Three New Species of *Corydalis* (Fumariaceae) from Northwestern Sichuan, China

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**Abstract.** The Jiuding Ridge (Sichuan, China) has been explored during the past several years by a team from Chengdu Institute of Biology, Chinese Academy of Sciences, and three undescribed species of *Corydalis* DC. (Fumariaceae) have been revealed and are apparently endemic to this mountain. The new species were observed in forest (*C. capitata* X. F. Gao, Liden & Y. W. Wang), alpine scree (*C. aeeaeae* X. F. Gao, Liden & Y. W. Wang), and alpine rocky limestone areas (*C. schistostigma* X. F. Gao, Liden, Y. W. Wang & Y. L. Peng). The two first species have their closest relatives in the Wolong-Balangshan District (Wenchuan, Sichuan). *Corydalis aeeaeae* differs from *C. panda* Liden & Y. W. Wang in its small size, few-flowered racemes, and broadly obtuse outer petals with low, short crests. *Corydalis capitata* differs from the *C. flexuosa* Franchet with deeply serrate petals, and the peculiar, thin, strictly erect lateral branches. *Corydalis schistostigma* is unique in the *C. curviflora* Maximowicz ex Hemsley group, in the deeply cleft stigma and very forward-projecting crests to the inner petals, and possibly has its affinities more to the north and northwest in the Hengduan Mountains.

**Key words:** China, *Corydalis*, Fumariaceae, IUCN Red List, Sichuan.

Chaping Mountain, with an elevation of 4990 m at Jiuding peak, is located in northwestern Sichuan, China. It is the nearest mountain above 4000 m, close to the Chengdu Plain. There are five natural reserves for protecting pandas and other wild animals in this mountain region. Because the main road runs along the Min River valley on the western side of the mountain and no roads reach the higher elevations, this area was neglected by botanists until 2002. During the past several years, Xin-Fen Gao and Yu-Lan Peng have explored the flora of this beautiful mountain. Among the botanical novelties are three new species of *Corydalis* DC. (Fumariaceae), which are described below. Magnus Lidén and Shengxiang Yu studied the species in the field in 2006, and one example has also been studied in cultivation.


Herba perennis glabra vel raro superne minutiissime papillosa; rhizoma tenui vertebrata bulbo apicali tenue ovato; caules ramosi 2-a 4-foliati ascendentes ad basim debiles; folia radicale 2-a 4-te mata foliolis profunde divisae lobis parvis ovatis brevissime mucronatis; folia caulina radicibus similia sed minora, petiolis brevioribus. Racemi breves, 3-a 7-flori, in statu fruigine mole prominenti erecti; bracteae inferiores 1-a 4-2 filiformes subglobose subquadratis, acutae, imbricatis, suffuturatis, longe acutae, valde obtusae. Corolla 1-a 2 mm longa; corolla auricula; petalum supernum late

obtusum brevissime et angustissime cristatum crista apicem petali non attingenti, calcari leviter curvato; petalum infernum late obtusum basi marsupiatum; stigma divaricatum 8-papillatum. Capsula ex pedicello stricto pendula, anguste fusiformis, venis papillosis.

Herbs, perennial, glabrous; rhizome thin, short, vertical, with fleshy scales and a few remains of broad fleshy leaf bases, crowned by a leaf rosette from a narrowly ovate bulb, and emitting several long, thin, slightly fleshy pale roots, basal portion usually buried below scree or soil surface; stems few to several, thin, ascending, 5-16 cm, simple or often branched with 2 or 3(to 4) leaves, often suffused with brownish purple, especially the stems and undersides and apices of leaf lobes. Petioles of rosette leaves 2-10 cm, lamina 1-4 × 1-3 cm, 2- to 4-terinate with deeply lobed leaflets; the ultimate lobes narrowly obovate, shortly mucronate, 2-4 mm; primary leaflets long-stalked, secondary ones shorter; lamina often densely and finely papillose abaxially, especially along veins. Racemes short, 3- to 7-flowered, not or scarcely elongating in fruit; lower bracts (1)2- to 3-terate, the upper ones smaller, less divided to entire, with acute lobes; pedicels thin, 7-10 mm, erect in fruit, smooth or finely papillose. Flowers pale to clear azure blue, sepals and veins sometimes with a purplish suffusion, the inner petals pale, but with the dorsal crests apically deeper blue, though usually white at the extreme apex, the purple blotch on the inner side of the inner petals tends to show through, especially in
herbarium specimens; sepal broadly triangular and deeply dentate to lanceolate and almost entire, 1–2 mm; outer petals with broad obtuse limbs, ericitate or usually with a shorter and narrower crest that does not reach the apex; upper petal with a slightly subsigmoidal curved, 9–10 mm spur into which a nectary protrudes ca. halfway or slightly more; inner petals 9–10 mm; the lower petal with a pouch or spurlet at the very base, abruptly widening into a 7-mm-wide, rounded limb; ovary with 12 to 16 ovules; stigma divaricate with 8 papillae. Capsule pendent from erect pedicels, narrowly fusiform, ca. 10 mm with 3 mm style, densely papillose along the veins, ca. 5–10 seeded.

**Distribution and habitat.** *Corydalis aenea* occurs usually on scree, sometimes in alpine meadows at 3700–4100 m. It is found only in Sichuan Province, China.

**IUCN Red List category.** *Corydalis aenea* is assessed as a taxon of Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

**Phenology.** *Corydalis aenea* flowers in late July to early September, fruits in late August to September.

**Etymology.** *Corydalis aenea* is named after Aenea, the island described in Greek mythology as the home of the sorceress Circe.

**Discussion.** The new species is placed in section *Elaineae* and is similar to the recently described *Corydalis panda* Liden & Y. W. Wang (Liden, 2006), but it is a much smaller and more delicate plant with the leaves more divided, the outer petals comparatively much broader (to 7 mm) and obtuse to shallowly emarginate with shorter and narrower crests, the lower petal with a distinct pouch at the base, the nectary longer, the ovary papillose, and ovules more numerous (12 to 16).


2. **Corydalis capitata** X. F. Gao, Liden, Y. W. Wang & Y. L. Peng, sp. nov. **TYPE:** China. Sichuan: Maoxian, Nanxin Zen, Anxiang, Wucailing, 3000 m, 26 June 2003 [l. & fr.], Xin-Fen Gao, Yu-Lan Peng & Hui-Li Zhao 5535 (holotype, CDBI), Figure 2.

Herba perennis glabra; rhizoma breve squamis subcassis imbricatis; caules erecti 4–ad 5-foliati suprae ramosi, ramis tenuebus strictis erectis paucifoliatis. Folia radicalia parva obtuso-triangularia bitemata foliosis profunde divisis lobis oblongis obtusis; folia caulina radicalibus similis breviter petiolata vel sessilis. Racemi terminales densissime multiflori in statu fructifico elongati; racemi axillares pauciflori; bracteae petiolatae anguste obovatae lobis parvis parvis lateralis prolatis praetereant; bracteae infimae foliis, superne simulantes; pedicelli erecti termini 7–12 mm longi, in fructu ad 20–30 mm elongati. Sepala albida, ca. 2.5 × 2 mm ovata circumcinta; corolla purpurea; petala extensoria margine dentata, crista lata acutissime dentata apice petali conspicue superant; calcri brevi; petala interna pallida; stigma rotundum 8-papillatum. Capsula linearia-oblonga ex pediculo stricto pendula 11–18-semena; semina parva nitida.

**Herbs.** perennial, glabrous, self-compatible; rhizome short, with a rather small hibernation bud, and a few coarse long linear roots; stems to several, angular, erect, 35–75 cm, with only 4 or 5 leaves in the upper 1/2 or 2/3. Radical leaves small, like the cauline; cauline leaves shortly stalked (upper ones subsessile), bright green adaxially, glaucous abaxially, rounded-triangular in outline, biteminate to subbinicate, with leaflets deeply cleft into oblong obtuse lobes. From the axils of the leaves, strict erect very thin flowering branches are produced, with few and tiny cauline leaves; terminal raceme with 10 to 25 flowers, very dense at anthesis, or perhaps with the basalmost flower more distant, the raceme elongating in fruit; racemes of axillary branches with fewer flowers; bracts narrowly obovate with 1 to 3 pairs of narrow lateral lobes, narrowed into a distinct stalk, 10–20 mm; lower bracts like the upper leaves; pedicels 7–12 mm in flower, elongating to 20–30 mm in fruit, straight and ± erect. Sepals rather large, ovate, margins dentate, ca. 2.5 × 2 mm, white; outer petals purple with broad short blue-purple crests that reach conspicuously beyond the apex of the petal and are sharply dentate, as are the rather wide margins of the limbs; spur comparatively short, ca. 8 mm, oblong, slightly curved, with robust nectary 2/3 as long; inner petals pale, 11–13 mm. Capsules pendent from erecto-patent pedicels, linearly oblong, ca. 11–18-seeded, to 20 mm with 2 mm style; seeds smooth, very small, ca. 1 mm.

**Distribution and habitat.** *Corydalis capitata* has been found only in a very restricted area above the villages Chashankedu and Anxiang from 3000–3300 m, in deep fertile soil in lush forests. It grows in sparse forest with some disturbance by yak, cow, and sheep.

**IUCN Red List category.** *Corydalis capitata* is assessed as a taxon of Least Concern (LC), according to IUCN Red List criteria (IUCN, 2001).

**Phenology.** *Corydalis capitata* flowers in June and early July and with the occasional late raceme into
early August. It is unmistakable with its densely packed flower heads. In late autumn, when the stems wither, several fresh basal leaf rosettes are formed.

**Etymology.** The specific epithet refers to the head-like inflorescence (from the Latin "caput," meaning "head").

**Discussion.** *Corydalis capitata* has been sold through the Internet by the Chen Yi nursery in Beijing, and is presently in cultivation in Europe. The origin of these cultivars is unknown.

*Corydalis capitata* is placed in section *Elatae*; it is slightly similar to *C. calycosa* H. Chuang, but is easily distinguished by the very dense racemes, the smaller
purple flowers with sharply serrate crests and margins, the large sepals, and the peculiar thin erect lateral branches.


Herba perennis glabra; rhizoma tenuissimum lineare, bulbo apicali tenueissimo ovato, radicibus penisaris linearibus; caulis saepe solitarius tenuis erectus simplex uni- vel bifoliatus basi filiformis. Folia radicale rotundata ternata vel quinquata folioli late obovatis, petiolis filiformibus; folia caulina sessilia in lobos 3 ad 5 anguste lanceolatos vel oblongos usque ad basin secta. Racemi breves, 3- ad 9-florii; bracteae integres lanceolatae (bracteae inferiorae saepe pro parte taeniatae) pedicello erecto stricto tenues 10-15(=20) mm longos subaequantes vel eis breviores. Sepala minuta; corolla caerulea vel cyanea, saepe partim purpureo-saffusa; petalum supernum latum subhyalinum viridum sordidum curvatum, calcari subtus concus; cristae petalorum interiorum bene evolutae apices petalorum valde superantes; stigmas profundo bifidum in quaeque segmentum 4-papillato. Capsula ignota sed verissimelit ex pedicello stricto pendula.

Herbs, perennial, glabrous; rhizome thin, terminating in a shortly stalked tiny bulb with a leaf rosette, and with scattered thin slightly fleshy pale linear storage roots; stems few, thin, erect, 8-20 cm tall, simple, with 1 or 2 leaves in the upper 1/3. Radical leaves with petioles 1-10 cm, lamina rounded, 10-15 mm wide with 3 to 5 obovate leaves, dark green adaxially, glaucous abaxially, glabrous; cauline leaves sessile, cut to the base into 3 to 5 narrowly lanceolate lobes, 10-15(-20) mm. Racemes 3- to 9-flowered; bracts lanceolate, entire or the lowermost often divided; pedicels straight, thin, erect, 10-15(-20) mm. Sepals very small, 0.2-0.4 mm; corolla deep blue, with pinkish purple markings on keels of outer petals, sometimes with a pinkish suffusion toward the spur, sepals, and apex of inner petals (crest excepted), rarely pale blue; upper petal narrowly ciliate, acute and curved upward at apex, with an 8-9 mm conical spur with nectary reaching more than halfway; lower petal with very short claw, gradually broadened into a broad rounded acuminate limb to 7 mm wide; inner petals 9 mm with very pronounced dorsal crests that protrude conspicuously beyond the junction of the inner petals; ovary with 14 to 16 ovules; stigma very deeply cleft, each half with 4 papillae, of which the basal ones show a tendency to be geminate. Fruit not known.

Distribution and habitat. Corydalis schistostigma can sometimes be found in grassland, but prefers more rocky habitats, usually on limestone, from 3500-3900 m. It is found only in Sichuan, China.

IUCN Red List category. Corydalis schistostigma is assessed as a taxon of Least Concern (LC), according to IUCN Red List criteria (IUCN, 2001).

Phenology. Corydalis schistostigma flowers in late July to August.

Etymology. The specific epithet refers to the deeply cleft stigma (from the Greek “schizein,” meaning “to cleave”).

Discussion. Corydalis schistostigma is placed in section Fasciculatae series Caryophylloides. The most similar species to C. schistostigma is C. shensiana Lidén ex C. Y. Wu, H. Chuang & Z. Y. Su, which has more numerous and more divided leaves, 7- to 15-flowered racemes, more or less dentate outer petals, a short and obtuse spur, shorter nectary, white-tipped inner petals (concolorous in C. schistostigma), and stigma with prominent basal lobes. Corydalis cytisiflora (Fedde) Lidén s.l., which is abundant in grasslands at the type locality, differs substantially from the new species in the broadly crested outer petals, numerous flowers, and stigma cleft up to half with rounded basal lobes (vs. stigma very deeply cleft without obvious basal lobes).

Paratypes. CHINA. Sichuan: Maoxian, Tumen Zhen, Guangming, Guolupengzi [31°39.289′N, 103°57.232′E], 3800-4000 m, meadow, 5 Aug. 2002, Xin-Fen Gao, Yu-Lan Peng & Wei-Guo Tu 3147 (CDBI); Maoxian, Fengyi Zhen, Jingzhou Cun, Dagou Zu, Sanjiaojia [31°39.25′N, 103°56.87′E], 3800-3900 m, limestone, 30 July 2006, M. Lidén 06-07, 13 (PE, UPS); Shiguxiang, Chashankedu, Shilinsi, 3500-3800 m, 1 Aug. 2006, M. Lidén 06-20 (PE, UPS).

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