
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 scipiform 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 fastigate. 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 without glochids. 
1b. Plants with normal stems, stem leaves, and laxer inflorescences; nutlets with 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.
3b. Abaxial aperture of nutlets oblong, elliptic, to orbicular, without emergence inside margin, sometimes abaxial aperture absent.

7a. Attachment scar of nutlet apical.
7b. Attachment scar of nutlet basal to middle adaxially.

8a. Stems 15–45 cm, bristly; bracts to 2 mm; abaxial aperture of nutlets deltate, 0.7–1 mm.
8b. Stems 3–7 cm, pubescent; bracts of inflorescences 3–8 × 3–6 mm; nutlets without glochids, attachment scar extending from base to apex 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.
12b. Basal and lower stem leaves with base attenuate to cuneate.

13a. Corolla limb 5–9(–11) mm wide ...................................................................................... 8. **M. sikkimensis**
13b. Corolla limb ca. 2.5 mm wide ..................................................................................... 9. **M. blepharolepis**

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
corollinlimb 3.8–9 mm wide .................................  2. M. multiensis
   17b. Leaf blade lanceolate to oblong, to 5.5 cm;
corolla white or with light yellow throat. .........  13. M. pseudotrachocarpa

16b. Corolla limb 2–3 mm wide.
   18a. Upper stem leaves elliptic to oblong, 0.5–1.5 cm;-
corolla blue .................................................................  3. M. pastulosa
   18b. Upper stem leaves oblong to lanceolate, 1–6 cm;
corolla limb 3. 8–9 mm wide .............................  13. M. pseudotrachocarpa

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. multiensis
      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. myosotidea

24b. Stem leaves spatulate or oblong-lanceolate.
   27a. Flowers in spikelike branches, with distinct bracts; bracts
      leaflike, oblong, 3–9 mm .................................................. 17. M. youngusbandii
   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. spathulata
      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. youngusbandii

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,

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, apiculate, obtuse, to rounded. Terminal inflorescences frequently ± elongated and spike-like, 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.


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


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).


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).


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 subacutete 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*

- Alpine meadows, thickets; 3300–4400 m. Qinghai, Xizang [Bhutan, India].

3b. *Microula pustulosa* var. *setulosa*

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


Stem leaves densely strigose and bristly. Nutlets glabrous.

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


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 lanceolate, sparsely long hispid outside and along margin, short strigose inside at apex. Corolla blue, glabrous; tube ca. 1.8 mm; appendages lunate, ca. 0.2 mm wide; 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).


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].


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.

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


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, with 2 subtending leaves. Flowers pedicellate, crowded. Calyx 4–5.5 mm, parted nearly to base; lobes narrowly triangular, densely hisrate 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.


Stems erect, mostly branched from base, 10–25 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, with 2 subtending leaves. Flowers pedicellate, crowded. Calyx 4–5.5 mm, parted nearly to base; lobes narrowly triangular, densely hisrate 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.

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

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 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 hirsute 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, glabrous; attachment scar near base. Fl. May-Sep.

Stems unbranched or short branched, 9-12 cm tall, spreading bristly. Leaf blade of lower stems ovate to narrowly oblong, 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, 1.5-4.5 cm, 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.

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 hirsip, with intermixed bristles. Corolla blue; tube ca. 2.2 mm, glabrous; appendages trapeziform, ca. 0.3 mm, apex minutely hirsute; 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.

Stems several, branched from base, ca. 12 cm tall, appressed or spreading, moderately densely minute hirsip, 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 hirsute 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.

Stems erect, to 14 cm tall, sparsely short strigose and spreading hirsip; 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

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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-oblancoolate or 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 suborbicular, ca. 0.4 mm in diam.; attachment scar near middle adaxially. Fl. Jun-Aug.

- Alpine meadows; 2200–4600 m. Gansu, E Qinghai, NW Sichuan, E Xizang.
- Alpine meadows; 2000–4600 m. Gansu, E Qinghai, NW Sichuan, E Xizang.

13a. Microula pseudotrilocarpus var. pseudotrilocarpus

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; 2200–4600 m. Gansu, E Qinghai, NW Sichuan, E Xizang.


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).


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

14a. Microula oblongifolia var. oblongifolia

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


- Alpine meadows; 3200–3400 m. Yunnan (Yulong Shan of Lijiang Xian).
- Forests, forest margins; 3400–3700 m. Yunnan (Zhongdian Xian).


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. Basal and lower stem leaves 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 obtuse. Corolla blue; tube ca. 2 mm, glabrous; appendages lunate, ca. 0.2 mm, limb 0.5–1.5 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).


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 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 obtuse. 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).


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-oblancoate, 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).


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 petiolar, 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; bristles; 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).


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 oblancoate, 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 cm, 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.


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. Jul-Aug-Sep.

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


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 subacut 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, part nearly to base; lobes narrowly triangular, short hispid and sparsely hirsute outside. Corolla blue; tube ca. 2 mm, glabrous; appendages low trapeziform, 0.3 mm, short pubescent; limb ca. 4 mm wide, glabrous; lobes suborbicular. Nutlets slightly bilaterally compressed, axially 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. Jul-Aug.

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


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; lobes opposite leaves, 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

1b. Terminal inflorescences slightly elongated.

2a. Corolla limb 4–6.6 mm wide, tube 1.5–2.2 mm .......................... 22a. var. *macrantha*

2b. Corolla limb 7–10 mm wide, tube 4–5 mm ............................... 22b. var. *trichocarpa*

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

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


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.


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.


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.


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; 3.7–5 × 0.5–1.4 cm, base attenuate, apex acute to obtuse; upper stem leaves sessile, smaller, apressed 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-ovate. 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.

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 oblong or narrowly obovate, 1.8–11 × 0.3–1.6 cm, adaxially sparsely strigose and sparsely hirsute, hairs discoid at base, base attenuate, apex rounded to subacute. Inflor escences 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 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 above base. Fl. Jun-Jul.

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


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. Inflor escences terminal or axillary, many flowered, becoming ± paniculate, ca. 10 cm, much branched; branches short strigose. Pedicel 1–2.5 cm. 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 hirsute, limb 5–8 mm wide, glabrous; lobes orbicular-ovobate. 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 (Nangqên Xian), NW Sichuan (Gangzi Xian), E Xizang.


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 few 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.


疏散微孔草 shu san wei kong cao


Stems ascending, much branched, (7–)15–20 cm tall, bristly. Lower stem leaves petiolate; upper leaves sessile, narrowly oblong to oblongate, 2–6.5 × 0.5–1.5 cm, short strigose and sparsely bristly, base attenuate, apex usually obtuse, sometimes obtuse. Inflor escences 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.


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. Inflor escences 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
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.


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

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.

小花西藏微孔草 xiao hua xi zang wei kong cao