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Taxonomic notes on *Camellia crassicolumna* and its related species (Theaceae)

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Abstract

Camellia crassicolumna (Theaceae) was described as an endemic species to southeastern Yunnan, China. In the most recent monograph of *Camellia*, seven names, including *C. crispula*, *C. atrothea*, *C. makuanica*, *C. haaniensis*, *C. purpurea*, *C. rotundata*, and *C. crassicolumna* var. *shangbaensis*, were listed as heterotypic synonyms of *C. crassicolumna*. Our examination of related specimens reveals that the statement 'ovariis pilosis' in the protologue of *C. crassicolumna* is incongruent with its type specimens whose ovaries are glabrous. The morphological traits of *C. crassicolumna* resemble *C. kwangsiensis* var. *kwangnanica*. Therefore, *C. crassicolumna* is reduced into *C. kwangsiensis* var. *kwangnanica*. The species status of *C. crispula* is reinstated with *C. atrothea*, *C. makuanica*, *C. haaniensis*, *C. purpurea*, *C. rotundata*, and *C. crassicolumna* var. *shangbaensis* treated as its heterotypic synonyms. A new combination, *C. crispula* var. *multiplex*, is proposed, and the lectotype of *C. atrothea* is designated here.

Keywords: *Camellia* sect. *Thea*; lectotypification; morphology; taxonomic treatment

Introduction

Camellia L. (1753: 515) sect. *Thea* Griffith (1854: 553), the tea-plant group, is of high economic value. There are 12 or 32 species in this section in different classification systems distributed in East and Southeast Asia (Chang 1984, Chang & Ren 1998, Ming 2000, Ming & Bartholomew 2007). China is its distribution center and diversification center, possessing almost all tea-plants (Chang & Ren 1998, Ming & Bartholomew 2007). In 1980s, there were more than forty new taxa of sect. *Thea* published in China (see Yang 2021), including *C. crassicolumna* Hung T. Chang (1981a: 91), *C. crispula* Hung T. Chang (1981a: 93), *C. atrothea* Hung T. Chang et H.S. Wang in Hung T. Chang (1984: 5), *C. rotundata* Hung T. Chang et F.L. Yu in Hung T. Chang (1984: 6), *C. haaniensis* Hung T. Chang et F.L. Yu in Hung T. Chang (1984: 7), *C. makuanica* Hung T. Chang et Y.J. Tang in Hung T. Chang (1984: 7), *C. multiplex* Hung T. Chang et Y.J. Tang in Hung T. Chang (1984: 7) and *C. purpurea* Hung T. Chang et B.H. Chen in Hung T. Chang (1984: 9). Ming (1992) treated *C. crispula*, *C. atrothea*, *C. rotundata*, *C. haaniensis, C. makuanica* as heterotypic synonyms, and *C. multiplex* as a variety of *C. crassicolumna,* respectively. Ming (2000) reduced *C. purpurea* and *C. crassicolumna* var. *shangbaensis* F.C. Zhang (1997: 437) into *C. crassicolumna*.

In the protologue and other related taxonomic literature (Chang 1981a,b, 1984, Chang & Bartholomew 1984, Ming 1992, Chang & Ren 1998, Ming 2000, Ming & Bartholomew 2007), *C. crassicolumna* was characterized by 5-locular tomentose ovary. However, after scrutiny of the literature and careful examination of specimens of these taxa, it was found that the description of the ovary of *C. crassicolumna* was incongruent with its type. Thus, the identity of this species and the relationship between it and other related species needed a further study.

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Materials and methods

Relevant specimens (or their images) conserved at herbaria E, GXMG, GXMI, HITBC, IBK, KUN, LBG, PE, SYS and TEA (acronyms based on Thiers (continuously updated)), and taxonomic literature were checked. The priority of a name was evaluated under Art. 11.4 of the Shenzhen Code (Turland *et al.* 2018; hereafter ICN).

Taxonomic treatment

1. *Camellia kwangsiensis* var. *kwangnanica* (Hung T. Chang & B. H. Chen) T. L. Ming (1992: 118) ≡ *C. kwangnanica* Hung T. Chang et B. H. Chen in Hung T. Chang (1984: 4)

Type:—CHINA. Yunnan: Guangnan, 1790m, 27 October 1982, *B.H. Chen et al. A20002* (holotype: SYS00095169! Fig. 1B; isotype: TEA!).

= *C. crassicolumna* Hung T. Chang (1981a: 91), quoad type specimens, ***syn. nov.***

Type:—CHINA. Yunnan, Xichou, November 1943, *C.P. Tsien 644* (holotype: PE00024303! Fig. 1A; isotypes: IBK00200083! 00200086!).

Notes:—*Camellia crassicolumna* was published twice as new species with the same type by the same authors in the same year: in *Acta Scientiarum naturalium Universitatis Sunyatseni* in February 1981 (Chang 1981a) and in '*A Taxonomy of the Genus* Camellia' in April 1981 (Chang 1981b). Obviously, the latter (Chang 1981b: 113) was a later isonym (Art. 6 Note 2 of the ICN).

In the protologue (Chang 1981a), the collection *C.P. Tsien 644* at PE was assigned as the type of *C. crassicolumna*. Only one sheet of this collection was deposited in PE with a barcode PE00024303 and can be taken as the holotype (Fig. 1A). Recently two more duplicates of *C.P. Tsien 644* were found at IBK (IBK00200083 and 00200086). Chang (1981a) indicated that *C. crassicolumna* was featured with 5-locular and tomentose ovary which is the key diagnostic character in specific delimitation in sect. *Thea* (Sealy 1958, Chang 1981a, b, 1984, Chang & Bartholomew 1984, Ming 1992, Chang & Ren 1998, Ming & Bartholomew 2007). However, all type specimens clearly show that the ovary of this species is glabrous (Fig. 2C), which is not consistent with the protologue. With the 5-locular glabrous ovary (Fig. 2C, D), the large capsule (5–8 cm in diam.) with thick pericarp (5–8 mm), the large flower (4–6 cm in diam.) with hairy sepals and petals (Fig. 2E, F), and the hairy terminal buds, young branches and leaf abaxial surface (Fig. 2A, B), it can be concluded that *C. crassicolumna* is conspecific with *C. kwangnanica* (Figs. 1, 2).

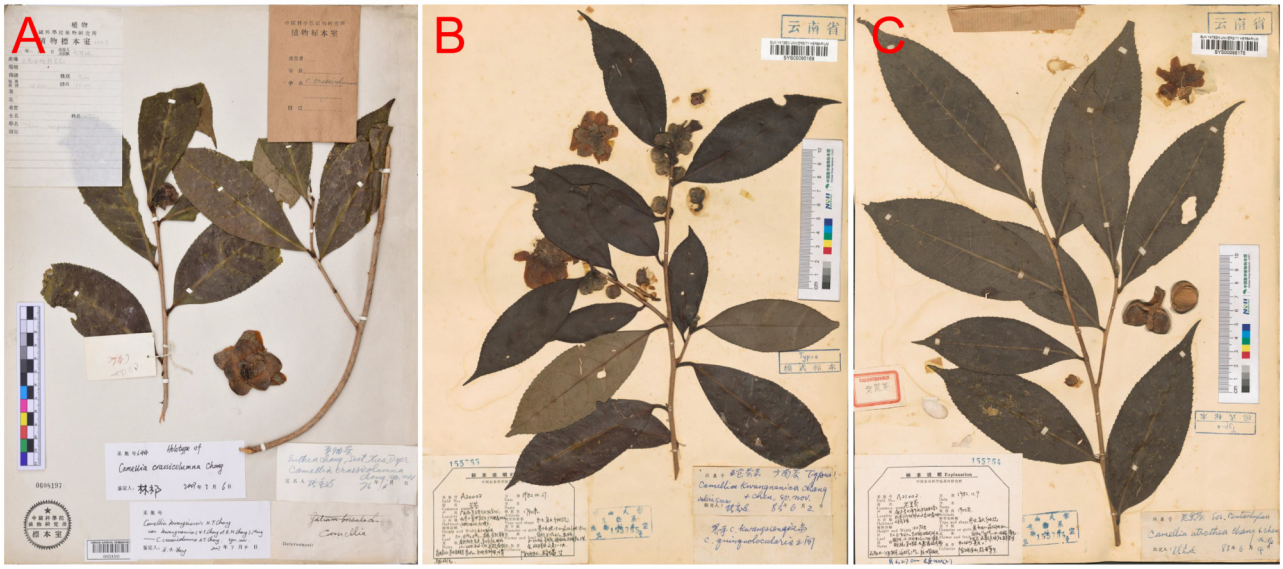

FIGURE 1. Type specimens of *Camellia crassicolumna* (*C.P. Tsien 644*, PE00024303) (**A**), *C. kwangsiensis* var. *kwangnanica* (*B.H. Chen et al. A20002*, SYS00095169) (**B**) and *C. atrothea* (*B.H. Chen et al. A21002*, SYS00095178) (**C**). Photo A by S.X. Yang, photos B and C from CVH (https://www.cvh.ac.cn/).

Camellia kwangnanica was validly published as a new taxon in 1984 (Chang 1984), later than the publication of *C. crassicolumna*. Ming (1992) proposed that *C. kwangnanica* was different from *C. kwangsiensis* only by the abaxially hairy sepals and petals, so the former was treated as a variety of the latter, which is adopted and reinforced by us because *C. kwangsiensis* and *C. kwangnanica* were often found in the same population according to our observations during field surveys. Consequently, *C. crassicolumna* is treated as a new heterotypic synonym of *C. kwangsiensis* var. *kwangnanica*.

Habitat:—Montane forests, 1050–1900m.

Distribution:—Endemic to China (Southeast Yunnan and West Guangxi).

Additional specimens examined:—**CHINA. Yunnan**: **Funing**, Lida, 1347m, 22 May 2014, *S.X. Yang et D.W. Zhao 4806* (KUN); Muyang, 1604m, 22 May 2014, *S.X. Yang et D.W. Zhao 4808, 4809, 4810* (KUN). **Guangnan**, Heizhiguo,1550m, 6 March 1940, *C.W. Wang 87540* (KUN); the same locality, 1850m, 9 November 1964, *Z.W. Lin 621* (KUN); the same locality, 1700m, 9 November 1964, *Q.A. Wu 9818* (KUN); the same locality, 1580m, 9 October 1979, *L.S. Xie et M. Cai 0448* (KUN); Zhetu, 6 November 1965, *65-Wenshan Exp. 214* (KUN, PE); the same locality, 1550m, 27 October 1982, *B.H. Chen et S.C. Ma A20008* (paratype of *C. kwangnanica*)(SYS); the same locality, 1585m, 17 November 2012, *S.X. Yang et W. Fang 3922, 3924, 3925, 3926, 3927, 3928* (KUN); the same locality, 1869m, 21 May 2014, *S.X. Yang et D.W. Zhao 4792, 4794, 4797*(KUN); the same locality, 17 August 2021, *S.X. Yang et Y.Z. Jiang 6720, 6721, 6723, 6725, 6734, 6736, 6737, 6738* (KUN); Dixu, 1680m, 18 November 2012, *S.X. Yang et W. Fang 3930* (KUN); the same locality, 1500m, 21 May 2014, *S.X. Yang et D.W. Zhao 4780, 4781, 4782, 4783, 4784* (KUN). **Xichou**, Fadou, 1550m, 22 December 2004, *S.X. Yang 1295, 1296* (KUN). **Guangxi: Tianlin**, Langping, 1097m, 13 September 2013, *Tianlin Exp. 451029130913006* (GXMI, GXMG); the same locality, 2 July 2016, *S.X. Yang 5484, 5485* (KUN).

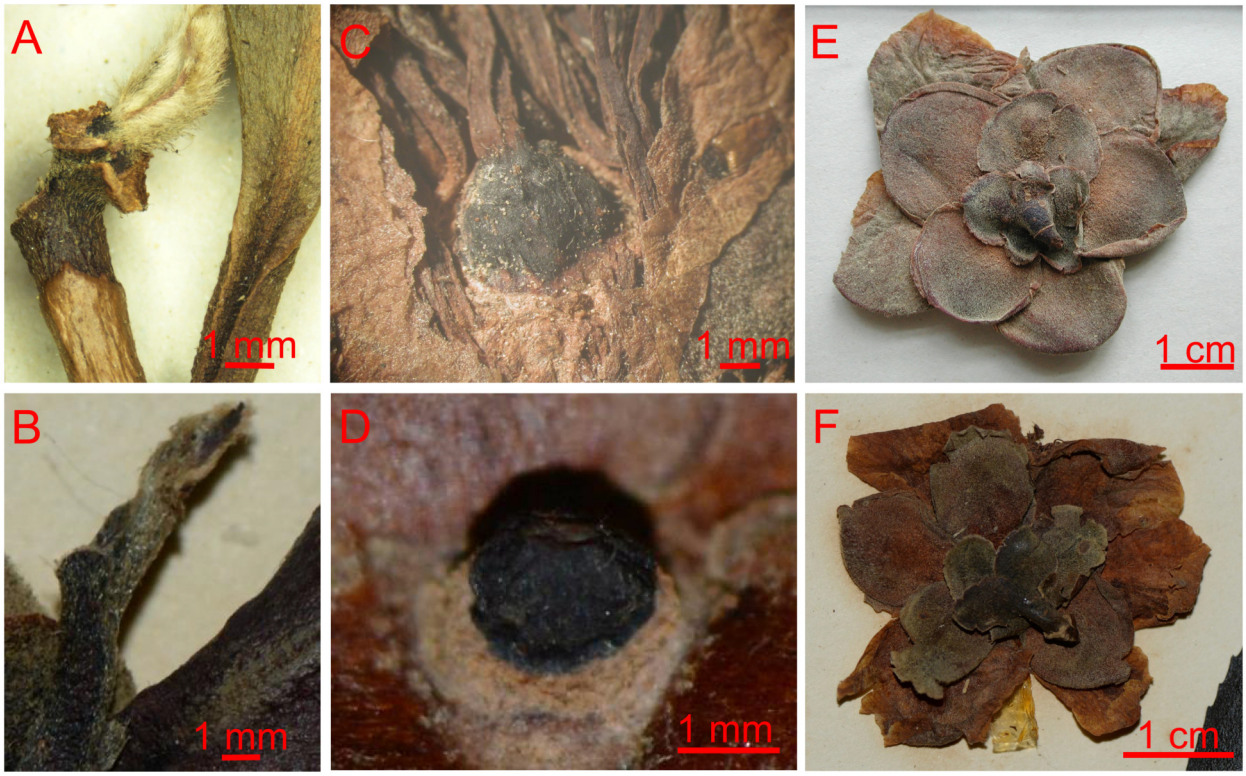

FIGURE 2. Morphological comparisons between *Camellia crassicolumna* (A, C, E) and *C. kwangsiensis* var. *kwangnanica* (B, D, F). **A, B.** Young branches and terminal buds. **C, D.** Ovaries. **E, F.** Abaxial surface of sepals and petals. Photos A, C, E by S.X. Yang and photos B, D, F by Li-Juan Luo and Qiang Fan (SYS).

2. ***Camellia crispula*** Hung T. Chang (1981a: 93)

Type:—CHINA. Yunnan: Jinping, 2000m, 12 May 1956, *SINO-USSR Yunnan Exp. 1344* (holotype: KUN0055527!; isotypes: PE00024305!, 00026331!, 00026337!, 00026338!, 00702766!).

= *Camellia atrothea* Hung T. Chang et H.S. Wang in Hung T. Chang (1984: 5), ***syn. nov.***

Type:—CHINA. Yunnan, Pingbian, 1900m, 7 November 1982, *B.H. Chen et al. A21002* (lectotype, **designated here:** SYS00095178! Fig. 1C; isolectotypes: SYS00095179!, TEA!).

= *Camellia rotundata* Hung T. Chang et F.L. Yu in Hung T. Chang (1984: 6), ***syn. nov.*** Type:—CHINA. Yunnan, Honghe, 1850m, 5 November 1982, *Y.J. Tang A24001* (holotype: SYS00095184!).

= *Camellia makuanica* Hung T. Chang et Y.J. Tang in Hung T. Chang (1984: 6), ***syn. nov.*** Type:—CHINA. Yunnan, Maguan, 1720m, 17 October 1982, *Y.J. Tang et al. A17003* (holotype: SYS00090461!).

= *Camellia haaniensis* Hung T. Chang et F.L. Yu in Hung T. Chang (1984: 7), ***syn. nov.*** Type:—CHINA. Yunnan, Jinping, 2220m, *B.H. Chen et al. A22005* (holotype: SYS00090460!; isotype: TEA!).

= *Camellia purpurea* Hung T. Chang et B.H. Chen in Hung T. Chang (1984: 9), ***syn. nov.*** Type:—CHINA. Yunnan, Pingbian, 1500m, 8 November 1982, *B.H. Chen A21003* (holotype: SYS00095186!; isotype: TEA!).

= *C. crassicolumna* var. *shangbaensis* F.C. Zhang (1997: 437), ***syn. nov.*** Type:—CHINA. Yunnan, Zhenyuan, 2450m, 3 November 1996, *F.C. Zhang et al. 01* (holotype: Yunnan Agriculture University; isotype: KUN0055550!).

Notes:—Chang (1984) cited a single gathering *B.H. Chen et al. A21002* at SYS as the type of *Camellia atrothea*. Two specimens of this gathering were found at SYS. The specimen SYS00095178 bears mature flower and fruit, so it is designated here as the lectotype (Fig. 1C).

Ming (1992, 2000) reduced seven taxa (*C. crispula*, *C. atrothea*, *C. rotundata*, *C. haaniensis*, *C. makuanica*, *C. purpurea* and *C. crassicolumna* var. *shangbaensis*) into *C. crassicolumna*, which is inappropriate because the ovaries of these taxa are tomentose and different from those of *C. crassicolumna*. However, it is true that the seven taxa are very close to each other so that it is difficult to find any substantial differences among them when their types are compared.

Chang (1984) stated that *C. atrothea* is close to *C. taliensis* and *C. irrawadiensis*, and different from them by thin and dull leaves, short petioles and pedicels, large and hairy sepals, and large fruits. These diagnostic features are shared by *C. crispula*.

The diagnostic characters of *Camellia rotundata* (pubescent young branches, pubescent leaves round at base and short petioles) listed in its protologue (Chang 1984) exactly occurs in *C. crispula*.

In the protologues (Chang 1984, Zhang 1997), *C. crassicolumna* with glabrous ovaries was selected as the kindred taxon of *C. makuanica*, *C. haaniensis* and *C. crassicolumna* var. *shangbaensis*, which is obviously inappropriate. The tomentose ovaries suggest that *C. makuanica*, *C. haaniensis* and *C. crassicolumna* var. *shangbaensis* are closer to *C. crispula*.

According to the protologues (Chang 1984), *C. purpurea* is different from *C. crispula* only by its 3-loculed ovaries. However, the specimens (*S.X. Yang 92009, 93537, 93538*) collected in the type locality of *C. purpurea* show that 3-, 4- and 5-loculed ovaries really coexist on the same tree.

In conclusion, there is no substantial differences can be found among *C. crispula*, *C. atrothea*, *C. rotundata*, *C. haaniensis*, *C. makuanica*, *C. purpurea* and *C. crassicolumna* var. *shangbaensis.* The seven taxa can be easily distinguished from other species of sect. *Thea* by 5-locular tomentose ovary, hairy sepals and petals, and hairy terminal buds and young branches, so it is advisable to treat all the seven taxa as one species. Therefore, the species status of *C. crispula*, the earliest described among the seven names, is reinstated and the rest six taxa are treated as its heterotypic synonyms.

Habitat:—Montane forests, 1300–2450m.

Distribution:—Endemic to Southeast and Central Yunnan, China.

Additional specimens examined:—**CHINA. Yunnan**: sine loc., *Tsiang Y. 13072* (PE). **Hekou**, Lianhuatan, 26 November 1993, *S.X. Yang 93533, 93534, 93535* (KUN); the same locality, 30 March 1995, *S.X. Yang 95682* (KUN). **Honghe**, Leyu, 1943m, 6 June 2014, *S.X. Yang et D.W. Zhao 4909, 4910, 4911, 4912* (KUN). **Jinping**, 2300m, 7 December 1958, *H.W. Li 309* (paratype of *C. crassicolumna*) (KUN, LBG); Fenshuiling, 2400m, 11 October 1996, *S.G. Wu et al. 3911* (KUN); the same locality, 2200–2350m, 12 November 2010, *S.X. Yang 2931* (KUN); the same locality, 2380m, 1 June 2014, *S.X. Yang et D.W.Zhao 4875, 4876, 4877, 4878, 4879* (KUN); the same locality, 1682m, 21 October 2020, *E.D. Liu et al. LED10179* (KUN); Kuihe, 1800m, 10 October 1996, *S.G. Wu et al. 3896* (KUN); Hetou to Guantang, 2100m, 17 October, *S.G. Wu et al. 4328* (KUN); Yongping, 2210m, 31 May 2014, *S.X. Yang et D.W. Zhao 4869, 4870, 4871, 4872, 4873* (KUN). **Maguan**, Dulong, 2250m, 28 May 1959, *Q.A. Wu 8132* (paratype of *C. crassicolumna*) (KUN); Jiahanqing, 1650m, 12 October 1979, *L.S. Xie & M. Cai 0450* (KUN); the same locality, 1650m, 9 September 1985, *L.S. Xie 85-031* (KUN); Gulinqing, 1780–1890m, 8 September 1985, *L.S. Xie 85-026, 85-027* (KUN); the same locality, 1700–1900m, 17 August 1994, *S.G. Wu et al. 2492* (KUN); the same locality, 1800m, 27 May 2014, *S.X. Yang et D.W. Zhao 4843, 4844, 4845* (KUN); Michang, 1695m, 27 May 2014, *S.X. Yang et D.W.*

Zhao 4838, 4839, 4840 (KUN). **Malipo,** Laojunshan, 1600–1800m, 10 December 1947, *K.M. Feng 13748* (paratype of *C. crassicolumna*)(KUN, PE); the same locality, 1300–1500m, 20 December 1947, *K.M. Feng 13964* (paratype of *C. crassicolumna*)(KUN, PE); the same locality, 13 May 2021, *E.D. Liu et al. OYY00201* (KUN). **Pingbian**, Heping, 2200m, 17 Janurary 2005, *S.X. Yang 1355* (KUN); Daweishan, 2100–2300m, 24 October 1989, *T.L. Ming et X.D. Li C-6, C-7* (KUN); the same locality, 2000m, 13 May 1992, *S.X. Yang 92009* (KUN); the same locality, 28 November 1993, *S.X. Yang 93537, 93538* (KUN); the same locality, 21 March 1995, *S.X. Yang 95685, 95686* (KUN); the same locality, 2150m, 2 July 2012, *S.X. Yang 3885* (KUN); the same locality, 29 May 2014, *S.X. Yang et D.W. Zhao 4852, 4853, 4855* (KUN); Guzubei, 1942m, 28 May 2014, *S.X. Yang et D.W. Zhao 4848, 4849* (KUN). **Wenshan**, Laojie, 1695m, 26 May 2014, *S.X. Yang et D.W. Zhao 4836, 4837* (KUN). **Xichou**, Xiangpingshan, 1800m, 15 November 1965, *65-Wenshan Exp. 313* (paratype of *C. crassicolumna*)(PE); the same locality, 1500–1700m, 2 September 1947, *K.M. Feng 11580* (PE); the same locality, 1800m, 29 September 1991, *W.J. Zhang et S.X. Yang 91001, 91002* (KUN); the same locality, 24 May 1994, *S.X. Yang et W.J. Zhang 94624* (KUN); the same locality, 1670m, 21 March 1995, *S.X. Yang 95633, 95634* (KUN); the same locality, 1700m, 27 December 2004, *S.X. Yang 1312* (KUN); the same locality, 1667m, 24 May 2014, *S.X. Yang et D.W. Zhao 4834* (KUN). **Xinping**, Erdaoqing, 2120m, 21 October 1958, *S.G. Wu 488* (PE). **Yuanjiang**, 5000 ft., *Henry 13551* (E); Jiezihe, 2050m, 31 October 1964, *Y.H. Li 05779* (KUN, PE); Yangchajie, 2200m, 9 November 1980, *G.D. Tao 23746* (HITBC, PE). **Yuanyang**, Shengcun, 1848m, 2 November 1982, *Y.J.Tan et S.C. Ma A25003* (SYS); the same locality, 1910m, 2 October 2005, *E.D. Liu 1320* (KUN).

3. *Camellia crispula* var. *multiplex* (Hung T. Chang et Y.J. Tang) S.X. Yang, ***comb. nov***. ≡ *C. multiplex* Hung T. Chang et Y.J. Tang in Hung T. Chang (1984: 7). ≡ *C. crassicolumna* var. *multiplex* (Hung T. Chang et Y.J. Tang) T.L. Ming (1992: 121).

Type:—CHINA, Yunnan: Wenshan, 2210m, 20 October 1982, *Y.J. Tang et al. A16003* (holotype: SYS00095168!; isotype: TEA!)

Notes:—Ming (1992) treated *C. multiplex* as a variety of *C. crassicolumna*. We accept Ming's treatment of the rank, but suggest to treat *C. multiplex* as the variety of *C. crispula* because they both have tomentose ovaries. *Camellia crispula* var. *multiplex* is different from the nominate variety by its glabrous young branches, pedicel and abaxial surface of sepals.

Habitat:—Montane forests, 1080–2000m.

Distribution:—Endemic to China (Southeast Yunnan and West Guizhou). Recently we found its new distribution in Guangxi (Yang *et al.* 2021).

Additional specimens examined:—**CHINA. Yunnan**: **Wenshan**, 2000m, 13 January 1933, *H.T. Tsai 51511* (KUN); Laojunshan, 2000m, 25 August 1961, *S.G. Wu 61-3723* (KUN); the same locality, 1900m, 24 April 1962, *G.M Feng 22027* (KUN); the same locality, 1900m, 28 October 1979, *L.S. Xie et M. Cai 0506* (KUN); the same locality, 1800m, 28 December 2004, *S.X. Yang 1322* (KUN); the same locality, 1695m, 26 May 2014, *S.X. Yang & D.W. Zhao 4837* (KUN). **Guizhou: Panxian**, Laochang, 31 August 1988, *Z.Y. Zhang 88-6, 88-9* (KUN). **Guangxi: Rongshui**, Jiuwan Mount. National Nature Reserve, 1200m, 26 December 2012, *S.X. Yang & W. Fang 4254, 4288* (KUN); the same locality, 1080m, 21 July 2014, *X.Q. Yu 125* (KUN).

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