

STATUS OF *CORYDALIS MEIFOLIA* VAR. *VIOLACEA* (FUMARIACEAE) AND A NEW VARIETAL RECORD FOR INDIA

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Nathaniel Wallich described *Corydalis meifolia* Wall. [Tent. Fl. Nepal.: 55, t. 41. 1826] based on the collection from Kumaon Himalaya. The species was distinguished by its unique foliage, with leaves dissected into linear filamentous segments (Fig. 3C). Vicary in 1831 collected purple-flowered *Corydalis* at Baorin Ghattee, North India [Vicary no. 50, lectotype, (CAL!)] and named it as "*C. violaceus*, nom. herb.", but never published it. Prain (1896) considered Vicary's specimens as distinct, but closely allied to *C. meifolia* Wall., hence described them as *C. meifolia* Wall. var. *violacea* Vicary ex Prain. Besides Vicary's collection from Garhwal, Prain (l.c.) included four more specimens in the protologue of his new variety. Of these Duthie's collection [No. 956] was from Garhwal in Uttarakhand, whereas those of Edgeworth, Brandis and Jaeschke were from Lahul in Himachal Pradesh. Ellis and Balakrishnan (1993) erroneously placed it under synonym of the typical variety, as the description given by them is representative of the typical plants and does not include the exclusive characters of var. *violacea*. Prain (l.c.) pointed that specimens referred to *C. meifolia* var. *violacea* by him were distinguishable by important morphological characters of comparative length of upper petal lamina and spur and suggested a possible species rank for the same.

During a recent field survey in the Gangotri National Park, Western Himalaya, India, one of us (PKP) collected plants akin to *C. meifolia* var. *violacea*. A detailed morpho-taxonomic study on these fresh collections along with the type specimen of var. *violacea* in CAL and other specimens housed in DD and BSD, hitherto referred to *C. meifolia* Wall., revealed that the taxon under consideration differs in many additional morphological characters as listed in following key. Since in our opinion these characters are enough to treat variety *violacea* at species rank, the same is raised here at the species rank. The two species can be distinguished as follows:

- 1a Flowers pinkish-purple or purple, with white spur; spur longer than broad, $1/2-1/3^{\text{rd}}$ the length of upper petal (including spur); ultimate leaf segments linear to linear-elliptic with close segmentation; bracteoles usually shorter than pedicels; dorsal wing of upper petal tapered smoothly without abrupt constriction *C. violacea*
- 1b. Flowers yellow or orange-yellow; spur yellow, orange or black-tipped reddish-maroon; spur as long as broad, $(1/4-1/5-1/7^{\text{th}})$ the length of upper petal (including spur); ultimate leaf segments linear or linear-lanceolate with lax segmentation; bracteoles usually as long as or longer than pedicels; dorsal wing of upper petal broadly rounded on hood, then abruptly narrowed and tapered at/on spur base (dorsal wing very narrow or absent in *C. meifolia* var. *ecristata*) *C. meifolia*

During the course of this study authors also came across few collections of *C. meifolia* Wall., collected from Chamoli district of Uttarakhand (Garhwal), differing from the typical plants in upper and lower petals being wingless/ecristate or very narrowly winged with sub-acute or obtuse tips and white membranous inner petals without black or dark purplish-brown tips. Review of relevant literature (Royle, 1834-39, Hooker & Thomson, 1855; Hooker, 1872; Prain, 1896; Jafri, 1974; Polunin & Stainton, 1984; Long, 1984; Lidén, 1989; Ellis & Balakrishnan, 1993, Press & al, 2000; Zang & al., 2008) revealed the identity of these specimens as *C. meifolia* Wall. var. *ecristata* C.Y. Wu & Z.Y. Su, a taxon hitherto known from China (Tibet) only. The same is described and illustrated as a new record for Indian flora. A key to the Himalayan species of '*meifolia*' group has been provided.

Corydalis violacea (Vicary ex Prain) Pusalkar & D.K.Singh, **comb. et stat nov.** *C. meifolia* Wall. var. *violacea* Vicary ex Prain in J. Asiat. Soc. Bengal II, 65: 49. 1896.

Perennial herb with spreading foliage and erect to ascending flowering stems, 15–40 cm high; storage rootstock thick, 1–2.5 cm broad, often comprising many strands and crowned with scarious, membranous and fibrous remains of petiole bases. Leaves mostly basal, many, long petioled; petiole 1–10 cm long, glabrous, flat, with broadened sheathing base; lamina oblong or oblong-elliptic in outline, 3-pinnatisect, 6–15 x 3–4 cm; primary pinnae oblong-lanceolate to ovate-oblong in outline, opposite to alternate, lower petioluled, upper subsessile to sessile, to 3 x 1.5 cm; ultimate segments/lobules linear-lacinate to narrowly elliptic-linear, cuspidate, 2–5 x 0.2–1 mm, glabrous, glaucous. Cauline leaves 1–3 pairs, opposite to sub-opposite, sometimes upper alternate; lower pair petioled, upper sessile or sub-sessile. Flowers purple or pinkish-purple with white spur, 12–15 mm long, arranged in terminal, simple, usually flat-topped corymbose raceme, on scape-like branches arising from the axis of basal leaves; lowermost bracteoles leaf-like, upper 2-pinnatisect, flabellately divided into linear-lacinate segments; pedicels filiform, to 3.5 cm long, exceeding bracteoles. Sepals 2, lateral, ovate, 0.8–1 x 0.8–1.2 mm, fimbriate-dentate, white, membranous, glabrous. Petals 4, outer 2 (upper and lower) dissimilar, free; inner 2 similar, cohering at tip. Upper (posterior/posticous) petal 12–15 mm long, basally spurred; limb 8–11 mm long, dorsally winged with wing rounded on hood then smoothly narrowed, apex obtuse; spur conical, obtuse, 4–5 mm long, 2–3 mm broad at base, longer than broad, 1/2–1/3rd the upper petal; nectary within spur, attached to the base, 1–1.5 mm long, not fused with spur wall. Lower (anterior/anticous) petal 8.5–11 mm long, base not saccate; lamina 4.7–5.3 mm long, dorsally winged, deflexed at maturity. Inner petals 2, cohering at tip, 8–9.5 mm long, dorsally winged, basally clawed; claw 0.5–1 mm long, curved or straight, spreading. Stamens 6, in two bundles; each bundle with central ditheous and lateral monothecous anthers; phalange forming membranous covering around carpel. Carpels 2; ovary 2–3 mm long, elliptic, glabrous; style 2.5–3.5 mm long, apically upcurved; stigma showing apical and lateral lobes with basal lobules, papillate. Capsules broadly elliptic-oblancooid, 7–12 mm long, biconvex, glabrous, with persistent style and stigma; seeds 5–7, biseriate or sub-biseriate, sub-orbicular, 1–1.3 mm across, black, glossy with attached caruncle.

Flowering & Fruiting: June (late)–September (late).

Habitat & Ecology: Occasional, amidst scree and rocks in lateral and supra-glacier moraines, often on boulder-strewn slopes bordering glacier lakes, rarely on rocky-grassy slopes between 4300–5300 m.

Specimens Examined: Uttarakhand: Uttarkashi district: Tehri Garhwal (now Uttarkashi), Gangotri, 4000–4242 m, August 1897, Keshvanand 16 (DD); Dudu gad under Srikanta, 4545–4850 m, 09.08.1883, J.F. Duthie 956 (DD); Ourie gad in Nila valley, 4242–4545 m, 15.08.1883, J.F. Duthie 956 a (DD); Gangotri National Park, Tapovan, 4200–4700 m, 23.09.1967, B.D. Naithani 37413 (BSD); Gangotri National Park, near Kedar Tal, 4500–5000 m, 31.07.002, Pusalkar 101767 (BSD); Kedar Ganga valley, on way to Thalayasagar Peak, 5000–5200 m, 04.08.2003, Pusalkar 103961 (BSD); Tehri district: Sahastra Tal, 5300 m, 16.09.1979, A.K. Goel 66053 (BSD); HIMACHAL PRADESH: Kinnaur district, Rupin Pass, 4764 m, 24.09.1964, N.C. Nair 34256 (BSD); Chitkul, left river bank, 21.09.1974, K.P. Janardhanan 53621 (BSD).

Distribution : INDIA [Western Himalaya: Himachal Pradesh, Uttarakhand], Endemic.

Corydalis meifolia Wall. var. ***ecristata*** C.Y. Wu & Z.Y. Su in C.Y. Wu, Fl. Xizang. 2: 312. 1985. *Corydalis lhasaensis* C.Y. Wu & Z.Y. Su in C.Y. Wu, Fl. Reipubl. Popularis Sin. 32: 280.1999. (Fig 2, 3B)

Perennial herb with spreading foliage and erect to ascending flowering stems, 8–35 cm high; rootstock long, thick; stems 2-many, arising from the axis of the basal leaves, tufted, striate, glaucous or glabrous, base with column of persistent broad, sheathing petiole bases. Foliage green or greyish-green, glabrous or glaucous. Leaves deeply and finely divided into linear-lanceolate to linear-elliptic or linear-lacinate ultimate segments; basal leaves large, long petioled; petioles 2–17 cm long, with broadly flattened, sheathing base, often with thin, scarious margins; lamina oblong-elliptic in outline, 3-pinnatisect, 8–20 x 2–7 cm; primary pinnae 5–7 pairs, ovate-lanceolate to oblong-elliptic in outline, 2–7 x 1–3 cm, pinnate or bipinnatifid; ultimate segments linear-lanceolate to linear-elliptic or lacinate, numerous, 2–5 x 0.3–1 mm; cauline leaves few, alternate to opposite; lowermost situated near the middle of stem, becoming shorter and sub-sessile above, 2-pinnatifid upwards. Flowers yellow with green hood and black-tipped spur showing reddish-maroon base, 10–15 mm long, in terminal, densely 10–20-flowered, flat-topped, corymbose raceme, to 8 cm long, elongated in fruiting; bracts equaling or exceeding the pedicels; lower bracts leaf-like, 2-pinnatisect into similar linear segments like foliage

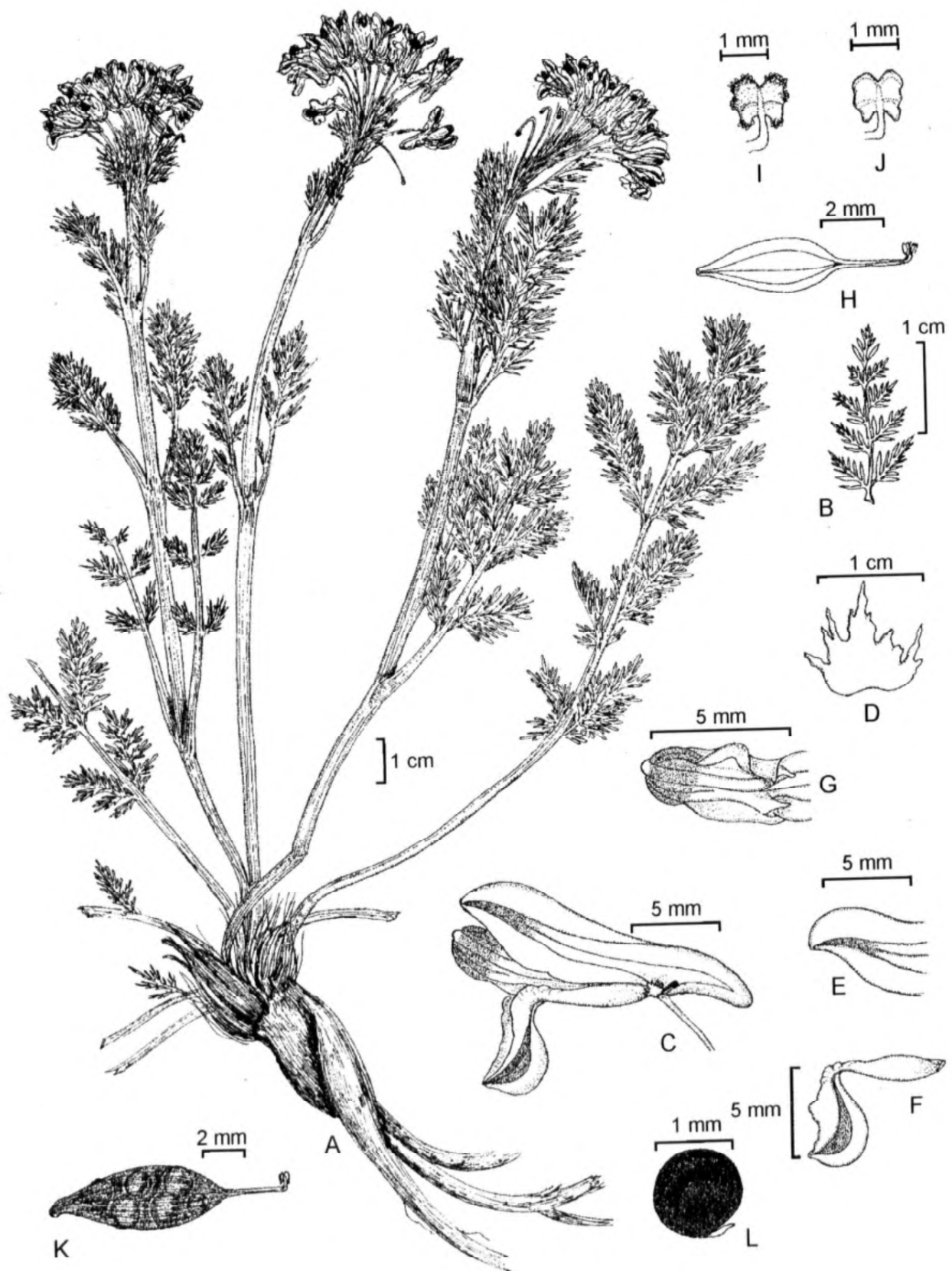


Fig. 1. *Corydalis violacea* (Vicary ex Prain) Pusalkar & D.K. Singh. A. Habit; B. Leaf pinna showing segmentation, C. Flower; D. Sepal; E. Upper petal apex showing dorsal wing; F. Lower petal showing lateral wing variation; G. Inner petal; H. Phalange with anthers; I. Flowering stigma with papillae; J. Fruiting stigma; K. Capsule; L. Seed.

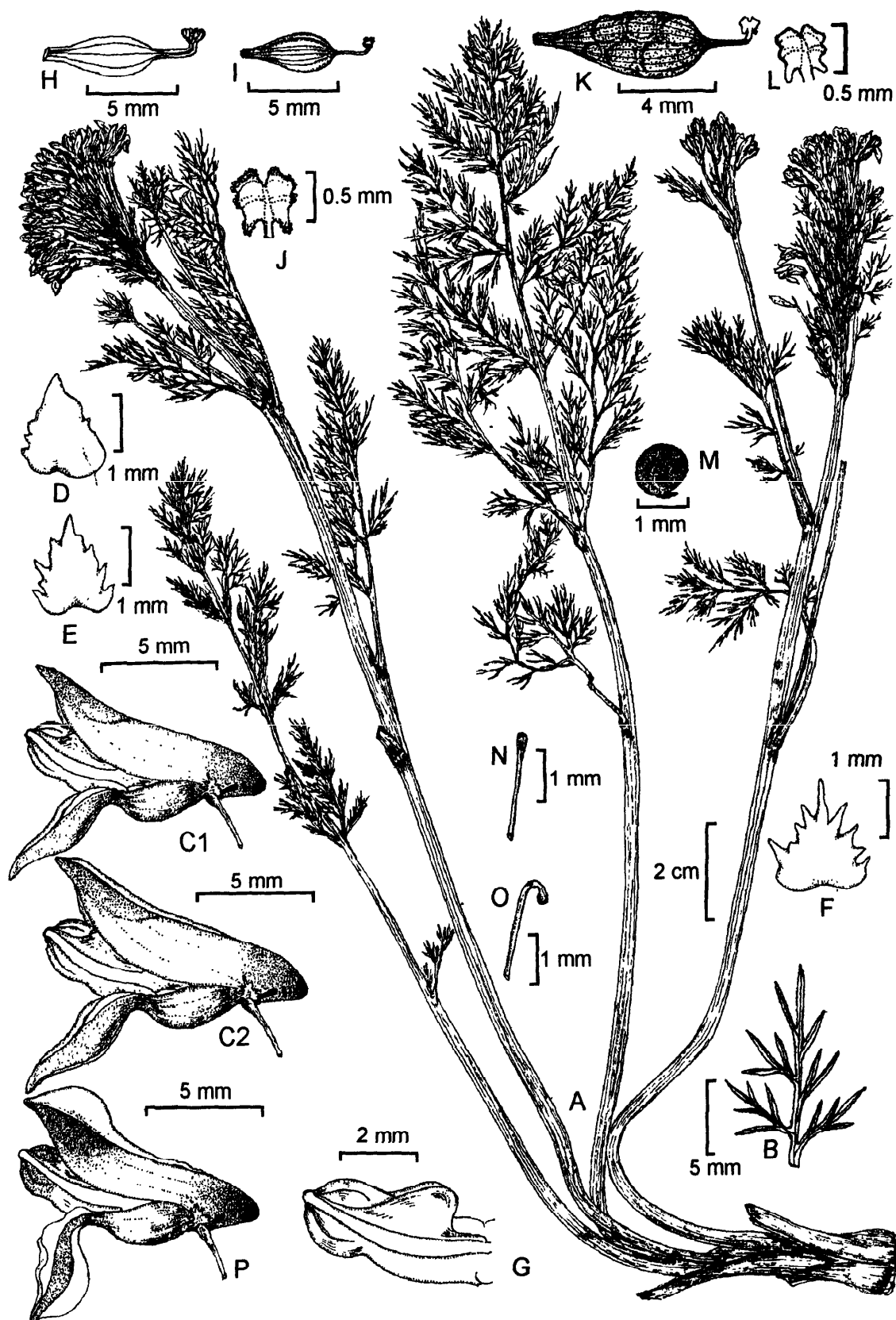


Fig. 2. *Corydalis meifolia* Wall. var. *ecristata* C.Y. Wu & Z.Y. Su: A. Habit; B. Leaf pinna showing segmentation; C1. Flower showing wingless upper/lower petal; C2. Flower showing narrowly winged upper/lower petal; D, E, F. Sepal (variation); G. Inner petal; H. Phalange with anthers; I. Carpel; J. Flowering stigma (with papillae); K. Capsule; L. Fruiting stigma (without papillae); M. Seed; N. Flowering pedicel; O. Fruiting pedicel; P. flower of *C. meifolia* Wall. var. *meifolia* showing, broadly winged upper/lower petal.



Fig. 3. A. *Corydalis violacea* (Vicary ex Prain) Pusalkar & D.K. Singh; B. *Corydalis meifolia* Wall. var. *ecrinata* C.Y. Wu & Z.Y. Su; C. *Corydalis meifolia* Wall. var. *meifolia*

and broad sheathing petiole; median bracts flabellate, palmately pinnatisect with flattened bases and deeply divided linear segments; pedicels 1–3 cm long, glaucous; flowering pedicels erect; fruiting pedicels apically curved. Sepals 2, lateral, ovate, ovate-cordate or ovate-reniform 1.5–2 x 1–1.5 mm, white, membranous, glabrous, margins wavy to irregularly fimbriate-dentate. Petals 4, outer 2 (upper and lower) dissimilar, free; inner 2 similar, cohering at tip. Upper (posterior/posticous) petal 10–15 mm long, spurred; petal lamina 8–12 mm long, yellow with green hood, often with purple lines on the neck, dorsally wingless or very narrowly winged, apex sub-acute; spur conical-saccate, as long as broad, 3–4 x 3–4 mm, obtuse, 1/5–1/6th the length of upper petal (including spur); nectary 0.8–1.2 mm long, attached to the spur base, not fusing with spur wall. Lower (anterior/anticous) petals yellow with basal part flushed with reddish-maroon, 8–12 mm long, equaling or exceeding upper petal lip, narrowed in the middle with 4–6 mm long, non saccate or sub-saccate base and 4–6 mm long limb; limb dorsally wingless or narrowly winged, deflexed, with sub-acute tip and lateral variable wings. Inner petals cohering at apex, creamy-white, sub-membranous, not black or dark-tipped, 6–8 mm long; lamina 4–6 mm long, apically rounded, obtusely mucronate snout, dorsally narrowly and laterally auriculate winged; base auricled, clawed. Stamens in two bundles, each with central ditheous and lateral pair of monotheous anthers; filaments forming white, membranous phalange enclosing ovary and style; anthers minute, 0.8–1 mm long, reaching stigma. Carpels 2, united; ovary oblanceolate or obovate, flattened, biconvex, 3–5 mm long with 2–3 mm long, apically upcurved style bearing 0.6–1 x 0.5–1 mm, flattened, bilobed, fused stigma, squarish in outline bearing 4 apical and 2 inconspicuous lateral papillate lobes with basal papillate lobes. Capsules narrowly obovoid, oblanceoid to broadly ellipsoid, 6–10 x 3–5 mm with persistent style and stigma; fruiting stigma glabrous, usually without papillae; seeds (4–) 6–10, biseriate or sub-biseriate, orbicular or sub-orbicular, often flattened or biconvex, 1–1.5 mm across, black, smooth or faintly foveolate, glossy, with attached caruncle.

Flowering & Fruiting: July–September.

Habitat & Ecology: Locally common, on open grassy slopes bordering glacier between 3400–4500 m.

Distribution: INDIA [Western Himalaya: Uttarakhand (Chamoli district)], CHINA (Tibet-Lhasa).

Specimens examined: Uttarakhand, Chamoli district, Nandadevi Biosphere Reserve, Hemkund, 4200 m, 02.10.1962, U.C. Bhattacharyya 24265 (BSD); Hemkund, 4000 m, 17.08.1963, U.C. Bhattacharyya 29482 (BSD); Valley of Flowers, May 1978, B.M. Wadhwa 62661 (BSD); Chamoli, B.P. Uniyal 89227 (BSD); On way to Hemkund, 18.10.1965, N.C. Nair 85950 (BSD); Lakshman Parbat, on way to Hemkund, 1.8–2.5 Km behind Lake/Shrine, 3800 m, 07.08.2008, Pusalkar 111131 (BSD).

KEY TO *CORYDALIS MEIFOLIA* GROUP OF THE HIMALAYA

- 1a. Spur as long as broad, (1/4–)1/5–1/7th the length of upper petal (including spur) 2
- 1b. Spur longer than broad, 1/2–1/3rd the length of upper petal (including spur) 3
- 2a. Upper and lower petal wingless *C. meifolia* Wall. var. *ecrinata* C.Y. Wu & Z.Y. Su
[Himalaya: China (Tibet, Lhasa), India (Uttarakhand, Chamoli)]

- 2b. Upper and lower petal broadly winged *C. meifolia* Wall. var. *meifolia*
[Himalaya: Bhutan, China, India (Jammu & Kashmir to Sikkim), Nepal, Pakistan]
- 3a. Flowers yellow; plant base with membranous remains of petiole bases; flowers 5–8; stigma with reduced basal lobes *C. sikkimensis* (Prain) Fedde
[Himalaya: Bhutan, India (Uttarakhand, Sikkim), Nepal]
- 3b. Flowers purple with white spur; plant base with fibrous remains of petiole bases; flowers 10–20; stigma with well-developed basal lobes *C. violacea* (Vicary ex Prain) Pusalkar & D.K. Singh
[Western Himalaya: India (Himachal Pradesh, Uttarakhand)]

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