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SYSTEMATICS

A synopsis of *Codonopsis* subg. *Pseudocodonopsis* (Campanulaceae: Campanuloideae), with description of a new species of uncertain provenance

Thomas G. LAMMERS* and Laura L. KLEIN[1]

Department of Biology and Microbiology, University of Wisconsin Oshkosh, Oshkosh, WI 54901, USA

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ABSTRACT. The species of *Codonopsis* subg. *Pseudocodonopsis* are inodorous herbaceous geophytes with an unbranched tuberous root no more than four times longer than thick; twining stems leafy at least toward base; horizontal to erect usually solitary terminal flowers, in which the corolla is rotate and cleft for more than three-fourths its length; pollen grains with 5-10 colpi covering less than one-fourth the distance from pole to pole and spinules 2-3 μm long; and a 3-locular ovary that forms an obconic capsule with a relatively short dehiscent apex, containing numerous smooth or finely striate seeds. The most recent synopsis recognized *C. convolvulacea* (here designated as the type of the subgenus), *C. efilamentosa, C. forrestii, C. grey-wilsonii* (as *C. nepalensis,* nom. illeg.), *C. limprichtii* (as "C. pinifolia", nom. invalid.), and *C. vinciflora. Codonopsis rosulata* is also a member of *C.* subg. *Pseudocodonopsis* despite its scapose non-twining stem and basally rosulate leaves. *Codonopsis hirsuta* was previously included in *C. convolvulacea,* but here is judged to be a distinct species allied to *C. limprichtii. Codonopsis mairei* was previously included in *C. forrestii,* but is here judged to be a distinct species allied to *C. convolvulacea.* Plants known only from cultivation, which have been identified as *C. forrestii* but differ from all known species in several characters, are described here as *C. macrophylla*, sp. nov. Yunnan is the center of diversity, harboring eight out of ten species; the exceptions are *C. grey-wilsonii,* endemic to the eastern Himalaya; and *C. macrophylla,* of uncertain provenance. From Yunnan, the ranges of various species extend into Sichuan, Guizhou, Tibet (Xizang), and/or Burma (Myanmar).

Keywords: Asia; Campanulaceae; Campanuloideae; Classification; *Codonopsis*; New species; *Pseudocodonopsis*; Taxonomy.

INTRODUCTION

Codonopsis Wall. (Campanulaceae: Campanuloideae) is endemic to southern and eastern Asia. It is characterized by a large tuberous root, herbaceous often scandent or climbing stems, flowers usually solitary and terminal, 5-10-colpate pollen, 3-(5)-locular ovary, apically dehiscent many-seeded capsule (rarely a berry partly subtended by the calyx lobes), and a chromosome number of $2n = 16$ (Lammers, 2007a). Three subgenera are recognized (Shen and Hong, 1983), which may be distinguished using the following key:

Key to the Subgenera of *Codonopsis*

1. Plants commonly fetid; root-tuber much longer than thick, sometimes branched; colpi covering more than $^2/_3$ the distance from pole to pole; fruit an ovoid capsule with elongate apex (rarely a berry partly subtended by the calyx lobes); seeds reticulate.....*C.* subg. *Codonopsis*

1. Plants not fetid; root-tuber no more than 4 times longer than thick, unbranched; colpi covering less than ½ the distance from pole to pole; fruit an obconic (rarely oblate) capsule, the dehiscent apex relatively short; seeds smooth or finely striate.
   2. Flower nodding to pendent; corolla campanulate, lobed for less than ½ its length; colpi covering ¼ -½ the distance from pole to pole; spinules on pollen grains ca. 1 μm long .... *C.* subg. *Obconicapsula* D. Y. Hong
   2. Flower horizontal to erect; corolla rotate, cleft for more than ¾ its length; colpi covering less than ¼ the distance from pole to pole; spinules on pollen grains 2-3 μm long ..... *C.* subg. *Pseudocodonopsis* Kom.

The autonymic subgenus is the largest of the three, with 52 species divided between two sections: *C.* sect. *Codonopsis* [including *Leptocodon* (Hook. f.) Lem. and *Campanumoea* Blume, s. str.] and *C.* sect. *Erectae* (Kom.) D. Y. Hong [including *Glosocomia* D. Don]. Its distribution extends from Afghanistan to Kamchatka and as far south as Java (Lammers, 2007a, 2007b). There is no modern taxonomic treatment of *C.* subg. *Codonopsis* in its entirety, though the floristic account for China (Shen and Hong, 1983) covers the majority of its members.

[1]Present address: Department of Botany, Miami University, Oxford, OH 45056, USA.
*Corresponding author: E-mail: lammers@uwosh.edu.

Codonopsis subg. *Obconicapsula* comprises but a single species, *C. dicentrifolia* (C. B. Clarke) W. W. Smith of the Himalaya. As noted by Fletcher (1937) and Grey-Wilson (1990), this species is intermediate in its characteristics and might logically be included in either subgenus. It resembles *C.* subg. *Codonopsis* in its floral posture, corolla morphology, and short pollen spinules, but also possesses the compact root-tubers, obconic short-beaked capsule, and smooth or finely striate seeds of *C.* subg. *Pseudocodonopsis;* furthermore, its colpi are of intermediate length. Were it not for this species, it would be very tempting to recognize the other two subgenera as distinct genera.

Codonopsis subg. *Pseudocodonopsis* is endemic to south-central China and adjacent areas. Grey-Wilson (1995) provided a useful summary of the group, in which he recognized six species: *C. convolvulacea*, *C. efilamentosa*, *C. forrestii*, *C. nepalensis*, "*C. pinifolia*", and *C. vinciflora.* In examining material for the *Flora of China* project, however, we recognized four additional species (one unnamed) referable to this subgenus, corrected nomenclatural problems with two of the names, and noted some additional synonymy. For this reason, we here present a synopsis of the subgenus, to make clear the rationale for changes from Grey-Wilson's treatment that will appear in the *Flora of China*.

TAXONOMIC TREATMENT

Codonopsis subg. **Pseudocodonopsis** Kom., Trudy Imp. S.-Peterburgsk. Bot. Sada 29: 102. 1908.—TYPE [here designated]: *Codonopsis convolvulacea* Kurz. This and *C. vinciflora* were the two original species assigned to this subgenus.

Twining geophytes (*C. rosulata* rosulate and scapose); plants terrestrial, inodorous; roots tuberous, large, no more than 4 times longer than thick, unbranched, whitish or brownish; stems typically branched, slender, up to 3 m long; latex white. Leaves exstipulate, alternate or sometimes opposite, simple, dorsiventral, pinnately veined (dillenid), entire or minutely toothed, flat or revolute, commonly petiolate. Flowers tetracyclic, actinomorphic, perfect, epigynous, relatively large, horizontal to erect, solitary on main stem and branches (in few-flowered axillary clusters in *C. efilamentosa*), chasmogamous, proterandrous, zoophilous. Calyx synsepalous, adnate to the ovary, forming an appendicular hypanthium; lobes 5, valvate, inserted at rim of hypanthium. Corolla early-sympetalous, rotate, cleft for more than ¾ its length, various shades of blue or purple, less often yellow or white, sometimes with a contrasting ring toward center; lobes 5, valvate. Stamens 5, antisepalous, inserted at top of ovary; filaments dilated basally, distinct but proximate, forming a dome over the base of the style; anthers tetrasporangiate, dithecal, introrsely dehiscent by longitudinal slits, basifixed, coherent; pollen (Morris and Lammers, 1997; Wei, 2001) oblate-spheroidal or suboblate, circular in polar outline, 34-48 μm polar diam. × 38-51 equatorial diam., (4-)6-colpate with colpi that cover less than one-fourth the distance from pole to pole, surface spinules 2-3 μm long, and a nexine less than 0.60 μm thick. Gynoecium syncarpous, 3-locular with axile placentation; ovary inferior, crowned by an annular nectary; ovules numerous, small, anatropous, unitegmic, tenuinucellate; style solitary, pubescent below apex; stigma large, broadly 3-lobed. Fruit an obconic (oblate in *C. grey-wilsonii*) capsule, the low-conic apex loculicidal via valves. Seeds usually small, numerous; testa smooth or faintly striate. Chromosome number unknown.

Distribution and ecology: Endemic to south-central China (Yunnan, Sichuan, Guizhou) and adjacent areas of Tibet (Xizang), the eastern Himalaya, and Burma (Myanmar). All of the species flower at the end of the monsoon season (August-October), and perfect seed in the dry interval before winter (Grey-Wilson, 1995).

Key to the Species of *Codonopsis* subg. *Pseudocodonopsis*

1. Stems procumbent or weakly scandent, 0.1-0.4 cm long; leaves basally rosulate ..... 1. *C. rosulata*
1. Stems twining, at least in the upper half, 0.5-3 m long; leaves cauline.
   2. Stems decumbent or ascending below the middle, twining above; leaves largely confined to the non-twining portion of stem.
      3. Stems hirsute; lamina ovate or narrowly oblong, hirsute abaxially ..... 2. *C. hirsuta*
      3. Stems glabrous; leaves linear or linear-lanceolate, glabrous ..... *3. C. limprichtii*
   2. Stems twining; leaves scattered throughout length of stem.
      4. Corolla lobes 26-50 mm long.
         5. Calyx lobes erect or spreading, 11-24 mm long; corolla glabrous, concolorous, the lobes narrowly elliptic; filaments without prominent auricles at summit of the dilated portion; capsules obconic, 24-26 mm long..... 9. *C. forrestii*
         5. Calyx lobes deflexed, 7-11 mm long; corolla pubescent within, with a darker ring at center, the lobes ovate; filaments with a pair of prominent auricles at summit of the dilated portion; capsules oblate, 12-14 mm long ..... 10. *C. grey-wilsonii*
      4. Corolla lobes 14-28 mm long.

6. Flowers mostly in axillary clusters; corolla lobes oblong, the apex rounded ..... 8. *C. efilamentosa*
6. Flowers terminal on main stem and upper branches; corolla lobes elliptic, the apex acute.
7. Petioles 10-13 mm long; calyx lobes 5-8 mm long, in bud free and divergent ..... 7. *C. vinciflora*
7. Petioles 1-7 mm long; calyx lobes (6-)8-16 mm long, in bud coherent and enveloping the corolla.
8. Lamina ovate, 5.5-7.5 × 3.3-5.1 cm, the apex obtuse; hypanthium 9-13 mm diam.; calyx lobes triangular; corolla lobes 15-18 mm wide ..... 6. *C. macrophylla*
8. Lamina linear-lanceolate, lanceolate, or ovate-lanceolate sometimes narrowly elliptic), 1.8-5 × 0.2-3 cm, the apex acuminate or acute; hypanthium 4-10 mm diam.; calyx lobes lanceolate or narrowly triangular; corolla lobes 7-15 mm wide.
10. Lamina linear-lanceolate to lanceolate (sometimes narrowly elliptic), 0.2-1.4 cm wide; hypanthium 3-5 mm long; corolla lobes 14-22 mm long ..... 4. *C. convolvulacea*
10. Lamina lanceolate to ovate-lanceolate, 1-3 cm wide; hypanthium 5-7 mm long; corolla lobes 22-28 mm long ..... 5. *C. mairei*

1. Codonopsis rosulata W. W. Sm., Notes Roy. Bot. Gard. Edinburgh 13: 157. 1921.—TYPE: CHINA. Sichuan: Mu-li mountains, amongst heavy grass, 28°12'N, 11000 ft, Aug 1918, *G. Forrest 16856* (holotype: E-00265625! isotype: K-000575332!).

Icones. Shen and Hong (1983), pl. 7.4.

Distribution. Endemic to south-central China, in northwestern Yunnan and southwestern Sichuan. Grassy slopes and margins of pine forests, 2,600-3,600 m.

Discussion. *Codonopsis rosulata* was not mentioned by Grey-Wilson (1995). Perhaps he was influenced in this by Anthony (1926), who assigned the species to *C.* subg. *Codonopsis*. While *C. rosulata* does differ from the remainder of *C.* subg. *Pseudocodonopsis* in its basally rosulate scapose habit, the distinctive corolla and capsule clearly support its inclusion here (Shen and Hong, 1983; Hong and Ma, 1992).

2. Codonopsis hirsuta (Hand.-Mazz.) D. Y. Hong & L. M. Ma in H. W. Li & Z. Y. Zhu, Fl. Sichuanica 10: 546. 1992. *Codonopsis limprichtii* var. *hirsuta* Hand.-Mazz., Akad. Wiss. Wien, Math.-Naturwiss. Kl., Anz. 61: 169. 1924. *Codonopsis convolvulacea* var. *hirsuta* (Hand.-Mazz.) J. Anthony, Notes Roy. Bot. Gard. Edinburgh 15: 178. 1926.—TYPE: CHINA. Sichuan: "ad terram abruptam calceam reg. temperatae supra vicum Lodjiahosan pr. oppidum Yenyüen, 3,000 m," 30 Sep 1914, *H. Handel-Mazzeti 5423* (holotype: W).

Distribution. Endemic to south-central China, in northwestern Yunnan and southwestern Sichuan. Open thickets and sunny grassy slopes, 2,400-3,100 m.

Discussion. *Codonopsis hirsuta* has been treated as a variety (Anthony, 1926; Shen et al., 1975; Shen and Hong, 1983; Huang, 1991) or heterotypic synonym (Nannfeldt, 1936) of *C. convolvulacea*, which is very similar in characters of leaf and flower. However, *C. hirsuta* has the distinctive habit of *C. limprichtii*, with the rather short stems divided into a leafy non-twining basal portion and an almost leafless twining apical portion; *C. convolvulacea* in contrast has longer stems that are leafy and twining throughout. Lammers (2007b) included *C. hirsuta* within the circumscription of *C. limprichtii* because of the distinctive habit they shared. However, the differences in pubescence and leaf morphology given in the key above are quite pronounced, with no intermediates. For that reason, we follow Hong and Ma (1992) in recognizing them as distinct species.

3. Codonopsis limprichtii Lingelsh. & Borza, Repert. Spec. Nov. Regni Veg. 13: 391. 1914. *Codonopsis convolvulacea* var. *limprichtii* (Lingel & Borza) Anthony, Notes Roy. Bot. Gard. Edinburgh 15: 178. 1926.—TYPE: CHINA. Yunnan: "Talifu, an schattigen Plätzen unter Kiefern vor Ai-ning-po, bei Pu-peng, 2,500 m," 21 Aug 1913, *H. W. Limpricht 851* (holotype: WRSL).

Codonopsis graminifolia H. Lév., Cat. Pl. Yun-nan: 24. 1916.—TYPE: CHINA. Yunnan: Pâturages des montagnes, partout, 2,400 m, Jul 1911, *E. E. Maire s.n.* (holotype: E; isotype: E). The holotype includes extraneous material of *C. convolvulacea* (Chamberlain, 1977).

Codonopsis limprichtii var. *pinifolia* Hand.-Mazz., Akad. Wiss. Wien, Math.-Naturwiss. Kl., Anz. 61: 170. 1924. *Codonopsis convolvulacea* var. *pinifolia* (Hand.-Mazz.) J. Anthony, Notes Roy. Bot. Gard. Edinburgh 15: 178. 1926. "Codonopsis pinifolia" (Hand.-Mazz.) Grey-Wilson, Plantsman 12: 89 (1990). Nom. invalid. sub Art. 33.4.—TYPE: CHINA. Yunnan: "In pinetis calide temperatis circa jugum Yenaping ad occid. oppidi Djientschwan (»Kientschwan«) ubique, s. calceo, arenaceo, etc., 2,800-3,250 m," 22 Sep 1916, *H. Handel-Mazzeti 10053* (Syntype: W). Specimens *3713 pro parte* and *4370,* both from near "Lidjiang" were also cited.

Icones. Grey-Wilson (1990), pg. 76 A [as "C. pinifolia"]; Grey-Wilson (1995), pg. 214 [as "*C. pinifolia*"].

Distribution. Endemic to south-central China, in northern Yunnan, southwestern Sichuan, and western Guizhou. Open grassy slopes, thickets, and pine forests, 1,500-3,300 m.

Discussion. Members of *C.* subg. *Pseudocodonopsis* with the half-twining habit of *C. hirsuta* (see above) but glabrous much narrower leaves have been called *C. convolvulacea* var. *pinifolia* (Anthony, 1926; Tsoong, 1935; Shen et al., 1975; Chamberlain, 1977; Shen and Hong, 1983; Huang, 1991). Grey-Wilson (1990) was of the opinion that this distinctive taxon merits specific rank. Unfortunately, in coining a name for it, he neglected to provide a full and direct reference to the basionym (*C. limprichtii* var. *pinifolia*), citing merely "syn. *C. convolvulacea* var. *pinifolia* Hand.-Mazz." As a result, "*C. pinifolia*" was not validly published. The binomial *C. graminifolia* is a heterotypic synonym of *C. convolvulacea* var. *pinifolia* (Anthony, 1926; Tsoong, 1935; Shen et al., 1975; Chamberlain, 1977; Shen and Hong, 1983; Huang, 1991; Lammers, 2007b) and would be the correct name for this variety at specific rank (Hong and Ma, 1992).

Shen et al. (1975) expanded the circumscription of *C. convolvulacea* var. *pinifolia* by adding to it *C. c.* var. *limprichtii* (Anthony, 1926; Shen and Hong, 1983; Huang, 1991). At varietal rank, the former name has priority. Grey-Wilson (1995) similarly could discern no way by which to distinguish the two. He, however, wished to recognized the resulting taxon at specific rank. In doing so, he maintained the invalid name "*C. pinifolia*" and cited *C. limprichtii* as a heterotypic synonym. The correct name under Art. 11.4 for the species thus circumscribed is *C. limprichtii*. Lammers (2007b) included *C. limprichtii* var. *hirsuta* as a heterotypic synonym of this species, but as noted above, it is here considered a distinct species, following Hong and Ma (1992).

4. Codonopsis convolvulacea Kurz, J. Bot. 11: 195. 1873. —TYPE: "Yunan, Hotha".

Codonopsis forrestii var. *heterophylla* C. Y. Wu, Rep. Yunnan Trop. Subtrop. Fl. Res. Inst. 1: 80. 1965.—TYPE: *T. T. Yü 10173*.

Icones. Oliver (1895), pl. 2385; Tsoong (1935), fig. 6; Wu and Li (1965), pl. XXX.1 [as *C. forrestii* var. *heterophylla*]; Grey-Wilson (1990), pg. 76 right; Huxley (1992), pg. 667(i); Grey-Wilson (1995), pg. 221 R; Morris and Lammers (1997), figs. 7-9 [pollen]; Wei (2001), pl. II.2-3 [pollen].

Distribution. Endemic to southern Yunnan and adjacent Burma (Myanmar); reports from other regions (e.g., by Prain, 1908; Limpricht, 1922; Tsoong, 1935; Cox, 1936; Fletcher, 1937; Finlay, 1972; Hara, 1982) refer to various other members of the subgenus. Forests, open woods, grassy slopes, pastures, and thickets, 1,000-4,600 m.

Discussion. The circumscription of this, the first member of *C.* subg. *Pseudocodonopsis* to be described, has varied dramatically over the years, depending upon which of the other taxa have been subordinated to it as varieties or heterotypic synonyms. Anthony (1926) recognized four varieties: *C. convolvulacea* var. *convolvulacea* (as "var. typica," nom. invalid. sub Art. 24.3), *C. c.* var. *limprichtii, C. c.* var. *hirsuta,* and *C. c.* var. *pinifolia*. Although Nannfeldt (1936) felt it was "pointless" to distinguish these varieties (as well as *C. forrestii*), they were accepted by Shen and Hong (1983) and Huang (1991), who added to them *C. c.* var. *efilamentosa, C. c.* var. *forrestii* and *C. c.* var. *vinciflora.* In this way, the entire subgenus save non-twining *C. rosulata* was reduced to a single species. As Grey-Wilson (1990, 1995) pointed out, however, there are consistent morphological and ecological differences among these groups of populations, which support their recognition at specific rank. Consequently, we adopt here a very narrow circumscription of *C. convolvulacea*, encompassing only the plants called *C. c.* var. *convolvulacea* by earlier authors (Anthony, 1926; Shen and Hong, 1983; Huang, 1991).

Codonopsis forrestii var. *heterophylla* has been treated as a heterotypic synonym of *C. vinciflora* by most authors (Shen and Hong, 1983; Huang, 1991; Hong and Ma, 1992). However, careful study of the photograph of the holotype included in the protologue indicates to us that this is not an appropriate disposition for the name. That photo shows a plant with lanceolate acuminate leaves on very short petioles and relatively long calyx lobes enveloping the flower in bud; in contrast, *C. vinciflora* has ovate or deltate acute or obtuse leaves on rather long petioles and relatively short divergent calyx lobes. Lammers (2007b) treated *C. forrestii* var. *heterophylla* as a heterotypic synonym of *C. forrestii,* but that assignment is likewise untenable, as the corolla seen in the photo is far smaller than in *C. forrestii*. There is nothing in either the photo or the diagnosis that precludes identifying the specimen as *C. convolvulacea.*

5. Codonopsis mairei H. Lév., Cat. Pl. Yun-nan: 24. 1916. —TYPE: CHINA. Yunnan: Haies, brousse, pâturages des mont. à Ta-Hai, 3,200 m, Jul 1911, *E. E. Maire s.n.* (holotype: E-00265629!).

Codonopsis retroserrata Z. T. Wang & G. J. Xu, Acta Phytotax. Sin. 31: 186. 1993.—TYPE: CHINA. Sichuan: Yan yuan, 2,400 m, 5 Sep 1986, *Z. T. Wang 869382* (holotype: CPU; isotype: PE).

Icon. Wang and Xu (1993), fig. 2 [as *C. retroserrata*].

Distribution. Endemic to south-central China, in northwestern Yunnan and southwestern Sichuan. Meadows and thickets, 2,400-3,200 m.

Discussion. *Codonopsis mairei* was not mentioned by Grey-Wilson (1995). Most authors have treated it as a heterotypic synonym of *C. forrestii* (Anthony, 1926; Ballard, 1939; Shen et al., 1975; Chamberlain, 1977; Shen and Hong, 1983; Huang, 1991; Hong and Ma, 1992; Lammers, 2007b). It does resemble that species vegetatively, but differs in its smaller flowers: the hypanthium is just 5-7 × 4-7 mm (vs. 9-17 × 8-13 mm in *C. forrestii*), the calyx lobes are just 8-12 mm long (vs. 12-24 mm), and the corolla lobes are 22-28 × 8-15 mm (vs. 30-50 × 10-20 mm). In addition, the leaves of *C. mairei* tend to be more ovate, more acuminate at the apex and more rounded at the base, with somewhat shorter petioles. In all these features, *C. mairei* more nearly resembles *C. convolvulacea,* from

which it can be distinguished by the characters given in the key.

Although we have not able to examine type material of *C. retroserrata,* its original description conforms completely with the type of *C. mairei* and the illustration that accompanies the protologue almost seems as though it could have been modeled on the same specimen. It may have been the fact that *C. mairei* was hiding in the synonymy of *C. forrestii* at that time that led Wang and Xu to conclude that they had an undescribed species in hand.

6. Codonopsis macrophylla Lammers & L. L. Klein, sp. nov.—TYPE: IRELAND. Dublin, "Cult. Glasnevin Bot. Gard., Figured Bot. Mag. t. 9581," 11 Aug 1937, "presented on behalf of the Royal Horticultural Society by the Editor of the *Botanical Magazine*" (holotype: K!). Figure 1

"*Codonopsis tibetica*" Anonymous, Gard. Chron. (ser. 3) 72: 184. 1922. Nom. invalid. sub Art. 32.3. Name applied to a living plant "collected by Forrest. Shown by Mr. A. K. Bulley, Ness, Neston, Cheshire," which received an Award of Merit from the Floral Committee of the Royal Horticultural Society.

Planta culta patriae ignotae a ceteras speciebus Codonopsidis subg. Pseudocodonopsidis lamina ovata 5.5-7.5 cm longa et 3.3-5.1 cm lata cum apice obtuso, hypanthio 9-13 mm diametro, et corolla lazulina cum annulo atrovinoso prope basin, corollae lobis ellipticis obtusis 15-18 mm latis distinguenda.

Stems twining counter-clockwise throughout their length, sparingly branched, 0.3-1.5 m long, suffused purple, glaucous. Leaves evenly distributed along stems, glabrous; lamina coriaceous, ovate, 5.5-7.5 cm long, 3.3-5.1 cm wide, adaxially dark green, abaxially whitish green; apex obtuse; base subcordate; margin denticulate and sparsely ciliate, dark purple, flat; petiole 4.5-5.5 mm long. Flowers solitary and terminal on main stems and branches, the portion above the last leaf 9-14 cm long. Hypanthium obconic, 6-9 mm long, 9-13 mm diam., glabrous. Calyx lobes triangular, 9-16 mm long, 4.5-6 mm wide, glabrous, in bud coherent and enveloping the corolla; apex acuminate or acute; margin entire; sinus acute. Corolla rotate, light lavender-blue with darker veins and a dark reddish purple ring at base; lobes elliptic, 2.6-2.8 cm long, 1.5-1.8 cm wide, connate for only 2-3 mm at base, the apex obtuse and subapiculate. Filaments 4-5 mm long, dilated into a broad triangular base, pilose on inner surface and margin and appressed to the top of the ovary, abruptly narrowed and reflexed at apex; anthers oblong, 4-6 mm long, coherent. Style 4 mm long. Seeds oblong, somewhat compressed, 1.5 × 0.7 mm, smooth, shining chestnut-brown.

Icones. Figure 1; Anonymous (1922), fig. 78 [as "*C. tibetica*"]; Besant (1925), fig. 46 [as *C. forrestii*]; Ballard (1939), tab. 9581 [as *C. convolvulacea* var. *forrestii*]; Finlay (1972), fig. 37 [as *C. convolvulacea* var. *forrestii*]; Grey-Wilson (1990), pg. 80 [as *C. forrestii*].

Distribution. Not known from nature, described from cultivated material.

Discussion. In his synopsis, Grey-Wilson (1995) pointed out that at least some of the material historically cultivated as *C. forrestii* (or *C. convolvulacea* var. *forrestii*) did not in fact conform to the characterization of that taxon. Specifically, he pointed to the specimen upon which Ballard's (1939) plate was based. This plant differed from typical *C. forrestii* in its ovate (vs. linear-lanceolate to ovate-lanceolate) leaves, 33-51 mm wide (vs. 7-35 mm wide), and subcordate (vs. cuneate or rounded) at base; hypanthium 6-9 (vs. 9-17) mm long; calyx lobes triangular (vs. lanceolate or elliptic); and corolla lobes 26-28 (vs. 30-50) mm long, light lavender blue with darker veins and a dark reddish purple transverse band at base (vs. blue to lavender blue and unmarked). Grey-Wilson (1995: 219) stated that this plant "does not match anything collected in the field and may represent another new species." He declined to christen it, however, citing the need for additional study.

Although no additional material has come to hand in the past 15 years, it is our opinion that the best way to make collectors aware of this species is to name it formally. If the plant has a name, it can be included in *Flora of China* and other regional reference works, thus increasing the chance that it will be rediscovered in its homeland.

As to where that homeland might be, little can be said for certain. On 19 September 1922, A. K. Bulley (the founder and owner of Bee's Seeds in Neston, Cheshire) exhibited before the Floral Committee of the Royal Horticultural Society a plant he identified as "*C. tibetica*", which he had grown from material collected in nature by George Forrest (Anonymous, 1922, 1923). On 15 August 1925, Director John W. Besant reported that the National Botanic Gardens at Glasnevin, Ireland, had *C. forrestii* in bloom, courtesy of A. K. Bulley (Besant, 1925); however, he made no mention of "*C. tibetica*" or the Award of Merit. The specimen upon which Ballard's (1939) plate was based was sent from Glasnevin to Kew in 1937 by Director Besant, who was said to have obtained it from Bulley. Ballard's (1939) comments regarding the culture at Glasnevin of the plant shown in his plate very closely parallel Besant's (1925) comments on the same topic. This permits us to infer continuity between Besant's plant and Ballard's. Furthermore, to judge from the published photographs and descriptions, Bulley's "*C. tibetica*" of 1922 is identical to Besant's *C. forrestii* of 1925 and Ballard's *C. convolvulacea* var. *forrestii* of 1937 (cf. Fletcher, 1937, 1949). If Bulley had accurate information on the source of the material he grew, the fact that he coined the epithet "tibetica" for it could be an indication that the homeland of *C. macrophylla* lies somewhere in that region.

Grey-Wilson (1995) was unaware of the survival of any living plants of this species, nor have we located any. The most recent indication of its survival that we have seen is the photograph published by Finlay (1972), showing plants in cultivation at Keillour in Scotland. They are a match

for Bulley's "*C. tibetica*" and Ballard's plate, and could conceivably stem from the same original introduction.

7. Codonopsis vinciflora Kom., Trudy Imp. S.-Peterburgsk. Bot. Sada 29: 103. 1908. *Codonopsis convolvulacea* var. *vinciflora* (Kom.) L. T. Shen, Fl. Reipubl. Popularis Sin. 73(2): 68. 1983. *Codonopsis convolvulacea* subsp. *vinciflora* (Kom.) D. Y. Hong in C. Y. Wu, Fl. Xizang. 4: 582. 1985.—TYPE: CHINA. Sichuan: "inter Va-sy-kou et Za-li in valle fl. Siao-tzin-che," 15 Jul 1893, *G. N. Potanin s.n.* (Syntype: LE). A specimen grown in the botanical garden at St. Petersburg from seed collected by Potanin was also cited (cf. Fletcher 1949).

Icones: Komarov (1908), tab. II.IV; Wilkie (1937), fig. XXI; Fletcher (1949), tab 59; Finlay (1972), fig. 35; Grey-Wilson (1990), pg. 97; Grey-Wilson (1995), pg. 221 F-K, 223.

Distribution: Endemic to south-central China, in northwestern Yunnan, southwestern Sichuan, and southeastern Tibet (Xizang). Thickets and forests, 1,800-4,600 m.

Discussion. *Codonopsis vinciflora* has been referred to *C. convolvulacea* as a heterotypic synonym (Chipp, 1908), variety (Shen and Hong, 1983; Huang, 1991), or subspecies (Hong, 1985; Hong and Ma, 1992). However, as noted by Grey-Wilson (1995), *C. vinciflora* consistently differs from that species in its wider leaves (ovate or deltate vs. linear lanceolate or lanceolate) of thinner texture with more obtuse apex and more prominently toothed

Figure 1. *Codonopsis macrophylla* Lammers & L. L. Klein (from the holotype).

margin, in its much longer petioles (10-13 vs. 1-3 mm), and its shorter calyx lobes (5-8 vs. 6-13 mm) that do not envelop the flower in bud. We therefore follow Anthony (1926) and several subsequent authors (Nannfeldt, 1936; Wilkie, 1937; Fletcher, 1949; Finlay, 1972; Gray-Wilson, 1990, 1995; Lammers, 2007b) who recognized this taxon at specific rank.

Codonopsis forrestii var. *heterophylla* has been treated as a heterotypic synonym of *C. vinciflora* (Shen and Hong, 1983; Huang, 1991; Hong and Ma, 1992). As discussed above, its type specimen is better referred to *C. convolvulacea.*

8. Codonopsis efilamentosa W. W. Sm., Notes Roy. Bot. Gard. Edinburgh 8: 107. 1913. *Codonopsis convolvulacea* var. *efilamentosa* (W. W. Sm.) L. T. Shen, Fl. Reipubl. Popularis Sin. 73(2): 69. 1983.—TYPE: CHINA. Yunnan: Eastern flank of the Lichiang Range, 27°30' N, on scrub in dry situations, 10,000 ft, Jul 1910, *G. Forrest 6258* (holotype: E-00265632!).

Distribution. Endemic to northwestern Yunnan and adjacent Burma (Myanmar).

Discussion. *Codonopsis efilamentosa* has been treated as a variety of *C. convolvulacea* by Shen and Hong (1983) and Huang (1991). However, *C. efilamentosa* consistently differs from that species in its clustered axillary (vs. solitary terminal) flowers, wider leaves (15-33 vs. 2-14 mm) on longer petioles (5-22 vs. 1-3 mm), longer hypanthium (6-10 vs. 3-5 mm), and oblong corolla lobes rounded at apex (vs. elliptic and acute or obtuse). We therefore follow Anthony (1926) and several subsequent authors (Tsoong, 1935; Nannfeldt, 1936; Fletcher, 1937; Gray-Wilson, 1990, 1995; Lammers, 2007b) who recognized this taxon at specific rank.

9. Codonopsis forrestii Diels, Notes Roy. Bot. Gard. Edinburgh 5: 171. 1912. *Codonopsis convolvulacea* var. *forrestii* (Diels) Ballard, Bot. Mag. 162: tab. 9581. 1939. *Codonopsis convolvulacea* subsp. *forrestii* (Diels) D. Y. Hong & L. M. Ma in H. W. Li & Z. Y. Zhu, Fl. Sichuanica 10: 546. 1992.—TYPE: CHINA. Yunnan: common on moist places on the banks of the Yangtse, 5,000-7,000 ft, Sep 1907, *G. Forrest 48* (holotype: E-00265630!).

Codonopsis forrestii var. *hirsuta* P. C. Tsoong & L. T. Shen, Acta Phytotax. Sin. 13(3): 55. 1975.—TYPE: CHINA. Sichuan: "Wobosego."

Icones. Grey-Wilson (1995), pg. 218, pg. 221 L-Q. Other illustrations purporting to show this taxon (Besant, 1925; Ballard, 1939; Finlay, 1972; Grey-Wilson, 1990) actually depict *C. macrophylla.*

Distribution. Endemic to south-central China, in northern Yunnan, southwestern Sichuan, and western Guizhou. Open woods and thickets, 1,800-3,900 m.

Discussion. *Codonopsis forrestii* has been referred to *C. convolvulacea* as a heterotypic synonym (Nannfeldt, 1936), variety (Finlay, 1972; Shen and Hong, 1983; Huang, 1991), or subspecies (Hong and Ma, 1992). However, *C. forrestii* differs from that species in its larger leaves (18-46 × 2-14 vs. 25-105 × 7-35 mm) on longer (3-13 vs. 1-3 mm) petioles and in its larger flowers: hypanthium 9-17 (vs. 3-5) mm long, calyx lobes 12-24 (vs. 6-13) mm long, and corolla lobes 30-50 (vs. 14-22 mm long). We therefore follow Anthony (1926) and several subsequent authors (Tsoong, 1935; Gray-Wilson, 1990, 1995; Lammers 2007b) who recognized this taxon at specific rank.

Codonopsis forrestii var. *hirsuta* differs only in some minor pubescence on the abaxial leaf surface. All subsequent authors (Shen and Hong, 1983; Huang, 1991; Hong and Ma, 1992; Lammers, 2007b) have included it under this species as a heterotypic synonym. *Codonopsis forrestii* var. *heterophylla* has also been included here as a heterotypic synonym (Lammers, 2007b), but as noted above, its type is indistinguishable from *C. convolvulacea.*

Codonopsis mairei was treated as a heterotypic synonym of *C. forrestii* by numerous authors (Anthony, 1926; Ballard, 1939; Shen et al., 1975; Chamberlain, 1977; Shen and Hong, 1983; Huang, 1991; Hong and Ma, 1992; Lammers, 2007b); it is here recognized as distinct for the reasons given above. In a similar vein, the plants here described as *C. macrophylla* were long identified as this taxon (Besant, 1925; Fletcher, 1937, 1949; Ballard, 1939; Finlay, 1972; Grey-Wilson, 1990).

10. Codonopsis grey-wilsonii J. M. H. Shaw, New Plantsman 3: 93. 1996. *Codonopsis nepalensis* Grey-Wilson, Plantsman 12: 99. 1990. Nom. illeg. sub Art. 53.1. Non *Codonopsis nepalensis* H. Hara, J. Jap. Bot. 53: 139. 1978.—TYPE: NEPAL. Kali Gandaki Valley, W. of Marpha, woodland fringes, ca. 3,500 m, Sep 1973, *C. Grey-Wilson & Phillips 777* (holotype: K; isotype: K).

Icones. Prain (1908) tab. 8178 [as *C. convolvulacea*]; Grey-Wilson (1990), pg. 87; Grey-Wilson (1995), pg. 215 [as *C. nepalensis* 'Himal Snow'], pg. 221 A-E [as *C. nepalensis*], pg. 222 [as *C. nepalensis* 'Himal Snow'].

Distribution. Endemic to the eastern Himalaya. Shrubberies and forest margins, 2,400-3,600 m.

Discussion. The Himalayan representative of *C.* subg. *Pseudocodonopsis* has been known for over a century, but until Grey-Wilson (1990) pointed out its distinguishing features, it had been identified as *C. convolvulacea* (Prain, 1908; Finlay, 1972; Hara, 1982) or *C. vinciflora* (Fletcher, 1949). *Codonopsis grey-wilsonii* differs from both those species by its longer (3-13 vs. 1-3 mm) petioles and larger flowers, with corolla lobes 30-45 (vs. 14-23) mm long and pubescent (vs. glabrous) on the lower third internally. The only other member of the subgenus with flowers so large is *C. forrestii* (with which it has sometimes been confused; cf. Grey-Wilson, 1995); these two species may be distinguished by the characters given in the key above.

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黨參屬輻冠黨參亞屬 (桔梗科桔梗亞科) 之分類大綱，兼報導產地不詳的一新種：闊葉黨參

Thomas G. LAMMERS and Laura L. KLEIN

Department of Biology and Microbiology, University of Wisconsin Oshkosh, Oshkosh, WI 54901, USA

黨參屬輻冠黨參亞屬的物種爲無氣味的草本地下芽植物，具有不分枝且長度小於直徑四倍長的塊根；纏繞莖至少靠近基部具有多枚葉子；花通常單朵頂生，其花冠爲輻狀且深裂超過其長度的四分之三；花粉粒 5-10 溝，溝的長度短於花粉兩極距離的四分之一，表面具有 2-3 μm 長的小突刺；子房三室；果實爲倒錐形蒴果，先端具有短開裂口，內含許多具細紋的種子。輻冠黨參亞屬最近的分類處理包含了雞蛋參 (*C. convolvulacea*，本文指定爲此亞屬的模式種)、心葉珠子參 (*C. efilamentosa*)、珠子參 (*C. forrestii*)、尼泊爾黨參 (*C. grey-wilsonii*；原用 *C. nepalensis* 爲不合法名)、直立雞蛋參 (*C. limprichtii*；原用 "*C. pinifolia*" 爲無效名) 與輻冠黨參 (*C. vinciflora*)。蓮座狀黨參 (*C. rosulata*) 雖然莖不具纏繞性且具蓮座狀基生葉，亦爲輻冠黨參亞屬的成員。毛葉雞蛋參 (*C. hirsuta*) 之前被併入雞蛋參 (*C. convolvulacea*) 之中，但本文處理認爲是與直立雞蛋參 (*C. limprichtii*) 較近緣的獨立物種。梅氏黨參 (*C. mairei*) 之前被併入珠子參 (*C. forrestii*) 但本研究認爲是與雞蛋參 (*C. convolvulacea*) 近緣的獨立物種。過往有一栽培植物被鑑定爲珠子參 (*C. forrestii*)，但是有一些特徵與其他所有已知的種都不相同，本文發表爲新種 - 闊葉黨參 (*C. macrophylla*, sp. nov.)。雲南爲輻冠黨參亞屬的多樣性中心，孕育了十種之中的八種，東喜馬拉雅特有的尼泊爾黨參 (*C. grey-wilsonii*) 及產地不明的闊葉黨參 (*C. macrophylla*) 除外；若干種類的地理分布由雲南延伸至四川、貴州、西藏及 / 或緬甸。

關鍵詞：亞洲；桔梗科；桔梗亞科；黨參屬；闊葉黨參；新種；輻冠黨參亞屬；分類學。