (Art. 6.9, 38.1 & 38.2) and the epithet *assamica* was legitimately used to name Assam tea for the first time. Sealy (1958: 119) and Ming (2000: 133) treated *T. viridis* var. *assamica* as a “combination” based on Masters’s (1844) “*T. assamica*” but they were incorrect because a combination must be based on a legitimate, previously published name (Art. 6.10) and “*T. assamica*” had not been validly published and thus had no status (Art. 12.1).

In his *Flore forestière de la Cochinchine*, Pierre (1887: t. 114, D¹, D²) validly published the combination *T. chinensis* var. *assamica* (Choisy) Pierre when he referenced “Choisy Mém. p. 68” to directly indicate the basionym *T. viridis* var. *assamica* (Art. 41.1). The page number Pierre (1887) cited is, however, incorrect but this should be treated as a correctable typographical error and so does not affect the valid publication of the new combination (Art. 41.3). The correct page number of Choisy’s *T. viridis* var. *assamica* is 156, or the 66th page of Choisy’s article (pages 91–186). Sealy (1958: 119) incorrectly cited page “67” and Chang (1998: 135) and Ming (2000: 133) repeated Sealy’s citation.

The currently widely accepted name of Assam tea, *C. sinensis* var. *assamica*, was validly published by Kitamura (1950: 59) with the authorship cited as “(Pierre) Kitam.” and giving the reference “Syn. *Thea sinensis* var. *assamica* Pierre, Fl. Forest. Cochinch. pl. 114 (1887)”. This citation is regarded

as an indirect reference through Pierre (1887) to the basionym *T. viridis* var. *assamica* published by Choisy (1855) (Art. 41.3). The error in the author citation is correctable and does not affect the valid publication of this new combination (Art. 41.3).

Later, Wight (1962: 298) thought that Assam tea should be treated as an independent species so he proposed the intended combination “*C. assamica* (Masters)”. This name cannot be recognized as a new combination since Masters’s “*T. assamica*” was not validly published and thus cannot act as a basionym (Art. 6.10) and the correct basionym, *T. viridis* var. *assamica*, was neither clearly indicated (Art. 41.5) nor indirectly referenced (Art. 41.8). Neither can it be otherwise validly published as a new species because there was no Latin description or diagnosis in the publications of Wight (1962) or Masters (1844) (Art. 39.1).

Hu & Chang (1964: 497) recognized *Thea* and treated “*T. assamica*” as a validly published name by Masters (1844) and cited the names published by Pierre (1887) and Kitamura (1950) in its synonymy with full and direct references. Though they accepted “*T. assamica*”, this name cannot be technically treated as a new species published by Hu & Chang (1964) because no Latin description or diagnosis was included or directly referenced (Art. 38.13 & 39.1). Neither can it be otherwise validly published as a new combination because the basionym *T. viridis* var. *assamica* and its reference was not clearly indicated as required by Art. 41.5 or indirectly referenced under Art. 41.8(a) (see Ex. 20) as Pierre (1887) provided an explicit reference to the basionym published by Choisy (1855).

Subsequently, Chang (1984: 11) proposed the intended combination “*Camellia assamica* (Mast.) Chang” and cited the names and references of Masters (1844) and Kitamura (1950) and referenced “Sealy, Rev. Gem. Camellia, 114, 1958”. This reference is full of typographical errors, it should be corrected to “Sealy, Revis. Gen. Camellia: 119, 1958”. However, the incorrect author citation and typographical errors in the reference do not prevent the potential valid publication of this new combination (Art. 41.6), if other conditions are fulfilled based on the ICN. Unfortunately, Chang (1984) did not clearly indicate the correct basionym as required by Art. 41.5. Meanwhile, because Sealy (1958) provided an explicit citation and referenced Choisy’s *T. viridis* var. *assamica* so Art. 41.8(a) (see Ex. 20) does not apply. Therefore, “*Camellia assamica*” was not validly published as a new combination by Chang (1984). Neither can it be otherwise validly published as a new species because there was no Latin description or diagnosis provided or directly referenced by Chang (1984) (Art. 38.13 & 39.1).

In *Flora Reipublicae Popularis Sinicae*, Chang (1998: 133) listed “*Camellia assamica* (Mast.) Chang” and cited “*Thea viridis* L. var. *asamica* (Mast.) Choisy Mem. Ternstroemia & Camellia 67. 1865”. This citation should be corrected to “*Thea viridis* L. var. *assamica* Choisy in Mém. Soc. Phys. Genève 14: 156. 1855”—besides other typographic errors, Chang (1998: 135) only referenced the abbreviated title of the article. Here, Chang (1998) indicated Masters’s “*T. assamica*” as the “basionym” and cited the correct basionym, *T. viridis* var. *assamica*, as a later synonym. But “*T. assamica*” was not validly

published and has no status (Art. 12.1) so it cannot act as a basionym (Art. 6.10). Though the correct basionym was not recognized by Chang (1998), his new combination *C. assamica* was nevertheless validly published because he did clearly mention the correct basionym and did directly reference its author and place of valid publication (Art. 41.5) though with incorrect page number and date. We prefer to treat these errors as correctable and so they do not affect the valid publication of this new combination (Art. 41.6).

Unfortunately, the type of *C. sinensis* var. *assamica* has been continuously neglected by monographers who successively revised the taxonomy of *Camellia* (Sealy, 1958; Chang, 1981, 1998; Chang & Bartholomew, 1984; Ming, 2000; Ming & Bartholomew, 2007) even though this taxon has been intensively studied. A number of syntypes of *T. viridis* var. *assamica* were found at K. They were examined and one of them with mature flowers is designated below as the lectotype (Fig. 1).



Fig. 1. Lectotype of *Thea viridis* L. var. *assamica* Choisy (Masters s.n., K). Photo: D.W. Zhao.

Camellia theifera

Seventeen years earlier than the publication of *T. viridis* var. *assamica*, “the tea plant of Assam”—*C. theifera*, was published in the caption of an illustration with analysis (Griffith, 1838: t. C). Though this name is literally absent from the text of Griffith (1838) containing the illustration, it was validly published because there was a group of figures showing the details of flower and fruit of *C. theifera* (Art. 38.8 & 38.9). Sealy (1958: 119) and Ming (2000: 133) did not realise that this name had been published in 1838 and incorrectly cited instead the description of Griffith (1854) as the protologue and treated *C. theifera* as a synonym of *C. sinensis* var. *assamica*.

Only the details of flower and fruit were drawn in the original illustration of *C. theifera*. In the article which this illustration accompanied, Griffith (1838: 105) reported that the leaves of Assam tea plants “were sufficiently coarse and varied in length from 4 to 8 inches”. Those characters, illustrated and recorded, are consistent with those of the syntypes found at E (barcodes E00681110 & E00691478), K and TCD (barcodes TCD0017977, TCD0018250 [exclude the specimen in the middle, which is a different species] & TCD0018251). One of the syntypes conserved at TCD (barcode TCD0017977) has flowers so it is designated below as the lectotype (Fig. 2).

Thea cochinchinensis

Thea cochinchinensis Lour. was validly published 48 years before *C. theifera* and 65 years before *T. viridis* var. *assamica* (Loureiro, 1790: 338). It may represent the same taxon of Assam tea (Chevalier, 1919: 529). Nevertheless, it has been suggested that this name should be abandoned (Cohen-Stuart, 1919) or treated as a synonym of *C. sinensis* (Seemann, 1859; Merrill, 1935; Sealy, 1958; Chang, 1981; Chang & Bartholomew, 1984; Ming, 2000).

Only a part of Loureiro’s collections have been preserved (Bretschneider, 1881). It is reported that what remains of his specimens are conserved at BM, LINN, LISU, MO and P (Merrill, 1935; Chaudhri & al., 1972; Stafleu & Cowan, 1981). The collections at LISU are believed to have been destroyed (Merrill, 1935; Chaudhri & al., 1972; Stafleu & Cowan, 1981). The first author visited BM and P and searched the online database of LINN and MO but did not find any credible type material of *T. cochinchinensis*, which concurs with former reports (Cohen-Stuart, 1919; Merrill, 1935).

The diagnosis, description and usage in the protologue of *T. cochinchinensis* are “sufficiently exact clearly” (Merrill, 1933: 232) to indicate one species of sect. *Thea* Griff. of *Camellia*—a monophyletic group that includes *C. sinensis* (Vijayan & al., 2009) and the species in this section can be used to produce tea. Griffith (1854: 553) established sect. *Thea* as a new taxon. It has priority over the combination sect. *Thea* (L.) Dyer in 1874 (Art. 11.4). The latter has been accepted by Sealy (1958: 111), Chang (1981: 108; 1998: 115), Chang & Bartholomew (1984: 137), Ming (1992: 116; 1999: 152; 2000: 110), Ming & Bartholomew (2007: 372) and Orel & Curry (2015: 263), but it is illegitimate because it is a later homonym of

sect. *Thea* Griff. (Art. 53.1). In the protologue Loureiro (1790: 338) wrote: “Habitat culta, inculcuaque in provinciis Borealiibus Cochinchinae”, which indicates that this species has both cultivated and wild plants in the northern provinces of Cochinchina. Though it is not clear where exactly the region “provinciis Borealiibus Cochinchinae” indicated by Loureiro is, its rough area may be outlined from his other records of localities in *Flora Cochinchinensis*. Bretschneider (1881) studied and summarised several specified localities recorded by Loureiro, such as “Province of *Binh khang* in the southern part of Cochinchina, 14° N. ...” and “Province of *Quang binh* in North-Cochinchina ...”, by which it may be reasonable to consider that “provinciis Borealiibus Cochinchinae” roughly indicates the area north of Hué in Vietnam since Loureiro lived at Hué, “the metropolis of Cochinchina”, at that time (Bretschneider, 1881; Chevalier, 1919).

Chevalier (1919: 529) suggested for *T. cochinchinensis* that “Il est toutetois permis de supposer qu’il s’agit du *Thea*

sinensis L. var. *assamica* Pierre” by which he (Chevalier, 1919) inferred that *T. cochinchinensis* might represent Assam tea. Chevalier (1919) also reported that the leaves of *C. tonkinensis* (Pit.) Cohen-Stuart and *C. gilbertii* (A.Chev.) Sealy were collected by local people in Vietnam and sold as substitutes of tea. However, the morphological characters described in Loureiro’s protologue do not match those of *C. tonkinensis* (in terms of the flower colour and the number of petals) or *C. gilbertii* (in terms of the number of stamens).

Merrill (1935: 267) treated *T. cochinchinensis* as a synonym of *T. sinensis* and concluded that “I see no reason for considering that *T. cochinchinensis* Lour. represents other than a form of the common tea plant.” *Camellia sinensis* is widely cultivated in Vietnam (Pierre, 1887; Hô, 1991); however, credible wild material of *C. sinensis* has not been found in the area north of Hué in Vietnam (Sealy, 1958; Ming, 2000). Instead, based on published data (see below) and the first author’s field and herbaria investigations (see Appendix 1), Assam tea is naturally distributed in this area and has been cultivated by the Vietnamese for centuries (Chevalier, 1919; Sealy, 1958; Ming, 2000). Therefore, we agree with the deduction of Chevalier (1919) that *T. cochinchinensis* may represent the same taxon as *C. theifera* and *T. viridis* var. *assamica*.

In order to further support for the identity of *T. cochinchinensis*, the natural species of sect. *Thea* of *Camellia* distributed in Vietnam are examined and discussed as follows.

Pierre (1887) listed five varieties under *T. chinensis*, viz. *T. chinensis* var. *assamica*, *T. chinensis* var. *bohea* (L.) DC., *T. chinensis* var. *cantonensis* (Lour.) Pierre, *T. chinensis* var. *pubescens* Pierre and *T. chinensis* var. *viridis* (L.) DC. The specimens he cited were, however, all collected from other places (e.g., Brazil, China, India, Japan, Malaysia and Réunion), none of them came from Cochinchina. Later, Pitard (1910) repeatedly listed these five varieties of *T. chinensis* but without citing any collection. Gagnepain (1943) did not mention *T. chinensis* var. *pubescens* but recognized that four of these five varieties of *T. chinensis* occurred in Indochina and cited collections of them. However, he (Gagnepain, 1943) reported only collectors but without citing corresponding collector numbers. Based on Gagnepain’s handwritten identifications (without date) on the specimens, most of the available specimens from north of Hué in Vietnam cited under the four varieties of *T. chinensis* by him (Gagnepain, 1943: 314 & 315) are Assam tea (see Appendix 1). The remainder are species that do not belong to sect. *Thea* (e.g., *Poilane 12806* [P barcodes P04500202 & P04511574] under the name *T. chinensis* var. *viridis* by Gagnepain is actually *C. tsiangpiensis* Hu). Later, Hô (1991: 535) recorded *C. sinensis* but adopted the same four varieties reported by Gagnepain (1943) without citing any specimens.

In *Supplément a la flore générale de l’Indo-Chine*, Gagnepain (1943: 310) described *T. yersinii* A.Chev. (the original epithet “*yersini*” in the protologue should be considered as an orthographical error of “*yersinii*” because it may be named after A. Yersin, 1863–1943; Art. 60.12 & 60C.1[b]). The collectors’ numbers of the syntypes were not indicated in the protologue. The first author searched several herbaria and found that *Chevalier 38684* (P barcodes P02142599,



Fig. 2. Lectotype of *Camellia theifera* Griff. (Griffith s.n., TCD barcode TCD0017977). Image scanned by Ms J. Stone (TCD).

P05278730 & P05278764), 38705 (P barcode P05312519), 38842 (P barcodes P02274496, P02274497, P02274498 & P04511724), *Poilane 7744* (P barcode P04511404) and *16693* (K, P barcode P04500223, VNM barcode VNM00003825) all bore the handwriting “*Thea yersini* A.Chev.”. So these are all syntypes of *T. yersinii*. However, the first author found that the syntypes represented three different taxa: Assam tea (*Chevalier 38684*, *38705* & *38842*), *C. corallina* (Gagnep.) Sealy (*Poilane 7744*) and *C. pubicosta* Merr. (*Poilane 16693*). Nevertheless, no one has so far lectotypified the name *T. yersinii*. The characters recorded in its protologue match those of *Chevalier 38684*, *38705* and *38842*. The sheet P02142599 of *Chevalier 38684* at P is designated below as the lectotype since it bears Gagnepain’s drawing. Therefore, *T. yersinii* is a synonym of Assam tea and *Poilane 7744* and *16693* are excluded from this name.

Sealy (1958: 131) placed *C. gracilipes* Merr. in sect. *Thea* “as a matter of convenience”. However, this treatment is not supported by Chang (1981), Chang & Bartholomew (1984), Ming (2000) and the first author. Our nuclear DNA investigation (in prep.) does not suggest that a clade is formed by *C. gracilipes* and sect. *Thea*. Although *C. gracilipes* is distributed in northern Vietnam, the first author did not find any record of its usage on the specimens examined (*Ban 4767* [HN, PE]; *Tagane & al. V3721* [FU]; *Tsang 27106* [E barcode E00681071, IBSC, K, SYS], *27151* [E barcode E00681073, IBSC, K, P barcode P04511530, SYS], *27275* [A barcode 00024749, E barcode E00284418, IBSC, K barcodes K000704327 & K000704328, KUN, P barcode P04511528, SYS] & *29576* [C, E barcode E00681072, IBSC, K, P barcode P04511529, SYS]) or in the literature available (Sealy, 1949, 1958; Chang, 1981; Chang & Bartholomew, 1984; Ming, 2000; Nguyễn, 2003).

Sealy (1958), Chang (1981) and Chang & Bartholomew (1984) recognized that *C. pubicosta* was a member of sect. *Thea*, a treatment with which Ming (2000) and the first author disagree. Our nuclear DNA analysis (in prep.) shows that *C. pubicosta* and sect. *Thea* do not form a clade. *Camellia pubicosta* naturally occurs in Vietnam (Sealy, 1958; Ming, 2000; also see Appendix 2) and the first author collected specimens in the forest of Vinh Phuc (*Zhao & al. 107(1)* & *107(2)* [TCD], see Appendix 2); however, during the field, herbarium and literature investigations, the first author found that local people did not use this species or plant it as a beverage or medicine source, nor did he find any information on its usage recorded on the specimens examined (see Appendix 2) or in the literature available (Merrill, 1942; Sealy, 1958; Chang, 1981; Chang & Bartholomew, 1984; Hô, 1991; Ming, 2000; Nguyễn, 2003; Gao & al., 2005).

Huang & al. (2014) reported the complete chloroplast genome of *C. pubicosta* and found that this species was closely related to *C. sinensis* and “may be classified into sect. *Thea*”. The fresh leaf material of *C. pubicosta* that they (Huang & al., 2014) used was collected in the “International *Camellia* Species Garden (Jinhua, Zhejiang, China)” in May 2011 without any voucher specimen cited. Meanwhile, they stated that “... *C. pubicosta* [was] native to Laos” (Huang & al., 2014: 11) and the plant materials were identified based on the taxonomic treatment in *Flora of China* (Ming & Bartholomew, 2007). The

original reference in Huang & al. (2014) is “Min TL, Bruce B: *Flora of China*. Beijing, China: Science Press; 2010” and is full of errors. The correct citation is given in the Literature Cited below. However, this *C. pubicosta* they (Huang & al., 2014) used has several problems. Firstly, *C. pubicosta* has not been found in Laos based on the first author’s investigations of specimens (from 44 herbaria, see Acknowledgements and Appendix 2) and literature (Merrill, 1942; Sealy, 1958; Chang, 1981; Chang & Bartholomew, 1984; Ming, 2000; Gao & al., 2005; Newman & al., 2007); secondly, no record of *C. pubicosta* can be found in the *Flora of China* (Ming & Bartholomew, 2007); and finally, the International *Camellia* Species Garden at Jinhua, Zhejiang, China may not have living material of *C. pubicosta* (Gao & al., 2005: 223; the first author’s correspondence with Prof. Jiyuan Li on 17 May 2017). Therefore, we doubt the credibility of the material of *C. pubicosta* used in Huang & al. (2014) and believe that this species is not a member of sect. *Thea*.

A recently published species of sect. *Thea*, *C. tenuistipa* Orel & al., is another synonym of Assam tea, whose type was collected in Vietnam (Orel & Curry, 2015: 263).

Apart from the published data discussed above for the identity of *T. cochinchinensis*, the first author examined *Camellia* collections from 44 herbaria (see Acknowledgements), especially those specimens collected in Vietnam. Specimens of Assam tea collected from north of and around Huế in Vietnam are listed in Appendix 1. As a natural taxon, the morphological characters of Assam tea vary in its areas of distribution. For example, in the northern Vietnamese provinces of Lao Cai and Lai Chau, especially along the Sino-Vietnamese border, some specimens (*Hiep & al. HAL 10438*, *Pélotot 4249* & *Poilane 17010* in Appendix 1) have a pedicel that is gradually swollen towards the top and/or a 3–4-lobed style. These character states might imply that Assam tea has introgressed with its neighbour *C. taliensis* (W.W.Sm.) Melch., a species of sect. *Thea* occurring in southern and southwestern Yunnan, China (Zhao & al., 2014) (Assam tea usually has a slender pedicel and a 3-lobed style whereas *C. taliensis* generally has a stout pedicel that is gradually swollen towards the top and a 5-lobed style). This morphological variation does not challenge the circumscription of Assam tea, on the contrary, it suggests that this taxon is naturally distributed in northern Vietnam, has natural geographical boundaries and may undergo gene exchange with a phylogenetically closely related species.

Since no original material of *T. cochinchinensis* is extant, a single specimen with mature flowers collected from northern Vietnam, *Poilane 25282* (P barcode P04511587), is designated below as the neotype (Art. 9.13).

■ PRIORITY OF THE NAMES

Camellia theifera, *T. cochinchinensis* and *T. viridis* var. *assamica* all represent plants of *Camellia* whose leaves can produce drinkable beverage (Loureiro, 1790; Griffith, 1838; Choisy, 1855). On the one hand, *C. theifera* and *T. viridis* var. *assamica* were reported as endemic to Assam (Griffith, 1838; Choisy, 1855) and their syntypes were collected there. These

two taxa share the same character states (see description below) and we think that they represent the same taxon (Assam tea) based on our analyses of their protologues and type materials. On the other hand, *T. cochinchinensis* was reported to be both indigenous to and cultivated in northern Vietnam (Loureiro, 1790). According to our analysis above, the only taxon that matches this information in sect. *Thea* of *Camellia* is Assam tea. Therefore, we conclude that *C. theifera*, *T. cochinchinensis* and *T. viridis* var. *assamica* are heterotypic synonyms of the same taxon.

However, only one correct name can be used to represent a taxon of living plant below the rank of genus (Art. 11.1) and its nomenclature is based on the priority of publication (Principle III) in the same rank (Art. 11.2). Clearly, *T. cochinchinensis* has priority over *C. theifera* and *C. assamica* in the rank of species. But, we prefer to recognize Assam tea as a variety of *C. sinensis* here because of their morphological and molecular

(Su & al., 2009; Yang & al. 2016) similarities. Tea and Assam tea have the same character states of flower and fruit, only differing from each other in habit, leaf size and the shape of the leaf apex—*C. sinensis* is usually a shorter shrub and has smaller leaves than Assam tea, and its leaf apex is acute or shortly attenuate with a rounded tip. By contrast, Assam tea is generally a tall tree, has large leaves and its leaf apex is attenuate or acuminate (see description below and Fig. 3). We think that these differences and those of geographical distributions (Sealy, 1958; Ming, 2000) are sufficient to warrant separation of Assam tea from *C. sinensis* at varietal level. Therefore, *Thea viridis* var. *assamica*, the basionym of *C. sinensis* var. *assamica*, has priority and the latter remains correct for Assam tea at the rank of variety (Art. 11.2 & 11.4) and *C. theifera* and *T. cochinchinensis* are herein treated as its earlier published synonyms.

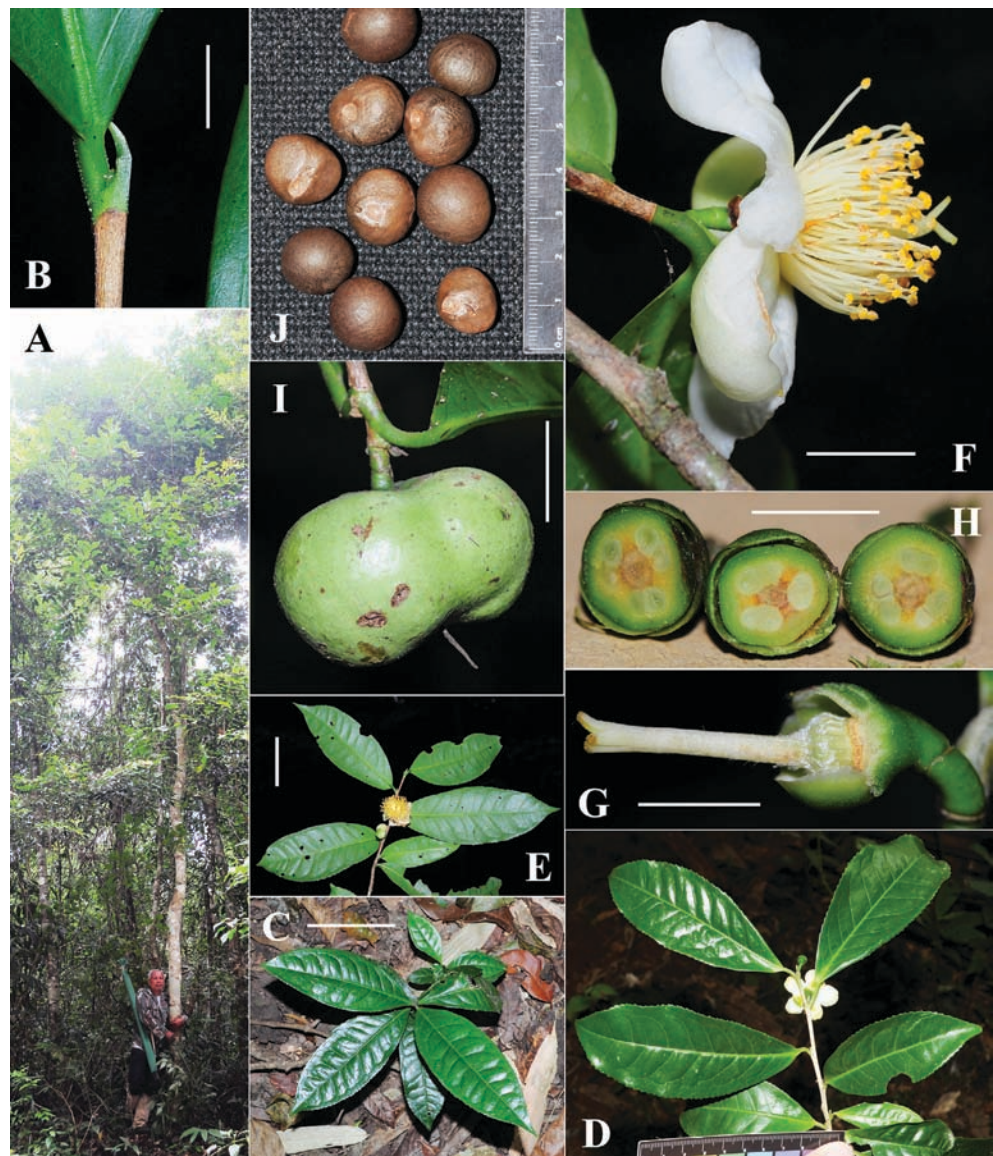


Fig. 3. *Camellia sinensis* (L.) Kuntze var. *assamica* (Choisy) Kitam. **A**, Habit; **B**, Terminal bud; **C**, Seedlings; **D & E**, Branchlets with flowers; **F**, Flower; **G**, A flower without petals, androecium and one and half sepals; **H**, Transections of immature fruits; **I**, Fruit; **J**, Seeds. — The bars represent 5 mm (in B), 10 cm (in C), 5 cm (in E), 1 cm (in F), 5 mm (in G), 5 mm (in H) and 1 cm (in I). The minimum graduation of the ruler in D and J indicates 1 mm. Photos: D.W. Zhao.

■ TAXONOMIC TREATMENT AND DESCRIPTION

Camellia sinensis (L.) Kuntze var. *assamica* (Choisy) Kitam. in Acta Phytotax. Geobot. 14: 59. 1950 ≡ *Thea viridis* L. var. *assamica* Choisy in Mém. Soc. Phys. Genève 14: 156. 1855 ≡ *T. chinensis* Sims var. *assamica* (Choisy) Pierre, Fl. Forest. Cochinch.: t. 114, D¹, D². 1887 ≡ *C. assamica* (Choisy) Hung T.Chang in Fl. Reipubl. Popul. Sin. 49(3): 133. 1998 – **Lectotype (designated here)**: INDIA. Assam: Chundoo, *Masters s.n.* (K!). — Fig. 1.

= *Thea cochinchinensis* Lour., Fl. Cochinch. 1: 338. 1790, **syn. nov.** – **Neotype (designated here)**: VIETNAM. Yên Bái [Yen Bai]: Bao Ha, 21 Feb 1936, *Poilane 25282* (P barcode P04511587!). — An image of the neotype is available at <https://science.mnhn.fr/institution/mnhn/collection/p/item/p04511587>

= *Camellia theifera* Griff. in Trans. Agric. Soc. India. 5: t. C. 1838 – **Lectotype (designated here)**: INDIA. Upper Assam, *Griffith s.n.* (TCD barcode TCD0017977!). — Fig. 2.

= *Thea yersinii* A.Chev. ex Gagnep. in Lecomte Fl. Indo-Chine, Suppl. 1 [ed. H. Humbert]: 310. 1943 (“*Thea yersinii*”), excl. *Poilane 7744 & 16693*, **syn. nov.** – **Lectotype (designated here)**: VIETNAM. [Khanh Hoa]: Massif du Hòn bà, province de Nhatrang, 1000–1500 m, 12 Sep 1918, *Chevalier 38684* (P barcode P02142599!). — An image of the lectotype is available at <https://science.mnhn.fr/institution/mnhn/collection/p/item/p02142599>

= *Camellia tenuistipa* Orel, Curry & Luu in Orel & Curry, Pursuit Hidden Camellias Vietnam China: 263. 2015, **syn. nov.** – Holotype: VIETNAM. Gia Lai: Kon Ka Kinh National Park, 22 Jan 2011, *Luu & Nguyen KKK 221* (NSW barcode NSW901734 [digital image!]).

Description (glossary follows Ming & Bartholomew, 2007, and Beentje, 2012). – Trees or shrubs up to 20 m tall, evergreen. Trunk smooth, yellowish or brownish grey, new branchlets puberulous or pubescent, terminal buds pubescent or puberulous. Leaves alternate, petiolate, petiole 2–9 mm long, puberulous; leaf blade elliptic, oblong or obovate, 8–29 cm × 3.5–10 cm, coriaceous, abaxially yellowish green, puberulous, especially along midrib, adaxially dark or yellowish green, shiny, midrib abaxially elevated and adaxially slightly raised or flat, secondary veins brochidodromous, 7–15 on each side of midrib, abaxially slightly elevated and adaxially slightly impressed or flat, base cuneate or attenuate, margin serrulate, apex attenuate or acuminate. Flowers axillary, solitary or up to 4 in a cluster, pedicellate, 2–3.5 cm in diam. Pedicel 4–14 mm long, slender or gradually swollen towards the top, bracteoles 2–3, alternate, caducous. Sepals 5, persistent, sub-orbicular or broadly ovate, 3–4.5 mm × 3–5 mm, outside glabrous, inside sericeous, margin ciliate. Petals 5–7 in 1–2 whorls, white or outer 1–3 petals with a tinge of green at apex, obovate, elliptic or rounded, 1–2.5 cm × 1–2 cm, glabrous on both surfaces. Stamens numerous in 3–5 whorls, 7–16 mm long, filaments pale yellow, glabrous, outer filaments basally adnate to petals for 1–3 mm. Ovary oblate or globose, sericeous; ovules 2–4 per carpel; style

6–15 mm long, glabrous or basally sparsely sericeous and gradually becoming glabrous upwards, apically (2–)3(–4)-lobed for 1–3 mm. Capsule oblate, bi-coccal or globose, 17–45 mm in diam., 12–20 mm in height, 1–3-loculed with 1–2 seeds per locule; pericarp 0.5–1.5 mm thick. Seeds brown or fuscous, globose, hemispherical or polyhedral, 1.2–2 cm in diam., glabrous. Flower Sep–Jan, fruit Feb–Dec (Fig. 3).

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Appendix 1. Examined specimens of *Camellia sinensis* (L.) Kuntze var. *assamica* (Choisy) Kitam. from north of and around Huế in Vietnam.

Information is listed as follows: **province (or unknown but in northern Vietnam):** date of collecting (if available), *collector* and *collector number* (herbarium code and/or sheet number or barcode), and/or notes or some identifications (under *Thea*) on the specimens, and/or comments made by the first author (indicated with *).

Cao Bang: 16 May 1999, *Phuong 1599* (HN); 17 May 1999, *Phuong 1643* (HN). **Ha Giang:** 13 Sep 2000, *Harder & al. DKH 5566* (HN, HNU No. 019011). **Hanoi:** *Pételot s.n.* (P barcode P04500207), *Thea sinensis*; 1909, *d'Alleizette s.n.* (P barcode P04500205), cultivated, *Thea chinensis* Seem. var. *assamica* Pierre; 29 Oct 1918, *Chevalier 37814* (P barcode P05278738), *Thea tonkinensis* Pitar. **Hoa Binh:** 1 Sep 1926, *Poilane 13083* (K, P barcodes P04500203 & P04511599, VNM barcode VNM00003732), *Thea chinensis* L. var. *assamica* Pierre; 20 Jun 1999, *Phuong 1978* (HN); 24 Jun 1999, *Phuong 2182* (HN); 5 Oct 2000, *Phuong 3610* (HN). **Lao Cai:** *Poilane s.n.* (P barcode P04511835, VNM barcodes VNM00003748 & VNM00003749), *Thea chinensis* L. var. *assamica* Pierre; 4 Aug 1926, *Poilane 12823* (VNM barcode VNM00003731), *Thea sinensis* L.; 17 Nov 1929, *Poilane 17010* (P barcode P04511836, PE barcode 01513487), *Thea chinensis* L. var. *assamica* Pierre, pedicel gradually swollen towards the top*; 22 Dec 1929, *Poilane 17223* (P barcode P04511598), *Thea chinensis* L. var. *assamica* Pierre; 11 Jan 1931, *Poilane 18828* (K, P barcode P04511578, VNM barcode VNM00003754), *Thea chinensis* L. var. *coantonensis* Pierre; Sep 1942, *Pételot s.n.* (P barcode P06614761) & *7918* (P barcode P06614766); 19 Jul 2004, *Atha & al. DA 4942* (HN). **Lai Chau:** Sep 1931, *Pételot 4249* (P barcode P04511595), *Thea chinensis* L. var. *bohea* Pierre, pedicel gradually swollen towards the top*; 6 Dec 1938, *Poilane 27033* (P barcode P04511577, PE barcode 01513488, SING barcode SING 0204915), *Thea chinensis* L. var. *cantonensis* Pierre; 7 Dec 2006, *Hiep & al. HAL 10438* (HN, P barcode P05108752), pedicel gradually swollen towards the top, style 3–4-lobed*. **Nam Dinh:** 21 Nov 1913, *Chevalier 29008* (P barcode P05278768). **Nghé An:** 18 Dec 2002, *Binh & Cuong VN 1027* (HN). **Ninh Binh:** 2 Sep 1926, *Poilane 13114* (P barcodes P05108760 & P06838097). **Phu Tho:** *Eberhardt 4432* (P barcodes P04511600 & P04511601), *Thea sinensis* var. *assamica*; Oct 1917, *Gilbert 37709* (P barcode P05108716); Dec 1917, *Gilbert 37708* (P barcode P05278774), *Thea bohea* L.; May 1918, *Gilbert 37707* (P barcode P05278773), *Thea bohea* L.; Jun 1918, *Gilbert 37482* (P barcode P05248034, VNM barcode VNM00003740), cultivated, *Thea chinensis* L.; Jun 1918, *Gilbert 37540* (P barcode P05286388, VNM barcode VNM00003741), *Thea chinensis*; Nov 1918, *Chevalier 39717* (VNM barcodes VNM00003737, VNM00003738 & VNM00003739), cultivated, *Thea sinensis* L.; 1920, *Chevalier 41094* (P barcodes P05108717, P06615051 & P06615052); 11 Apr 1924, *Pasquier 62* (P barcode P06615042); 23 Jan 1961, *Loc 3075* (HNU); Nov 2011, *Hoc 18* (VNF No. BC-TV001237); 12 Jun 2012, *VMNB 2065* (VNMN). **Quang Ninh:** 8 May 1918, *Chevalier 37894* (P barcodes P05286385 & P05286386, VNM barcode VNM00003762), *Thea viridis* L.; 23 Jun–31 Aug 1939, *Tsang 29277* (C, E barcode E00681070, K, SING barcode SING 0204890). **Quang Tri:** 10 Mar 1936, *Poilane 25310* (P barcode P06615011). **Son La:** Nov 2003, *Phuong 7050* (HN). **Thai Nguyen:** 22 Oct 2004, *Phuong 9441* (HN). **Thanh Hoa:** 11 Sep 1920, *Poilane 1821* (K, P barcodes P04511594 & P04511596, VNM barcode VNM00003750), *Thea chinensis* L. var. *bohea* Pierre. **Thua Thien Hue:** *Eberhardt 2570* (P barcode P04511592), *Thea chinensis* L. var. *cantonensis* Pierre; *Eberhardt 3303* (P barcode P04511664), *Thea chinensis* L. var.?: 18 Feb 1919, *Chevalier 40734* (P barcode P06615035); May–Jul 1927, *Clemens 4379* (BM, P barcode P04511597), cultivated, *Thea chinensis* L. var. *bohea* Pierre; 10 Sep 1938, *Poilane 27747* (P barcodes P04511663 & P04511663, PE barcode 01513489; SING barcode SING 0204914), *Thea chinensis* L. var. *assamica* Pierre. **Vinh Phuc:** 23 Jun 2000, *Phuong 2645* (HN); 18 Nov 2015, *Zhao & al. 105(1)* (TCD). **Yen Bai:** 21 Feb 1936, *Poilane 25282* (P barcode P04511587, VNM barcode VNM00003756), cultivated, *Thea sinensis* L. var. *cantonensis* Pierre. **Unknown (Tonkin):** Dec 1874, *Pierre 479* (P barcode P04511631); May 1917, *Chevalier 37306* (P barcode P05248030), cultivated, *Thea sasanqua*; Jun 1918, *Chevalier 38071* (P barcode P05312446); Jun 1918, *Chevalier 38072* (P barcode P05248035, VNM barcode VNM00003757), *Thea chinensis* L. var. *cantonensis* Pierre; Oct 1960, *Halle 113* (P barcode P04964510), *Thea sinensis*.

Appendix 2. Examined specimens of *Camellia pubicosta* Merr.

Information is listed as follows: **COUNTRY, province:** date of collecting (if available), *collector* and *collector number* (herbarium code and/or sheet number or barcode, and/or notes about type status).

VIETNAM. Hanoi: 18 Oct 1887, *Balansa 3183* (P barcodes P04500222 & P05312525); Nov 1887, *Balansa 3861* (K, P barcodes P04500222, P04511359 & P04511360); Jun 1918, *Chevalier 37872* (P barcodes P05278755, P05278756 & P05278758, VNM barcode VNM00003828); 1 Jun 1918, *Fleury 37816* (P barcode P05278765); 29 Oct 1918, *Chevalier 37815* (P barcodes P05286438, P05286439, P05286440, P05312501, P05312502 & P05312504, VNM barcode VNM00003826); 19 Nov 1924, *Pételot 1727* (A barcode 00024753, holotype); 28 Aug 1940, *Pételot 2285* (HNU) & 2598 (A barcode 00024752, paratype); 5 Nov 1940, *Pételot 6655* (VNM barcodes VNM00003813 & VNM00003814). **Nghé An:** 11 Aug 1929, *Poilane 16693* (K, P barcode P04500223, VNM barcode VNM00003825, syntypes of *Thea yersinii*); 22 Dec 1962, *Lan B.268* (HN, IBSC barcode 0256478, VFM); 17 Jul 1998, *Ninh C605* (HNU). **Phu Tho:** Nov 1930, *Pasquier s.n.* (P barcode P04511793); 3 Jul 2003, *Phuong 6490* (HN). **Vinh Phuc:** Nov 1930, *Pételot 3837* (P barcode P04500226, VNM barcode VNM00003827), 7 Feb 1965, *Sino-Vietnam Exp. 1943* (KUN barcode 0695860, PE barcode 01679142); 13 Oct 1975, *Ve 15090* (HN); 31 May 1977, *Phuong 181* (HN); 13 Oct 1995, *Rosmann 95690* (P barcode P05247463); 19 Nov 1998, *Ninh 9886* & *98117* (HNU); 18 Oct 1998, *Qin & al. 108* (HITBC No. 088385); 24 Oct 2001, *Phuong 4540* (HN); 31 Oct 2004, *Li & al. 604* (HN); 18 Nov 2015, *Zhao & al. 107(1)* & *107(2)* (TCD).