

CORYDALIS IN CHINA I: SOME NEW SPECIES

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Twenty-nine new species of *Corydalis* (Fumariaceae) from China, mainly from Tibet, Sichuan and Yunnan, are described.

Keywords. Chinese flora, Fumariaceae.

INTRODUCTION

During the last decade revisionary work of *Corydalis* has been carried out simultaneously for *Flora Sinica* by a group in Kunming (including the senior author Su Zhi-Yun) under Prof. Wu Zheng-Yih, and on a more global scale by the second author, M. Lidén, in Göteborg. Happily, we were able to join forces in 1991, when Lidén visited Kunming for a period of one month, and the foundation for the present cooperation was laid. We have since had regular contact, including a field expedition to NW Yunnan in 1993, a visit by Dr Su to Göteborg in 1994, and a joint tour to the major herbaria in Sichuan in 1995.

The genus *Corydalis* comprises nearly 440 species distributed in 33 sections. All sections and about 300 species occur in China, and more than two-thirds of these are endemic. A fair proportion of the species have been described during the last 10–15 years, and several from recently collected material. Many species are known from the type only, or from very few collections, and there are certainly still new species to discover, for example in NW Sichuan, and parts of W Yunnan and S Tibet. A checklist of the Chinese species will be published as the final part (III) in this series. Part II will include several more new taxa, and some new combinations.

Unfortunately, the infrageneric taxonomy of *Corydalis*, as currently formalized, is far from satisfactory, and several new sections will have to be described. In the account below sections are indicated only when a valid name is available. Descriptions of new sections will be included in the final checklist.

In the descriptions below, measurements of fruit length do not include styles, unless explicitly stated. For species belonging to sect. *Fasciculatae* (perennial herbs with a fascicle of swollen storage roots) the swollen parts are referred to simply as 'roots'.

***Corydalis parviflora* Z.Y. Su & Lidén, sp. nov. Figs 1C, 4f.**

Herba perennis caulis erectis foliatis ramosis foliis basalibus longipetiolatis laminis triangularibus biternatis pinnulis ovatis crasso-serratis. Inflorescentiae racemosae

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densiflorae. Bracteae parvae lanceolatae pedicellis aequantes. Flores flavi, parvi, non vel breviter calcarati. Capsulae linearo-lanceolatae seminibus uniseriatis.

Type: Guangxi, Huanjian, 420m, 20 iv 1981, *Cheng Shuo-Xian & Sa Won-Ian* 56663 (holo. KUN).

(sect. *Sophorocapnos*) Perennial chasmophytic glabrous herb. *Stems* 25–35cm, branched above. *Basal leaves* long-stalked (petiole c.20cm), with 7–10 × 10–15cm triangular biternate lamina. Leaflets shortly stalked, ovate, entire to slightly lobed, grossly and sparingly dentate, apparently somewhat fleshy, glaucous beneath, 3–4 × 1.5–2cm. *Cauline leaves* like the radical, but less divided, often ovate and simply pinnate. *Racemes* long-stalked, 5–10-flowered, rather dense in flower, somewhat elongating in fruit. *Bracts* 2–5mm, lanceolate. *Pedicels* 2–5mm, not elongating in fruit. *Flowers* small and inconspicuous, 10–14mm long, or as little as 6mm in cleistogamous racemes. *Sepals* minute or absent. *Outer petals* shortly crested; spur of upper petal 0–4mm long. *Inner petals* 6–10mm long. Nectary obsolete or very short. *Stigma* transversally oblong with two large papillae at each end, with a pair of small geminate papillae below each. *Capsules* linear-lanceolate, c.25 × 2mm with one row of seeds. *Seeds* about 1.2mm in diameter, flattened, smooth in the centre, but towards the obtuse back with several concentric rows of small tubercles; elaiosome thin and broad, folded over the seed.

Distribution and ecology. S China: SE Yunnan, SW Guizhou, E Guangxi; chasmophyte, 420–1500m.

Additional specimens examined. GUANGXI. Lingui, 'in rupibus', 1500m, 3 vi 1954, *Deng Sian Fu* 160 (IBG).

YUNNAN. Wenshan, 'in rupibus', 1440m, 31 iii 1959, *C.A. Wu* 7243 (KUN).

GUIZHOU. Anlong, 1300m, 15 vi 1956, *Guizhou Exped.* 5397 (PE).

Corydalis parviflora frequently produces depauperate flowers which are smaller than normal, and may lack a spur altogether. The flattened seeds with broad membranous elaiosomes indicate the section *Sophorocapnos* where we have tentatively placed it, but the chasmophytic life-form and apparently perennial habit mark its isolated position.

***Corydalis vermicularis* Lidén & Z.Y. Su, sp. nov. Figs 1D, 2f.**

Herba rupicola gracilis procumbens. Caules foliati ramosi debili elongati. Folia longepetiolata parva ternata lobis integris vel bi- usque tripartitis. Bracteae foliaceae longepetiolatae tripartitae. Pedicelli 1–2cm longi, fructiferi ad 4–8cm longi. Flores flavi. Petala exteriora apice subrotundata. Petalum posticum 16–18mm, calcar laminae subaequant. Capsulae lineari-oblongae. Semina caruncula magna cupulata.

Type: Sichuan, Tongpu (98°29'N 31°38'E), 1 x 1976, *Xizang Exped.* 6115 (holo. KUN).



FIG. 1. A, *Corydalis caput-medusae* (holotype); B, *C. qinghaiensis* (holotype); C, *C. parviflora* (holotype); D, *C. vermicularis* (Dege Exped. 0664); E, *C. glaucissima* (holotype).

Perennial (?) chasmophytic herb with trailing weak stems and small long-stalked leaves. *Stems* 20–30cm (?basal parts unknown), branched. *Leaves* thin and soft, up to 13cm long with a small ternately divided lamina. Leaflets sessile or shortly stalked, obovate, entire to more or less deeply divided into obovate lobes, 2–3 × 2–4cm. *Racemes* 'leaf-opposed', 3–5-flowered. *Bracts* 3–5cm with a long-stalked tripartite lamina, cuneate at base. *Pedicels* 1–1.5cm in flower, elongating to 4–8cm and basally recurved in fruit. *Sepals* ovate, 1.5mm long, denticulate. *Outer petals* shortly cristate with broad obtuse limb. *Upper petal* 14–16mm long with a rather narrow curved spur 5–7mm long. *Nectary* about $\frac{3}{5}$ as long as spur. *Lower petal* 9mm long, with a long claw. *Inner petals* 8mm long, each with dark purple apex. *Stigma* with four apical papillae and rounded basal lobes. *Fruit* linear-oblong, 1–6-seeded, slightly constricted between the seeds, 4–9 × 2mm with a style 1.5mm long. *Seeds* black, smooth, c.2mm, each capped with a prominent lobed elaiosome.

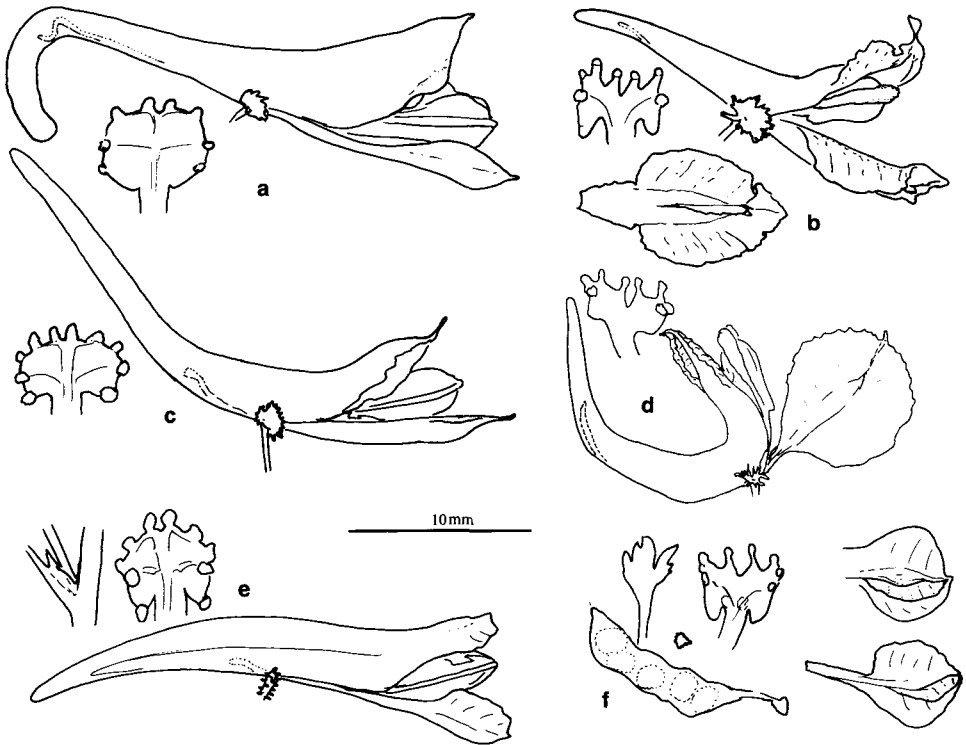


FIG. 2. Flowers and stigmas of (a) *Corydalis caput-medusae* (holotype); (b) *C. tenerrima* (KGB 491, GB): bottom, lower petal; (c) *C. pseudomucronata* (holotype); (d) *C. liana* (holotype): right, lower petal; (e) *C. asplenifolia* (holotype): top left, base of petiole; (f) *C. vermicularis* (holotype): top left, bract; bottom left, fruit; middle left, sepal; top middle, stigma; top right, apex of upper petal; bottom right, lower petal.

Distribution and ecology. W Sichuan, chasmophyte.

Additional specimen examined. SICHUAN. Dege, 3500m, 22 viii 1979, *Dege Exped.* 0664 (SM).

This strange species is very similar to *C. breviostrata* C.Y. Wu & Z.Y. Shu in corolla, stigma, and seed, but differs in the large bracts and the trailing habit. The two constitute a yet undescribed section.

***Corydalis wuzhengyiana* Z.Y. Su & Lidén, sp. nov.** [Not illustrated]

C. imbricatae valde affinis sed foliis anguste oblongis pinnis distantibus racemis subspicatis laxioribus floribus majoribus differt.

Type: Tibet, Zogang, 3800m, *Qing-Zang exp.* 12054 (holo. KUN).

(sect. *Chrysocapnos*) Rhizomatous perennial. *Rhizome* long and slender, branched, with remnants of old petioles. *Stems* several, ascending, 10–25cm long, leafy and branched, especially towards the base. *Leaves* narrowly oblong, 8–12cm including a 3–4cm long petiole, pinnate with 4–6 pairs of distant pinnae decreasing in size towards the base of the leaf. Pinnae about 1cm long, rounded with cuneate bases, subsessile, trifid to pinnatifid with dense, broadly overlapping ovate lobes, papillose-scabrid along the margins. *Racemes* rather dense in flower, much elongating in fruit, 10–16-flowered. Lower *bracts* pinnatifid, upper ones lanceolate, entire, papillose-scabrid, slightly longer than the 5–10mm long *pedicels* which are strongly reflexed in fruit. *Sepals* about 0.5mm, slightly dentate. *Corolla* yellow, c.18mm long. *Upper petal* narrowly crested with a 9–10mm long downwardly curved spur. *Inner petals* 8mm long. *Stigma* as in *C. imbricata*. *Capsule* elliptic-oblong, 1–6-seeded, 8–9 × 2–3mm, with a 2.5–3mm long style. *Seeds* 1.7mm, smooth.

Distribution. Known from three collections in E Tibet and W Sichuan, 3800–4100m.

Additional specimens examined. TIBET. Bamba near Baxoi, C.Y. Wu *et al.* 4615 (KUN).
SICHUAN. Litang, H.J. Wang *et al.* 8273 (WUK).

This species is closely related to *C. imbricata* Z.Y. Su & Lidén, but differs in the long narrow leaves with distant leaflets, the long narrow racemes, and the larger flowers. It is quite similar to *C. dasyptera*, but is smaller in all parts.

***Corydalis imbricata* Z.Y. Su & Lidén, sp. nov.** Figs 3B, 6f.

C. dasypterae & *C. wuzhengyanae* affinis, sed racemis densissimis floribus minoribus tenuioribus facile differt.

Type: Tibet, Lhasa, 4330m, vi 1939, *Richardson* 83 (holo. BM).

(sect. *Chrysocapnos*) Perennial without a distinct basal leaf-rosette. *Root* elongate, apically continued into a simple or branched rhizome; each branch with few to several flowering stems. *Stems* 7–25cm long with 3–5 leaves, branched. *Leaves* and, in particular, bracts somewhat fleshy and densely papillose-scabrid along margins

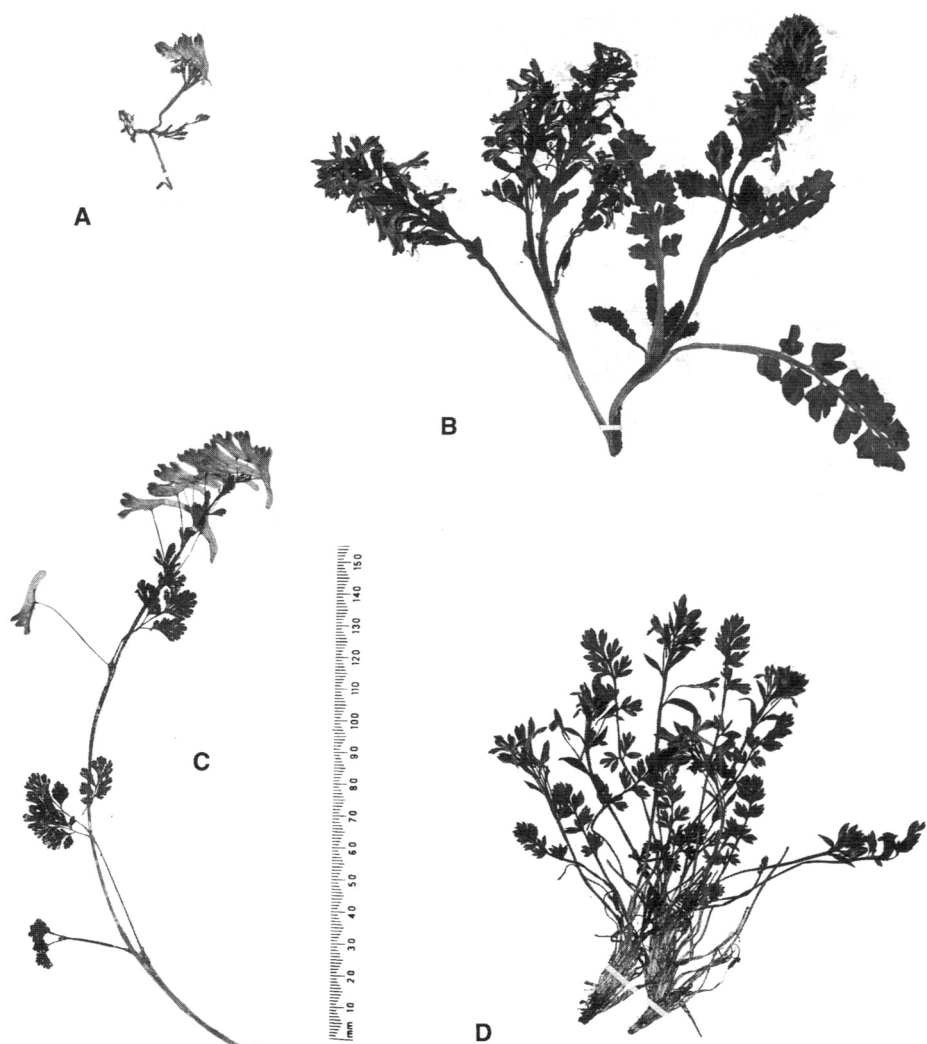


FIG. 3. A, *Corydalis tsangensis* (holotype); B, *C. imbricata* (holotype); C, *C. auriculata* (holotype); D, *C. anagynova* (holotype).

and veins. Basal leaves up to 10cm long with broad sheathing petioles; lamina c.5cm, oblong, pinnate, with (4–)5–6 pairs of pinnae; leaflets more or less deeply cut into 3–8 overlapping broadly obovate-acute lobes. Uppermost leaves much smaller, sessile. *Racemes* very dense, 20–30-flowered, slightly elongating in fruit. Lower *bracts* entire to three-fid (the lowermost sometimes pinnately divided); upper ones entire, oblanceolate to subspathulate, equalling or longer than the 5–10mm long pedicels that are recurved in fruit. *Flowers* yellow with darker apex. *Sepals* minute or up to 1mm, dentate. *Outer petals* broadly to narrowly crested; crests sometimes shallowly dentate; spur of upper petal subequalling lamina, 6–8mm long, slightly to strongly

curved downwards. *Inner petals* 6–7mm long, dark brown at apex. *Stigma* quadrangular with prominent basal lobes, with four apical papillae, two submarginal geminate lateral papillae, and a geminate papilla on each of the basal lobes. *Capsule* 2–6-seeded, oblong, 6–9 × 1.5–2mm with style 2mm. *Seeds* 1.5mm, smooth.

Distribution. Central Tibet, 3600–5100m.

Additional specimens examined. TIBET. Lhasa: G.C. Xia & T.K. Mi 292 (IMM, KUN); J.W. Zhang 6250 (PE-Ec); Y.T. Zhang & K.Y. Lang 1654, 2327 (PE); B.Z. Guo & W.Y. Wang 22067 (HNWP); Veg. Group 6418 (PE-Ec); Forestry group of Comm. Compr. Exp. 75-119 (CCE); P. Aufschneider s.n. (BM); 4000m, Guthrie 20248 (K); 'grassy banks, flowers yellow', 3600m, 1 vi 1942, Ludlow & Sherriff 8630 (BM, E, K); 'dry hill slopes, flowers dirty yellow', 4000–4300m, 14 vi 1942, Ludlow & Sherriff 8720 (BM); 'open rocky hillside, flowers dirty yellow', 4000m, 17 v 1943, Ludlow & Sherriff 9498 (BM); Jomda, Gabila, 4820m, P.Q. Zhong 5195 (PE); Dengqen, Nayonggushan, Veg. Group 9344 (PE-Ec.); Qushui, G.X. Fu 75 (PE); Rinbung, Xizang Exp. 1535 (PE); Xigaze, P.Q. Zhong 5673 (PE); Tingri, J.W. Zhang & K.Y. Lang s.n. (PE).

The very dense racemes of small flowers and the closely spaced leaf-lobes clearly distinguish this species from *C. dasyptera* and *C. wuzhengyiana*.

***Corydalis anaginova* Lidén & Z.Y. Su, sp. nov. Figs 3D, 4d.**

C. tibeto-oppositifolia C.Y. Wu & Z.Y. Su, *C. simplex* Lidén & *C. govaniana* Wall. affinis, sed bracteis integris pedicellis gracilioribus longioribusque floribus multo minoribus calcaribus brevioribus differt.

Type: Tibet, Lhasa (29°04'N 91°05'E), 'corolla dirty yellow; on steep hillsides', 4500m, 25 vi 1943, Ludlow & Sherriff 9698 (holo. BM).

(sect. *Chrysocapnos*) Perennial herb. *Rhizome* densely clothed with long shiny yellowish cataphylls and leaf-remnants. *Stems* 10–20cm long, unbranched with a pair of small opposite leaves (sometimes reduced to vaginate scales) close to the base. *Radical leaves* 5–10cm long with oblong lamina 3–5cm long, pinnate with 3–4 pairs of pinnae. *Pinnae* ovate, subpinnate to deeply divided into 3–7 acute to shortly acuminate lobes, 5–8 × 2–3mm. *Racemes* lax, 6–16-flowered. *Bracts* lanceolate, 5–13 × 1–2.5mm, gradually smaller upwards. *Pedicels* slender, 11–20(–25)mm, probably recurved in fruit. *Sepals* minute. *Corolla* dirty yellow. *Outer petals* rather broadly crested, acute; upper petal 11mm long with a short narrow spur 3–4mm long and a slender nectary about half as long as spur. *Inner petals* 6mm long. *Ovary* elliptic with style 2–2.5mm. *Stigma* quadrangular with four indistinct apical papillae, two lateral geminate submarginal papillae and geminate basal papillae on the basal triangular lobes. *Fruit* and *seeds* unknown.

Distribution. Known only from the type collection.

Corydalis anaginova belongs in the *C. govaniana* group, and is most similar to *C. tibeto-oppositifolia* C.Y. Wu & Z.Y. Su and *C. simplex* Lidén. However, the much smaller flowers and the dense leaf residues at base clearly distinguish our new species.

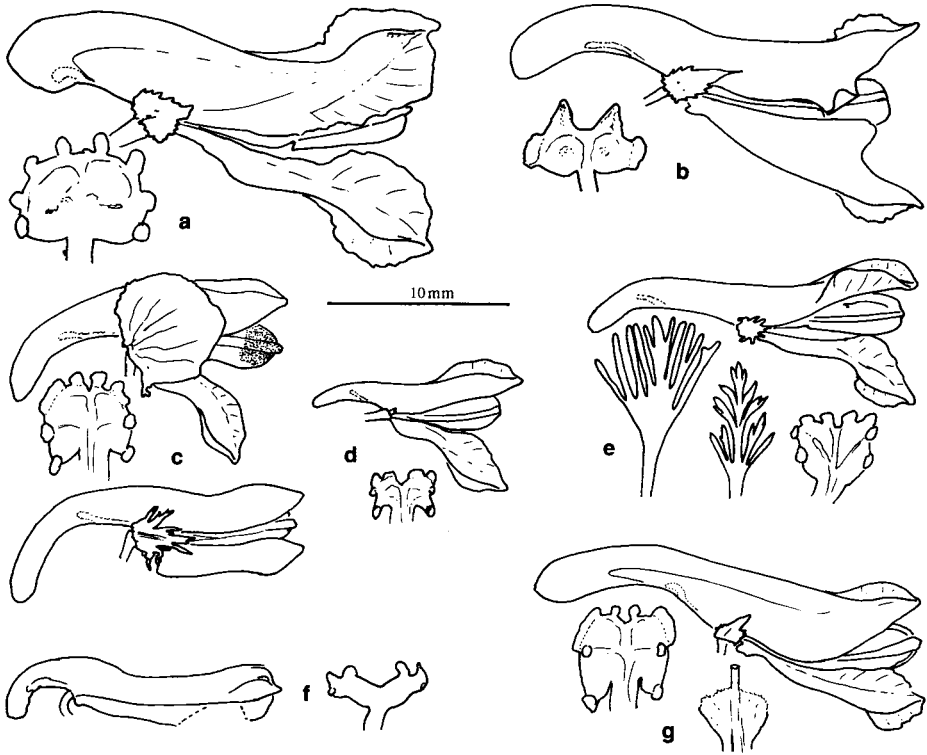


FIG. 4. Flowers and stigmas of (a) *Corydalis praecipitorum* (isotype in E); (b) *C. lasiocarpa* (holotype); (c) *C. peltata* (SBL 57, E) with a flower of *C. iochanensis* (KEY 612, E) for comparison; (d) *C. anaginoва* (holotype); (e) *C. tsangensis* (holotype): bottom left, bract; bottom centre, leaf; (f) *C. parviflora* (holotype); (g) *C. auriculata* (holotype): bottom, base of petiole.

***Corydalis qinghaiensis* Z.Y. Su & Lidén, sp. nov. Figs 1B, 8a.**

Herba perennis caespitosa foliis oblongis bipinnatisectis lobis obovatis vel spatulatis plus minusve mucronatis. Bracteae biternatipartitae pedicellis fructiferis 2–4cm longis apice hamatis aequantes. Sepala parva profunde lobata. Corolla cristata calcaribus longis.

Type: Qinghai, Golmud, 4400m, 6 ix 1988, S.G. Wu *et al.* 2866 (holo. KUN).

Perennial herb with a long taproot apically branching into several stems, which are clad along their elongate underground parts (10–12cm × 3–4mm) with scaly remnants of old cataphylls or leaves. At ground level they become rather much branched and produce dense cushions. *Aerial stems* 3–8cm, leafy. *Lower leaves* equalling the stems, each with a flattened slightly vaginate petiole c.4cm long; lamina oblong, 4–6 × 2.5cm, bipinnate with 7–9 pinnae, each with 3–5 pinnulae; pinnulae more or less deeply divided into 3–4 obovate mucronate lobes 3–5 × 2–3mm; pinnae and pinnulae very closely set and overlapping, especially when young. *Uppermost leaves*

similar to the bracts. *Racemes* very dense, corymbose, many-flowered (10–20). *Bracts* 2–4cm, stalked, biternately divided into narrowly subspathulate to oblanceolate lobes 4–8 × 1–2mm. *Pedicels* 2–4cm, erect, apically sharply recurved in fruit. *Sepals* divided to the base into three filiform lobes, 1.5–2mm long. *Corolla* of unknown colour (probably yellow), upwardly directed. Upper petal c.20mm long, crested, and with a straight narrow cylindrical spur 11–12mm long, down-curved at the very apex. *Nectary* about $\frac{3}{4}$ as long as the spur. *Inner petals* 8–9mm long, pale or sometimes with bluish spots on the dorsal wings. *Fruit* (immature) elliptic, few-seeded, 8–10mm with 3mm long style. *Seeds* unknown.

Distribution. Qinghai, sandy slopes, 4400–4900m.

Additional specimen examined. QINGHAI. Wu-lan-wu-la, 4900m, 30 vi 1990, S.G. Wu *et al.* (*Hohxil shan exp.*) K-722 (KUN).

The dense cushion-like habit and the upwardly directed flowers in *C. qinghaiensis* suggest a relation to *C. hendersonii* Hemsl., but our new species can be easily distinguished by the pinnately divided leaves, the many-flowered racemes, the non-tapering spur, and the shorter style.

***Corydalis tsangensis* Lidén & Z.Y. Su, sp. nov. Figs 3A, 4e.**

Corydalis nanae similis sed plantis minoribus foliis caulinis 2 oppositis calcaribus longioribus differt.

Type: Tibet, Tsang (Shang), Logrum Phu, 5000m, 12 vii 1951, P. Aufschneiter s.n. (holo. BM).

Very small plant. Perennating parts, roots, and radical leaves unknown. *Stems* 5–6cm long including a thin basal, presumably subterranean part c.3cm long. *Cauline leaves* 2, opposite, 18mm long, pinnate with 2–3 pairs of pinnae. These entire, or cleft to the base into two lanceolate segments. *Racemes* corymbose, dense, 4–5-flowered, with a 2cm long peduncle. *Bracts* stalked, flabellate-divided into several linear-oblong obtuse lobes, about 10mm long. *Pedicels* straight in flower, 4–9mm long. *Flowers* probably pale blue. *Sepals* c.1.5mm long and 1mm broad, rather deeply dentate. *Outer petals* crested. *Upper petal* c.17mm long with a slender slightly tapering, slightly down-curved 8mm long spur. *Nectary* about $\frac{2}{3}$ as long as spur. *Lower petal* 9mm long, straight, slightly undulate-crenate. *Inner petals* 8mm long. *Ovary* oblong-ovate with 10 ovules, biseriate; style c.3mm long. *Stigma* rounded at base with four apical papillae and two pairs of geminate lateral papillae. *Fruit* and *seeds* unknown.

Distribution. SE Tibet, known only from the type collection, the sheet of which has two small specimens (top and upper left-hand plants) together with fragments of *C. polygalina* and *C. hookeri*.

Corydalis latiflora Hook.f. & Th. and *C. nana* Royle are similar to *C. tsangensis* in the small size and the opposite leaves, but their stigmas are quite different.

***Corydalis liana* Lidén & Z.Y. Su, sp. nov. Figs 2e, 5G.**

C. davidiana subsimilis, sed caulibus et rachidibus foliorum inter nodis arcuatis foliis magis divisis floribus minoribus petalis anticis apice fimbriato-denticulatis longe distat.

Type: Yunnan, Judian, Xinzhu, 'in rupibus musci-obtectis sub sylvis', 3000m, 5 vi 1987, Li *et al.*, SBL (Sino-British expedition to Lijiang) 1147 (holo. E, iso. K).

(sect. *Davidiana*) Basal parts unknown. *Stem* >50cm, leafy, branched, with branches diverging at wide angles. *Middle cauline leaves* shortly petiolate (upper sessile), five times ternate with long petiolules. Leaflets strictly opposite (as in all *Davidiana*). Ultimate leaflets ovate to obovate, entire. Rhachis of leaf conspicuously arcuate between the nodes (as are also the stems to a lesser degree). *Racemes* up to 10-flowered. *Bracts* lanceolate, equalling the 3–4mm long slender pedicels. *Sepals* c.1mm, deeply lacerate-dentate. *Corolla* yellow. *Upper petal* narrowly crested with a 15mm long upwardly strongly curved spur. *Nectary* $\frac{2}{3}$ as long as the spur. *Lower petal* ecristate with broad obtuse dentate limb, smoothly narrowed towards the base. *Inner petals* 7mm long. *Stigma* transversally rectangular with four apical papillae and a single pair of lateral geminate papillae, like that of *C. yunnanensis*, but without the basal prolongations. *Fruit* and *seeds* unknown.

Distribution and ecology. NW Yunnan, known only from the type collection; moss-covered rock in forest.

Although clearly belonging in the section *Davidiana*, *Corydalis liana* is immediately distinguished from all other species of *Corydalis* by the peculiar stem and leaf structure.

***Corydalis tenerrima* C.Y. Wu, Z.Y. Su & Lidén, sp. nov. Figs 2d, 9.**

Corydalis yunnanense affinis sed foliis multo divisis petalis exterioribus late alatis breve et anguste denticulato-cristatis facile differt.

Type: Yunnan: Deqen (Atuntze), Xishan, Mietzimu, 'fl. flavi', 3200m, T.T. Yü 8555 (holo. KUN).

(sect. *Davidiana*) Perennial with a dense cluster of long roots, 1–2mm thick. *Stem* usually single, erect, 70–140cm, about 5mm thick at base, sulcate, rather weak, leafy throughout but branched only above. *Radical leaves* long-stalked, large, with lamina up to 30cm across; cauline leaves progressively smaller upwards; uppermost ones subsessile. *Lamina* triangular in outline, (three) four times ternately to subpinnately divided with long petiolules; leaflets ovate, deeply divided into small obovate, discrete or slightly overlapping lobes. *Racemes* several, simple or usually branched below, 10–20-flowered, dense at first, soon elongating. *Pedicels* 2–5mm long during anthesis, c.5–6mm and reflexed in fruit. *Bracts* oblong-acute, equalling the pedicels, entire or slightly lobed or dentate. *Sepals* whitish, fimbriate-dentate, 2–3mm, rarely minute. *Corolla* golden yellow with a pleasant fragrance. *Outer petals* with very broad ovate



FIG. 5. A, *Corydalis aspleniifolia* (holotype); B, *C. lasiocarpa* (holotype); C, *C. pseudodensispica* (holotype); D, *C. oreocoma* (holotype); E, *C. pseudofilisecta* (holotype); F, *C. rockiana* (holotype); G, *C. liana* (holotype), leaf only.

limbs, and short dentate crests that do not reach the apex. Spur of upper petal straight or slightly curved upwards, tapering to a subacute apex, 9–12mm long. *Nectary* slender, reaching almost to the tip of the spur. *Lower petal* with a short broad claw. *Inner petals* 7–9mm long. *Stigma* with prominent epapillate basal lobes, geminate lateral papillae and four apical substipitate papillae. *Capsule* oblong, 5–8-seeded, 9–11 × 2mm, with a long stout style, 3–3.5mm long. *Seeds* 1.5mm, smooth.

Distribution and ecology. Known only from Xishan W of Deqen (Atuntze) in NW Yunnan. Wet glades in semishade, 3200–4000m, forming stands.

Additional specimens examined. YUNNAN. Deqen (Atuntze), Xishan, 3500–4000m, 29 ix 1993, KGB (Kunming-Göteborg Botanic expedition) 491 (E, GB, KUN). Cultivated in Göteborg Botanic Garden.

Two rather small, but rich, stands of this rare species were found during the KGB expedition on Xi shan (West mountain), which towers above Deqen (Atuntze) to about 4200m. It was growing in openings in the forest on the east slope, and still had some flowers remaining in late September. It differs from the vegetatively similar *C. yunnanensis* in the higher, thicker, and more juicy and fragile stem, the much divided leaves, and the very broad obtuse outer petals with short dentate crests that do not reach the apex.

In nature *C. yunnanensis* flowers in early summer, whereas *C. tenerrima* is still blooming in September. In cultivation, however, both flower in early summer with a couple of weeks difference only.

***Corydalis caput-medusae* Z.Y. Su & Lidén, sp. nov. Figs 1A, 2a.**

C. weigoldii Fedde valde affinis sed inflorescentiis capitatis compactim floribundis floribus gracilioribus calcaribus arcuato-curvatis laminis conspicue longioribus, pedicellis brevioribus facile differt.

Type: Yunnan, Ludian, Xinjie (Sin-kai), 'sub sylvis, fl. violet sombre', v, 2800m, *E.E. Maire* s.n. (holo. P).

(sect. *Elatae*) Erect perennial. *Rhizome* elongate, clothed along most of its length with thick fleshy imbricate scales that become dark and hard in the dry state. *Radical leaves* few, in a lax rosette at the apex of the rhizome, 12–20cm long, with large thick petiole-bases; petiole 8–13cm long. Lamina glaucous beneath, green above, triangular, 4–6 × 5–7cm, biternate, with long-stalked primary leaflets; secondary leaflets sessile, or the median one stalked, two to three times subternately cut into oblong lobes. *Stems* 25–30cm, erect, sparingly leafy, simple, 25–30cm. *Cauline leaves* 2–3(–4), mostly in the upper half of the stem, like the radical; upper ones small and sessile. *Racemes* very dense, 8–15-flowered. *Bracts* about 2cm long, much divided into several narrow acute lobes; upper ones smaller and less divided. *Pedicels* 5–9mm, elongating to 15(–20)mm in fruit. *Sepals* c.1mm, dentate. *Corolla* dark violet (rarely white). *Upper petal* ecristate, with a conspicuous mucro, 26–30mm long including a long slender cylindrical curved spur 15–17mm long. *Nectary* about $\frac{2}{3}$ as long as spur, curved in S-shape distally. *Lower petal* 14mm long, mucronate, straight. *Inner petals* 12mm long. *Stigma* rounded without basal lobes, with six apical papillae and two pairs of lateral geminate papillae. *Capsule* reflexed on erect pedicels, 10 × 3–4mm, excluding a 2.5–3mm long style. *Seeds* 6–10, biseriate, 1.7–1.8mm, smooth.

Distribution. Known from three localities in NE Yunnan, 2800–3200m.

Additional specimens examined. YUNNAN. Qiaojia: Io-shan (Iochan), 'vallons humides, fl. violettes, en touffes', 3200m, v, *R.P. Maire* s.n. (P); Dagan: Tianxing (Tien-sin), 'fl. blanches', vii, 3100m, *R.P. Maire* s.n. (P).

Bracts and fruits of *C. caput-medusae* are similar to those of *C. weigoldii* Fedde, but our new species is distinguished by the capitate racemes, slender curved spurs, and the straight lower petal. The stigma is also different; in *C. weigoldii* it is squarish with four apical papillae.

***Corydalis kiukiangensis* C.Y. Wu, Z.Y. Su & Lidén, sp. nov. Fig. 6c.**

Herba perennis. Rhizoma apice squamis et petiolis incrassatis bulbis formatis. Caulis erectus strictus 5–6-foliatus superne ramosus ramis erectis. Folia caulina triangularia biternata foliolis rotundatis breve petiolulatis profunde tripartitis lobis plus minusve dentatis vel 2–5-lobatis lobulis ovatis vel suboblongis. Bracteae rotundatae breviter petiolatae infimae multo divisae superiores minores plus minusve profunde dentatae, pedicellis gracilis c.10mm longis subaequantes vel paullo breviores. Flores pallide viridi-flavi. Petala exteriora breviter et anguste cristata. Calcar cylindricum glande nectarifera $\frac{2}{3}$ partes calcaris attingenti.

Type: NW Yunnan, upper Kiukiang valley (Clulung, Lethaca), 'margin of thickets, flws pale greenish yellow', 1950m, 31 vii 1938, *T.T. Yü* 19529 (holo. PE, iso. E).

Perennial glabrous herb, 30–60cm long. *Rhizome* c.3mm thick, apically with a hard bulb of fleshy petiole-bases; below with fibrous remnants from the bulb of the previous year. Stem lateral to the bulb, erect, leafy (5–6 leaves), with strict erect branches. *Radical leaves* long-stalked. *Cauline leaves* c.10cm long with triangular 5–6 × 5–6cm lamina, very glaucous beneath, biternate with shortly stalked rounded leaflets which are deeply cleft into 2–3 dentate ovate lobes. Upper leaves with a tendency to membranous auricles at base. *Racemes* 5–11-flowered, rather lax. *Bracts* rounded, shortly petiolate; lower ones much divided to coarsely dentate; upper ones smaller, more or less dentate, or the uppermost small and entire, equalling or slightly shorter than the slender pedicels which are c.10mm long. *Sepals* kidney-shaped, 0.5mm long, 1–1.5mm broad, finely dentate. *Corolla* pale greenish yellow. *Upper petal* shortly and narrowly crested, 2cm long with a cylindrical or slightly tapering spur about 11mm long. *Nectary* almost $\frac{2}{3}$ as long as the spur. *Lower petal* very slightly crested, and with a broad prominent pouch close to the middle. *Inner petals* 9–10mm long. *Stigma* with two narrow central apical papillae flanked by two broader less discrete ones, two lateral geminate papillae, and with basal lobes each carrying a geminate papilla (this is the most common stigma type in the genus). *Fruit* (immature) c.16-seeded, narrowly obovoid, with seeds in two rows, 10 × 2–3mm. *Style* 3mm long. *Seeds* unknown.

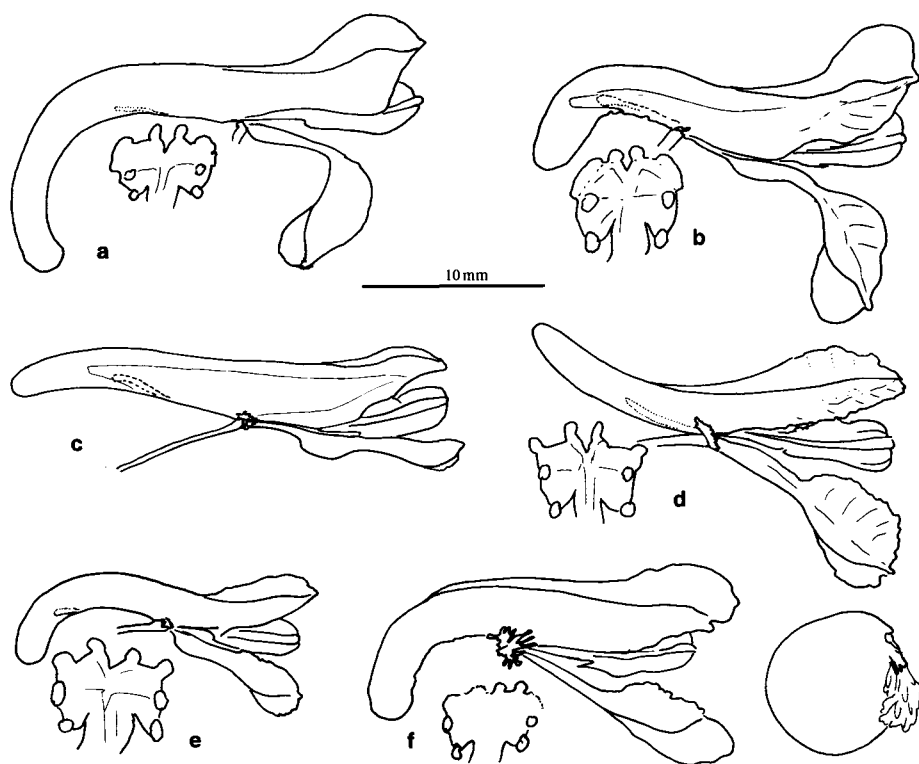


FIG. 6. Flowers and stigmas of (a) *Corydalis pseudodensispica* (holotype); (b) *C. rockiana* (holotype); (c) *C. kiukiangensis* (holotype); (d) *C. petrodoxa* (holotype); (e) *C. imbricata* (holotype); (f) *C. pseudoscaberrula* (holotype): bottom right, seed.

Distribution. NW Yunnan, known only from the type collection.

Corydalis kiukiangensis is a rather isolated species, although the large fleshy leaf-bases, the yellow flowers and the narrowly obovoid fruit suggest a possible affinity to the *C. acuminata* group.

***Corydalis pseudomucronata* C.Y. Wu, Z.Y. Su & Lidén, sp. nov. Fig. 2b.**

C. mucronata persimilis, sed sepalis suborbicularibus minoribus (in illa triangularis) stigmatibus quadratis apice papillis 6 (in illa triangularis margine papillis 9) differt.

Type: Sichuan, Guanxian, 1530m, *F.T. Wang* 20661 (holo. KUN, iso. PE).

(sect. *Mucronatae*) Suberect to ascending perennial with few stems arising from a short rhizome with densely crowded fleshy scales (like in sect. *Elatae*). *Stems* 20–50cm, slender, sparingly branched above. *Radical leaves* few, long-stalked, in a lax apical rosette; cauline leaves 4–5, similar to the radical but progressively more shortly stalked upwards, triangular in outline, bipinnate; ultimate leaflets rounded to ovate, crenate-dentate. *Racemes* 5–15-flowered, very lax. *Bracts* small, entire, or

the lowermost with a few teeth. *Pedicels* thin, erecto-patent, c.10mm long. *Sepals* rounded, 1.5–2mm, finely dentate. *Corolla* purple. *Outer petals* long-acuminate at apex, ecristate; upper petal with a narrow tapering spur, c.20mm long, with a nectary c.5mm long. *Inner petals* 11–12mm long. *Stigma* broad and flat-topped with six apical simple papillae, and two pairs of geminate lateral papillae. *Fruit* ellipsoid, c.20-seeded, 9–13 × 2.5–3mm with 3mm long style. *Seeds* very small, c.1mm, smooth.

Distribution and ecology. Central and N Sichuan, 1100–2000m. Flowering April–May.

Additional specimens examined. SICHUAN. Guanxian, 1530m, F.T. Wang 20522 (A); Pingwu, Sich. Med. 13003 (SM); Qingchuan, Sichuan Fl. 2400 (SM); Chengdu, W.P. Fang 13503 (KUN); Shifang, Sich. Med. 0113 (SM); Junlian, SEPE Yi 0121 (KUN, PE, SM, SZ); Xingwen, M.Y. Fang & Yibin 8 (SZ); Ebian, s.c. (?).

Corydalis pseudomucronata is closely related to *C. vivipara* Fedde and *C. mucronata* Franchet, and indeed very similar to the latter, but has smaller suborbicular sepals, and a rather different stigma. In *C. vivipara* and *C. mucronata* the stigma is narrowly deltoid with nine marginal papillae (excluding the geminate lateral and basal ones).

***Corydalis aspleniifolia* Lidén & Z.Y. Su, sp. nov. Figs 2c, 5A.**

C. ternatifoliae affinis sed foliis multo-divisis bracteis divisis floribus petalis exterioribus leviter emarginatis mucronatis facile differt.

Type: Sichuan, Chengkou, R.P. Farges s.n. (holo. P).

(sect. *Asterostigmata*) Perennial herb, glabrous below, but often finely papillose-puberulent on upper parts of stems and pedicels. *Rhizome* probably ± vertical, 3cm long, c.3–4mm thick, possibly with horizontal branches. *Stems* 20–30cm, apparently axillary from a lax rosette of basal leaves with wide sheathing petiole-bases. *Basal leaves* c.15cm long, long-stalked with triangular bi-(tri-)pinnate lamina 5–6 × 4–5cm; ultimate leaflets more or less deeply dentate or divided into narrowly oblong acute lobules. *Cauline leaves* 3–6, like the radical, becoming smaller upwards, with narrow vaginae that in the upper leaves have distinct free teeth (as in *C. ternatifolia*). *Racemes* rather dense, 4–9-flowered, shortly pedunculate, subsecund. *Lower bracts* stalked, much divided into acute lobes; *upper bracts* gradually smaller and less divided, longer than the 3–4mm long slender pedicels. *Sepals* c.0.5mm, deeply dentate. *Corolla* horizontal, apparently purplish with the keels of the outer petals darker. *Outer petals* ecristate. *Spur* of upper petal almost straight or slightly curved downwards, tapering towards the apex, 13–15mm long with a very short nectary. *Lower petal* with a very narrow claw gradually widened into a narrow limb, shallowly emarginate with a slight mucro. *Inner petals* 11–12mm long, pale at apex. *Ovary* narrowly linear with 20–25 ovules. *Stigma* rounded with six simple papillae and two pairs of geminate papillae. *Fruit* and *seeds* unknown.

Distribution. NE Sichuan and SE Gansu.

Additional specimen examined. GANSU. Wenxian, 720m, 24 iii 1972, Wang Z.-B. 20444 (NW Bot. Inst.).

A rather elegant species, related to *C. ternatifolia* C.Y. Wu, Z.Y. Su & Lidén, but easily distinguished by the much divided leaves, the puberulent stem and the slightly curved spur.

***Corydalis ternatifolia* C.Y. Wu, Z.Y. Su & Lidén, sp. nov. Fig. 10A.**

Corydalis asplenifoliae & *C. martinii* affinis, sed a priore differt foliis minus divisis foliolis dentatis, a posteriore petiolis superioris basin anguste auriculatis floribus multo minoribus ecristatis obtusis nectario brevioribus.

Type: Hubei, Fangxian, *Shennongjia-expedition* 21236 (holo. PE).

(sect. *Asterostigmata*) Perennial glabrous herb, (sometimes) with slender stolons. *Flowering stems* ascending, several, 25–40cm tall, axillary from a small rosette of basal leaves with wide membranous petiole-bases. *Basal leaves* 15–20cm long, long-stalked with triangular biternate to bipinnate lamina; leaflets ovate-acute, serrate. *Cauline leaves* 5–8, like the radical, becoming smaller upwards, ternate to biternate, with narrow vaginae that in the upper leaves have distinct free teeth (as in *C. ternatifolia*). *Racemes* rather lax, 5–9-flowered, shortly pedunculate. *Lower bracts* similar to the uppermost leaf, sessile or short-stalked, ternate with three dentate obovate leaflets; *upper bracts* small, sharply dentate, equalling the thin 5–10mm long pedicels. *Flowers* horizontal, red, purple, or white. *Sepals* 0.5–1mm, deeply dentate. *Outer petals* ecristate; upper petal 17–19mm long with straight to slightly arcuate spur tapering towards the apex, 8–12mm long with a very short nectary; lower petal with a narrow claw widened into a narrow rounded obtuse to slightly emarginate limb. *Inner petals* 8–10mm long, pale at apex. *Stigma* broad at apex with eight simple apical papillae and two pairs of geminate papillae, the lower ones on prominent basal lobes. *Fruit* 20–30 × 1–1.5mm, torulose, 10–20-seeded. *Style* 2–3mm long. *Seeds* 1mm, smooth.

Distribution. W Hubei and E Sichuan.

Additional specimens examined. HUBEI. Fangxian, *Shennongjia-expedition* 21180 (PE); Shennongjia, 'flowers purple or white', 1600m, Jiang & Tao 302 (E, WUH); Badong (Patung), 10 v 1934, Ho-Ch'ang Chow 150 (E, PE).

SICHUAN. Chengkou, 1400m, T.L. Dai 100258 (SZ), 100523 (KUN, SZ); Xuanhan, *Xuanhan exp.* 00442 (SM); Beichuan, D.X. Chen 0213 (KUN, SZ).

Superficially, *C. ternatifolia* is similar to *C. martinii* in leaves and fruits, but it has very different much smaller and obtuse flowers, smaller seeds, stigma with more numerous papillae, and the petioles of the upper leaves are narrowly auriculate. *C. asplenifolia* (previous species) has similar flowers, and is probably the closest relative, but is widely different in the leaves.

***Corydalis peltata* Lidén & Z.Y. Su, sp. nov. Fig. 4c.**

C. iochanensis affinis sed sepalis valde majoribus subintegris petalis exterioribus cristatis distinguitur.

Type: Yunnan, Lijiang, Yulongshan: Xian-ji-yan, 'in glareosis', 3300m, 7 ix 1986, *M. He* 31 (holo. KUN).

(*Asterostigmata* s.l.) Perennial glabrous herb with a few fibrous roots from a short weak rhizome crowned by a loose fascicle of rather small leaves. *Stems* ascending, axillary, 15–20cm, leafy, with branches growing out late. *Basal leaves* 3–6cm long, long-stalked with triangular biternate lamina, green above, green or glaucous beneath; leaflets more or less deeply divided into 5–8 obovate obtuse lobes. *Racemes* dense in flower, lax in fruit, 5–8-flowered. *Flowers* creamy white to yellow with the tips of the inner petals tipped with dark purple. *Sepals* like two huge shields, 5 × 5.5mm, subentire. *Outer petals* narrowly crested, acute. *Spur* of upper petal 6–7mm long, curved downwards, with nectary about half as long. *Lower petal* with two gibbosities at base. *Inner petals* 7mm long. *Fruit* (immature) obovate-elliptic, 8 × 2.5–3mm long with a 2mm long style. *Seeds* unknown.

Distribution. Known from three collections in the Yulongshan range N of Lijiang, 3300–3400m.

Additional specimens examined. YUNNAN. Lijiang, Yulongshan: above Mahuangba, 'Abies forest, flowers creamy white', 3300m, 9 vi 1987, *SBL* (Sino-British expedition to Lijiang) 535 (1270) (E, K); South ridge, Bai-shui, 'mixed woodland, flowers creamy white', 3400m, 27 v 1987, *SBL* 57 (225) (E, KUN).

Although very similar to *C. iochanensis*, our new species is easily distinguished by the thinner roots, the crested outer petals, and in particular by the very large sepals. Similarities with *C. stenantha*, *C. radicans* and *C. taliensis* indicate a possible position in sect. *Asterostigmata* s.l.

***Corydalis auriculata* Lidén & Z.Y. Su, sp. nov. Figs 3C, 4g.**

C. pubicaulae & *C. petrophilae* affinis, sed caulibus petiolis pedicellisque gracilioribus foliis lobulis oblongis vel obovatis inflorescentiis multifloris differt.

Type: Tibet, Rima (28°25'N 97°02'E), 'Shady places under bushes, flowers pale green', 3 iv 1950, *F. Kingdon Ward* 19277 (holo. BM; iso. E, K, TI).

(sect. *Pubicaules*) Root and lower part of stem unknown. *Stems* long and slender, sparingly branched, leafy. *Leaves* with long and slender petioles with rounded finely eroded-dentate leaf-ears. Lamina biternate with deeply ternatisect leaflets; lobes more or less divided into oblong subacute lobes, glabrous to slightly papillose scabrid on the veins beneath. *Racemes* 10–15-flowered. *Lowermost bract(s)* large, like the upper

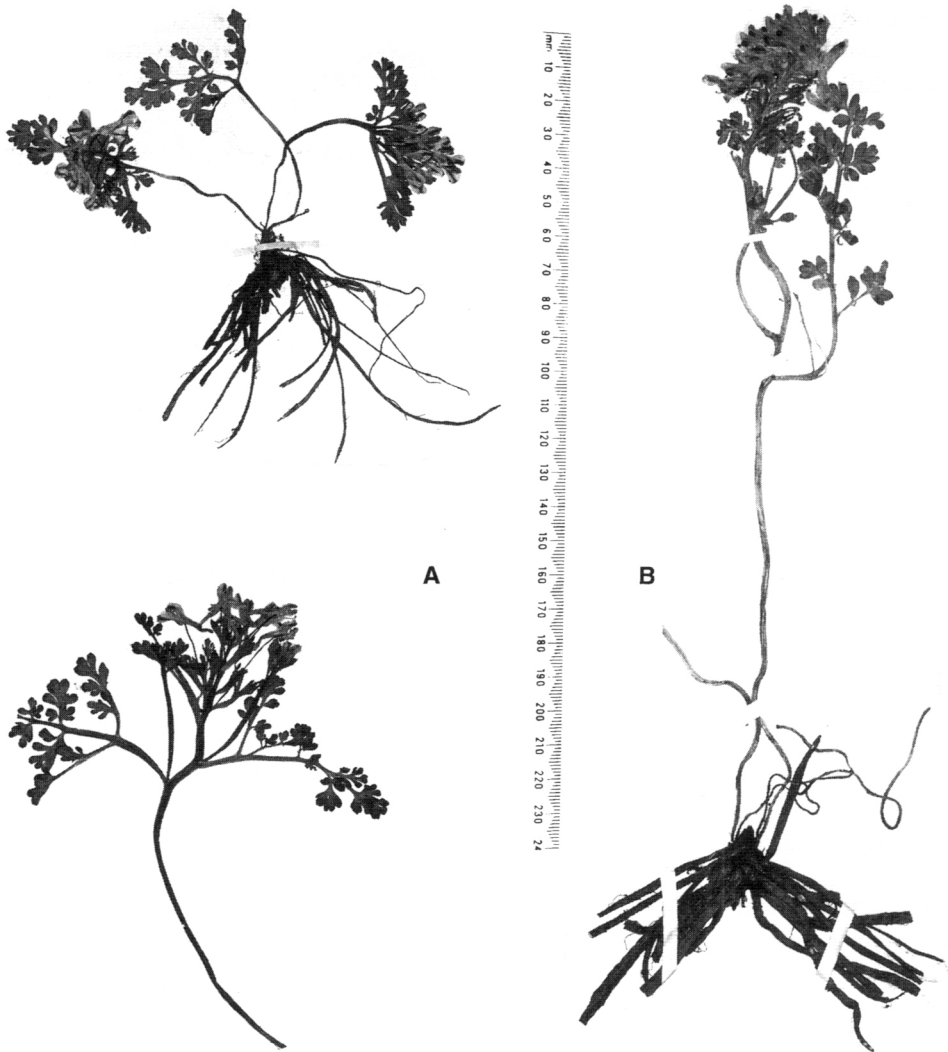


FIG. 7. A, *Corydalis petrodoxa* (holotype); B, *C. pseudoscaberula* (holotype).

leaves; *subsequent bracts* progressively smaller and less divided upwards, much shorter than the long 10–32mm long filiform pedicels which are probably erect in fruit. *Sepals* 1–1.5mm, finely dentate. *Corolla* ‘pale green’ or ‘cream, fading to dull red’, with rather short and low, sometimes dentate, crests on the outer petals. *Spur* of upper petal 9mm long, cylindrical, straight or slightly curved downwards, with a slender nectary $\frac{1}{3}$ – $\frac{1}{2}$ as long. *Lower petal* with a small sub-basal pouch. *Inner petals* 9mm long. *Stigma* quadrangular with distinct basal lobes. *Immature fruit* elliptic, 8 × 2mm, with style 2.5mm long. *Seeds* unknown.

Distribution and ecology. SE Tibet, flowers in early spring at low altitudes (1500–1800m) in shady and moist habitats.

Additional specimens examined. TIBET. Rong Tö (28°28'N 97°02'E), 'In masses along every damp hedge and streamside. Flowers cream, fading to dull red', 5–6000m, 19 iv 1933, *F. Kingdon Ward* 10348 (BM).

Corydalis auriculata is similar to *C. pubicaulis* C.Y. Wu & X. Zhuang, which can be separated by the ecristate corolla and the linear fruits, and to *C. petrophila* Franch., which differs in the crenate-dentate leaflets, the few-flowered racemes, and the thicker pedicels. As *C. auriculata* flowers at an altitude and during a season of low collecting activity, it may be far commoner than indicated by the few records known.

***Corydalis pseudoincisa* C.Y. Wu, Z.Y. Su & Lidén, sp. nov. Figs 8b, 10b.**

C. incisae similis, sed caulibus basi squamatis sepalis profunde fimbriato-incisis. A *C. hemsleyanae* racemis multifloris sepalis majoribus et a *C. anethifoliae* foliis minus divisis differt. Petalum anticum non vel inconspicue bullatum.

Type: Shaanxi, Meixian, 'in vallibus', 1100m, 20 iv 1957, *Wang Zhuo Bing* 17662 (holo. KUN).

(sect. *Incisae*) Perennial glabrous herb. *Rhizome* (?) short, with several fibrous roots. *Stems* slender, 20–40cm, suberect, leafy and branched. *Leaves* biternate, lower ones long-stalked, progressively more short-stalked upwards and with smaller and more auriculate vaginae; leaflets shortly stalked to sessile, rhombic in outline, more or less deeply dentate to divided. *Racemes* dense at first, becoming lax in fruit, 5–15-flowered. *Lower bracts* leaf-like, 1–2 × 1cm, with a short broad stalk, ternately divided with deeply dentate or incised leaflets. *Upper bracts* smaller, deeply pectinate-dentate; uppermost bracts lanceolate with a few teeth. *Pedicels* 5–10mm in flower, 10–15mm and erect in fruit. *Sepals* deeply divided into long fimbriae, c.2–3.5mm long. *Corolla* blue. *Outer petals* subspathulate with rather broad obtuse limbs and short crests that do not reach the apex. *Spur* of upper petal about 10mm long with very short nectary. *Lower petal* almost straight with narrow claw. *Stigma* broad with prominent basal lobes and a rather deep median cleft. *Capsule* oblong, 8–10 × 2–3mm, 3–8-seeded. *Style* 2mm long. *Seeds* in two rows, 2mm long, smooth, each with a small adpressed elaiosome.

Distribution. Known from a few collections from Shaanxi and Gansu.

Additional specimens examined. SHAANXI. *Xing Ji-Qing* 3851, 3940, 5722, 5878 (SZ).

GANSU. Tianshui, Baiyangring, *Huanghe exped.* 3820 (WUK); Taibaishan, Haopingsu, 1 iv 1939, *Fu X.-T.* 2850 (KUN); near Shi Ja Chuang, 'stones beside water, pink', 6 iv 1914, *Farrer & Purdom* 20 (E, K); Tchou kio tsa, 6 iv 1919, *Licent* 4981 (K).

Corydalis pseudoincisa is very similar to *C. hemsleyana* Prain, and *C. anethifolia* C.Y. Wu & Z.Y. Su, but can be distinguished from those species by the lax raceme, the straight lower petal, the larger and more shaggy sepals, and the less divided leaves.

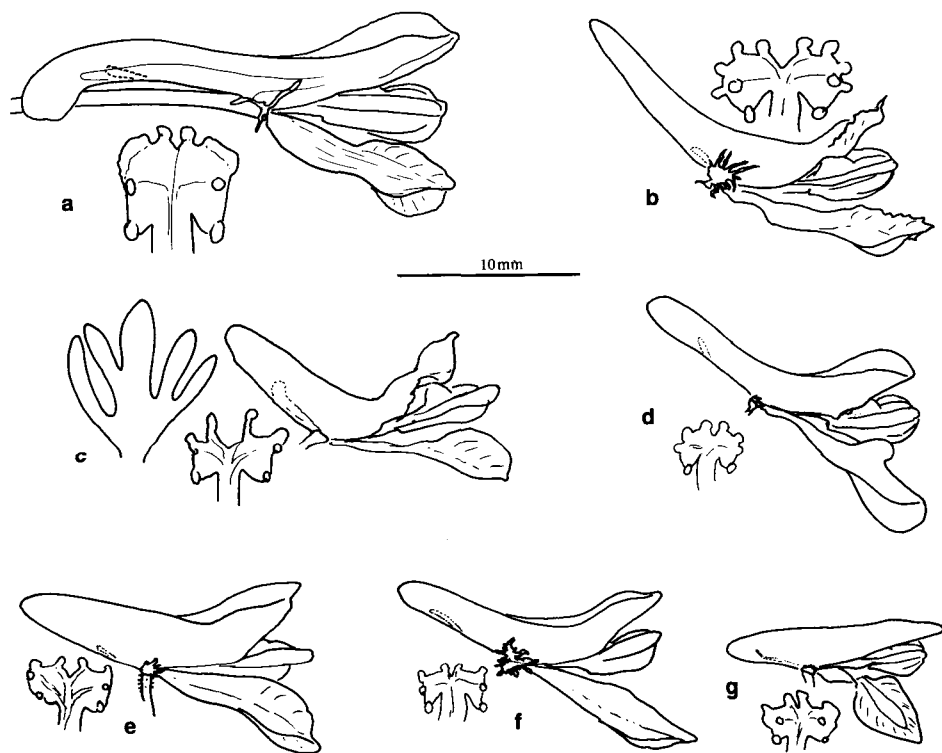


FIG. 8. Flowers and stigmas of (a) *Corydalis qinghaiensis* (S.G. Wu et al. K-722, KUN); (b) *C. pseudoincisa* (holotype); (c) *C. verna* (holotype); (d) *C. oreocoma* (holotype); (e) *C. pseudofilisecta* (holotype); (f) *C. glaucissima* (holotype); (g) *C. uvaria* (holotype).

***Corydalis pseudodensispica* Z.Y. Su & Lidén, sp. nov. Figs 5C, 6a.**

C. densispicae C.Y. Wu affinis, sed floribus majoribus calcaribus longioribus valde arcuato-curvatis facile distinguenda.

Type: Sichuan, Garze, Jichou-shan, 4180m, 15 vi 1980, Z.G. Liu & Y.B. Wang 22748 (holo. CDBI).

(sect. *Fasciculatae* ser. *Feddeana*) *Roots* oblong with long narrow stalks. *Radical leaves* unknown. *Stems* 18–28cm, simple, with 3(–4) distinctly veined leaves from the middle of the stem. *Cauline leaves* more or less sessile, triangular-oblong, pinnate with 2–3 pairs of deeply ternatisect leaflets; upper leaves triangular, less divided, grading into the lower bracts, glabrous to papillose-scabrid beneath, and very finely so also along the margins, especially of bracts. *Raceme* dense at first, soon elongating, 10–25-flowered. *Bracts* cuneate at base, pectinately divided to coarsely pectinate-dentate, or the uppermost entire, lanceolate, c.10mm long. *Pedicels* slender, 5–10mm in flower. *Sepals* absent (?). *Corolla* probably yellow, with distinct dark veins. *Outer petals* highly but rather shortly crested with crest reaching to the tip of the spur or slightly beyond. *Upper petal* with a long strongly curved spur, 15–17mm long with



FIG. 9. *Corydalis tenerrima* (KGB 491, GB).

a slender nectary $\frac{1}{3}$ – $\frac{1}{2}$ as long. *Lower petal* not or slightly gibbous at base. *Inner petals* 8mm long. *Stigma* with a pair of discrete central apical papillae flanked by more or less confluent papillae (a type found in all species in ser. *Feddeanae*). *Fruit* and *seeds* unknown.



FIG. 10. A, *Corydalis ternatifolia* (holotype); B, *C. pseudoincisa* (holotype).

Distribution. W Sichuan, 3500–4300m.

Additional specimens examined. SICHUAN. Jiulong (Chiu-lung), 4300m, vi 1929, J.F. Rock 17469 (A, BM, K); 3500m, *sin. coll.* 0183 (SZ).

Corydalis pseudodensispica is possibly related to *C. densispica* but distinguished at a glance by the long curved spur, the small sessile leaves, and the long thin root-stalks.

Corydalis pseudobalfouriana Lidén & Z.Y. Su, *sp. nov.* [Not illustrated]

C. appendiculatae valde affinis et *C. oxypetalae* similis sed differt radicibus longe stipitatis pedicellis brevioribus et praetera a priore foliis minus divisis, a posteriore pedicellis recurvatis floribus diversis.

Type: Yunnan, Yongning, 'flowers brilliant blue. Pastures', 4000m, 22 vi 1922, *F. Kingdon Ward* 5243 (holo. E).

(sect. *Fasciculatae* ser. *Appendiculatae*) Very similar to *C. appendiculata* in floral details, but more like *C. balfouriana* and *oxypetala* in general habit. *Roots* 5–13 × 2–4mm, abruptly narrowed into long thin stalks. *Radical leaves* 1–2, small, with 4 rounded leaflets. *Stems* simple, 20–25cm. *Cauline leaves* 2, towards the upper part of the stem, sessile, digitately divided with five lanceolate leaflets. *Racemes* 7–12-flowered, long and narrow. *Bracts* lanceolate, entire, longer than the pedicels which are 2–4mm in flower, 5mm and strongly downwardly curved in fruit. *Sepals* minute or absent. *Corolla* brilliant blue, very similar to that of *C. appendiculata*, including the diminutive spur on the lower petal. *Style* 1–1.5mm. *Fruit and seeds* unknown.

Distribution. N Yunnan, known only from the type specimen.

C. pseudobalfouriana is very closely related to *C. appendiculata* but has a rather different foliage. As suggested by the specific epithet, it is similar to *C. balfouriana* in habit, but the recurved pedicels and several floral details show that they are not related. From both these species *C. pseudobalfouriana* differs in the long-stalked tuberous roots and short pedicels.

Corydalis oreocoma Lidén & Z.Y. Su, *sp. nov.* Figs 5D, 8d.

C. pseudoadoxae C.Y. Wu affinis, sed caulibus foliolis pedicellisquae multo gracilioribus bracteis profunde divisis petalis anticis trilobatis facile distinguitur.

Type: Tibet, Kongbo, Namlu la (29°59'N 94°19'E), 3900m, 10 vii 1947, *F. Kingdon Ward* 15369 (holo. BM).

(sect. *Fasciculatae* ser. *Fusiformes*) *Bulbs* c.5mm, hard, spherical. *Roots* long, very narrowly fusiform. *Radical leaves* long-stalked, with ternately divided lamina; leaflets deeply divided into 2–4 oblong lobes. *Stems* slender, suberect, 14–30cm, simple, or sometimes with one branch. *Cauline leaves* usually 2, subsessile, biternatisect into narrowly lanceolate lobes. *Racemes* 8–20-flowered, long and lax. *Lower bracts* like the leaves, but smaller; *upper bracts* lanceolate, entire, equalling or shorter than the very thin pedicels, which are 14–30mm long. *Sepals* minute, dentate. *Outer petals* brilliant blue, rather broadly crested. *Spur* of upper petal cylindrical, narrow, about 7mm long with nectary a little less than $\frac{2}{3}$ as long. *Lower petal* with conspicuous auricles or lobes about $\frac{2}{3}$ from the base. *Inner petals* 8–9mm long, dark blue at apex. *Ovaries* aborted on the available material. *Stigma* with lateral papillae not clearly geminate. *Fruit and seeds* unknown.

Distribution. SE Tibet, damp ground in forest.

Additional specimen examined. 29°58'N 94°50'E, 4100m, 1 viii 1935, F. Kingdon Ward 12113 (BM).

A very elegant species, perhaps related to *C. pseudoadoxa* (C.Y. Wu & X. Zhuang) C.Y. Wu & X. Zhuang, which has similar flowers, but the slender habit, the narrow leaflets and the capillary pedicels render *C. oreocoma* a quite different appearance.

***Corydalis glaucissima* Lidén & Z.Y. Su, sp. nov. Figs 1E, 8f.**

C. pseudoadoxae affinis, sed foliis radicalibus multo minoribus minus divisis sepalis multo majoribus roseis conspicue fimbriato-dentatis differt. Tota planta glaucissima.

Type: Yunnan/Tibet border, Kakarpo, 'alpine turf precipices', 4900m, 19 vii 1913, F. Kingdon Ward 800 (holo. E).

(sect. *Fasciculatae* ser. *Fusifformes*) Similar to *C. pseudoadoxa*, but roots thicker at base, distally tapering. Leaves extremely glaucous on both sides, fleshy. Stems erect, c.10cm, each with one leaf. Radical leaf (one only present) ternate with two-cleft leaflets; lobes broad, rounded, imbricate. Cauline leaf with a short but distinct stalk, like the radical but lobes narrower. Racemes 5–10-flowered. Bracts entire, lanceolate-spathulate, or the lower with a few lobes at base, equalling or shorter than the pedicels. Pedicels 6–18mm. Sepals 1–2 × 2mm, deeply fimbriate-dentate, reddish. Corolla blue. Outer petals narrowly crested. Upper petal 13–14mm long with slightly tapering spur 6–7mm long. Nectary almost $\frac{3}{4}$ as long as spur. Limb of lower petal rhombic-subacute, 10mm long. Inner petals 8mm long. Ovary linear with 7–8 ovules. Stigma like that of *C. pseudoadoxa*, broader than long with four apical simple papillae. Fruit and seeds unknown.

Distribution. Known only from the type collection, made by F. Kingdon Ward on the border between Tibet and Yunnan on the highest point of his Kakarpo (Kaguerpo) climb.

This species differs from the closely related *C. pseudoadoxa* (C.Y. Wu & X. Zhuang) C.Y. Wu & X. Zhuang in the very glaucous leaves and the large fimbriate sepals. In *C. pseudoadoxa* the radical leaves are dark green, and usually much larger.

***Corydalis uvaria* Lidén & Z.Y. Su, sp. nov. Fig. 8g.**

C. oxypetalae & *C. balfouriana* affinis, *C. appendiculata* superficialiter similis, sed radicibus fasciculatis tuberibus rotundatis stipitatis stigmatibus peculiari distinguenda. Differt praetera a posteriore pedicellis fructiferis erectis floribus minoribus ecristatis.

Type: Sichuan, Inter Woloho & Choso (Gaitiu), 'ad ripas', 2800m, 15 vi 1914, C. Schneider 1584 (holo. E).

(sect. *Fasciculatae*) Superficially similar to *C. appendiculata*, but more closely related to *C. balfouriana*. Roots spherical to oblong, 5–8 × 4mm, sessile or shortly stalked. Radical leaves unknown. Stems simple, 15–20cm, with two leaves. Leaves sessile or

shortly stalked, ternate, leaflets sessile or the central shortly stalked; lateral leaflets 2–3(–5)lobed, central 3-lobed; lobes oblanceolate, subacute, glaucous and densely and finely papillose beneath. *Racemes* 5–12-flowered, lax. *Lower bracts* similar to the upper leaves, with up to 7 lobes; upper bracts 3-lobed to entire. *Pedicels* erect in fruit, 10–20mm. *Sepals* minute, denticulate. *Corolla* purplish blue, small, ecristate. *Upper petal* 11mm long, including a triangular obtuse spur 4mm long. *Nectary* thin, $\frac{2}{3}$ as long as spur. *Lower petal* 6–7mm long, abruptly widened into a triangular-ovate obtuse lamina. *Inner petals* 6mm long. *Stigma* with the ‘lateral’ geminate papillae situated on the lamina of the stigma about halfway to the centre. *Fruit* and *seeds* unknown.

Distribution. Known from two collections in South Sichuan.

Included by Handel-Mazzetti (*Symb. Sin.* 7(2): 350) under *C. oxypetala* Franch.

Additional specimen examined. SICHUAN. Muli, 3500m, *sin. coll.* 0128 (SZ).

Corydalis uvaria can be distinguished from *C. oxypetala* Franch. and *C. balfouriana* Diels by the different roots and foliage, and the peculiar stigma. *C. appendiculata*, which is habitually similar, clearly differs in the recurved fruiting pedicels and the larger crested flowers.

***Corydalis pseudofilisecta* Lidén & Z.Y. Su, sp. nov. Figs 5E, 8e.**

Differt a *C. pachycentra* habitu multo graciliore radicibus tenuioribus nectario breviori cristis petalorum exteriorum ultra apicem provectis.

Type: Tibet, Hills N of Lhasa (29°40'N 91°05'E), ‘banks of streams, bright skye blue with white throat’, 4500m, 10 vi 1942, *Ludlow & Sherriff* 8681 (holo. BM, iso. E).

(sect. *Fasciculatae* ser. *Curviflorae*) *Roots* very slender. *Stem* delicate, 10–20cm high, with narrow tapering base and two leaves above the middle of the stem. *Leaves* sessile, divided to the base into 3–5 linear lobes, c.2cm long. *Racemes* 3–14-flowered, dense at first, elongating in fruit. *Bracts* linear, equalling the slender 10mm long pedicels which are erect and 10–15mm long in fruit. *Sepals* 0.5–1mm long, dentate. *Corolla* blue with white inner petals. *Outer petals* with rather narrow crests that protrude beyond the apices of the petals. *Upper petal* 14mm long with a triangular spur about 7mm long. *Stigma* similar to that of *C. verna*, but basal lobes less pronounced. *Fruit* smooth, elliptic, c.5mm long, few-seeded, with style 2.5mm long.

Distribution and ecology. Vicinity of Lhasa, damp streamsides and clefts in rocks, 4000–4700m.

Additional specimens examined. TIBET. Lhasa, ‘in clefts in rocks, flowers bright blue’, 4000m, 14 vi 1943, *Ludlow & Sherriff* 9582 (BM, E); ‘damp streamside, flowers blue’, 4700m, 1947, *Guthrie* 20249 (K); *Yang J.-S.* 90-335 (KUN); loco ignoto, 4000m, *Richardson* 171 (BM).

This species bears a superficial resemblance to *C. oreocoma*, but the structure of the inner petals and the stigma reveal that it belongs in the ser. *Curviflorae*, of which it

is the most western representative. It is apparently very local, and has so far been collected only in close vicinity to Lhasa.

***Corydalis verna* Z.Y. Su & Lidén, sp. nov. Fig. 8c.**

A *Corydalis pachycentrae* valde affinis differt bracteis palmato-divisis ovulis numerosis.

Type: Tibet, Kam, Yangtse drainage basin: river Golovoj, small river Var-mun-chuo, 19 iii 1901, 4000–4500m, *Ladighin* s.n. (holo. LE).

(sect. *Fasciculatae* ser. *Curviflorae*) *Roots* narrowly fusiform, distally tapering. *Radical leaves* long-stalked, each with a small rounded palmatisect lamina with 5–9 more or less overlapping obovate lobes, rather fleshy and strongly glaucous on both sides. *Stems* 5–10cm, each with two leaves. *Cauline leaves* sessile or shortly stalked, ternately divided; leaflets entire or deeply divided into narrowly obovate obtuse lobes. *Racemes* very dense at anthesis, 3–6-flowered. *Bracts* digitately cleft into usually five oblong segments; central lobe often much broader than the lateral. *Pedicels* 5–10mm. *Sepals* minute or absent. *Outer petals* ecristate, obtuse; spur of upper petal c.7mm long, slightly tapering towards the obtuse apex, with a nectary about half as long. *Inner petals* 10mm long, with (as in all species in the series) broad, obtuse dorsal wings that are prolonged beyond the apex of the petals. *Ovules* numerous (23–24). *Stigma* rather deeply cleft, with a pair of long sharply set off apical papillae flanked by a pair of shorter indistinct papillae. *Fruit* and *seeds* unknown.

Distribution. Known only from the type collection, west of the distribution area of *C. pachycentra*.

Although obviously closely related to *C. pachycentra*, our new species is readily recognized by the much divided bracts, the very numerous ovules (24; in *C. pachycentra* fewer than 10), and the early flowering. The spur is more triangular in shape, and the stigma is slightly different with deeper median cleft and more angular basal lobes.

***Corydalis rockiana* C.Y. Wu, Lidén & Z.Y. Su, sp. nov. Figs 5F, 6b.**

C. melanochlora similis, sed bulbis multo minoribus, radicibus paucioribus crassis floribus late et breviter cristatis differt.

Type: Tibet, Jupar range, Kerab valley, vi 1926, *J.F. Rock* 14408 (holo. E; iso. A, K).

(sect. *Fasciculatae* ser. *Fibrosae*) *Roots* oblong, tapering at apex, 40–60 × 2.5–5mm. *Bulb* small. *Radical leaves* triangular to triangular-oblong, long-stalked (petiole 4–6cm, lamina 2–3 × 2cm), pinnate to bipinnate; leaflets entire or cut into 2–3 narrowly oblong subobtuse lobes, rather fleshy. *Stem* with an 8–15cm long leafless, probably mostly subterranean part; upper part 3–8cm with 2–4 leaves, simple, or with a late axillary raceme from the upper leaf. *Cauline leaves* bi- to tri-ternatisect with narrowly oblanceolate lobes. *Racemes* dense, 10–15(–20)-flowered, slightly

elongating in fruit. *Lower bracts* similar to upper cauline leaves but smaller; upper bracts trifid or even entire. *Flowers* white with the apices of the inner petals blue-tipped. *Sepals* minute. *Outer petals* with short and broad entire crests. *Upper petal* 17–20mm long with a cylindrical downwardly curved spur 8–9mm long; nectary about half as long as spur. *Lower petal* 12–13mm long, slightly saccate at base. *Inner petals* 10–11mm long. *Stigma* quadrangular with four apical papillae, a pair of geminate lateral submarginal papillae, and a basal pair of geminate papillae on the basal lobes. *Fruit* (very immature) lanceolate, 13×1.5 –2mm, gradually narrowed into a 2.5mm long style. *Seeds* unknown.

Distribution and ecology. NE Tibet. Contrary to *C. melanochlora*, this species does not inhabit rough screes, but more stable and finer soils.

A colour slide of this plant taken in NE Tibet, and presented to us by a distinguished Kunming botanist, tipped the balance in favour of recognizing this taxon as a distinct species. Although it is rather similar to *C. melanochlora*, it has much smaller underground bulbous parts, fewer and thicker roots, white flowers, and shorter and broader crests to the outer petals. There are also minor differences in leaves and bracts, and the ecology is quite different.

***Corydalis petrodoxa* Lidén & Z.Y. Su, sp. nov. Figs 6d, 7A.**

C. tenuicalcaratae persimilis, sed foliis late triangularibus inflorescentiis corymbosis pedicellis gracilibus bracteis multo longioribus calcaribus brevioribus longe distat.

Type: Tibet, Kongbo, Pungkar (30°17'N 93°36'E), 'on rocks', 4400m, 1 viii 1947, Ludlow, Sherriff & Elliot 15538 (holo. BM, iso. E).

(sect. *Fasciculatae* ser. *Scaberulae*) *Roots* several, long and rather thin, to 1.5mm thick, unbranched. *Stems* with a slender naked tapering probably subterranean base 5–10cm long, and a short leafy branched aerial part 4–6cm. *Radical leaves* long-stalked, triangular, bipinnate with three pairs of shortly stalked opposite pinnae, each with 3–5 sessile pinnulae. Pinnules lobed into 2–5 obovate segments, fleshy, more or less papillose beneath. *Cauline leaves* 2–3, alternate or rarely subopposite, like the radical but shortly stalked. *Racemes* corymbose, dense, c.10-flowered. *Lower bracts* to 2cm long, narrowed into a distinct stalk; lamina obtriangular, ternately divided with dentate to divided lobes; upper bracts becoming progressively smaller with the uppermost entire, oblanceolate, papillose-scabrid along the margin. *Pedicels* of lower flowers to 30mm long. *Sepals* small, short and broad, deeply dentate. *Corolla* dark yellow with the keels of the outer petals brown. *Upper petal* c.19mm long with 10–11mm long straight slender spur, with a rather broad crest shortly decurrent on the spur. *Nectary* about half as long as spur. *Lower petal* 12mm long, shortly and broadly crested with a long rectangular lamina gradually narrowed towards the base. *Inner petals* 9–10mm long. *Stigma* quadrangular with prominent basal lobes, each with geminate papillae, laterally with a pair of geminate submarginal papillae, and

with two broad indistinct papillae flanking two narrow ones at apex (common stigma type). *Fruit* and *seeds* unknown.

A rather isolated species known only from the type collection from SE Tibet.

***Corydalis pseudoscaberrula* Lidén & Z.Y. Su, sp. nov. Figs 6f, 7B.**

Corydalis scaberulae Maxim. affinis, sed pinnis foliorum petiolulatis racemis compactim floribundis bracteis margine ciliatis floribus minoribus differt.

Type: Tibet, Atsa pass, 'on slate screes', 5300–5700m, 24 viii 1927, *F. Kingdon Ward* 6162 (holo. K).

(sect. *Fasciculatae* ser. *Scaberulae*) *Roots* several, simple, 30–60 × 2–3mm. *Radical leaves* unknown. *Stem* 10cm above and 15cm below the lowermost leaf, tapering to a slender base; above with four leaves, the upper small. *Leaves* oblong, shortly stalked, bipinnate (the upper pinnate) with four pairs of shortly stalked pinnae; leaflets entire or divided into 2–3 obovate lobes, fleshy, papillose-scabrid along the margins and sparingly so on the veins beneath. *Racemes* very dense, capitate, 20–25-flowered (?). *Bracts* with long one-celled marginal hairs, subternately to pectinately divided with acute lobes and a short flat stalk. *Pedicels* equalling bracts, suberect, apically hooked in fruit, 10–12mm long, thick. *Sepals* deeply lacinate dentate. *Corolla* long persistent, pale yellow with the inner petals tipped with blackish purple. *Outer petals* with broad wings that protrude conspicuously beyond the apex. *Upper petal* c.20mm long with a 7–8mm long strongly recurved spur. *Lower petal* 12mm long, with a narrow claw. *Inner petals* 10mm long, including claw 5mm. *Stigma* quadrangular with slightly developed basal lobes; with paired basal and lateral papillae, and two indistinct broad papillae flanking two narrow ones at apex. *Fruit* broadly obovate, 7 × 3mm with style 3–3.5mm. *Seeds* about 1.8mm, smooth.

Distribution. Known only from the type specimen.

This species is similar to *C. scaberula*, but the denser racemes of smaller flowers, and the strongly ciliate bracts are distinctive. Their distribution areas are widely separated.

***Corydalis lasiocarpa* Lidén & Z.Y. Su, sp. nov. Figs 4b, 5B.**

C. kingii valde affinis, sed caulibus ramosis racemi multiflori bracteis apice erosodenticulatis, floribus acuminatis late denticulato-cristatis, capsulis papilloso-puberulentibus facile differt.

Type: Tibet, 60 miles N Lhasa, Reting (close to Damxung; 30°22'N 91°28'E), 'moist place on hillside amongst small shrubs and stones, flowers pale mauve', 4200m, 19 vii 1944, *Ludlow & Sherriff* 11033 (holo. E, iso. BM).

(sect. *Capnogorium*) Basal parts unknown. *Stems* 30–40cm long (or longer), with three to four leaves in the upper part of the stem, branched. *Basal (?) cauline leaves* 4–8 × 2.5–7cm, shortly stalked, triangular-ovate, sub-bipinnate. Primary leaflets

stalked, secondary ones sessile, entire to more or less divided into 2–3 acute ovate lobes. Upper leaves smaller and sessile. *Racemes* subsecund, 13–22-flowered, dense in flower, elongating in fruit. *Bracts* 3–4mm long, ovate, more or less dentate. *Pedicels* erect, slender, 5–10mm long in flower, elongating to 10–20mm in fruit. *Sepals* ovate acuminate, dentate. *Corolla* pale mauve, horizontal. *Outer petals* with short dentate crests, acuminate at apex and with prominent lateral lobes or auricles. *Upper petal* 20–22mm long, with a stout cylindrical, slightly down-curved spur 9mm long. *Nectary* a little more than half as long as the spur. *Lower petal* with a tiny pouch at base, with a broad claw. *Inner petals* 10–11mm long with long linear claw c.7mm. *Stigma* broader than long with two flat large triangular papillae at apex and with indistinct lateral papillae. *Capsules* (immature) linear, densely papillose-puberulent. Seeds unknown.

Distribution. Known from two collections from Reting N of Lhasa.

Additional specimens examined. TIBET. North of Lhasa, 19 vii 1942, Ludlow & Sherriff 8929 (E, BM).

Together with *C. kingii* Prain this species constitutes a very distinct taxon, which we have decided to include in the sect. *Capnogorium*. *Corydalis lasiocarpa* clearly differs from *C. kingii* in the branched stem, dentate bracts, crested outer petals with comparatively shorter spur, much broader claw to the lower petal, and the puberulent fruit.

***Corydalis praecipitorum* C.Y. Wu, Z.Y. Su & Lidén, sp. nov. Fig. 4a.**

Differt a *C. grandiflora* C.Y. Wu & Z.Y. Su foliis bracteis floribusque minoribus floribus purpurascensibus (in illa floribus flavi ad 2.8cm longis); a *C. crista-galli* Maxim. cristis petalorum exteriorum humiliorum subintegris stigmatibus rotundatis margine papillis 8 praeditis (in illa subquadratis papillis 6).

Type: Gansu, upper Tebbu country, south Minshan range, 'flowers dark reddish purple', 3400m, vi 1925, Rock 12495 (holo. NAS; iso. E, GH, K, PE).

(sect. *Capnogorium*) Suberect perennial. *Rhizome* long, slender to rather robust, simple or branched, crowned at apex by a few large membranous scales and a lax rosette of leaves. *Radical leaves* pinnate, oblong to oblong-obovate, with 4–5 pinnae; these \pm deeply lobed into 2–5 broad obtuse lobules. The lowermost pinnae smaller than the other, and often entire. *Stems* axillary, simple, 10–26cm, with 1–3 small leaves at the middle, with 1–2 pairs of entire ovate pinnae and a terminal trilobed leaflet. *Racemes* 4–10-flowered, \pm dense at first, much elongating in fruit. *Bracts* stalked, lower ones broad, 10–20mm long, entire to divided into three broadly ovate-acute lobes; upper bracts 5–10mm, entire, elliptic to lanceolate. *Pedicels* 5–8mm in flower, elongating to 10–17mm in fruit. *Sepals* triangular to rounded, finely dentate, 3–4 \times 3mm. *Corolla* purple, horizontal. *Outer petals* broad with rather short undulate crests projecting slightly beyond the tip. *Spur* of upper petal short and broad, obtuse, 7–8mm long, with nectary about $\frac{2}{3}$ as long. *Inner petals* 12–13mm long, with rather

narrow dorsal wing. *Stigma* rounded with eight papillae. *Fruit* (immature) oblong, to 5-seeded, with a stout 3mm long style. Seeds unknown.

Distribution. South Gansu.

Additional specimens examined. GANSU. Upper Tebbu country, south Minshan range, 'flowers dark reddish purple', 3400m, vi 1925, *Rock* 12494 (E); *ibid.* 12530 (K); *ibid.* 12830 (K); Schimen, 25 vii 1930, *Hummel* 4455 (S).

A beautiful species, related to *C. cristagalli*, *C. potanini* and *C. grandiflora*. From the last it deviates in the smaller purple flowers, from the other two in the obovate-oblong leaves with obtuse leaflets, the narrower petal-crests, and more papillae on the stigma.

ACKNOWLEDGEMENTS

We are grateful to Prof. Wu Zheng-Yih and Dr Zhuang Xuan from Kunming for generously sharing their results. We would also like to thank the staff of all the herbaria we have consulted (A, BM, CBDI, CCE, E, GB, GH, IMM, K, KUN, LE, NAS, P, PE, PE-ec, S, SM, SZ, TI, WUK). Special thanks are extended to the Royal Botanic Garden Edinburgh for their hospitality and generosity; a substantial part of the research behind this paper was conducted during an 8-month visit by Magnus Lidén in 1988. We would also like to thank the editors for their patience and their close scrutiny of our first version of this paper.

Received 3 January 1996; accepted with revision 17 May 1996