

30. MICROULA Bentham in Bentham & J. D. Hooker, Gen. Pl. 2: 853. 1876.

微孔草属 wei kong cao shu

Herbs biennial, usually hispid or bristly, rarely pubescent. Roots terete. Stems erect to ascending, frequently branched from base, sometimes very short. Leaves alternate, margin entire, rarely with obscure teeth; lateral veins few, not conspicuous. Cymes short, crowded, rarely elongated, becoming spiciform or racemelike, sometimes 1-flowered at a branching point opposite a leaf; bracts obscure. Calyx 5-parted, slightly enlarged in fruit, subtending nutlets. Corolla blue or white, low salverform; throat 5-appendaged; appendages opposite lobes; limb 5-lobed, spreading horizontally. Stamens included. Ovary 4-parted. Style included; stigma compressed globose. Gynobase nearly flat or low fastigiata. Nutlets ovoid or long turbinate, slightly dorsiventrally, rarely slightly bilaterally compressed, or abaxial and adaxial surfaces extended and becoming long turbinate, usually tuberculate, glabrous or short pubescent, rarely with glochids, abaxially usually with an aperture, aperture margin 1- (or 2)-layered; attachment scar extending from base to apex adaxially.

Twenty-nine species: Bhutan, N and NE India, Nepal, Sikkim; all in China.

- 1a. Plants apparently almost stemless with a rosette of leaves flat on ground and a very dense central cluster of flowering branches; nutlets with glochids 29. *M. tibetica*
- 1b. Plants with normal stems, stem leaves, and laxer inflorescences; nutlets without glochids.
 - 2a. Nutlets long turbinate, abaxial aperture orbicular, at apex of nutlets 23. *M. turbinata*
 - 2b. Nutlets ovoid.
 - 3a. Abaxial aperture of nutlets deltate or triangular, with a membranous emergence inside margin, attachment scar at base adaxially.
 - 4a. Plants not bristly; corolla limb 5–8 mm wide, tube 2–4 mm; abaxial aperture of nutlets deltate, 0.7–1 mm.
 - 5a. Stems densely hispid; leaves and calyx hirsute; inflorescences short, crowded; pedicel ca. 1 mm 24. *M. longituba*
 - 5b. Stems short strigose; leaves and calyx short strigose; inflorescences with many branches, widely spaced; pedicel 1–2.5 mm 25. *M. floribunda*
 - 4b. Stems and leaves bristly; corolla limb 2–3 mm wide, tube 1–1.8 mm; abaxial aperture of nutlets triangular, 0.9–1.5 mm.
 - 6a. Leaf blade spatulate-linear to linear, 2–7 mm wide, abaxially with few bristles along midvein only 26. *M. stenophylla*
 - 6b. Leaf blade narrowly oblong to oblanceolate, 5–15 mm wide, short strigose, abaxially with scattered bristles 27. *M. diffusa*
 - 3b. Abaxial aperture of nutlets oblong, elliptic, to orbicular, without emergence inside margin, sometimes abaxial aperture absent.
 - 7a. Attachment scar of nutlet apical.
 - 8a. Stems 15–45 cm, bristly; bracts to 2 mm; abaxial aperture of nutlets frequently occupying entire abaxial surface 22. *M. trichocarpa*
 - 8b. Stems 3–7 cm, pubescent; bracts of inflorescences 3–8 × 3–6 mm; nutlets without abaxial aperture 28. *M. tangutica*
 - 7b. Attachment scar of nutlet basal to middle adaxially.
 - 9a. Nutlets slightly bilaterally compressed, without abaxial aperture 21. *M. efoveolata*
 - 9b. Nutlets ± dorsiventrally compressed, with abaxial aperture.
 - 10a. Nutlets glabrous, slightly shiny, black spotted 20. *M. leiocarpa*
 - 10b. Nutlets tuberculate or wrinkled.
 - 11a. Stems bristly.
 - 12a. Basal and lower stem leaves with base rounded to broadly cuneate, abruptly constricted into a petiole.
 - 13a. Corolla limb 5–9(–11) mm wide 8. *M. sikkimensis*
 - 13b. Corolla limb ca. 2.5 mm wide 9. *M. blepharolepis*
 - 12b. Basal and lower stem leaves with base attenuate to cuneate.
 - 14a. Corolla limb pubescent outside; nutlets ca. 3 mm, abaxial aperture ca. 2.2 mm 7. *M. forrestii*
 - 14b. Corolla limb glabrous outside; nutlets less than 2.6 mm, abaxial aperture usually less than 1 mm (ca. 2.2 mm in *M. involucriformis*).
 - 15a. Terminal inflorescences closely subtended by 2 bractlike leaves 1.5–3.5 cm; bracts 4–7 mm; nutlets ca. 2.6 mm, abaxial aperture ca. 2.2 mm 10. *M. involucriformis*
 - 15b. Terminal inflorescences subtended by 1 leaf, if 2 then not adjacent, or smaller than 1 cm; bracts extremely small,

- nutlets less than 2 mm, abaxial aperture less than 1 mm.
- 16a. Corolla limb 3.8–5.5(–9) mm wide.
- 17a. Leaf blade mostly elliptic, to 2.7 cm; corolla limb ca. 5.5 mm wide 2. *M. muliensis*
- 17b. Leaf blade lanceolate to oblong, to 5.5 cm; corolla limb 3.8–9 mm wide 13. *M. pseudotrichocarpa*
- 16b. Corolla limb 2–3 mm wide.
- 18a. Upper stem leaves elliptic to oblong, 0.5–1.5 cm; corolla blue 3. *M. pustulosa*
- 18b. Upper stem leaves oblong to lanceolate, 1–6 cm; corolla white or with light yellow throat.
- 19a. Stem leaves oblong, 1–2.2 cm; stems to 11 cm tall; corolla white 15. *M. polygonoides*
- 19b. Stem leaves narrowly lanceolate to narrowly oblong, 1.5–6 cm; stems ca. 5 cm tall; corolla light blue with light yellow throat 18. *M. hispidissima*
- 11b. Stems hispid or glabrous or nearly so.
- 20a. Basal part of stem glabrous or nearly so.
- 21a. Petiole of lower stem leaves long; leaf blade ovate, cuneate-orbicular to cordate-cuneate at base; pedicels of lowermost flowers 2–4 cm 6. *M. longipes*
- 21b. Petiole of lower stem leaves less than 3 cm; leaf blade broadly cuneate to attenuate at base; pedicels of lowermost flowers less than 2(–3.2) cm.
- 22a. Plants sparsely pubescent; leaves glabrous abaxially; pedicel 0.8–1 mm; calyx glabrous outside; nutlets ca. 3 mm, abaxial aperture ca. 2.8 mm 19. *M. rockii*
- 22b. Plants hispid; leaves pubescent on abaxial surface; pedicel 8–32 mm; calyx pubescent outside; nutlets less than 2.7 mm, abaxial aperture 0.6–2.5 mm.
- 23a. Stem leaves elliptic to narrowly ovate, short strigose; pedicel 1–3.2 cm; calyx densely short strigose; corolla limb 3–4 mm wide; abaxial aperture of nutlets 1.5–2.5 mm 5. *M. bhutanica*
- 23b. Stem leaves narrowly oblong to narrowly elliptic, glabrous or sparsely short strigose abaxially; pedicel to 0.2 cm; calyx pubescent along midvein; corolla limb 5–7 mm wide; abaxial aperture of nutlets ca. 0.6 mm 14. *M. oblongifolia*
- 20b. Basal part of stem ± hispid.
- 24a. Stem leaves elliptic to narrowly ovate.
- 25a. Aperture of nutlets at apex of abaxial surface 1. *M. ovalifolia*
- 25b. Aperture of nutlets at middle of abaxial surface.
- 26a. Stems spreading hispid or bristly, 11–19 cm; nutlets 1.6–1.8 mm, abaxial aperture 0.7–0.9 mm, attachment scar near base 2. *M. muliensis*
- 26b. Stems densely short hispid, to 8 cm; nutlets ca. 1.5 mm, abaxial aperture ca. 0.5 mm, attachment scar at middle on adaxial surface 4. *M. myosotideia*
- 24b. Stem leaves spatulate or oblanceolate.
- 27a. Flowers in spikelike branches, with distinct bracts; bracts leaflike, oblong, 3–9 mm 17. *M. younghusbandii*
- 27b. Flowers few, forming short crowded inflorescences, with obscure bracts.
- 28a. Stems to 5 cm.
- 29a. Leaf blade spatulate, 1.4–4.5 cm × 3.5–8 mm; corolla limb 3–3.5 mm wide 16. *M. spatulata*
- 29b. Leaf blade narrowly oblong to narrowly oblong-oblanceolate, 0.7–1.9 cm × 2–4 mm; corolla limb 2–2.5 mm wide 17. *M. younghusbandii*
- 28b. Stems more than 12 cm.
- 30a. Stems with solitary leaf-opposed flowers at branching points above middle 12. *M. ciliaris*
- 30b. Stems without solitary leaf-opposed flowers.
- 31a. Corolla limb ca. 2 mm wide, appendages lunate,

- ca. 0.2 mm; nutlets ca. 2.4 mm, abaxial aperture ca. 1 mm, attachment scar near base 11. *M. jilongensis*
- 31b. Corolla limb 5–7 mm wide, appendages nearly trapeziform, ca. 0.5 mm; nutlets ca. 1.8 mm, abaxial aperture ca. 0.4 mm, attachment scar at middle or below on adaxial surface 14. *M. oblongifolia*

1. *Microula ovalifolia* (Bureau & Franchet) I. M. Johnston, Contr. Gray Herb. 73: 62. 1924.

卵叶微孔草 luan ye wei kong cao

Stems erect or nearly so, frequently branched from base, 2.5–32 cm tall, short hispid. Basal and lower stem leaves petiolate, narrowly elliptic to spatulate; upper stem leaves sessile or petioles short, to 1.4 cm; leaf blade narrowly elliptic to ovate, 0.9–4.5 cm × 4–14 mm, short strigose, base attenuate, broadly cuneate to rounded, apex subacute, obtuse, to rounded. Terminal inflorescences frequently ± elongated and spikelike, 1.4–3 cm, few to many flowered; axillary inflorescences few flowered. Pedicel 1–5 mm. Calyx 2–2.5 mm; lobes narrowly triangular, densely pubescent outside. Corolla blue; tube ca. 2 mm, glabrous; appendages trapeziform or low trapeziform, ca. 0.5 mm, short pubescent; limb 3–7 mm wide, glabrous; lobes suborbicular to obovate. Nutlets ovoid, ca. 1.8 × 1 mm, finely tuberculate, short pubescent; aperture apical, elliptic to suborbicular, ca. 0.5 mm; attachment scar near base.

• Alpine meadows, thickets, valleys; 3300–4400 m. Sichuan, Xizang.

- 1a. Stems 9–32 cm; corolla limb 5–7 mm wide, glabrous outside 1a. var. *ovalifolia*
- 1b. Stems ca. 2.5 cm; corolla limb ca. 3 mm wide, sparsely pubescent outside 1b. var. *pubiflora*

1a. *Microula ovalifolia* var. *ovalifolia*

卵叶微孔草 (原变种) luan ye wei kong cao (yuan bian zhong)

Schistocaryum ovalifolium Bureau & Franchet, J. Bot. (Morot) 5: 105. 1891.

Stems 9–32 cm tall. Corolla limb 5–7 mm wide, glabrous outside. Fl. Jul-Sep.

• Alpine meadows, thickets; 3300–4400 m. W Sichuan.

1b. *Microula ovalifolia* var. *pubiflora* W. T. Wang, Acta Phytotax. Sin. 18: 112. 1980.

毛花卵叶微孔草 mao hua luan ye wei kong cao

Stems ca. 2.5 cm tall. Corolla limb ca. 3 mm wide, sparsely pubescent outside.

• Valleys; ca. 4200 m. Xizang (Yadong Xian).

2. *Microula muliensis* W. T. Wang, Acta Phytotax. Sin. 18: 270. 1980.

木里微孔草 mu li wei kong cao

Stems branched from base, 11–19 cm tall, sparsely

spreading hispid or bristly. Petiole of basal and lower leaves to 1 cm; leaf blade elliptic-ovate to spatulate-elliptic, 1.4–2.7 cm × 4–10 mm, base attenuate to broadly cuneate, apex obtuse to rounded; upper stem leaves sessile, elliptic, smaller, 4–14 mm, densely short strigose, abaxially with more hairs. Inflorescences terminal and axillary, short, crowded, several flowered; bracts narrowly elliptic, to 2 mm. Pedicel ca. 1 mm. Calyx ca. 2 mm, to 4 mm in fruit, parted nearly to base; lobes linear, short strigose, margin densely short hispid, apex obtuse. Corolla dark blue; tube ca. 1.8 mm, glabrous; appendages deltate, ca. 0.7 mm, margin short pubescent; limb ca. 5.5 mm wide, glabrous; lobes suborbicular. Nutlets ovoid, 1.6–1.8 × 1–1.2 mm, finely tuberculate, short pubescent; aperture above middle, narrowly elliptic, 0.7–0.9 mm; attachment scar near base. Fl. Aug.

• Alpine meadows; ca. 3500 m. Sichuan (Muli Xian).

3. *Microula pustulosa* (C. B. Clarke) Duthie, Bull. Misc. Inform. Kew 1912: 39. 1912.

小果微孔草 xiao guo wei kong cao

Stems ascending, usually branched from base, 4–8 cm tall, densely short hispid, with few intermixed bristles. Petiole of basal and lower stem leaves to 6 mm; leaf blade spatulate to oblong; upper stem leaves short petiolate to sessile, elliptic to oblong, 0.5–1.5 cm × 2–5 mm, densely short strigose, base attenuate to broadly cuneate, apex subacute to obtuse. Pedicel to 3 mm, densely short strigose. Flowers opposite leaves, or few and crowded in terminal short inflorescences. Calyx ca. 1.8 mm, parted nearly to base; lobes narrowly triangular, densely short pubescent outside. Corolla blue; tube 1–1.2 mm; appendages lunate, ca. 0.2 mm, with hairs; limb 2.5–3 mm wide; lobes broadly elliptic-obovate. Nutlets ovoid, 1.5–1.8 × ca. 1.2 mm, finely tuberculate, glabrous or short pubescent; aperture above middle, suborbicular, 0.2–0.3 mm wide; attachment scar at lower part of adaxial surface. Fl. Aug-Sep.

Alpine meadows, gravelly slopes; 4100–4700 m. Qinghai, Xizang [Bhutan, India].

- 1a. Leaves densely short strigose; nutlets short pubescent 3a. var. *pustulosa*
- 1b. Leaves densely strigose, bristly; nutlets glabrous 3b. var. *setulosa*

3a. *Microula pustulosa* var. *pustulosa*

小果微孔草 (原变种) xiao guo wei kong cao (yuan bian zhong)

Eritrichium pustulosum C. B. Clarke in J. D. Hooker, Fl. Brit. India 4: 164. 1885.

Leaves densely short strigose. Nutlets finely tuberculate, short pubescent.

Alpine meadows, gravelly slopes; 4100–4700 m. S Qinghai, S and SE Xizang [Bhutan, NE India].

3b. *Microula pustulosa* var. *setulosa* W. T. Wang, Acta Phytotax. Sin. 18: 112. 1980.

刚毛小果微孔草 gang mao xiao guo wei kong cao

Stem leaves densely strigose and bristly. Nutlets glabrous.

- Gravelly slopes; 4200–4300 m. NE Xizang (Naqu Xian).

4. *Microula myosotidea* (Franchet) I. M. Johnston, Contr. Gray Herb. 73: 62. 1924.

鹤庆微孔草 he qing wei kong cao

Schistocaryum myosotideum Franchet, Bull. Mens. Soc. Linn., Paris 2: 903. 1891; *Anoplocaryum myosotideum* (Franchet) Brand.

Stems erect, branched from base or not branched, 1.4–8 cm tall, densely short hispid. Basal and lower stem leaves short petiolate, spatulate; upper stem leaves sessile or nearly so, narrowly elliptic, 0.6–1.6 cm × 2–2.5 mm, densely short strigose, base attenuate to broadly cuneate, apex obtuse to rounded. Flowers opposite leaves on lower part of stems and upward, or several flowers at apices of stems and branches forming short inflorescences. Calyx ca. 2 mm, parted nearly to base; lobes linear-lanceolate, sparsely long hispid outside and along margin, short strigose inside at apex. Corolla blue, glabrous; tube ca. 1.8 mm; appendages trapeziform, ca. 0.4 mm; limb ca. 4 mm wide; lobes orbicular-ovate. Nutlets broadly ovoid, ca. 1.5 × 1.2 mm, finely tuberculate, glabrous; aperture above middle, elliptic, ca. 0.5 mm; attachment scar at middle of adaxial surface. Fl. Aug.

- Alpine meadows; ca. 3800 m. Yunnan (Heqing Xian).

5. *Microula bhutanica* (T. Yamazaki) H. Hara, J. Jap. Bot. 51: 9. 1976.

大孔微孔草 da kong wei kong cao

Actinocarya bhutanica T. Yamazaki, J. Jap. Bot. 46: 52. 1971.

Stems erect or ascending, frequently branched from base, or not branched, 5–22 cm tall, sparsely short hispid or glabrescent below. Petiole of basal and lower leaves 0.6–3 cm; leaf blade spatulate to elliptic, 2.5–6.5 × 0.7–2 cm, base attenuate or broadly cuneate, apex subacute to subobtuse; upper stem leaves short petiolate to sessile, narrowly elliptic to narrowly ovate or ovate, 0.6–3 cm, short strigose. Pedicel of lower flowers 1–2.2(–3.2) cm, sparsely hispid above. Flowers opposite leaves on lower or middle part of stems and above; lower flowers thin, long pedicellate; upper flowers forming terminal short crowded inflorescences. Calyx 1.5–2 mm, to 3 mm in fruit, parted nearly to base; lobes narrowly triangular, densely short strigose outside, sparsely pubescent inside. Corolla blue, glabrous; tube 1.2–1.8 mm; appendages

lunate, ca. 0.2 mm; limb 3–4 mm wide, glabrous; lobes suborbicular. Nutlets ovoid, 2.2–2.7 × 2–2.2 mm, finely tuberculate or wrinkled, sparsely short pubescent; aperture elliptic to suborbicular, 1.5–2.5 mm, on upper 2/3 to entire abaxially; attachment scar at middle of adaxial surface. Fl. Jul–Sep.

Barren slopes, rock crevices, forest margins; 3000–4100 m. SW Sichuan (Muli Xian), N Yunnan [Bhutan].

6. *Microula longipes* W. T. Wang, Acta Phytotax. Sin. 18: 272. 1980.

长梗微孔草 chang geng wei kong cao

Stems erect, not branched or with a single branch above, 9–18 cm tall, glabrous below, sparsely short hispid above. Basal leaf 1; lower stem leaves long petiolate; upper stem leaves subsessile; petiole 0.8–6 cm, sparsely short hispid; leaf blade elliptic-ovate to ovate, 1.5–10 × 1–2.8 cm, sparsely short strigose, base broadly cuneate to cordate-cuneate, apex mucronate. Flowers opposite leaves on middle or upper part of stems. Pedicel of lower flowers thin, 2–4 cm; pedicel of upper flowers 2–10 mm, sparsely short pubescent. Calyx ca. 1.8 mm, parted nearly to base; lobes narrowly triangular, glabrous outside, sparsely pubescent inside, apex subacute, markedly 3-veined. Corolla blue, glabrous; tube ca. 1.2 mm; appendages lunate, ca. 0.2 mm; limb ca. 4.5 mm wide, glabrous; lobes suborbicular. Anthers narrowly oblong, ca. 0.5 mm. Nutlets unknown. Fl. Jul.

- Slopes, forest margins; 3300–3500 m. Sichuan (Muli Xian).

7. *Microula forrestii* (Diels) I. M. Johnston, Contr. Gray Herb. 81: 83. 1928.

丽江微孔草 li jiang wei kong cao

Omphalodes forrestii Diels, Notes Roy. Bot. Gard. Edinburgh 5: 169. 1912; *Microula hirsuta* I. M. Johnston.

Stems erect, short branched, 20–30(–60) cm tall, densely spreading hispid. Lower stem leaves long petiolate; middle stem leaves short petiolate; upper stem leaves sessile, narrowly elliptic, 3–10 × 1–2.8 cm, hispid, base attenuate, margin entire, apex obtuse to rounded. Inflorescences terminating branches, ca. 1 cm wide, ca. 7-flowered, with 2 subtending leaves. Flowers pedicellate, crowded. Calyx 4–5.5 mm, parted nearly to base; lobes narrowly triangular, densely hirsute outside, long hispid inside. Corolla blue; tube ca. 2.5 mm, glabrous; appendages low trapeziform, ca. 1 mm, apex short pubescent; limb 6–7 mm wide; lobes orbicular-ovate, sparsely short strigose outside. Nutlets triangular-ovoid, ca. 3 × 2.3 mm, with irregular conical emergences; aperture narrowly oblong, ca. 2.2 mm; attachment scar above base adaxially. Fl. Jul.

- Alpine slopes. Yunnan.

8. *Microula sikkimensis* (C. B. Clarke) Hemsley, Hooker's Icon. Pl. 26: t. 2562. 1898.

微孔草 wei kong cao

Anchusa sikkimensis C. B. Clarke in J. D. Hooker, Fl.

Brit. India 4: 168. 1883; *Anoplocaryum limprichtii* Brand; *Tretocarya sikkimensis* (C. B. Clarke) Oliver.

Stems erect or ascending, not crowded, frequently branched from base, or not branched, 6–65 cm tall, bristly, sometimes sparsely strigose. Basal and lower stem leaves long petiolate, broadly lanceolate to ovate or narrowly ovate, 4–12 × 0.7–4.4 cm, base rounded to broadly cuneate, apex acute to acuminate, rarely obtuse; upper stem leaves gradually reduced upward, short petiolate to sessile, narrowly ovate to broadly lanceolate, short strigose, abaxially bristly along midvein, adaxially sparsely bristly, hairs discoid at base, base attenuate, margin entire. Inflorescences terminal, crowded, 0.5–1.5 cm wide, sometimes slightly elongated to ca. 2 cm; basal bracts leaflike, other bracts 0.5–2 mm. Pedicel densely short strigose. Calyx ca. 2 mm, to 3.5 mm in fruit, parted nearly to base; lobes linear to narrowly triangular, sparsely pubescent and long hispid outside, margin densely pubescent and short strigose inside. Corolla blue or blue-purple; tube 2.5–3.8 mm, glabrous; appendages low trapeziform or lunate, ca. 0.3 mm, glabrous or short pubescent; limb 5–9(–11) mm wide, glabrous; lobes suborbicular. Nutlets ovoid, ± dorsiventrally compressed, 2–2.5 × ca. 1.8 mm, with fine tubercles and short hairs; aperture in middle and upper parts of abaxial surface, narrowly oblong, 1–1.5 mm; attachment scar at center of adaxial surface. Fl. May–Sep.

Hillside meadows, thickets, forest margins, river banks, fields; 2900–4500 m. Gansu, Qinghai, SW Shaanxi, W Sichuan, SE Xizang, NW Yunnan [Bhutan, India, Nepal, Sikkim].

9. *Microula blepharolepis* (Maximowicz) I. M. Johnston, *J. Arnold Arbor.* 33: 72. 1952.

尖叶微孔草 *jiang ye wei kong cao*

Omphalodes blepharolepis Maximowicz, *Bull. Acad. Imp. Sci. Saint Pétersbourg* 37: 504. 1881.

Stems unbranched or short branched, 9–12 cm tall, spreading bristly. Leaf blade of lower stems ovate to narrowly ovate, 3–7 × 0.9–1.4 cm, base rounded, abruptly constricted into a petiole 3–3.2 cm, apex acute. Upper leaves gradually reduced upward; petiole short, bristly; leaf blade lanceolate, 1.5–4 mm, densely short strigose, base broadly cuneate to attenuate, apex acuminate. Inflorescences terminal or sometimes from upper axils, crowded, short; bracts lanceolate, 2–4 mm. Pedicel 0.5–2 mm. Calyx ca. 2 mm, parted nearly to base; lobes triangular-lanceolate, densely hirsute outside, and sparsely short strigose inside. Corolla tube ca. 1.8 mm, glabrous; appendages low trapeziform, ca. 0.5 mm, apex pubescent; limb ca. 2.5 mm wide, glabrous; lobes suborbicular. Anthers narrowly oblong, ca. 0.6 mm. Nutlets tuberculate.

• Qinghai (Xinghai Xian).

10. *Microula involucriformis* W. T. Wang, *Acta Phytotax. Sin.* 18: 273. 1980.

总苞微孔草 *zong bao wei kong cao*

Stems branched from lower part, ca. 48 cm tall, ca. 4 mm in diam., bristly; branches to 10 cm. Lower and middle stem leaves petiolate; leaf blade spatulate-oblong to narrowly

oblong, ca. 6.5 × 1.5–1.9 cm, base attenuate to cuneate, apex subacute; upper leaves sessile, long elliptic to narrowly ovate, 4–5.8 cm, densely strigose, sparsely bristly. Inflorescences terminal, 5–14 mm wide; subtending leaves usually 2, sessile, orbicular-ovate to broadly ovate, 1.5–3.5 cm; bracts orbicular-ovate to ovate, 4–7 × 3–6 mm. Flowers short pedicellate, crowded. Calyx ca. 2.8 mm, parted to base; lobes linear-lanceolate, short strigose, margin densely long hispid, with intermixed bristles. Corolla blue; tube ca. 2.2 mm, glabrous; appendages trapeziform, ca. 0.3 mm, apex minutely hispid; limb ca. 4.5 mm wide; lobes orbicular-ovate, glabrous. Nutlets ovoid, ± dorsiventrally compressed, ca. 2.6 × 2 mm, sparsely tuberculate; aperture narrowly oblong, ca. 2.2 mm; attachment scar at center of adaxial surface. Fl. Jun–Jul.

• Mountains; ca. 3100 m. Sichuan (Baoping Xian).

11. *Microula jilongensis* W. T. Wang, *Acta Phytotax. Sin.* 18: 112. 1980.

吉隆微孔草 *ji long wei kong cao*

Stems several, branched from base, ca. 12 cm tall, appressed or spreading, moderately densely minute hispid, not bristly. Petiole of basal and lower stem leaves to 1.5 cm; leaf blade narrowly oblanceolate to narrowly oblong, 3–4 cm × 5–7 mm, base attenuate, apex subobtuse to subacute; upper leaves sessile, oblong to narrowly oblong, 1.5–3.5 cm, moderately densely short strigose. Inflorescences terminal; bracts triangular to narrowly elliptic, 1–6 mm. Pedicel and inflorescence branches gray short strigose. Flowers crowded. Calyx ca. 2 mm, parted nearly to base; lobes narrowly triangular, densely hispid outside, apex sparsely strigose inside. Corolla blue; tube ca. 1.2 mm, glabrous; appendages lunate, ca. 0.2 mm, apex short pubescent; limb ca. 2 mm wide, glabrous; lobes suborbicular. Anthers narrowly elliptic, ca. 0.7 mm. Nutlets ovoid, ca. 2.4 × 1.5 mm, with few tubercles, glabrous; aperture in upper part of abaxial surface, narrowly oblong, ca. 1 mm; attachment scar near base. Fl. Jul–Aug.

• Meadows; ca. 4000 m. Xizang (Gyirong Xian).

12. *Microula ciliaris* (Bureau & Franchet) I. M. Johnston, *Contr. Gray Herb.* 73: 62. 1924.

巴塘微孔草 *ba tang wei kong cao*

Schistocaryum ciliare Bureau & Franchet, *J. Bot. (Morot)* 5: 105. 1891; *Omphalodes ciliaris* (Bureau & Franchet) Brand.

Stems erect, to 14 cm tall, sparsely short strigose and spreading hispid; branches with 2 leaves subtending inflorescences. Basal and lower stem leaves long petiolate, spatulate, 2.8–4.7 cm × 4–9 mm, base attenuate, apex obtuse; upper stem leaves ± sessile, narrowly oblong to spatulate-oblanceolate, 1.8–3.4 cm, short strigose, apex acute. Inflorescences terminal, crowded, 5–10 mm wide; bracts narrowly triangular to linear-lanceolate, 2–5 mm; upper branches with flowers at branching points, opposite leaves. Pedicel 0.5–2.5 mm. Flowers long pedicellate. Calyx ca. 3 mm, parted to base; lobes triangular-lanceolate, sparsely short strigose, margin densely pubescent. Corolla blue, glabrous; tube ca. 2 mm; appendages low trapeziform, ca. 0.5 mm; limb

ca. 8 mm wide; lobes suborbicular. Fl. Jun.

- Alpine meadows; ca. 3800 m. SW Sichuan.

13. *Microula pseudotrichocarpa* W. T. Wang, Acta Phytotax. Sin. 18: 274. 1980.

甘青微孔草 gan qing wei kong cao

Stems erect to ascending, branched from base or above middle, 10–44 cm tall, sparsely strigose and spreading bristly. Basal and lower stem leaves long petiolate, lanceolate-oblong to narrowly spatulate-oblong to oblong, (1–)3–5.5 × 5–15 cm, base attenuate, apex ± acute; upper stem leaves ± sessile, narrowly elliptic to narrowly oblong, smaller, 1–3 cm, strigose, sparsely bristly. Inflorescences terminal or axillary, initially crowded, subglobose, to 1.5 cm in fruit, sometimes with a long pedicellate flower opposite a leaf at branching on middle of stem; bracts lanceolate to narrowly elliptic, 1–4 cm. Pedicel to 1 mm, to 5 mm in ebracteate flower below inflorescences. Calyx 2–2.5 mm, short strigose and sparsely hirsute, parted nearly to base; lobes linear-triangular. Corolla blue, glabrous; tube 1.5–2(–3) mm; appendages low trapeziform or lunate, ca. 0.3 mm; limb 3.8–9 mm wide; lobes broadly ovate. Nutlets ovoid, ca. 2 × 1.2 mm, with fine tubercles and short hairs; aperture oblong, ca. 1 mm; attachment scar near middle adaxially. Fl. Jun–Aug.

- Alpine meadows; 2200–4600 m. Gansu, E Qinghai, Sichuan, Xizang.

- 1a. Corolla limb 3.8–5.5 mm wide 13a. var. *pseudotrichocarpa*
 1b. Corolla limb 7–9 mm wide 13b. var. *grandiflora*

13a. *Microula pseudotrichocarpa* var. *pseudotrichocarpa*

甘青微孔草 (原变种) gan qing wei kong cao (yuan bian zhong)

- Corolla limb 3.8–5.5 mm wide.
 • Alpine meadows; 2200–4500 m. Gansu, E Qinghai, NW Sichuan, E Xizang.

13b. *Microula pseudotrichocarpa* var. *grandiflora* W. T. Wang, Acta Phytotax. Sin. 18: 274. 1980.

大花甘青微孔草 da hua gan qing wei kong cao

- Corolla limb 7–9 mm wide.
 • Alpine meadows; 3000–4600 m. Sichuan (Muli Xian), Xizang (Lhasa Shi).

14. *Microula oblongifolia* Handel-Mazzetti, Symb. Sin. 7: 821. 1936.

长圆微孔草 chang yuan wei kong cao

Stems frequently several from base, 16–20 cm tall, densely nearly spreading hispid and sparsely bristly, or glabrous on lower parts. Lower stem leaves petiolate; upper stem leaves sessile, spatulate-oblong to narrowly oblong or narrowly elliptic, 1–7 × 4–11 cm, sparsely short hispid

or abaxially glabrous or sparsely short strigose along midvein, base attenuate to broadly cuneate, apex ± acute to obtuse. Inflorescences terminal, 5–7 mm wide, few flowered. Pedicel to 2 mm. Flowers crowded. Calyx ca. 2 mm, parted nearly to base; lobes lanceolate, hirsute or pubescent only along midvein outside. Corolla blue, glabrous; tube ca. 1.8 mm; appendages nearly trapeziform, ca. 0.5 mm; limb 5–7 mm wide; lobes orbicular-obovate. Nutlets triangular-ovoid, ca. 1.8 × 1.5 mm, with fine conical tubercles and short hairs; aperture suborbicular, ca. 0.4 mm in diam.; attachment scar at middle or below on adaxial surface. Fl. Jun–Jul.

- Alpine meadows, forests, forest margins; 3200–3700 m. Yunnan.

- 1a. Stems ± spreading hispid, sparsely bristly; leaf blade sparsely short hispid; calyx hirsute; nutlet attachment scar at middle of adaxial surface 14a. var. *oblongifolia*
 1b. Stems glabrous on lower parts, sparsely strigose at apex; abaxial surface of leaf blade glabrous or sparsely short strigose along midvein only; calyx glabrous except for pubescent midvein outside; nutlet attachment scar below middle of adaxial surface 14b. var. *glabrescens*

14a. *Microula oblongifolia* var. *oblongifolia*

长圆微孔草 (原变种) chang yuan wei kong cao (yuan bian zhong)

Stems ± spreading hispid, sparsely bristly. Leaf blade sparsely short hispid. Calyx hirsute. Nutlet attachment scar at middle of adaxial surface.

- Alpine meadows; 3200–3400 m. Yunnan (Yulong Shan of Lijiang Xian).

14b. *Microula oblongifolia* var. *glabrescens* W. T. Wang, Acta Phytotax. Sin. 18: 275. 1980.

疏毛长圆微孔草 shu mao chang yuan wei kong cao

Stems glabrous on lower parts, sparsely strigose at apex. Abaxial surface of leaf blade glabrous or sparsely short strigose along midvein only. Calyx glabrous except for pubescent midvein outside. Nutlet attachment scar below middle on adaxial surface.

- Forests, forest margins; 3400–3700 m. Yunnan (Zhongdian Xian).

15. *Microula polygonoides* W. T. Wang, Acta Phytotax. Sin. 18: 275. 1980.

蓼状微孔草 liao zhuang wei kong cao

Stems branched from base, 6–11 cm tall, densely short strigose, somewhat spreading bristly; branches 3–6, gradually ascending or suberect, with short secondary branchlets to 2 cm. Lower stem leaves petiolate; upper stem leaves ± sessile, gradually reduced upward, narrowly oblong to oblong,

1–2.2 cm × 3–6 mm, abaxially densely short strigose, adaxially densely hirsute, sometimes hispid, sparsely bristly along margin, hairs discoid at base, base cuneate, apex acute. Flowers opposite leaves on lower part of stems, few borne in leaf axils and apices of branches. Pedicel less than 1 mm, to 1–2 mm in fruit, hispid. Calyx ca. 2 mm, to 3 mm in fruit; lobes narrowly triangular, hirsute outside. Corolla white, glabrous; tube ca. 1 mm; appendages lunate, ca. 0.2 mm; limb ca. 2 mm wide; lobes suborbicular. Nutlets ovoid, ca. 1.5 × 1 mm, finely tuberculate, glabrous; aperture at center. Fl. Aug–Sep.

- Hillsides; ca. 3300 m. Yunnan (Dêqên Xian).

16. *Microula spathulata* W. T. Wang, Acta Phytotax. Sin. 18: 276. 1980.

匙叶微孔草 *chi ye wei kong cao*

Stems gradually ascending, branched from base, 2.2–5 cm tall, densely obliquely spreading and appressed hispid. Basal and lower stem leaves long petiolate; petiole of upper stem leaves 0.2–1.8 cm; leaf blade spatulate, 1.4–4.5 cm × 3.5–8 mm, abaxially glabrous except for midvein and margin short strigose, adaxially more strigose, base attenuate, apex rounded to acute. Flowers opposite leaves. Pedicel of lower flowers 14–22 mm, 1–3 mm in upper flowers. Calyx ca. 2.8 mm, parted nearly to base; lobes narrowly triangular-lanceolate, densely pubescent outside, apex subobtuse. Corolla blue; tube ca. 2 mm, glabrous; appendages lunate, ca. 0.2 mm, sparsely short pubescent; limb 3–3.5 mm wide, glabrous; lobes suborbicular. Nutlets ovoid, ca. 1.8 mm, slightly wrinkled; aperture oblong to narrowly oblong, 1–1.5 mm; attachment scar below middle adaxially. Fl. Jun.

- Alpine meadows; ca. 3300 m. Yunnan (Zhongdian Xian).

17. *Microula younghusbandii* Duthie, Bull. Misc. Inform. Kew 1912: 40. 1912.

小微孔草 *xiao wei kong cao*

Eritrichium younghusbandii (Duthie) Brand; *Microula bothriospermoides* W. T. Wang.

Stems erect to gradually ascending, frequently branched from base, 1.5–5 cm tall, densely hispid. Basal and lower stem leaves ± sessile, narrowly oblong to oblong-ob lanceolate, 0.7–1.9 cm × 2–4 mm, short strigose, base attenuate, apex acute. Inflorescences bracteate on stems and branches; bracts narrowly oblong, 3–9 mm, densely strigose. Pedicel 1–4 mm. Flowers opposite leaves, or forming short and crowded or narrow and long spikelike branches. Calyx 1.5–1.7 mm, parted nearly to base; lobes triangular-lanceolate, densely hispid outside. Corolla blue-purple or white, glabrous; tube 1.2–1.3 mm; appendages low trapeziform, 0.2–0.4 mm; limb 2–2.5 mm wide; lobes suborbicular. Nutlets triangular-ovoid to broadly ovoid, 1.2–2 × 1–1.5 mm, finely tuberculate, glabrous; aperture elliptic to oblong, 0.5–0.8 mm, at middle; attachment scar at or below middle of adaxial surface. Fl. Jun–Sep.

- Alpine meadows, ravines, thickets; 3000–4200 m. Qinghai (Nangqên Xian), W Sichuan, S Xizang, NW Yunnan (Zhongdian Xian).

18. *Microula hispidissima* W. T. Wang, Acta Phytotax. Sin. 18: 113. 1980.

密毛微孔草 *mi mao wei kong cao*

Roots straight, to 20 cm, crowns 2–6 mm in diam. Stems branched from base, ca. 5 cm tall, densely spreading bristly. Leaves mostly petiolate, only uppermost sessile; petiole 0.5–2 cm; leaf blade spatulate, narrowly lanceolate to narrowly oblong, 1.5–6 cm × 4–10 mm, densely and minutely hispid, abaxially with long bristles along midvein and margin, adaxially sparsely hispid, hairs discoid at base, base attenuate, apex obtuse to subacute. Inflorescences terminal on branches; bracts narrowly elliptic, to 5 mm, densely hispid, bristly; flowers also at branching points on lower part of stems. Flowers few, crowded, short pedicellate. Calyx ca. 2.5 mm, parted nearly to base; lobes narrowly triangular, hirsute outside, margin densely short hispid. Corolla light blue; throat light yellow; tube ca. 1.4 mm, glabrous; appendages low trapeziform, ca. 0.3 mm, densely minutely hispid; limb ca. 3 mm wide; lobes orbicular-ovate, glabrous. Nutlets ovoid, ca. 1.8 mm, somewhat tuberculate; aperture above middle, elliptic, ca. 0.6 mm; attachment scar at middle of adaxial surface. Fl. Jun.

- Alpine meadows; ca. 3600 m. Xizang (Nyalam Xian).

19. *Microula rockii* I. M. Johnston, Contr. Gray Herb. 81: 82. 1928.

柔毛微孔草 *ruo mao wei kong cao*

Anoplocaryum rockii (I. M. Johnston) Brand.

Stems frequently branched from below, 6–20 cm tall, sparsely pubescent, usually glabrous below. Lower stem leaves petiolate; leaf blade spatulate to oblanceolate, 1.4–2.9 cm × 4–8 mm, base attenuate, apex rounded to obtuse; upper stem leaves sessile, elliptic to ovate, gradually reduced, 4–12 mm, abaxially glabrous, adaxially sparsely pubescent or glabrescent. Inflorescences several, crowded, or 1-flowered at apices of short branches. Pedicel 0.8–1 mm. Calyx blue, ca. 2 mm, parted nearly to base, glabrous outside, ciliate along margin, appressed pubescent inside. Corolla light blue, glabrous; tube (1.2–)1.8–2 mm; appendages nearly trapeziform, ca. 0.5 mm; limb 3.5–8 mm wide; lobes suborbicular. Nutlets ovoid, ca. 3 × 2 mm, sparsely short pubescent, finely tuberculate below; aperture narrowly oblong, ca. 2.8 mm; attachment scar at middle of adaxial surface. Fl. Jul.

- Alpine meadows; 3400–4000 m. SW Gansu (Xiahe Xian), E Qinghai.

20. *Microula leiocarpa* W. T. Wang, Acta Phytotax. Sin. 18: 277. 1980.

光果微孔草 *guang guo wei kong cao*

Stems suberect, branched from base, 2–3 cm tall, spreading bristly. Petiole 2–10 mm; leaf blade narrowly lanceolate to spatulate or narrowly oblong, 1–3.5 cm × 3–9 mm, strigose, base attenuate, apex acute to subobtuse. Inflorescences terminal, few flowered; bracts narrowly elliptic, 3–7 mm. Calyx ca. 1.5 mm, to 3 mm in fruit, parted

nearly to base; lobes narrowly triangular, short strigose outside, densely hispid along margin. Corolla blue, glabrous; tube ca. 1.5 mm; appendages lunate, ca. 0.2 mm; limb ca. 1.6 mm wide; lobes orbicular-ovate. Nutlets ovoid, 1.5–1.8 × 1–1.2 mm, glabrous, slightly shiny, brown-black spotted; aperture narrowly oblong, 1–1.1 mm; attachment scar below middle of adaxial surface. Seeds ovate, ca. 1.2 × 1 mm. Fl. Aug-Sep.

• Moist shaded places in valleys; ca. 2700 m. Yunnan (Dêqên Xian).

21. *Microula efoveolata* W. T. Wang, Acta Phytotax. Sin. 18: 277. 1980.

无孔微孔草 wu kong wei kong cao

Stems branched from base, 6–19 cm tall, densely spreading hispid. Basal and lower stem leaves petiolate, spatulate to narrowly obovate, 4–6 cm × 5–9 mm, base attenuate, apex subacute to rotund; upper stem leaves gradually reduced upward, sessile, narrowly oblong to narrowly elliptic, 1.6–3.7 cm, sparsely short strigose. Inflorescences terminal, few flowered; 2 lowermost bracts elliptic, 6–10 mm, other bracts triangular to narrowly elliptic, 1.5–3 mm; branching points of upper stem with a solitary long pedicellate flower. Flowers crowded. Calyx ca. 2.5 mm, to 4.8 mm in fruit, parted nearly to base; lobes narrowly triangular, short hispid and sparsely hirsute outside. Corolla blue; tube ca. 2 mm, glabrous; appendages low trapeziform, ca. 0.3 mm, apex short pubescent; limb ca. 4 mm wide, glabrous; lobes suborbicular. Nutlets slightly bilaterally compressed, abaxially rhomboid-triangular, ca. 1.8 × 1 mm, center longitudinally ribbed, without aperture; lateral surfaces ca. 1.2 mm wide, with few fine tubercles and extremely short hairs; attachment scar above base of adaxial surface. Fl. Jun-Jul.

• Alpine meadows; ca. 3400 m. Sichuan (Muli Xian).

22. *Microula trichocarpa* (Maximowicz) I. M. Johnston, Contr. Gray Herb. 81: 83. 1928.

长叶微孔草 chang ye wei kong cao

Stems erect, branched above or throughout, 15–45 cm tall, moderately densely spreading bristly or hispid. Stem leaves gradually reduced upward, short petiolate to sessile, narrowly oblong to narrowly spatulate, 2–9 cm, short strigose, adaxially sparsely bristly, base attenuate, margin entire to obscurely finely dentate, apex acute. Inflorescences terminal, ca. 1 cm wide, sometimes slightly elongated to 1.5 cm; bracts to 2 mm. Flowers crowded, long pedicellate, opposite leaves on upper stems. Calyx 1.7–2.2 mm, to 3.5 mm in fruit, parted nearly to base; lobes narrowly triangular, sparsely long hispid and hirtellous outside, short strigose inside. Corolla blue; tube 1.5–5 mm, glabrous; appendages triangular to lunate, ca. 0.3 mm, short hispid; limb 4–10 mm wide, glabrous or sparsely pubescent outside; lobes suborbicular. Nutlets gray-white, broadly ovoid, 1.8–2.5 × 1.2–2 mm, with fine tubercles and extremely short hairs; aperture elliptic, on nearly entire adaxial surface; attachment scar at apex adaxially.

• Forests, ravines, field margins; 2400–3600 m. Gansu, E Qinghai, Shaanxi, Sichuan.

- 1a. Terminal inflorescences catkinlike 22c. var. *lasiantha*
- 1b. Terminal inflorescences slightly elongated.
 - 2a. Corolla limb 4–6.6 mm wide, tube 1.5–2.2 mm 22a. var. *trichocarpa*
 - 2b. Corolla limb 7–10 mm wide, tube 4–5 mm 22b. var. *macrantha*

22a. *Microula trichocarpa* var. *trichocarpa*

长叶微孔草 (原变种) chang ye wei kong cao (yuan bian zhong)

Omphalodes trichocarpa Maximowicz, Bull. Acad. Imp. Sci. Saint Pétersbourg 26: 500. 1880.

Terminal inflorescences slightly elongated. Corolla tube 1.5–2.2 mm; limb 4–6.6 mm wide. Fl. Jun-Jul.

• Forests, ravines, field margins; 2400–3600 m. Gansu, E Qinghai, Shaanxi (Taibai Shan), W Sichuan.

22b. *Microula trichocarpa* var. *macrantha* W. T. Wang, Acta Phytotax. Sin. 18: 278. 1980.

大花长叶微孔草 da hua chang ye wei kong cao

Terminal inflorescences slightly elongated. Corolla tube 4–5 mm; limb 7–10 mm wide.

• *Picea* forests. N and NW Sichuan.

22c. *Microula trichocarpa* var. *lasiantha* W. T. Wang, Acta Phytotax. Sin. 18: 278. 1980.

毛花长叶微孔草 mao hua chang ye wei kong cao

Terminal inflorescences catkinlike. Corolla tube 1.5–2.2 mm; limb ca. 6 mm wide, sparsely pubescent outside.

• *Abies* forests, forest margins; 3500–3600 m. NW Sichuan.

23. *Microula turbinata* W. T. Wang, Acta Phytotax. Sin. 18: 279. 1980.

长果微孔草 chang guo wei kong cao

Stems branched from base, to 40 cm tall, strigose, sparsely short bristly below; branches erect to gradually ascending. Lower stem leaves petiolate, oblong-elliptic to linear-oblongate, 3–7 × 0.5–1.4 cm, base attenuate, apex acute to obtuse; upper stem leaves sessile, smaller, appressed pubescent. Inflorescences terminal or axillary; bracts narrowly elliptic, 1–3 mm; lower inflorescences frequently ebracteate. Flowers crowded, those on stem long pedicellate, at branching points opposite leaves. Calyx 2–3.5 mm, to 4 mm in fruit, sparsely appressed pubescent outside, ciliate along margin, parted nearly to base; lobes lanceolate-linear. Corolla blue or white, glabrous; tube ca. 2.2 mm; appendages low trapeziform, ca. 0.4 mm; limb 5–6 mm wide; lobes orbicular-obovate. Nutlets long turbinate, 2.5–3 mm, minutely hispid, with scattered fine tubercles and 4 longitudinal ribs; aperture orbicular, at apex of nutlets. Fl. Jul-Aug.

• Alpine meadows; 3000–3900 m. SW Gansu (Xiahe Xian), SE Qinghai (Jigzhi Xian), Shaanxi (Taibai Xian), NW Sichuan.

24. *Microula longituba* W. T. Wang, Acta Phytotax. Sin. 18: 113. 1980.

长筒微孔草 chang tong wei kong cao

Stems with several long branches from base, ca. 24 cm tall, densely gray hispid, mixed hispid and hirsute above. Basal and lower stem leaves long petiolate; upper stem leaves short petiolate, spatulate to narrowly oblanceolate or narrowly oblong, 1.8–11 × 0.3–1.6 cm, adaxially sparsely strigose and sparsely hirsute, hairs discoid at base, base attenuate, apex rounded to subobtusate. Inflorescences terminal or axillary, 5–8 mm wide; bracts 1–2 mm. Pedicel ca. 1 mm. Flowers crowded. Calyx ca. 2 mm, parted to base; lobes lanceolate-linear, hirsute outside. Corolla dark blue, glabrous; tube 3.5–4 mm; appendages low trapeziform, 0.3–0.4 mm; limb 5–7 mm wide; lobes suborbicular, sometimes apex obtusely fine dentate. Nutlets gray-white, rhombic-ovoid, ca. 2 × 1.2 mm, glabrous, finely tuberculate; aperture above middle, deltate, ca. 0.7 mm, inside margin with membranous emergence, surfaces obscurely longitudinally 1-ribbed; attachment scar near base. Fl. Jun-Jul.

• Alpine meadows; ca. 3600 m. E Xizang (Zogang Xian).

25. *Microula floribunda* W. T. Wang, Acta. Phytotax. Sin. 18: 114. 1980.

多花微孔草 duo hua wei kong cao

Stems gradually ascending, branched from base, 6–32 cm tall, short strigose. Lower stem leaves petiolate; upper stem leaves sessile, spatulate to linear-spatulate or oblong, 1.5–7.5 cm × 2.5–12 mm, adaxially densely short strigose, hairs discoid at base, base attenuate, apex rounded to obtuse; midvein slightly sunken. Inflorescences terminal or axillary, many flowered, becoming ± panicate, ca. 10 cm, much branched; branches short strigose. Pedicel 1–2.5 mm. Calyx 2–2.5 mm, to 3–3.5 mm in fruit, densely strigose outside, parted nearly to base; lobes linear-lanceolate. Corolla dark blue; tube 2–3 mm, glabrous; appendages nearly trapeziform, ca. 0.6 mm, short hispid; limb 5–8 mm wide, glabrous; lobes orbicular-obovate. Nutlets triangular-ovoid, ca. 2 × 1.5 mm, finely tuberculate; aperture deltate, on upper part of abaxial surface, ca. 1 mm; attachment scar above base adaxially. Fl. Jul-Sep.

• Hillside meadows, thickets, gravelly river banks; 3300–3800 m. S Qinghai (Nangqen Xian), NW Sichuan (Gangzi Xian), E Xizang.

26. *Microula stenophylla* W. T. Wang, Acta Phytotax. Sin. 18: 114. 1980.

狭叶微孔草 xia ye wei kong cao

Stems erect to ascending, frequently much branched from base, 5–24 cm tall, short strigose, spreading bristly. Leaf blade spatulate-linear to linear, 1.5–7.5 cm × 2–7 mm, abaxially sparsely bristly only along midvein, adaxially ± strigose or minutely hispid, with intermixed bristles, hairs and bristles discoid at base, base attenuate, margin sparsely short

bristly, apex acute. Flowers opposite leaves from lower or middle part of stem upward, or several flowers terminating branches and forming crowded or lax short inflorescences. Calyx 1.8–2 mm, parted nearly to base; lobes narrowly triangular, hirsute outside and along margin, strigose inside. Corolla blue or white, glabrous; tube ca. 1.8 mm; appendages low trapeziform or lunate, ca. 0.3 mm; limb 1.5–2 mm wide; lobes orbicular. Nutlets triangular-ovoid, 2–2.5 × ca. 1 mm, with fine tubercles and short hairs; aperture deltate, 0.9–1.2 mm, on upper part of abaxial surface; attachment scar near base. Fl. Jun-Aug.

• Dunes, marshes, field margins, thickets; 3000–4700 m. SW Gansu (Xiahe Xian), E and S Qinghai, NW Sichuan (Zoigê Xian), Xizang.

27. *Microula diffusa* (Maximowicz) I. M. Johnston, J. Arnold Arbor. 33: 72. 1952.

疏散微孔草 shu san wei kong cao

Omphalodes diffusa Maximowicz, Bull. Acad. Imp. Sci. Saint Pétersbourg 27: 504. 1881; *Tretocarya vaillantii* Danguy.

Stems ascending, much branched, (7–)15–20 cm tall, bristly. Lower stem leaves petiolate; upper leaves sessile, narrowly oblong to oblanceolate, 2–6.5 × 0.5–1.5 cm, short strigose and sparsely bristly, base attenuate, apex usually subacute, sometimes obtuse. Inflorescences racemelike, 2–8 cm; bracts leaflike, linear to narrowly so, 0.8–2.5 cm × 1–3 mm. Pedicel ca. 0.8 mm. Calyx ca. 1.6 mm, to ca. 4.5 mm in fruit, parted nearly to base; lobes triangular, hirsute outside. Corolla purple-blue or white, glabrous; tube ca. 1 mm; appendages low trapeziform, ca. 0.3 mm; limb 2–3 mm wide; lobes orbicular-ovate. Nutlets narrowly ovoid, 2–2.2 × ca. 1.2 mm, with few fine tubercles and short hairs; aperture triangular, 1.2–1.5 mm, membranous emergence inside margin, ca. 0.3 mm; attachment scar near base. Fl. Jun-Sep.

• Sandy areas, marshes, gravelly slopes, field margins, forests; 2200–4200 m. NW and SW Gansu, E and S Qinghai, E Xizang.

28. *Microula tangutica* Maximowicz, Bull. Acad. Imp. Sci. Saint Pétersbourg 26: 500. 1880.

宽苞微孔草 kun bao wei kong cao

Stems single or several, frequently branched in lower part, 3–7 cm tall, spreading pubescent. Basal and lower stem leaves petiolate, spatulate, ca. 3 cm × 4–10(–14) mm, pubescent, base attenuate, apex rounded and obtuse; middle and upper stem leaves sessile, spatulate to elliptic, 0.9–1.4 cm. Inflorescences terminal, few flowered; bracts crowded, broadly ovate, orbicular-ovate, to suborbicular, 3–8 × 3–6 mm. Calyx ca. 1.2 mm, to 2 mm in fruit, parted nearly to base; lobes narrowly triangular, short strigose inside, margin villous. Corolla blue or white, glabrous; tube ca. 1.1 mm; appendages lunate, ca. 0.2 mm; limb ca. 2.2 mm wide; lobes orbicular. Nutlets suboblique, ca. 1.8 × 1.2 mm, glabrous, with few fine tubercles, abaxially with 3 obscure longitudinal ribs, without aperture; attachment scar above adaxially. Fl. Jul-Sep.

• Alpine meadows, gravelly slopes; 3600–5200 m. Gansu

Flora of China 16: 391–401. 1995.

(Tianzhu Xian), E and S Qinghai, NE Xizang.

29. *Microula tibetica* Bentham in Bentham & J. D. Hooker, Gen. Pl. 2: 853. 1876.

西藏微孔草 xi zang wei kong cao

Herbs ca. 1 cm tall, sparsely short hispid or subglabrous. Branches very short and crowded in middle of conspicuous leaf rosette. Leaves prostrate, spatulate, 3–13 × 0.8–2.8 cm, abaxially short white bristly, hairs discoid at base, adaxially sparser and short strigose, base attenuate into petiole, margin subentire or undulate, apex rounded to obtuse. Inflorescences terminal, very crowded and forming dense headlike cluster; bracts linear to oblong-linear, 0.2–2 cm, short pubescent, adaxially with intermixed short bristles. Pedicel less than 0.8 mm, elongated to 5 mm, pendulous in fruit, stout, sparsely short hispid. Calyx ca. 1.5 mm, to 3 mm in fruit; lobes narrowly triangular, sparsely pubescent outside, ciliate along margin. Corolla blue or white, glabrous; tube ca. 1.2 mm; appendages low trapeziform, ca. 0.3 mm; limb 1.2–4 mm wide; lobes orbicular-ovate. Nutlets ovate to subrhombic, 2–2.5 × 1.6–2 mm, finely tuberculate with glochids on tubercles or not tuberculate, with or without aperture; attachment scar at middle or slightly above adaxially.

Lakeshore marshes, disturbed slopes and roadsides, rocky areas, meadows; 3500–5300 m. Qinghai, Xinjiang, Xizang [India, Nepal].

- 1a. Corolla limb 1.2–1.8 mm wide; nutlets with abaxial aperture 29c. var. *pratensis*
- 1b. Corolla limb 3.2–4 mm wide; nutlets without abaxial aperture.
 - 2a. Nutlets tuberculate 29a. var. *tibetica*
 - 2b. Nutlets not tuberculate 29b. var. *laevis*

29a. *Microula tibetica* var. *tibetica*

西藏微孔草 (原变种) xi zang wei kong cao (yuan bian zhong)

Microula benthamii C. B. Clarke.

Corolla limb 3.2–4 mm wide. Nutlets tuberculate, without aperture. Fl. Jul-Sep.

Sandy marshes on lakeshores, sandy slopes, plateau meadows; 4500–5300 m. Xizang [N India, Nepal].

29b. *Microula tibetica* var. *laevis* W. T. Wang, Acta Phytotax. Sin. 18: 115. 1980.

光果西藏微孔草 guang guo xi zang wei kong cao

Corolla limb 3.2–4 mm wide. Nutlets not tuberculate, without aperture.

• Sandy slopes, rocky areas; 4900–5200 m. Xizang.

29c. *Microula tibetica* var. *pratensis* (Maximowicz) W. T. Wang, Acta Phytotax. Sin. 18: 115. 1980.

小花西藏微孔草 xiao hua xi zang wei kong cao

Tretocarya pratensis Maximowicz, Bull. Acad. Imp. Sci. Saint Pétersbourg 27: 505. 1881.

Corolla limb 1.2–1.8 mm wide. Nutlets tuberculate, aperture present, at center, elliptic to orbicular, ca. 0.5 mm.

• Open disturbed soil, often along roads and slopes, marshes, meadows; 3500–5300 m. Qinghai, Xinjiang, S Xizang.

Flora of China 16: 391–401. 1995.