

A NEW SPECIES OF *CODONOPSIS* WALL. (CAMPANULACEAE) FROM ARUNACHAL PRADESH, INDIA

S.S. DASH¹ AND A.A. MAO

Botanical Survey of India, Arunachal Pradesh Regional Centre, Itanagar 791 111

¹E-mail : ssdash2002@yahoo.co.in

ABSTRACT

Codonopsis vadsea is described and illustrated from Vadse hills of Kurung Kumey district of Arunachal Pradesh, India.

Key words : Arunachal Pradesh, *Codonopsis*, *Campanulaceae*, new species.

Codonopsis Wall. (Campanulaceae) is a perennial herbaceous genus native to Indo-China and Eastern Asia (Morris & Lammers, 1997). The genus with 55 species is distributed in Afghanistan, Pakistan, Himalayas (Bhutan, Nepal and Sikkim), Southern China, Taiwan and Japan (Rechinger & Schiman-Czeika, 1965, Hong & al., 2011, Shimuzu, 1993). Members of this genus are characterized by solitary and large campanulate flowers. Many of the members of the genus having a peculiar foetid odour and three subgenera *Codonopsis*, *Obconicapsula* D.Y.Hong and *Pseudocodonopsis* Kom. were recognized based on foetid odour and corolla character. Studies on pollen morphology (Lee & al., 1988, Morris & Lammers, 1997, Dunbar, 1984) and cytology (Lee, 1967) establish the circumscription of the genus with its allied genera *Campanumoea* and *Leptocodon*. Many species of the genus are having medicinal properties and used in Chinese and Korean traditional health care systems (Ghindre & Seong, 2010). C.B. Clarke (1881) reported 10 species of *Codonopsis* Wall. under two section *Campanulamoea* and *Cyclocodon* from British India; Clement (2001) reported 13 species from Bhutan; Haridasan & Mukherjee (1996) reported 13 species of *Codonopsis* Wall. from India; Giri & al. (2008) reported two species of *Codonopsis* Wall. from Arunachal Pradesh.

Recently, during a botanical exploration in Vadse hills of Kurung Kumey district of Arunachal Pradesh, the authors came across one interesting species of *Codonopsis* Wall. A critical study of the specimen in consultation with available literature (Clarke, 1881; Shen & Hong, 1983; Haridasan & Mukherjee, 1996; Clement, 2001; Hong & al., 2011) and herbaria (BSHC, CAL, ASSAM) have revealed that it is morphologically different from all the known species of the genus and hitherto undescribed. Hence it is described here as *Codonopsis vadsea*. An illustration (Fig.1) along with the image of the species is provided for the easy identification.

***Codonopsis vadsea* S.S.Dash & A.A.Mao, sp. nov.**

(Pl.1; Fig.1)

Herbae erectae, foetidae; foliis oppositis, basi truncatis, ad marginem sparsim ciliatis; hypanthio late hemispherico; calycis tubo glabro et $\frac{1}{3}$ ovarii adnato atque lobis crenulatis distante; corolla tubulosa, intra nigripunctata, tubo 1.4 - 2.2 $\times$ 0.8 - 1.2 cm, filis ciliatis dense, antheris longistrosus affixis, stylo erecto, stigmathe cylindrico glabro. *Codonopsis vadsea* S.S.Dash & A.A.Mao; ex affinitate *C. tubulosae* Kom. and *C. benthamii* Hook.f., & Thomson ab utroque foliis oppositis habitu erectis, petiolis basi amplectentibus, calycis tubo glabro et $\frac{1}{3}$ ovarii adnato, calycis lobi costa obscura, tubo corollae intra nigripunctato, antheris ad fila longistrosus affixis, stylo erecto, stigmathe cylindrico distincta

Erect herbs, plants with foetid odour, leaves opposite, truncate at base, sparsely ciliate at margin, hypanthium broadly hemispherical, calyx tube adnate $\frac{1}{3}$ rd of ovary, lobes distantly crenulate, corolla tubular, blackish punctuate inside, tube 1.4 - 2.2 $\times$ 0.8 - 1.2 cm, filaments densely ciliate, anthers attached lengthwise; style erect, stigma cylindrical, glabrous. *Codonopsis vadsea* S.S.Dash & A.A.Mao similar to *Codonopsis tubulosa* Kom. and *Codonopsis benthamii* Hook.f., & Thomson but differs by the presence of opposite leaves with erect habit, petioles with clasping base, calyx tube glabrous and adnate to $\frac{1}{3}$ rd of ovary, rib

obscure in calyx lobe; presence of blackish punctate in inner side of corolla tube; lengthwise attachment of anther to filament and erect style with cylindrical stigma.

Typus : (here designated): India; Arunachal Pradesh, Kurung Kumey district, Vadse mountain, 3800 m, (27°.55.25'.4" N & 92°.58.42'.6" E); 4.8.2010, *A.A.Mao & S.S.Dash* 31846. (Holo: CAL; Iso: CAL).

Herbs, perennial. Stem erect, 0.5–1.0 m long, flaccid; branches sparsely puberulous or glabrescent, foetid smell when bruised. Leaves opposite; petiole 1–1.7 cm long, glabrous, often clasping stem at base; blade oblong-lanceolate to elliptic-lanceolate, 3–3.5 × 1.5–1.9 cm, base truncate, often oblique, margin shallowly crenate, ciliate, apex narrowly acute, both surfaces minutely pubescent, lower surface grey-green, upper surface pale green. Flowers terminal, solitary; pedicel 1–3.5 cm long, glabrous or with very minute sparse pubescence; hypanthium broadly hemispherical, glabrous. Calyx tube obconic, adnate to $\frac{1}{3}$ rd of ovary, lobes broadly ovate or oblong, 1–1.7 × 0.4–0.7 cm, glabrous on both surfaces, margin distantly crenate, teeth obtuse, margin sparsely ciliate, apex narrowly acute. Corolla greenish yellow, tubular, tube 1.4–2.2 × 0.8–1.2 cm, outside glabrous, inside black punctate, 5 lobed, coriaceous, lobes ovate or deltoid, 4–6 × 3–5 mm, acute, margin minutely ciliate, longitudinal veins conspicuous outside; throat wider at apex. Stamens 5; filaments 8–10 mm long, dilated at base; anthers sagittate, 3–4 mm long, slightly concave, attached to filaments lengthwise, minutely glandular at point of attachment, filaments densely ciliate, cilia longer toward base. Ovary

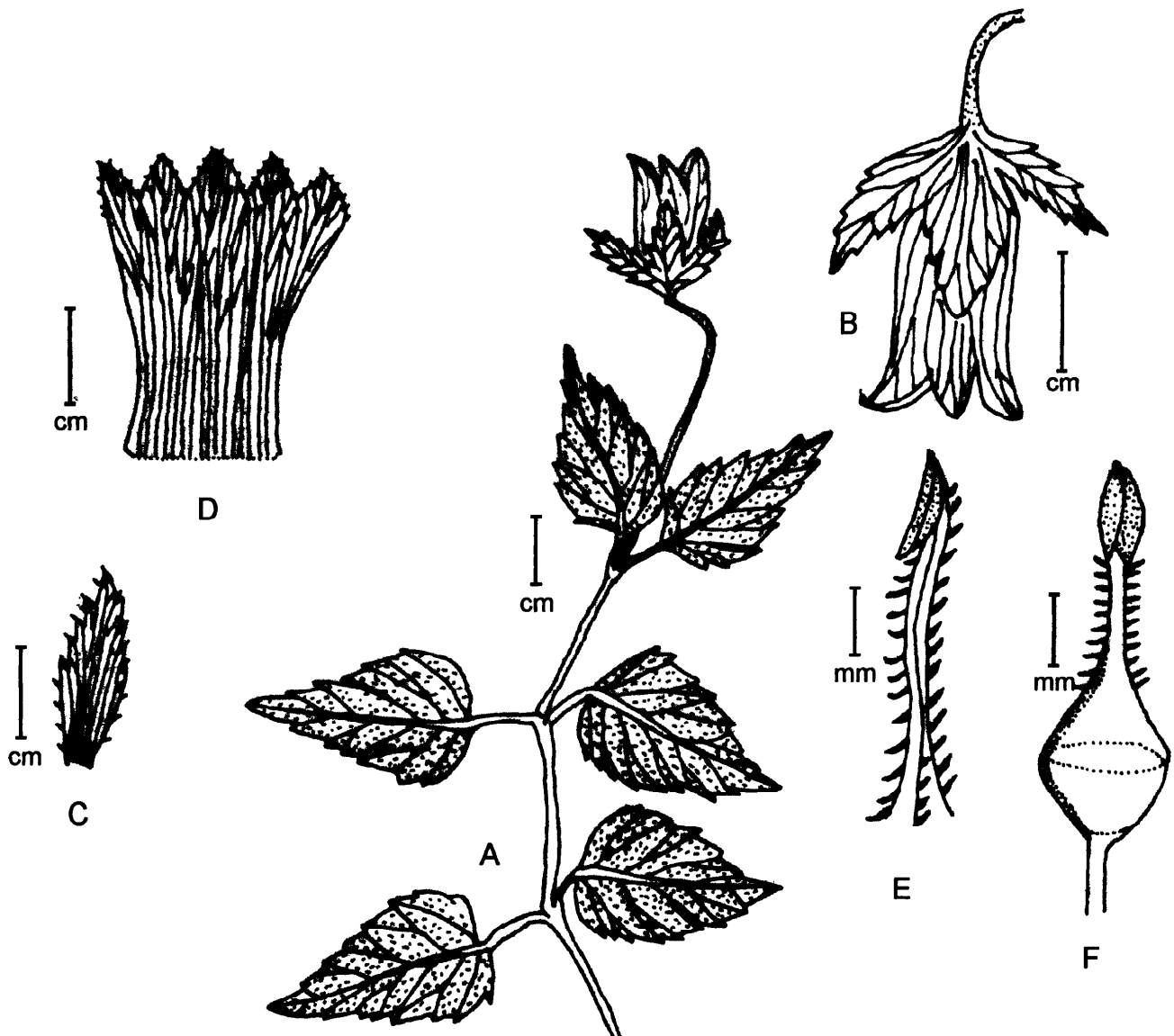


Fig. 1. *Codonopsis vadsea* S.S.Dash & A.A.Mao: A. Flowering twig; B. Flower; C. Calyx lobe; D. Opened corolla; E. Stamen; F. Pistil

semi-inferior, 4 - 5 mm across, style erect, 6 - 7 mm long, densely ciliate, stigma cylindrical, 4 - 5 mm long, minutely 3-lobed, glabrous, black punctate. Capsules not seen.

Flowering: July - September.

Habitat: The plant is found growing in sub-alpine to alpine grassy slopes at an elevation of 3700 - 4000 m; in association with *Bistorta macrophylla* (D.Don) Sojak, *Caltha scaposa* Hook.f. & Thomson, *Dichocarpum adiantifolium* (Hook.f. & Thomson) W.T.Wang & Hsiao; *Gentiana tubiflora* (Wall. ex G.Don) Grisebach; *Swertia cordata* (G.Don) C.B.Clarke, *Pedicularis gracilis* subsp. *gracilis* (Wall.) P.C.Tsoong etc.

Conservation status: Not evaluated.

Distribution: India: Arunachal Pradesh, Possibly Endemic.

Etymology: The species is named after the locality (Vadse hills of Kurung Kumey district, Arunachal Pradesh, India) from where it has been collected.

The species closely resembles to *Codonopsis tubulosa* Kom. by presence of tubular nature of corolla, indumentums of stem, petiolate opposite leaves and ciliate nature of filaments; with *Codonopsis benthamii* Hook.f. & Thomson having erect habit, similar leaf shapes, tubular nature of corolla. However, on closer examination, all the three species differ in many key characters and can be distinctly differentiated. The comparative account of the key morphological characters is given in Table 1.

Table 1. Comparative account of key morphological characters of *Codonopsis vadsea* S.S.Dash & A.A.Mao, *Codonopsis benthamii* Hook.f. & Thomson and *Codonopsis tubulosa* Kom.

Characters	<i>Codonopsis vadsea</i> S.S.Dash & A.A.Mao	<i>Codonopsis tubulosa</i> Kom.	<i>Codonopsis benthamii</i> Hook.f. & Thomson
Habit	Erect herbs	Twinning herb	Erect herbs
Stems	stem sub-glabrous or sparsely hairy	sparsely villous	Appressed hairy
Leaves	Opposite; petioles 1 - 1.7 cm long, petiole base often clasping stem; blade oblong-lanceolate to elliptic-lanceolate; both surfaces sparsely pubescent; base truncate; margin ciliate; apex narrowly acuminate.	Opposite; petioles 0.1 - 0.7 cm long, not clasping stem; blade lanceolate, ovate or elliptic; upper surface densely pubescent. lower surface hispidulous; base cuneate or rounded; margin without cilia, crenulate; apex acute or obtuse.	Alternate or sub-opposite; petioles 2 - 6 cm long; blade ovate-elliptic, densely hirsute on both surfaces, base truncate, margin without cilia, acuminate at apex, margin crenate.
Calyx	Tube adnate to $\frac{1}{3}$ rd of ovary, both surfaces completely glabrous; lobes narrowly elliptic, margin shallowly crenulate, sparsely ciliate.	Tube adnate to $\frac{1}{2}$ of ovary, densely villous; lobes broadly ovate, villous basally.	tube adnate up to $\frac{1}{2}$ of ovary, lobes ovate or deltoid, margins crenulate, densely ciliate.
Corolla	Tube 1.8 - 2.2 cm, lobes ovate, acute, margins very minutely ciliate, glabrous on both side, blackish punctate on ventral side, coriaceous.	Tube 2 - 3.7 cm long, lobes deltoid, margin without cilia, without blackish punctate, membranous.	Tubular-campanulate, 1.9 - 2.3 cm long, lobes deltoid, without cilia, not punctate, membranous.
Filaments	Densely ciliate, anthers attached lengthwise.	Sparsely ciliate, anthers attached at one point.	Densely ciliate, anthers attached at one point
Ovary	Style densely ciliate, stigmatic lobes cylindrical, erect.	Style sparsely ciliate, stigmatic lobes globose or slightly cylindrical, erect.	Style sparsely ciliate, stigmatic lobes ovoid, recurved.



Plate 1. *Codonopsis vadsea* S.S.Dash & A.A.Mao

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Botanical Survey of India, Kolkata for the facilities, to Dr. David E. Brufford, Harvard University Herbaria for confirming the identity of *Codonopsis vadsea* S.S. Dash & A.A. Mao as a distinct species and giving his valuable suggestion while going through the manuscript; Dr. K.N.Gandhi, Harvard University for rendering the Latin diagnosis; Dr. P. Lakshminarsimhan, Scientist, Central National Herbarium for sending the type image of *Codonopsis benthamii* Hook.f. & Thomson.

REFERENCES

- CLARKE, C.B. 1881. *Campanulaceae*- In: J.D. Hooker (ed.), The flora of British India, Vol 3. Reve. London.
- CLEMANT, R. A. 2001. *Campanulaceae*- In: L.S.Springate (ed.), Flora of Bhutan vol. 2(3): pp.1375 - 1396. Royal Botanic Garden, Edinburgh.
- DUNBAR, A. 1984. Pollen morphology in *Campanulaceae* IV. Nor. J. Bot. 4: 1 - 19.
- GHINDRE, B.K. AND E.S. SEONG. 2010. Improving antioxidant activity in *Codonopsis lanceolata* plants via over expression of the α -tocopherol methyltransferase (α -tmt) gene. Plant Growth Regulations 63(1): 1 - 6.
- GIRI, G.S., A. PRAMANIK AND H.J. CHOWDHURY. 2008. Materials for the flora of Arunachal Pradesh Vol. 2. Botanical Survey of India, Kolkata. pp.1-492.
- HARIDASAN, V.K. AND P.K. MUKHERJEE. 1996. *Campanulaceae* In: P.K.Hajra & M.Sanjappa (eds.), Fascicles of Flora of India, Vol 22: 25 - 118.
- HONG DE-YUAN, LIAN YONG-SHAN AND SHEN LIAN-DAI. 1983. *Campanulaceae* (*Campanuloideae* and *Lobelioideae*). In: Hong De-yuan, (ed.), Fl. Reipubl. Popularis Sin. 73(2): 1 - 173.
- HONG, DE-YUAN, G. SONG, T.G. LAMMERS AND L.L. KLEIN. 2011. *Campanulaceae*- In: Fl. of China, 19: 505-563. Science Press, Beijing and Missouri Botanical Garden, St. Louis.
- LEE, Y.N. 1967. Chromosome numbers of flowering plants in Korea (1): J. Korean Cult. Res. Inst., Ewha Women's Univ. 11: 455-478.
- LEE, S., Y.J. CHUNG AND J. LEE. 1988. A palynotaxonomic study of the Korean *Campanulaceae*. Korean J. Pl. Taxon. 18: 115 - 131.
- MORRIS, K.E. AND T.G. LAMMERS. 1997. Circumscription of *Codonopsis* and the allied genera *Campanulamoeba* and *Leptocodon* (*Campanulaceae: Campanuloideae*). I. Palynological data.-Bot.Bull. Acad. Sin. 38: 277 - 284.
- RECHINGER, K.H. AND H. SCHIMAN-CZEKA. 1965. *Campanulaceae* in K.H.Rechinger (ed.). Flora Iranica, Lfg.13. Akademische Druck- und Verlagsanstalt, Graz.p. 1 - 55 + plate 1 - 12.
- SHEN, L.D. AND D.Y. HONG. 1983. *Codonopsis* Wall. In: D.Y. Hong (ed.), Flora Reipublicae Popularis Sinicae. Vol 73(2): 32 - 66. Science Press, Beijing.
- SHIMUZU, T. 1993. *Campanulaceae* In: K. Iwatsuki et al. (eds.) Flora of Japan, Vol.3a. Kodansha, Tokyo, pp. 405 - 418.

अरुणाचल प्रदेश, भारत से कोडोनॉप्सिस (कैम्पेनुलेसी) की एक नई जाति

एस.एस. दाश एवं ए.ए. माओ

भारतीय वनस्पति सर्वेक्षण, अरुणाचल प्रदेश, क्षेत्रीय केन्द्र, इटानगर 791111

सार संक्षेप

कोडोनॉप्सिस वाडसीआ एस.एस.दाश एवं ए.ए.माओ (कैम्पेनुलेसी) का वर्णन एवं चित्रांकन अरुणाचल प्रदेश, भारत के कुरुंग-कुमे जिले की वाडसे पहाड़ियों से हुए हैं।