

## FUMARIACEAE IN NORTH EAST INDIA : NEW SPECIES AND RECORDS IN *CORYDALIS* AND *DACTYLICAPNOS*

M. K. PATHAK, KRISHNA CHOWLU<sup>1</sup>, B. SAIKIA<sup>2</sup> AND M. LIDÉN<sup>3\*</sup>

*Botanical Survey of India, Central National Herbarium, Howrah-3, India*

<sup>1</sup>*Center for Orchid Gene Conservation of Eastern Himalayan Region (COGCEHR), Henbung-795129  
Senapati district, Manipur, India*

<sup>2</sup>*Rajiv Gandhi University, Itanagar Arunachal Pradesh, India*

<sup>3</sup>*Uppsala University Botanic Gardens, Villavägen 8, 75236 Uppsala, Sweden*

\*E-mail: magnus.liden@botan.uu.se

### ABSTRACT

A synopsis for the NE Indian species of the genera *Corydalis* DC. and *Dactylicapnos* Wall. is presented. *Corydalis arcuata* (Arunachal Pradesh, Tibet), *C. biflora* (Sikkim) and *C. stenophylla* (Arunachal Pradesh, Sikkim) are described as new species. Six species, namely *Corydalis auricilla* Lidén, *C. davidii* Franch. (s. l.), *C. diffusa* Lidén, *C. inopinata* Prain, *C. pterygopetala* Hand.-Mazz. and *C. tangutica* Peshkova (s. l.) are reported as new to India. Another seven species of *Corydalis* and five species of *Dactylicapnos* were either overlooked in *Flora of India* or became known to the Indian flora after its publication: *C. cashmeriana* subsp. *longicalcarata* (D.G. Long) Lidén, *C. ecristata* (Prain) D.G. Long, *C. jigmei* C.E.C. Fisch. & Kaul, *C. khasiana* Lidén, *C. pseudojuncea* Ludlow & Stearn, *C. rubrisepala* Lidén, *C. uranoscopa* Lidén and *Dactylicapnos burmanica* (K.R. Stern) Lidén, *D. cordata* Lidén, *D. lichiangensis* (Fedde) Hand.-Mazz., *D. odontocarpa* Lidén, and *D. platycarpa* Lidén. Two species of *Corydalis*, namely, *C. chaerophylla* DC., and *C. gouldii* Lidén, are reported as new to the Flora of China area (Xizang: Yadong [Tibet: Chumbi]).

### INTRODUCTION

The genus *Corydalis* is one of the larger and more diverse genera in the Himalayan region. The recently completed Flora of China account (Zhang & al., 2008), treated no less than 357 species (a further three are added in this paper) of which 121 occur in Tibet. The Flora of India (Ellis & Balakrishnan, 1993) dealt with 52 species; Flora of Nepal (Lidén, 2011) with 45 species; Flora of Bhutan (Long, 1984) with 32 species and another 7 from Sikkim and/or Chumbi; 16 species are listed in the Myanmar checklist (Kress, 2003), and in Materials for the flora of Arunachal Pradesh (Hajra & al., 1996) 8 species are mentioned.

Of these, Arunachal Pradesh is botanically little known. As a necessary basic step towards an exploration of the *Corydalis* and *Dactylicapnos* flora of the East Himalayas, we have compiled the present survey based on recent fieldwork (M. K. Pathak -2008, 2009, 2010, 2011 & 2012; M. Lidén, Krishna Chowlu & B. Saikia - 2010; Lidén, Saikia & R. Mili, 2012) as well as herbarium studies, mainly in ARUN, ASSAM, BM, CAL, E, F, K, S, TI and UPS. For North West Arunachal Pradesh, we have seen photographs of several species for which herbarium specimens do not exist. We now know at least 25 species of *Corydalis* from Arunachal Pradesh as against 8 species mentioned in the Materials for the Flora of Arunachal Pradesh, but believe that this figure will rise with increased exploration, both from discoveries of new species and from new records of species known from the Tibetan side of the Himalayan chain or other neighbouring countries.

Part of the genus *Dactylicapnos* has recently been treated by Lidén (2010). Novelties from this paper are shortly recapitulated here, together with some additional distributional notes.

Our review takes as a baseline, the *Flora of India* treatment (Ellis & Balakrishnan, 1993), but the sequence of species is systematic, following *Flora of China* (Zhang & al., 2008). Reference is also made to *Materials for the Flora of Arunachal Pradesh* (Hajra & al., 1996) when required.

Specimens are cited, whenever relevant, with particular reference to Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim and West Bengal (Darjeeling). We also include a couple of new records for the Chumbi district in South Tibet (=Xizang: Yadong).

We emphasize that the list is not complete; *Corydalis* sect. *Chrysocapnos* and the *Dactylicapnos grandifoliolata* group are not covered. The first is a predominantly West Himalayan group and the latter is dealt with in a separate paper (Lidén & Pathak, in print).

In the present paper *Corydalis arcuata* (Arunachal Pradesh, Tibet), *C. biflora* (Sikkim) and *C. stenophylla* (Arunachal Pradesh, Sikkim) are described as new species. Six species, namely *Corydalis auricilla* Lidén, *C. davidii* Franch. (*s. l.*), *C. diffusa* Lidén, *C. inopinata* Prain, *C. pterygopetala* Hand.-Mazz. and *C. tangutica* Peshkova (*s. l.*) are reported as new to India. Another seven species of *Corydalis* and five species of *Dactylicapnos* were either overlooked in *Flora of India* or became known to the Indian flora after its publication: *C. cashmeriana* subsp. *longicalcarata* (D.G.Long) Lidén, *C. ecristata* (Prain) D.G.Long, *C. jigmei* C.E.C. Fisch. & Kaul, *C. khasiana* Lidén, *C. pseudojuncea* Ludlow & Stearn, *C. rubrisepala* Lidén, *C. uranoscopia* Lidén and *Dactylicapnos burmanica* (K.R.Stern) Lidén, *D. cordata* Lidén, *D. lichiangensis* (Fedde) Hand.-Mazz., *D. odontocarpa* Lidén, and *D. platycarpa* Lidén. Two species of *Corydalis*, namely, *C. chaerophylla* DC., and *C. gouldii* Lidén, are reported as new to the Flora of China area (Xizang: Yadong [Tibet: Chumbi]).

### CORYDALIS DC.

#### Section CHEILANTHIFOLIAE

1. ***Corydalis ophiocarpa*** Hook.f. & Thomson, Fl. Ind. 1: 259. 1855; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 68. 1993; H.J. Chowdhery & al., in Hajra & al., (eds.) Mat. Fl. Arunachal Pradesh 1: 122. 1996; Zhang Mingli & al., in C.Y. Wu & al., (eds.) Fl. China 7: 307. 2008.

*Distribution*: Widely distributed in Himalaya and China.

*Specimens examined*: India, Arunachal Pradesh: Anjaw, Di Chu gorge, *Kingdon-Ward* 19429 (BM!); above Dong, forest, 2000m, *Lidén* 2010, photograph (UPS!); Subansiri (Hajra & al., 1996, specimen not seen).

#### Section DACTYLOTUBER

***Corydalis alpestris*** C.A.Mey. Verz. Pfl. Casp. Meer. 176. 1831.

A caucasian species, not known from India, but confused with the next species (*C. tangutica*).

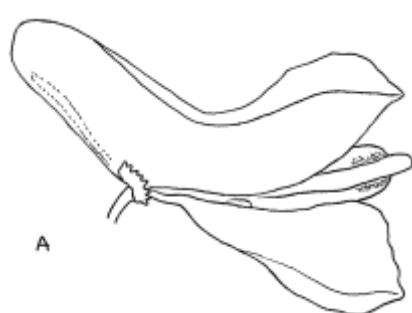
2. ***Corydalis tangutica*** Peschkova in Bot. Zhurn. 75(1): 87. 1990; Zhang Mingli & al., in C.Y. Wu & al., (eds.) Fl. China 7: 328. 2008, sensu lato.

This is a poorly resolved complex, known from West China, Tibet, Bhutan and Kashmir. The Arunachal Pradesh and [some] South Tibet plants differ in their round leaflets and large flowers and may represent an undescribed species (Zhang Mingli & al., 2008).

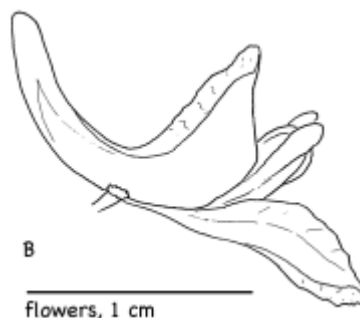
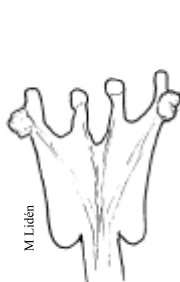
*Specimens examined*: India: Arunachal Pradesh: Tawang, 27°37'8.60"N, 92°13'39.40"E, *P. Boardman* (photo - 1). Bhutan: Upper Thimpu-chu, 14000 ft (4300m), slaty blue with black anther, growing in dwarf Rhododendron, 26.05.1985, *S. Bowes Lyon* 9024 (E!). Tibet: Lela, Chayul Charne, 28°27'N, 92°56'E, 15500 ft (4700m), 8.05.1936, *Ludlow & Sherriff* 1560 (BM!); Takarla, N. Sangacholin, 28°39'N, 92°06'E, 15500 ft (4700m), 28.06.1936, *Ludlow & Sherriff* 2237 (BM!); Langong, 13500 ft (4100m), 28.05.1938, *Ludlow & Sherriff* 3922 (BM!); Tse La, 28°45'N, 94°0'E, 15000 ft (4600m), 22.06.1938, *Ludlow, Sherriff & Taylor* 5627 (E!, BM!, A!); Tsari, Bimbila, 13500ft (4100m), 11.06.1936, *Ludlow & Sherriff* 2114 (BM!, A!); Wala, Pashö (=Baxoi), *J. Hanbury Tracy* 98 (BM!); Hills South of Lhasa, 14000 ft, 06. 06.1942, *Ludlow & Sherriff* 8666 (BM!). (Photo - 1)



**Plate 1 :** *Corydalis tangutica* Peschkova (Photo: Pete and Pamela Boardman, North Wales, UK).



**Fig. 1A :** *Corydalis auricilla* Lidén & Z.Y. Su



**Fig. 1B :** *Corydalis pterygopetala* Hand.-Mazz.



#### Section DAVIDIANAE

3. ***Corydalis auricilla*** Lidén & Z.Y. Su, Fl. China 7: 333. 2008.

(Fig. 1A ; Pl. 2)

Species previously known from Yunnan and NE Burma. This is a new record for India.

*Specimens examined* : India: Arunachal Pradesh, Upper Siang, Eckodumbing peak area, 28°44.139'N, 95°10.020'E, 4000m, 25.07.2010, *M. K. Pathak* 72993 (CAL!); Pemashree 3800m, 12.09.2011, *M. K. Pathak* 54325 (CAL!).

*Corydalis auricilla* is closely related to *C. pterygopetala* Hand. - Mazz. in the *C. yunnanensis* group, but differs in more divided leaves with narrower leaflets, comparatively broader spur, obovoid capsules with seeds  $\pm$  in two rows and stigma with basal lobes clinging to style.

4. ***Corydalis pterygopetala*** Hand.-Mazz., Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 62: 222. 1925; Zhang Mingli & al., in C.Y. Wu & al., (eds.) Fl. China 7: 332. 2008.

*C. pterygopetala* was previously known from SE Xizang, W Yunnan and N Burma and has now been discovered in Anjaw, Arunachal Pradesh. This is a new record for India.



**Plate 2 :** *Corydalis auricilla* Liden & Z.Y. Su; Bottom right *Corydalis pseudolongipes*

*Specimens examined* : India: Arunachal Pradesh, Anjaw, Dong, E of the village, 28°09'N, 97°09'E, 3100 - 3600m, forest margins, usually close to running water, 27.08.2012, M. Lidén, B. Saikia & R. Mili 24 (CAL!). (Fig.1B)

5. ***Corydalis arcuata*** M.K.Pathak, Krishna Chowlu, B.Saikia et Lidén **sp. nov.** (Fig. 2; Pl. 3)

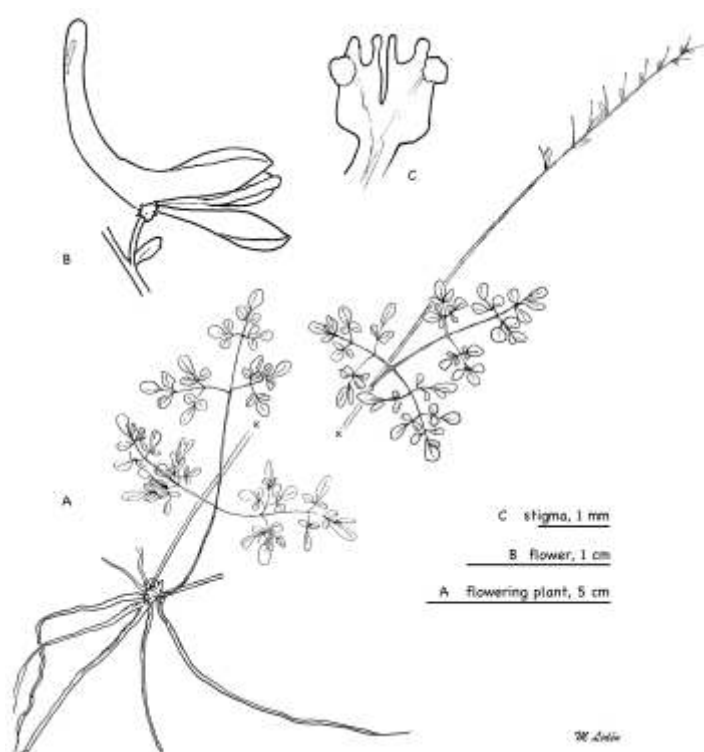
Perennial herb, 20 - 35cm tall. Rhizome short, with a cluster of 3 to 6 long coarse roots 1 - 1.5mm thick, and a diffuse leaf rosette. Flowering stems erect, one to few, with one leaf in lower third and a second leaf in upper third, unbranched or with a short flowering branch from upper leaf. Lamina triangular to ovate triangular, 5 - 12 × 5 - 12cm, three to four times ternately compound with rather long primary petiolules. Ultimate leaflets rounded to obovate, obtuse, 3 - 9 × 3 - 6mm; petioles of radical leaves and lower cauline leaf 4 - 10cm long, base vaginate; upper petiole 1 - 2(-3)cm long. Inflorescence a 5- to 12- flowered raceme; peduncles 3 - 6cm long, about equaling raceme; elongating in fruit pedicels 4 - 9mm long; bracts narrowly obovate, entire (rarely the lowermost divided), obtuse, 2 - 4(-6)mm long. Sepals rounded, 1 × 1mm, circumdentate. Corolla uniformly yellow without a blackish purple apex to inner petals; outer petals with rather short entire obtuse crest 1 - 1.5mm broad; spur of upper petal curved upwards, 12 - 17mm long, tapering to a narrow tip, with nectary reaching almost to the tip of the spur; inner petals ca 9mm long with broad limb slightly longer than claw; dorsal wings slightly overtopping apex. Style 3 - 4mm long; stigma squarish, deeply cleft to about 2/3, apically with 4 papillae, and close to apical corners a lateral submarginal geminate papillae on each side; basal lobes lacking or inconspicuous. Fruit unknown.

*Flowering* : April -June.

In grassland and humid forest, at an altitude of 2000 - 3000m.

This is the daintiest species in the *C. yunnanensis* group, which has its main diversity in Western Yunnan. *Corydalis arcuata* is closely related to *C. delicatula* D.G.Long from Bhutan, but differs in the slender up-curved tapering spur (short, broad and more or less straight in *C. delicatula*), more deeply cleft and basally truncate stigma (clef to about 1/2 and with basal auricles in *C. delicatula*), nectary reaching almost to the tip of the spur (in *C. delicatula* to ca 2/3) and small bracts (lowermost bract usually very large and leaf-like in *C. delicatula*).





**Fig. 2 :** *Corydalis arcuata* M.K. Pathak & al.,



**Plate 3 :** *Corydalis arcuata* M.K. Pathak & al.,  
(Photo: Pete and Pamela Boardman, North Wales, UK).

*Etymology* : Latin *arcus* : bow

*Type* : India: Arunachal Pradesh, Lower Subansiri, 2 km NE inside Tale valley, 2320m, under forest in wet places, fairly common, a delicate semi-erect herb 30cm, light green, whole plant slender, stem purplish green, flowers yellow, 17.04.1980, *G. D. Pal* 77682 (Holo : ARUN).

*Additional specimens examined* (paratypes) : India: Arunachal Pradesh, Zang to Senge Dzong, on moist soil slopes along rocky corner, flowers yellow, 01.06.1957, *R. S. Rao* 7984 (ASSAM, image!, as *C. davidii*, we have seen a photo of the sheet only, but close to next locality); West Kameng, 27°23'11.39"N, 92°20'33.59"E, ca 3000 m, *P. Boardman* (photo - 3). China: Tibet (Xizang): Medog county, Renqinpeng, in grassland, 2000m, 22.04.1993, *Sun H.*, *Zhou Z.K.* & *Yu H.Y.*, (ETM) 5631 (KUN!).

6. **aff. *Corydalis davidii*** Franch., *Nouv. Arch. Mus. Hist. Nat.*, sér. 2, 8: 198. 1885; Zhang Mingli & al., in C.Y. Wu & al., (eds.) *Fl. China* 7: 330. 2008.

*Distribution* : This species complex is known from South West China and Myanmar.

*Specimens examined* : India: Manipur, Ching Sow, 2560m, May 1882, *Watt* 6537 (CAL!, E!, K!, sterile specimen, previously recorded as *C. dorjii* D.G.Long).

Specimens given for West Kameng in Hajra & al., (1996) are *C. arcuata* M.K.Pathak & al.,

#### Section **RADICOSAE**

7. ***Corydalis drepanantha*** D.G.Long in *Notes. Roy. Bot. Gard. Edinburgh* 42: 101. 1984; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), *Fl. India* 2: 52.1993; Chowdhery & al., in Hajra & al., (eds.), *Mat. Fl. Arunachal Pradesh* 1: 121. 1996.

*Specimen examined* : India: Arunachal Pradesh, between Pangchen and Le, Nyam Juang Chu, 27°45'N, 91°49'E, 2285m, 04.04.1936, *Ludlow & Sherriff* 1272 (BM-holo!).

8. ***Corydalis cavei*** D.G.Long in *Notes Roy. Bot. Gard. Edinburgh* 42: 103 1984; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), *Fl. India* 2: 44. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), *Fl. China* 7: 342. 2008.

Described from Sikkim. Fairly common in East Nepal and neighbouring areas of South Tibet; one record from Sikkim (Lidén, 1989, 1995). Given as endemic for India (Sikkim) in Flora of India.

*Specimens examined* : Nepal: Phallut, 27°12' N 88°01'E, 11000 ft, 01.09.1919, *G.H. Cave s.n.* (E!); Koshi zone, Sankhuwa Sabha Distr., Numbuk (Mumbuk) 3500m, (Barun Khola) 3100m, 18.07.1988, 27°40' N 87°10'E, *M. Suzuki & al.*, 8880624 (E!); Koshi zone, Sankhuwa Sabha Distr., Numbuk (Mumbuk) 3500m, (Barun Khola) 3100m, 18.07.1988, 27°40' N 87°10'E, *M. Suzuki & al.*, 8880601 (E!).

*Additional record* : India: Sikkim: 3km South Thangu East of Yathang, 2012, *J. Nilsson* (photo: UPS, CAL!).

9. **Corydalis crispa** Prain in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65: 30. 1896; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 49. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 342. 2008.

A widespread species in South Tibet and Bhutan. It is given as endemic to India in Flora of India.

*Note* : We are not aware of any herbarium specimens collected in India. There is, however, a recent photograph by *P. Boardman*, confirming that it is part of the Indian flora. Arunachal Pradesh: Tawang (Pl. - 4)

10. **Corydalis diffusa** Lidén in Rheedea 5: 6. 1995; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 341. 2008. **(Pl. 5)**

Closely related to *C. crispa*, but differs in entire outer petals, sharply dark-tipped inner petals and details of stigma.

*Photograph examined* : Arunachal Pradesh: Tawang, *P. Boardman* (Plate - 5).

*Note* : This species was previously known from NE Bhutan: Upper Mo Chu, *Miehe* 00 - 160 - 43 (GOET!); *Miehe* 00 - 240 - 07, (GOET!) and S Tibet (Xizang): Cona, *Guo B.Z. & Wang W.Y.* 22788 (KUN!, HNWP); *Guo B.Z. & Wang W.Y.* 23023 (HNWP); Nangxian, *Xiz. Dr. Herb. Exp.* 72-493 (PE!, HNWP); Zuo-la ("Cona Plant"), 4680m, *Wu Zheng Yi* 75-885 (KUN-holo).

#### Section **HIMALAYANAE**

11. **Corydalis casimiriana** Duthie & Prain ex Prain in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65: 27. 1896; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 43. 1993.

Widely distributed in Himalaya from Kashmir to SE Tibet (Lidén 1995) and Arunachal Pradesh.

*Specimens examined* : India: Arunachal Pradesh: West Kameng, Se La, 4300m, 21.09.1964, *J. Joseph* 40186 (ASSAM!); Tawang, Se La (Sella pass), wet stony slopes, 4300m, August 2010, *Krishna Chowlu & B. Saikia s. n.* (RGU-ITA); Anjaw, E of Dong, 28°09'N, 97°09'E, 3100 - 3600m, forest margins, close to or in running water, 27.08.2012, *M. Lidén, B. Saikia & R. Mili* 23 (CAL!); 28°07'N, 97°10'E, in gravel in stream, 3870m, 28.08.2012, *M. Lidén, B. Saikia & R. Mili* 6 (CAL!) ; West Siang, Treck Junction to Renu II camp, 3400m, 06.09.2012, *M. Bhaumik* - 29379 (ARUN!).

Flora of India (2: 43) records it from Meghalaya, but the specimens seen belong to *C. khasiana* Lidén. All records of *C. casimiriana* East of Kali Gandaki (WC Nepal) refer to ssp. *brachycarpa* Lidén, which is very distinct from the Western ssp. *casimiriana*, and should perhaps be given status of species.

12. **Corydalis rubrisepala** Lidén in Rheedea 1: 34. 1991.

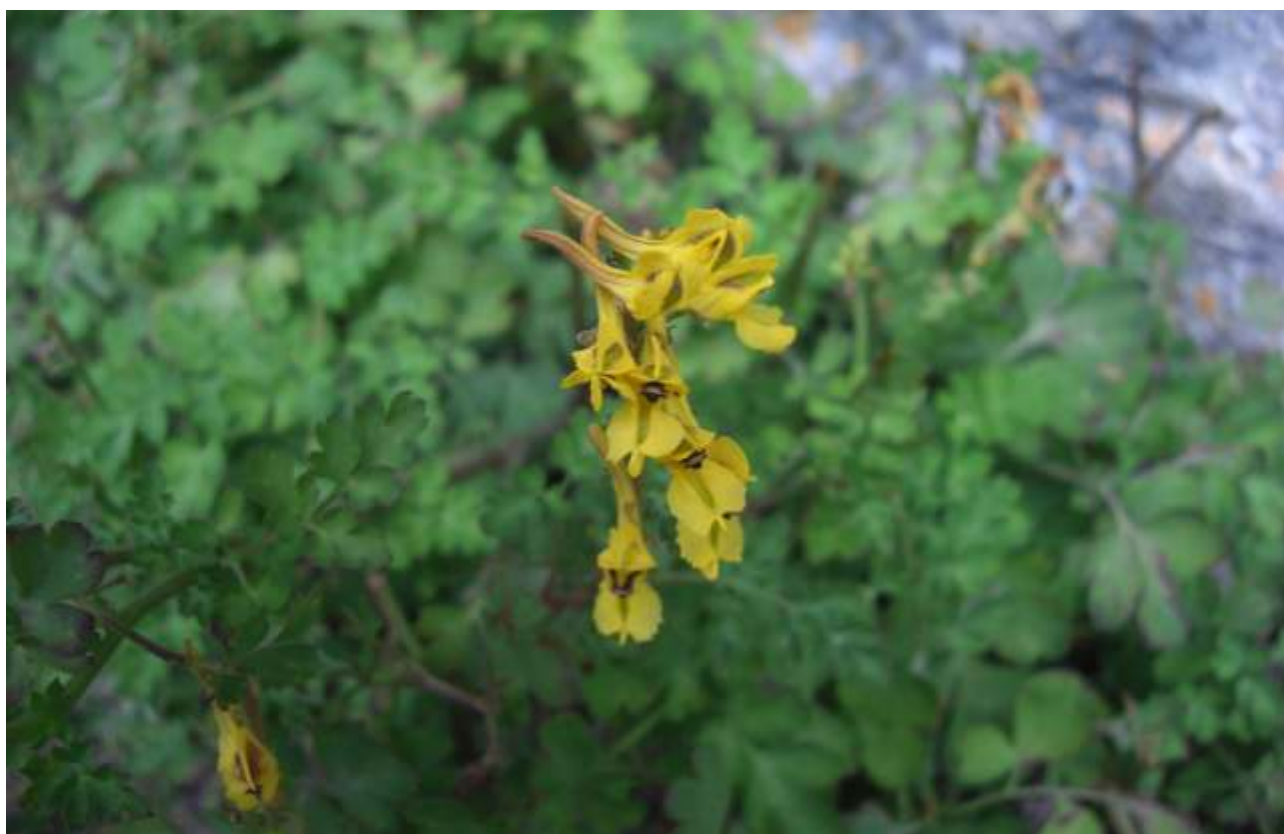
Previously only known from Ze La on the main E. Himalayan chain in West Arunachal Pradesh. Now found at Se La slightly further to the West. Not treated in Flora of India.

*Specimens examined* : India: Arunachal Pradesh, Tawang: Se La (Sella pass), among shrubs in meadow, August 2010, *Krishna Chowlu & B. Saikia s. n.* (RGU-ITA!); West Kameng, South of Se La, *M. Lidén* (Plate 6)

13. **Corydalis khasiana** Lidén in Rheedea 1: 34. 1991.

Previously known from Meghalaya (where it is apparently common) and Bhutan (a single record). A record of *C. pseudolongipes* from Bangladesh (Kundu, 2008) may refer to this species (specimen not seen). Not treated





**Plate 4 :** *Corydalis crispa* Prain (Photo: Pete and Pamela Boardman, North Wales, UK).



**Plate 5 :** *Corydalis diffusa* Liden (Photo: Pete and Pamela Boardman, North Wales, UK).



**Plate 6 :** *Corydalis rubrisepala* Liden

45. 1993; Zhang Mingli & al., in C.Y.Wu & al., (eds.), Fl. China 7: 344. 2008.

Apparently very rare and scattered; Sikkim and Tibet. Shown as endemic to Sikkim in Flora of India.

*Specimens examined* : India: Sikkim: Near Jelep La, 12-13000' 13.08.1910 *W. W. Smith* 4339 (CAL!). Tibet: Linzhi, Nixi, 3100m, along river, 30.07.1965, *Zhang Y.T. & Lang K.Y.* 1164 (PE!).

in Flora of India. New record for Arunachal Pradesh.

*Specimen examined* : India: Arunachal Pradesh, Lohit valley, *Kingdon-Ward* 102 (ASSAM!).

14. ***Corydalis gouldii*** Lidén in *Rheedea* 1: 34. 1991.

Previously known from Bhutan. New to the Flora of China.

*Specimens examined* : Tibet: Chumbi [Xizang: Yadong]: Ta [Sa?]-chey-Kung, 21.07.1884 *King's coll* 525 (CAL! Prain scribbled on this sheet: "distinct species probably").

15. ***Corydalis pseudolongipes*** Lidén in *Bull. Brit. Mus. (Nat. Hist.) Bot.* 18: 532, ff. 22D & 23D. 1989; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), *Fl. India* 2: 70. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), *Fl. China* 7: 343. 2008. **(Pl. 2)**

*Distribution* : From East Nepal to Arunachal Pradesh [Bhutan, South Tibet]. Reported in Hajra & al., (1996) from the Kameng, Tawang and Lohit districts, but Lohit specimen is *C. khasiana*.

*Specimen examined* : India: Arunachal Pradesh: Dibang Valley, way to Dambuen, 1600m, 16.04.2001, *M.K. Pathak* 73470 (CAL!); Kameng, Sangetswan - Zimithang road, 20.08.1976, *P.K. Hajra* 68357 (ASSAM!).

A record of *C. pseudolongipes* from Bangladesh (Kundu, 2008, specimen not seen) may refer to *C. khasiana*.

16. ***Corydalis changuensis*** D.G.Long in *Notes Roy. Bot. Gard. Edinburgh* 42: 102 1984; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), *Fl. India* 2:





**Plate 7 :** *Corydalis inopinata* Prain ex Fedde (Photo: Sung Han, Kunming Institute of Botany, Yunnan, China)

#### Section **MUCRONIFERAE**

***Corydalis boweri*** Hemsl. in J. Linn. Soc., Bot. 30: 108 1894; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 45. 1993.

Described from Tibet. This is a taxonomic synonym of *C. mucronifera* Maxim. which is not known from India. Flora of India mentions it as endemic to India. But the plant alluded to is *C. uranoscopa*.

***Corydalis mucronifera*** Maxim., Fl. Tangut. 51. 1889; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 66. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 347. 2008.

Widely distributed in Tibet and Qinghai. Not known from India. Sikkim specimen thus determined is *C. inopinata* Prain ex Fedde.

17. ***Corydalis inopinata*** Prain ex Fedde, Repert Spec. Nov. Regni Veg. 22: 26. 1925; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 347. 2008. **(Pl. 7)**

*Distribution* : Widely distributed in South Tibet from Kashmir to Lhasa. New record to India.

*Specimen examined* : India: Sikkim: above Giagong 16500ft (5000m), 14.08.1909, *Smith & Cave* 2456 (CAL!); Kashmir, Puga, Rupshu, in gravel along stream, 15500ft (4700m), fls greenish yellow, plant often





**Plate 8 :** *Corydalis dubia* Prain (Photo: Pete and Pamela Boardman, North Wales, UK)

pinkish, 04.07.1931, Koelz 2181 (NY!); Tibet: Yadong [Chumbi]: Phari, Ting, August 1879, *Dungbo* s. n. (CAL!).

#### Section **LATIFLORAE**

18. ***Corydalis uranoscopa*** Lidén in Edinburgh J. Bot. 55: 347. 1998; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 347. 2008.

Known only from a small area in Kumaon and neighbouring Tibet. Described after publication of Flora of India (previously misdetermined as *C. boweri*).

*Specimens examined* : India: Kumaon, Shimla, 09.09.1908, *Inagal* 24228 (CAL!); Kutti Yangti valley, Byans, 11 - 12000ft (3500 - 3700m), 30.07.1886, *Duthie coll.* 531 (CAL!).

19. ***Corydalis dubia*** Prain in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65(1): 36. 1896; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 45. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 349. 2008. **(Pl. 8)**

Several collections exist in the border area between Tibet and Arunachal Pradesh.

*Specimen examined* : India: Arunachal Pradesh, Tawang: Tulung La, 27°50'N, 92°15'E, *Ludlow & Sherriff* 706 (BM!); Tawang, *P. Boardman* (Plate 8); Kameng, Lenang, *M. Walsh* (photo!); West Siang, 28°45'N, 94°E, *Ludlow & Sherriff* 3973 (TI!); Upper Subansiri 28°40'N, 93°42'E, *Kingdon-Ward* 11938 (BM!).

The species is described from Tibet: Phari (Chumbi). Some of the Eastern specimens deviate in looser growth, much more compound bracts and more obtuse spur; they have been recognised as *C. tsariensis* Ludlow (Ludlow & Stern, 1975), and should perhaps be recognized as a distinct species.





**Plate 9:** *Corydalis meifolia* Wall. (Photo: Pete and Pamela Boardman, North Wales, UK)

20. ***Corydalis hendersonii*** Hemsl. in J. Linn. Soc., Bot. 30: 109. 1894; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 60. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 348. 2008.

Widely distributed at high altitudes in the Tibetan highlands from Kashmir to Sikkim, Qinghai and E Tibet.

*Specimen examined* : India: Sikkim: Zlonak, Naku La, 17500ft (5300m), *Smith & Cave* s. n. (CAL!); Kashmir: Rupshu, Khyong, 16.500ft (3800m), *Koelz* 2256 (E!, NY!).

21. ***Corydalis meifolia*** Wall. Tent. Fl. Nepal. 2: 55. 1826; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 66.1993. **(Pl. 9)**

*Photograph examined* : India: Arunachal Pradesh: Tawang, *P. Boardman* (Plate 9); Kameng, Gangpubit to Gori Chen, *M. Walsh* (photo!).

22. ***Corydalis stracheyi*** Duthie ex Prain, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65: 37. 1896; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 73. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 348. 2008.

*C. purpureacalcarata* C.Y.Wu et Z.Y.Su, Fl. Xizang. 2: 313, f. 107, 1-7. 1985.

New record for Arunachal Pradesh.

*Specimen examined* : India: Arunachal Pradesh: Anjaw: E of Dong, 28°09'N; 97°10'E, 3890m, a single plant growing in West facing (dry) rock crevice close to water flowing over cliff edge, 28.08.2012, *M. Lidén, B. Saikia & R. Mili* 5 (CAL!); Kumaon, Pindari, 10 - 12000ft., *Strachey & Winterbottom* 9 (type of *C. stracheyi*, K-holo, GH-iso). Burma: Kachin: Ma[rpij]o, Aug 1888, *Badal Khan* s. n. (CAL!, Prain remarked on this sheet that it must be mislabeled, apparently without any other reason than that it was geographically distant from the other known finds of the species at that time); Adung valley, 12500ft (3800m), on slaty schistose rocks in waterfall,

25.06.1931, *Kingdon - Ward* 9702 (F!); 9703A (F!). China: Yunnan: Deqen, *Feng G.M.* 6169 (KUN!); SE Xizang: Zayu, Qing Zang Exp. 73 - 10431 (type of *C. purpureocalcarata*, PE-holo!, KUN-iso!).

This species is widespread in the Himalayas, ranging from Kumaon to North Burma and North West Yunnan. The distribution gap between Bhutan and Anjaw may be illusory, as the area is poorly studied. The geographically close specimens listed above are rather small with glabrous fruits and a well developed dorsal crest on the upper petal, but both characters occurs also further West.

#### Section GERANIIFOLIAE

23. ***Corydalis borii*** C.E.C.Fisch. in Bull. Misc. Inform. *Kew* 1940 : 31. 1940; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 41. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7:358. 2008.

From South East Yunnan and Burma to Manipur and Nagaland. Given as endemic to India in Flora of India.

*Specimens examined* : India: Nagaland, Japoo, 8000ft (2440m), May 1882, *G. Watt* 6879 (CAL!); Bhingku, Naga hills, 8000ft (2440m), 05.11.1935, oak forest, *N. L. Bor* 6785 (K-holo!); Pulebudge, Naga hills, 5000ft (1500m), 04.08.1935, *N. L. Bor* 6349, (K 00065342, image!); Thekubama, Naga hills, 7000ft (2100m), 18.06.1935, 4456 (K 00065343, image!). Burma: Kachin, Sirhoi, 7500ft (2300m), 25.07.1934, *Kingdon-Ward* 17863 (A!); Chin hills: mt Victoria, 8000ft (2440m), *Kingdon-Ward* 22805 (E!, S-Bergius!). China: Yunnan: Jingdong, 2500m, *Li, M.G.* 1012 (PE! KUN!).

24. ***Corydalis chaerophylla*** DC., Prodr. 1: 128. 1824; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 44. 1993.

*Distribution* : From North West Himalaya to Arunachal Pradesh. New to the Flora of China area. Flora of India records it from Nagaland. However, the specimen (in CAL: sterile!) is probably *C. borii*.

*Specimens examined* : India: Arunachal Pradesh, Kameng: to Chakoo, 9.06.1957, *R. S. Rao* 8188 (ASSAM!); West Siang, Sidaroa camp to Mobo mountain top, 3200m, 27.08.2011, *Bhaumik* 27027 (ARUN!). Tibet (Xizang): Yadong, Sorn Doing-tang, below Kuika (?) in the Chumbi, 16.08.1888, *Kings coll. s. n.* (CAL!)

25. ***Corydalis geraniifolia*** Hook.f. & Thomson, Fl. Ind. 1: 269. 1855; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 44. 1993; Chowdhery & al., in Hajra & al., (eds.), Mat. Fl. Arunachal Pradesh 1: 122. 1996.

Hajra & al., (1996) included this species (Kameng, 1600 - 2500m, in open forests) with an illustration. In major Indian herbaria (ARUN, ASSAM, CAL & DD) we could not locate any specimen from Arunachal Pradesh.

#### Section ASTEROSTIGMA

26. ***Corydalis leptocarpa*** Hook. f. & Thomson, Fl. Ind. 1: 260. 1855; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 44. 1993; Chowdhery & al., in Hajra & al., (eds.), Mat. Fl. Arunachal Pradesh 1: 122. 1996; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 362. 2008.

*Specimens examined* : India: Arunachal Pradesh, Kameng, 2 miles from Chako towards Jobrang(?), 9000ft (2750m), 9.05.1957, *Rolla Seshagiri Rao* 7217 (ASSAM!); 7596 (ASSAM!); Aka hills, June 1934, *N L Bor* 15963 (ASSAM!); Anjaw, Hawaii, Malasong mt, Apr. 2010, *R. Gogoi* s. n. (ARUN!); Manipur, Senapati district, Vaiono Hill, 2.06.2005, *A. A. Mao* 109020 (ASSAM!); Dzuko valley, Jakhama hills, 2400m, shady places in forest, 4.04.2006, *A. A. Mao & R. Gogoi* 111284 (ASSAM!).

#### Section PUBICAULES

- Corydalis auriculata*** Lidén & Z.Y.Su, Edinburgh J. Bot. 54: 71. 1997; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 365. 2008.

This species was collected by *Kingdon-Ward* in SE Tibet near Zayu, Rima, [28°25'N, 97°02'E] 3 Apr 1950 according to the type specimen label (*Kingdon-Ward* 19277, BM-holo!). An isotype is in the Shillong herbarium (ASSAM!) with the preliminary label "on the way to Sadiya". Sadiya is located on the Assam plain close to the Lohit mountains, but the name was also used by the British administration in 1950 as a general term for the East

districts of Arunachal Pradesh. We therefore, without evidence to the contrary, presume that the holotype label information is correct, and that the collection was made on the Tibetan side of the border. It is of course possible, even probable, that the species is native also to India, but as yet this can not be confirmed.

#### Section **TRACHYCARPAE**

**Corydalis dorjii** D.G.Long in Notes Roy. Bot. Gard., Edinburgh 42(1): 93. 1984; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 52. 1993.

*Distribution* : Bhutan and neighbouring part of Tibet. Erroneously recorded from India (Manipur) in Flora of India. This sterile collection (*Watt* 6537, CAL!, E!) is *C. davidii* Franch. sensu lato.

#### 27. **Corydalis stenophylla** B.Saikia, Krishna Chowlu, M.K.Pathak et Lidén, **sp. nov.** (Fig. 3)

Glabrous glaucous perennial herb. Rhizome very short, vertical, with a fascicle of 3 - 6 cylindric sessile storage roots 10 - 20 × 1.5 - 3mm, and with very small pale overwintering bud(s). Stems one to few, erect, very slender, unbranched or usually with a single branch, (10-) 15 - 25 (-30)cm long (including thin tapering subterranean part 2 - 5cm, usually with a single leaf in upper half. Radical leaves one to few with petiole ca 10cm long; lamina similar to that of cauline leaf. Cauline leaf with petiole 1 - 5cm; lamina dark green above, slightly glaucous beneath, ternately divided (rarely simple or with the terminal leaflet again divided) into narrowly linear leaflets (1.5-) 3 - 7cm × 1 - 1.5 (-2)mm, below with prominent midvein. Raceme 2- to 5- flowered, dense in anthesis, elongating in fruit. Bracts linear to lanceolate, 3 - 9(-25)mm, rapidly decreasing in size upwards; pedicels 4 - 7mm and erecto-patent in flower, in fruit elongating to 10 - 12mm and sharply recurved at base. Sepals whitish, 0.5 × 1mm, much dentate. Corolla yellow with brownish veins and markings; inner petals darker at apex (except for the dorsal crest). Outer petals not or very slightly crested. Upper petal 10 - 11mm, subacute; spur 3.5 - 4.5mm, straight, slightly tapering towards apex; nectary very short and thin, hardly discernable. Lower petal 7- 8mm, with slightly saccate claw, slightly constricted at the middle and with rhombic-acute rather broad limb. Inner petals 6 - 7mm with short claw. Style 2mm. Stigma very peculiar, much broader than long with 2 central apical papillae and the two lateral divisions patent, slightly curved, each terminating in 2 not clearly geminate papillae. Fruit and seeds unknown.

This species belongs to the section *Trachycarpae* on account of its clustered fleshy roots, thin unbranched stem with tapering underground base, narrow entire leaflets with parallel veins, recurved fruiting pedicels and yellow corolla with darker veins. It is most similar to *C. helodes* Lidén & J. Van de Veire from West Yunnan, but differs in cylindric (vs fusiform) storage roots, often branched stem, much larger radical leaves, a single and less divided cauline leaf with very long leaflets, much broader lower petal, a diminutive (vs conspicuous) nectary and a different stigma.

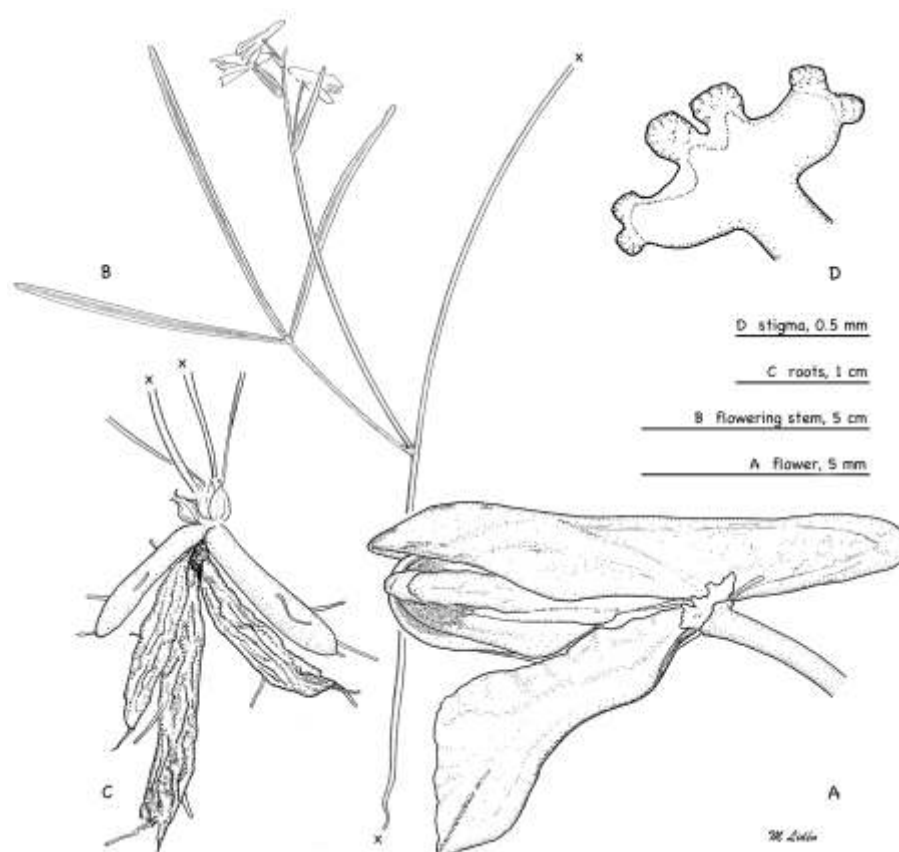
*Etymology* : gr. *stenos*: narrow, thin; *phyllon*: leaf

*Type* : India: Arunachal Pradesh: Tawang: Se La (pass on border between Tawang and West Kameng), on wet bouldery slopes, 4300m, August 2010, *Krishna Chowlu & B. Saikia* 101 (Holo : CAL)

*Additional specimens examined (paratypes)*: India: Sikkim, Dikchu valley, 11 - 12000ft (3400 - 3700m), 23.07.1910, *W. W. Smith* 3715 (CAL!); Tosa 14 - 15000ft (4300 - 4600m), 03.08.1910, *W. W. Smith* 4072 (CAL!); Below Lam Pokhri, 27°29'N, 88°12'E, on mossy boulders, 4180m, 19.07.1992, *D. G. Long, R. J. D. McBeath, H. J. Noltie & M. F. Watson* (ESIK) 509 (E!).

#### 28. **Corydalis biflora** Lidén, M.K.Pathak, Krishna Chowlu et B.Saikia **sp. nov.** (Fig. 4)

Glabrous perennial herb. Rhizome very short, vertical, with a cluster of 3 to 7 coarse storage roots and a small or indistinct apical bulb. Storage roots fusiform, 20 - 40 × 4 - 6mm, basally narrowed to a thick indistinct stalk. Stems simple, usually few, 4 - 10 (-16)cm, with one leaf in upper third (rarely lacking). Radical leaves prominent with thin petioles 3 - 10cm long; lamina trifoliate; leaflets subsessile, entire (rarely deeply divided), thickish, green above (?), very glaucous and with prominent veins beneath, broadly obovate, obtuse to truncate at apex, 9 - 17 × 7 - 12mm. Cauline leaf simple, sessile, 5 - 14mm long, ca 2mm broad at base, tapering to an acuminate apex. Raceme with two closely set flowers; bracts similar to cauline leaf, 3 - 7mm long; pedicels 6 - 12mm long.



**Fig. 3:** *Corydalis stenophylla* B. Saikia & al.,

Flowers of unknown colour, possibly yellow (see discussion below), inner petals darker at apex. Sepals ca 0.5mm long, deeply cut into 2 to 3 lobes. Outer petals acute, with very narrow dorsal crest; upper petal 13 - 14mm long; spurs 5 - 6mm long, slightly tapering to obtuse slightly downcurved apex; nectaries thin, reaching about 2/3 through the spur. Lower petal shallowly saccate in basal half, apical half rather narrow; inner petals 8 (-9)mm long. Stigma transversely rectangular without basal lobes, apically cleft to 1/3, with 4 apical simple papillae; lateral geminate papillae distinctly laminal; with geminate papillae in outer basal corners. Fruit and seeds unknown; ovary with ca 10 ovules in two rows.

Although we lack information on fruiting pedicel behaviour, flower colour or DNA, we conclude that this species belongs in the section *Trachycarpae* and may be related to *Corydalis juncea*, as indeed hinted at by the collectors. We base this on a) resting bulb small, b) veins of radical leaves prominent beneath, c) cauline leaves and bracts sharply acute to acuminate, d) angle between pedicel and flower slightly obtuse like that of *C. juncea*, indicating that the pedicels might possibly recurve in fruiting stage, e) cauline leaf simple, like in *C. juncea*, f) outer petals apparently with distinct venation and a brownish apical keel. The fact that the species was initially determined as *C. juncea* may also be taken as an indication that our new species is yellow-flowered.

The differences between our new species and *Corydalis juncea* are, however, substantial. *C. biflora* has, a) short stems with 2 flowers (not long with 10 to 30 flowers), b) radical leaves once ternate with thickish rounded sessile leaflets (not bi- to tri-ternate with stalked lanceolate thin leaflets), c) outer petals almost devoid of dorsal crest, d) style short (ca 1.5mm, not 2.5 - 3mm) and e) stigma with 4 simple papillae and with distinctly laminal lateral geminate papillae (in *C. juncea* 6 simple papillae and  $\pm$  marginal lateral geminate papillae).

*Etymology* : lat. *bis*: twice, double; *flos*: flower

*Type* : India: Sikkim: Thangchung La, 16000ft (4900m), 15.07.1909, *Smith & Cave* 1479 (Holo : CAL; Iso : CAL).

Known from the type locality only.



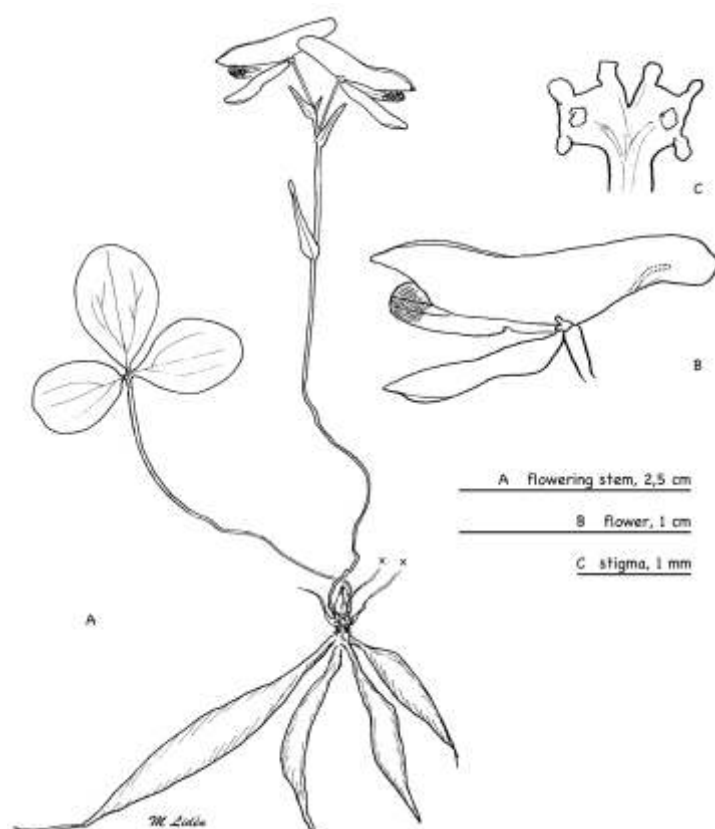


Fig. 4 : *Corydalis biflora* Liden & al.,

29. ***Corydalis pseudojuncea*** Ludlow & Stearn in Bull. Brit. Mus. (Nat. Hist.) Bot. 5: 62. 1975; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 369. 2008.

Reported from India by Rawat (1997). Also known from Tibet and Nepal (Lidén 1989).

*Specimens examined* : India: Tehri Garhwal, Kedarnath, 25.07.1981, Ellis & Sanjappa 5989 (CAL!).

30. ***Corydalis juncea*** Wall., Tent. Fl. Nepal. 2: 54, t. 42. 1826; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 63. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 369. 2008.

*Specimens examined* : India: Arunachal Pradesh: Tawang, 27°49'N; 92°14'E, Kingdon-Ward 11812 (BM!). This species also occurs in Tibet.

31. ***Corydalis polygalina*** Hook.f. & Thomson, Fl. Ind. 1: 263. 1855; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 369. 2008. **(Pl. 10)**

*C. graminea* Prain, J. Asiat. Soc. Beng. 85: 23. 1886.

This is a new record for Arunachal Pradesh. The determination is tentative, as there are some similar species, and we have had access to photographs only, and therefore no possibility to study roots or stigma, which are very informative characters for this species complex. *C. polygalina* is a variable taxon, distributed from East Nepal to Bhutan and S. Tibet, the plants from Tawang and Kameng have more floriferous raceme than previously recorded for this species (12 to 25 flwrs vs 10 to 15). *Corydalis quinquefoliolata* Ludlow & Stearn, which is known only from the type (South East Xizang, Nangxian), deviates in shorter pedicels, usually entire bracts and a very peculiar stigma.

*Specimens examined* : India: Sikkim: Sikkim Himalaya, 11.09.1849, 14000 - 16000ft (4300 - 4900m), J. D. Hooker s. n., (lectotype K! BM, E); Peykiong La, August, 12000ft (3700m), King's coll. s. n. (holotype of *C. graminea*, CAL!); Arunachal Pradesh: Kameng, Lugtren to Lenang, M. Walsh (photo); Gangpubit to Guzang, M. Walsh (photo); Tawang, P. Boardman (Photo - 10).



**Plate 10 :** *Corydalis polygalina* Hook.f. & Thomson (Photo: Pete and Pamela Boardman, North Wales, UK)

#### Section **FUSIFORMES**

32. ***Corydalis cashmeriana*** Royle, Illus. Bot. Himal. 69 (1834), 1.16, f. 1. 1833; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 42. 1993; Chowdhery & al., in Hajra & al., (eds.), Mat. Fl. Arunachal Pradesh 1: 121. 1996; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 392. 2008.

The species is given in Hajra & al., (1996) from Upper Subansiri, “swampy areas of open valleys, 2500 - 3500m”, a habitat that does not fit any of the species in the *C. cashmeriana* aggregate, but may refer to *C. trifoliata* or another blue-flowered species. Specimens not seen.

32.1. ***Corydalis cashmeriana* subsp. *cashmeriana***

From W Himalaya Eastwards to W Nepal, a single record from Tibet.

- 32.2. ***Corydalis cashmeriana* subsp. *longicalcarata*** (D.G.Long) Lidén, Fl. China. 7: 392. 2008. *C. ecristata* var. *longicalcarata* D.G.Long in Notes Roy. Bot. Gard. Edinburgh 42: 93. 1984.

*Distribution* : From Central Nepal to Bhutan and South Tibet. Sikkim and Darjeeling in India.

*Specimens examined* : India: Sikkim, Patung La, 10000ft (3000m), 10.07.1877, flower blue, *G. King* 4193 (CAL!); Patung La, 10000ft (3000m), 13.07.1877, *G. King* 4360 (CAL!).

33. ***Corydalis ecristata*** (Prain) D.G.Long in Notes Roy. Bot. Gard. Edinburgh 42: 91. 1984; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 392. 2008. *Corydalis cashmeriana* var. *ecristata* Prain in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65(1): 22 1896.

*Distribution* : From East Nepal to W Arunachal Pradesh and Tibet: Chumbi (Xizang: Yadong). New to Arunachal Pradesh.

*Specimens examined* : India: Sikkim, Zemu Valley, 17000ft (5200m), 16.07.1909, *Smith & Cave* 1574 (CAL!); Eumtuso La, 15000ft (4600m), 12.07.1909, *Smith & Cave* 1293 (CAL!); Tosa, 14500ft (4400m), 30.07.1910, *W. W. Smith* 3954 (CAL!); Ningbil, 14000ft (4300m), 03.08.1910, *W. W. Smith* 4089 (CAL!); Chamnago, 13000ft (4000m), 27.04.1910, *W. W. Smith* 3770 (CAL!); Tokud La?, 14.07.1877, *Kings coll.* 4326 (CAL!); Jongri, 13000ft (4000m), July 1896, *Pantlings coll. s. n.*, Acc. No. 19441 (CAL!); Arunachal Pradesh: Kameng: Kimneago to Yangser, *M. Walsh* (photo!); Yangren to Tse Nam, *M. Walsh* (photo!); Lugathang to Kimneago, *M. Walsh* (photo!).

34. **Corydalis jigmei** C.E.C.Fisch. & Kaul in Bull. Misc. Inform. Kew 1940: 266. 1940; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 393. 2008.

A high altitude dwarf species similar to *C. cashmeriana*, known from North East Nepal, Sikkim, Bhutan and South East Tibet. Described from Chumbi. Omitted in Flora of India.

*Specimens examined* : India: Sikkim: Zlonak, 14 - 17000ft (4300 - 5200m), 28.07.1909, *Smith & Cave* 2041 (CAL!); 09.08.1909, *Smith & Cave* 2332 (CAL!).

35. **Corydalis trifoliata** Franch. in Bull. Bot. Soc. France 33: 392. 1886; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 75. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 390. 2008.

*Distribution* : Widely distributed from Southwest China [W Yunnan, SE Tibet], North Myanmar, India [Arunachal Pradesh, Sikkim] and Bhutan to East Nepal.

*Specimens examined* : India: Arunachal Pradesh: Upper Siang, Ruitala (Ekodumbing) peak area, 28°43.189'N, 95°10.610'E, 3346 - 3954m, 23.07.2010, *M. K. Pathak* 73088 (CAL!); possibly also Upper Subansiri (see note under *C. cashmeriana*); Poshing La, *Kingdon-Ward* 13961 (BM!); Kameng, Chang La to Pangi La, *M. Walsh* (photo!); Sikkim, ZuKola 13500ft (4100m), 31.07.1893, *H. A. Cummins, s. n.*, Acc. No. 19456 (CAL!). Burma: Adung valley, 13000ft (4000m), 06.07.1931, steep earth faces in high speciose meadow, *Kingdon-Ward* 9758 (F!).

#### Section **PRIAPOS**

36. **Corydalis oligantha** Ludlow & Stearn in Bull. Brit. Mus. (Nat. Hist.), Bot. 5(2): 60. 1975; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 67. 1993; Zhang Mingli & al., in C.Y. Wu & al., (eds.), Fl. China 7: 424. 2008.

Known from W Yunnan, Arunachal Pradesh and Bhutan. Omitted in Hajra & al., (1996).

*Specimens examined* : India: Arunachal Pradesh, W Kameng, Rupa to Bomdila, 6000ft (1800m), flowers pale mauve, 11.05.1957, *R. S. Rao* 7275 (CAL!); 2 - 22 miles from Chako, 9000ft (2700m), moist soil surface, flowers bluish white, 09.05.1957, *R. S. Rao* 7216 (CAL!); W Kameng, Balipura (Balipara) frontier tract, *Kingdon-Ward* 11470 (BM!).

#### **DACTYLICAPNOS WALL.**

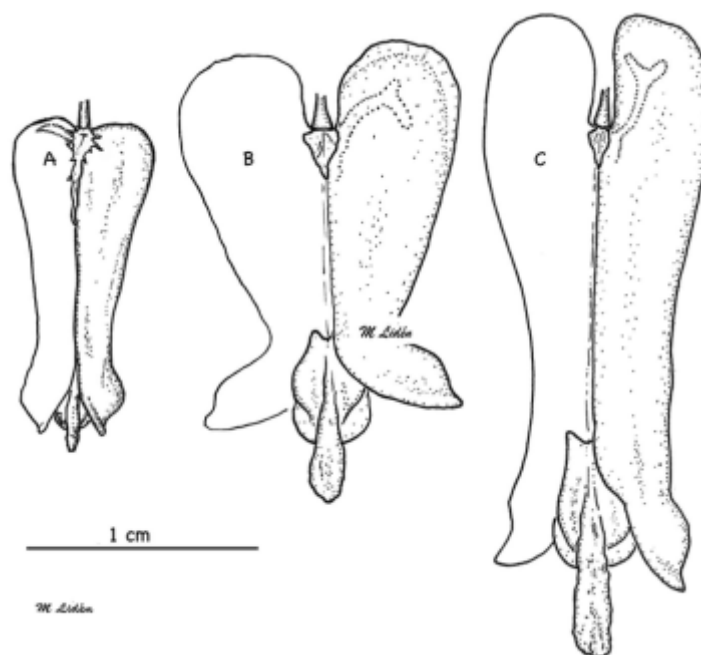
In *Flora of India* (Ellis & Balakrishnan, 1993) the species of this genus are subsumed under *Dicentra*, a mainly North American genus of scapose perennials with purple flowers. Morphological and molecular evidences (Lidén & al., 1997) show convincingly that the leafy yellow-flowered climbers in *Dactylicapnos* are more closely related to *Corydalis* and *Fumaria* than to *Dicentra*.

#### Section **DACTYLICAPNOS**

1. **Dactylicapnos burmanica** (K.R.Stern) Lidén in Nordic J. Bot. 25: 35. 2008; Zhang Mingli & Lidén in C.Y. Wu & al., (eds.), Fl. China 7: 293. 2008; Lidén in Nordic J. Bot. 28: 659. 2010. *Dicentra burmanica* K.R. Stern, Brittonia 19: 280. 1967. (Fig. 5)

Recorded from China, Myanmar and India.

*Specimens examined* : India: Nagaland, Kohima, cultivated in gardens (rare), 2290m, flowers yellow, tuber carrot-like, 27.07.2005, *A. A. Mao* 109227 (ASSAM!); Burma: Kachin, Pooritong, 09.1899, *Shaik Mokim* 721 (CAL).



**Fig. 5 :** **A.** *Dactylicapnos lichiangensis* (Fedde) Hand.-Mazz., **B.** *Dactylicapnos cordata* Lidén.,  
**C.** *Dactylicapnos burmanica* (K.R. Stern) Lidén

2. ***Dactylicapnos cordata*** Lidén in Nordic J. Bot. 28(6): 658. 2010.

Described from East Nepal; a single record from India.

*Specimens examined* : India: West Bengal, Darjeeling, Kurseong, May 1915, *E. A. C. Modder* 82 (CAL!)

3. ***Dactylicapnos scandens*** (D.Don) Hutch. in Bull. Misc. Inform. Kew 1921: 105. 1921; Zhang Mingli & Lidén in C.Y. Wu & al., (eds.), Fl. China 7: 293. 2008. *Dielytra scandens* D.Don, Prodr. Fl. Nep. 198. 1825. *Dicentra scandens* (D.Don) Walp., Repert. 1: 118. 1842; Hook.f., Fl. Brit. India 1: 121. 1872, p. p.; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 79. 1993.

*Distribution* : Widely distributed from Central Nepal to South China; one record from Sri Lanka (tea plantation), see Khanh (1972). India: Arunachal Pradesh, Manipur, Meghalaya, Sikkim and West Bengal (Darjeeling).

*Specimen examined* : India: Arunachal Pradesh, West Kameng, Bomdila, 6km towards Tonga valley, 2500m, forest, golden yellow flowers, fruit green, 19.09.1964, *J. Joseph* 39911 (ASSAM!). We have not seen specimens from other districts given in Hajra & al., (1996): Changlang, Kameng, Siang, Subansiri, Tirap. At least some of these probably are based on specimens of *D. paucinervia* or *D. grandifoliolata* (see Lidén & Pathak, unpublished).

4. ***Dactylicapnos macrocapnos*** (Prain) Hutch. in Bull. Misc. Inform. Kew 1921: 105. 1921; Zhang Mingli & Lidén in C.Y. Wu & al., (eds.), Fl. China 7: 293. 2008. *Dicentra macrocapnos* Prain in J. Asiat. Soc. Bengal 65: 12. 1896; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 78. 1993.

The subsp. *macrocapnos* is known from Garhwal, Kumaon and the extreme West of Nepal.

5. ***Dactylicapnos platycarpa*** Lidén in Nordic J. Bot. 28(6): 658. 2010.

A Bhutanese species with a single record from India.

*Specimens examined* : India: West Bengal, Darjeeling, Senchal WLS, way to Tung, 14.10.2008, *A.K. Ghosh* 41501 (CAL!).

6. ***Dactylicapnos odontocarpa*** Lidén in Nordic J. Bot. 28(6): 658. 2010.

An East Nepalese species with a single record from India.

*Specimens examined* : India: Sikkim, Lachung, 8500ft (2600m), 31.08.1892, *G. A. Gammie* 1077 (CAL!)

7-9. The ***Dactylicapnos grandifoliolata*** group (three species, distributed from East Nepal to North Burma) is dealt with in a separate paper (Lidén & Pathak, in print)

#### Section MINICALCARA

10. ***Dactylicapnos lichiangensis*** (Fedde) Hand.-Mazz., Symb. Sin. Pt VII: 338. 1931; Zhang Mingli & Lidén in C.Y. Wu & al., (eds.), Fl. China 7: 294. 2008.

*Distribution* : SW China and Arunachal Pradesh (Anjaw). Omitted in Flora of India.

*Specimens examined* : India: Arunachal Pradesh: Anjaw: Di Chu valley 4500ft (1400m), 27.06.1950, *Kingdon-Ward* 20023 (UPS!); 1km S. Walong, 19.05.2011, *R. Gogoi* 24315 (ARUN).

11. ***Dactylicapnos roylei*** (Hook.f. & Thomson) Hutch. in Bull. Misc. Inform. Kew 1921: 104 1921; Zhang Mingli & Lidén in C.Y. Wu & al., (eds.), Fl. China 7: 294. 2008. *Dicentra roylei* Hook.f. & Thomson, Fl. Ind. 273. 1855; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 79. 1993.

*Distribution* : Widely scattered in the Himalayas and China.

*Specimens examined* : India: Arunachal Pradesh, Subansiri, 1400 - 1600m, fide Hajra & al., (1996), no specimen seen; Meghalaya, Shillong, 02.07.1923, *Upendranath Kanjilal* 7785 (ASSAM!); Sikkim, Jong, 29.05.1903, *P. E. Younghusband s. n.*, Acc. Nos. 19227 & 19228 (CAL!); Uttarakhand, Dippi, 8000ft (2400m), *Dr. Brandis* 3272 (CAL!); Chamba, 8000ft (2400m), 20.09.1896, *J. H. Lace* 1506 (CAL!). Bhutan: *Griffith* 1748 (CAL!); Jeta, 9000ft (2750m), 23.08.1963, *Sengupta* 682 (CAL!). Nepal: Likhu Khola, 8500ft (2600m), 16.06.1964, *McCosh* 237 (E!). China: Tibet (Xizang): Kongbo, Tsangpo valley, Tripe to Gyala, 29°43'N, 94°55'E, 21.07.1938, *Ludlow & al.*, 5330 (UPS!).

12. ***Dactylicapnos torulosa*** (Hook.f. & Thomson) Hutch. in Bull. Misc. Inform. Kew 1921: 104 1921; Zhang Mingli & Lidén in C.Y. Wu & al., (eds.), Fl. China 7: 294. 2008. *Dicentra torulosa* Hook.f. & Thomson, Fl. Ind. 272. 1855; J.L. Ellis & N.P. Balakr. in B.D. Sharma & al., (eds.), Fl. India 2: 79. 1993.

*Distribution* : India, Bangladesh, Bhutan, China and Myanmar.

*Specimens examined* : India: Arunachal Pradesh, Kameng, Rupa, edge of forest, 1800m, “flowers pink” (!), Oct 1964, *J. Joseph* 40423 (CAL!); Lower Dibang Valley, Tewarigaon, 1300m, 30.04.2001, *M. K. Pathak* 44 (CAL!); Meghalaya: Khasia hills, Kyllong rock, 21.08.1976, *G. H. Bhaumik* 60239 (ASSAM!); Khasia, *Griffith* 832 (UPS!).

#### ACKNOWLEDGEMENTS

Authors are grateful to Dr. Paramjit Singh, Director, Botanical Survey of India for facilities, useful advice and encouragement. They are thankful to the Heads of Offices of Botanical Survey of India, Central National Herbarium (CAL), Howrah, Eastern Regional Center, Shillong, Meghalaya (ASSAM) and Arunachal Pradesh Regional Center, Itanagar (ARUN) for permission to study in the herbarium. They are indebted to the Curators of the BM, E, F, K, S, TI and UPS for consultation of their herbaria. Thanks are also due to the Defence Personnel at Se La and Walong for their kind hospitality during our field survey. They are indebted to Prof. Arup Kumar Das (Rajiv Gandhi University, Itanagar) for useful discussion. Pete and Pam Boardman and Martin Walsh have kindly allowed us to cite their photographs from Arunachal Pradesh, for which specimens are not available. Dr. M. Bhaumik, BSI, APRC, Itanagar has kindly agreed to allow access to his collections from West Siang, Arunachal Pradesh. The 2010 Se La expedition was made possible by a grant from the Caterpillar Foundation. Air tickets and lodging costs for Magnus Lidén were covered by a grant from Travellers Club, Sweden.

Only a few days after submitting this manuscript, Mitilesh K. Pathak died following a heart attack. His absence is deeply felt.

#### REFERENCES

ELLIS, J. L. AND N. P. BALAKRISHNAN. 1993. Fumariaceae. In: Sharma, B. D. & N. P. Balakrishnan (eds.). Fl. India 2: 34-87, Botanical Survey of India, Calcutta.



- HAJRA, P. K., D. M. VERMA AND G. S. GIRI. 1996. Materials for the Flora of Arunachal Pradesh. Vol. 1. (Fumariaceae, pp 121-126). Fl. India ser. 2. BSI, Calcutta.
- JAFRI, S. M. H. AND M. QAISER 1974. Fumariaceae. In: Nasir, E. and S. I. Ali (eds.), *Fl. W. Pakistan*, Vol. 61. Pakistan Agricultural Research Council, Islamabad, pp: 26-32.
- KHANH, T. C. 1972. Beitrag zur Kenntnis der Sippenstruktur des Genus *Dicentra* Bernh. subgenus *Dactylicapnos* (Wall.) K.R.Stern (Fumariaceae). *Repert. Spec. Nov. Regni Veg.* **83**: 511-575.
- KRESS, W. J., R. A. DEFILIPPS, E. FARR AND D. Y. Y. KYI. 2003. A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar (Papaveraceae, pp 322-323). National Museum of Natural History, Washington DC. ISSN 0097-1618.
- KUNDU, S. R., 2008. A Compendium of Papaveraceae s. l. in Indian Subcontinent: its Distribution and Endemism. *Int. J. Bot.* **4**: 249-259.
- LIDÉN, M., 1989. *Corydalis* in Nepal. *Bull. Brit. Mus. (Nat. Hist.), Bot.* **18**: 479-539.
- LIDÉN, M., 1991. Revision of *Corydalis* sect. *Fumarioides* sect. nov.: Part I. *Rheedea* **1**: 29-35.
- LIDÉN, M., 1995. A revision of *Corydalis* sect. *Fumarioides* Lidén: Part II. *Rheedea* **5**: 1-36.
- LIDÉN, M., T. FUKUHARA, J. RYLANDER AND B. OXELMAN. 1997. Phylogeny and classification of Fumariaceae with emphasis on *Dicentra* s.l., based on the plastid gene rps16 intron. *Pl. Syst. Evol.* **206**: 411-420.
- LIDÉN, M., 1998. New species of *Corydalis* from Burma, Bhutan and India. *Edinburgh J. Bot.* **55**: 343-350.
- LIDÉN, M. 2010. Three new species of *Dactylicapnos* (Fumariaceae) and a synopsis of the *D. macrocapnos* complex. *Nordic J. Bot.* **28**: 1-5.
- LIDÉN, M. 2011. Fumariaceae. In: Watson, K. & al., (eds.), *Flora of Nepal*. Vol. **3**. pp. 49-77. Royal Botanic Garden, Edinburgh.
- LIDÉN, M. AND M. K. PATHAK (in print). Studies in *Dactylicapnos* (Papaveraceae – Fumarioideae) part II. Revision of sect. *Pogonosperma* sect. nov., with a new species *D. arunachalensis*. *Nordic Journal of Botany*.
- LONG, D. G. 1984: Fumariaceae. In: A. J. C. Grierson & D. G. Long (eds.), *Flora of Bhutan* **1** (2): 379-408. Royal Botanic Garden, Edinburgh.
- LUDLOW, F AND W. T. STEARN. 1975. New Himalayan and Tibetan species of *Corydalis*. *Bull. Brit. Mus. (Nat. Hist.), Bot.* **5**(2): 45–69.
- PRAIN, D. 1896. Noviciae Indicae X: Some additional Fumariaceae. *J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist.* **65**(2): 10-41.
- RAWAT, R.S., 1997. *Corydalis pseudojuncea* Ludlow (Fumariaceae) A new record for India. *J. Bombay Nat. Hist. Soc.* **94**: 434-436.
- ZHANG MINGLI, SU ZHIYUN AND M. LIDÉN. 2008. *Corydalis*. In: Wu Zhengyi & al., (eds.) *Flora of China* **7**: 295-428.

## पूर्वोत्तर भारत में फुमेरिएसी: कोरिडेलिस एवं डेक्टिलिकेप्नोस वंशों की नयी जातियां एवं नये अभिलेख

एम के पाठक, कृष्ण चौलू, बी सैकिया एवं एम लिडेन

### सारांश

कोरिडेलिस एवं डेक्टिलिकेप्नोस वंशों की पूर्वोत्तर भारतीय जातियों के संक्षिप्त आलेख में कोरिडेलिस अर्कुएटा (अरुणाचल प्रदेश, तिब्बत), कोरिडेलिस बाइफ्लोरा (सिक्किम) तथा कोरिडेलिस स्टेनोफायला (अरुणाचल प्रदेश, सिक्किम) के नयी जातियों के रूप में वर्णन किया गया है। छः जातियां : कोरेडेलिस ऑरिसिला, कोरिडेलिस डेविडी, कोरिडेलिस डिफ्यूजा, कोरिडेलिसा इनोपिनेटा, कोरिडेलिस टेरिगोपेटेला, कोरिडेलिस टेंगुटिका के भारत में नयी जातियों के रूप में रिपोर्ट की गयी है। कोरिडेलिस की अन्य सात एवं डेक्टिलिकेप्नोस की पाँच जातियों की “फ्लोरा ऑफ इंडिया” में या तो अनदेखी हो गयी या इसके प्रकाशन के बाद ये जानकारी मिली। कोरिडेलिस कश्मीरिएना उपजाति लॉगिकैलकेरेटा, कोरिडेलिस इक्रिस्टेटा, कोरिडेलिस जिग्मेइ, कोरिडेलिस खासिएना, कोरिडेलिस स्यूडोजुनसिया, कोरिडेलिस रुब्रिसेपेला, कोरिडेलिस यूरेनोस्कोपा तथा डेक्टिलिकेप्नोस बर्मेनिका, डेक्टिलिकेप्नोस कोर्डेटा, डेक्टिलिकेप्नोस लिंकिंगेंजेंसिस, डेक्टिलिकेप्नोस ओडोडोकार्पा, डेक्टिलिकेप्नोस प्लेटिकार्पा। दो जातियां कोरिडेलिस चेराफायला एवं कोरिडेलिस गॉल्डी “फ्लोरा ऑफ चाईना” (जिजेंग: योदोंग/तिब्बत: चम्बी) से नये रिपोर्ट किये गये हैं।