

88. TAPHROSPERMUM C. A. Meyer in Ledebour, Fl. Altaic. 3: 172. 1831.

沟子芥属 *gou zi qi shu*

Glaribraya H. Hara.

Herbs biennial or perennial. Trichomes simple, rarely absent. Roots often fleshy, narrowly fusiform, basally with a whorl of caducous or persistent scalelike leaves. Stems prostrate, ascending, or erect. Basal leaves petiolate, not rosulate, simple, entire. Cauline leaves petiolate, entire, lowermost whorled or alternate. Racemes many flowered, bracteate throughout or rarely only basally. Fruiting pedicels ascending or divaricate, straight or recurved. Sepals oblong, erect, glabrous or subapically pubescent, base of lateral pair not saccate. Petals white, longer than sepals; blade obovate or broadly so, apex rounded or emarginate; claw obscure. Stamens 6, subtetradynamous; filaments of median pairs dilated at base; anthers ovate, apex rounded. Nectar glands confluent, subtending bases of all stamens. Ovules to 12 per ovary. Fruit dehiscent siliques or silicles, cylindric, narrowly conical, or obcordate, ovate, or oblong, angustiseptate, terete, or latiseptate, sessile or subsessile; valves distinctly veined, glabrous or papillate, torulose or smooth; replum widely flattened throughout or only basally; septum complete, rarely absent or perforate and reduced to a rim; style to 3 mm; stigma capitate, entire. Seeds uniseriate or biseriate, wingless, oblong, plump or flattened; seed coat foveolate or papillate, not mucilaginous when wetted; cotyledons incumbent, oblique, or accumbent.

Seven species: Bhutan, China, India, Kazakstan, Kyrgyzstan, Mongolia, Nepal, Russia, Tajikistan; six species (three endemic) in China. *Taphrospermum platypetalum* Schrenk, which is endemic to Soongaria in Kazakstan, might also be present in neighboring Xinjiang. It has racemes bracteate only basally, glabrous sepals, and cylindric fruit.

- 1a. At least some of the lowermost cauline leaves verticillate, other leaves opposite and/or alternate.
 - 2a. Plants densely hirsute throughout with trichomes 0.5–1 mm 6. *T. tibeticum*
 - 2b. Plants glabrous or puberulent with papillae 0.05–0.2 mm.
 - 3a. Petals broadly obovate, (7–)8–9(–10) × (3.5–)4.5–6 mm; seeds foveolate; sepals caducous, margin ciliolate; septum absent 4. *T. verticillatum*
 - 3b. Petals narrowly obovate, 3–3.5 × 1.5–2 mm; seeds papillate; sepals persistent, margin not ciliolate; septum complete 5. *T. lowndesii*
- 1b. All leaves alternate.
 - 4a. At least some leaves dentate; fruit oblong or ovate, latiseptate 2. *T. himalaicum*
 - 4b. Leaves entire or rarely repand; fruit narrowly conical or obcordate, angustiseptate at least basally.
 - 5a. Fruit obcordate, not torulose, (4–)5–7 mm wide; septum absent; cotyledons accumbent 3. *T. fontanum*
 - 5b. Fruit narrowly conical, torulose, (1.8–)2–2.5(–3) mm wide; septum complete or rarely reduced to a rim; cotyledons incumbent 1. *T. altaicum*

1. *Taphrospermum altaicum* C. A. Meyer in Ledebour, Fl. Altaic. 3: 173. 1831.

沟子芥 *gou zi qi*

Cochlearia altaica (C. A. Meyer) J. D. Hooker & T. Anderson; *Taphrospermum altaicum* var. *macrocarpum* Z. X. An.

Herbs (4–)10–23(–30) cm tall, with narrowly fusiform roots, glabrous except for fruit. Stems prostrate, ascending, or erect, few to many from base. Leaves not rosulate, somewhat fleshy; petioles of basal and lowermost cauline leaves 1–4(–9) cm; leaf blade suborbicular, subcordate, ovate, or oblong, (0.5–) 1–2.5 × (0.4–)0.7–2 cm, gradually smaller upward, base obtuse or subcordate, margin entire or rarely repand, apex obtuse or rounded. Racemes densely flowered, elongated in fruit, bracteate throughout; bracts leafy. Fruiting pedicels glabrous, slender, strongly recurved or nearly forming a loop, (3–)5–8(–12) mm. Sepals oblong,

0.8–1.5(–2) × 0.5–0.8(–1) mm, persistent or caducous, membranous at margin. Petals white, obovate, (1.5–)2–2.5(–3) × (0.5–)0.8–1.5 mm, apex rounded or slightly emarginate, clawlike base to 0.5 mm. Filaments 0.8–1.2 mm, median pairs dilated, to 0.3 mm wide at base; anthers ovate, 0.2–0.3 mm. Ovules 6–10(–12) per ovary. Fruit narrowly conical, strongly torulose, angustiseptate at least basally, (4–)7–10 (–12) mm, base cordate or truncate and (1.8–)2–2.5(–3) mm wide, apex acuminate; valves membranous, sparsely puberulent with papillae to 0.3 mm, rarely subglabrous, distinctly veined; replum widely expanded at base, narrowly flattened elsewhere; septum complete or rarely perforate and reduced to a rim, membranous; style slender, (0.5–)0.7–1.2(–1.5) mm. Seeds brown, oblong, plump, 1.4–1.8 × 0.8–1.2 mm; cotyledons incumbent or oblique. Fl. Jun–Aug, fr. Jul–Sep.

Mountain meadows, forest margins, gravelly ridges, open slopes, roadsides; 2000–4000 m. Gansu, Qinghai, Xinjiang, Xizang [Kazakstan, Kyrgyzstan, Mongolia, Russia, Tajikistan].

2. *Taphrospermum himalaicum* (J. D. Hooker & Thomson) Al-Shehbaz et al. in Al-Shehbaz, Harvard Pap. Bot. 5(1): 102. 2000.

须弥沟子芥 *xu mi gou zi qi*

Cochlearia himalaica J. D. Hooker & Thomson, J. Proc. Linn. Soc., Bot. 5:154. 1861.

Herbs (2–)5–10(–15) cm tall, glabrous throughout except for fruit and calyx. Root narrowly fusiform-linear, fleshy, apex with minute scalelike leaves. Stems solitary from fleshy root then producing a rosette with prostrate or rarely ascending to erect branches. Leaves not rosulate; petioles of basal and lowermost cauline leaves (0.5–)1–2.5(–4) cm, gradually shorter upward; leaf blade broadly ovate or oblong, 4–10(–15) × 2–6(–10) mm, gradually reduced in size upward, base obtuse or subcordate, margin lobed, toothed, repand, or entire, apex obtuse or rounded. Racemes densely flowered, elongated considerably or not elongated in fruit, bracteate throughout; bracts leafy, representing all cauline leaves. Fruiting pedicels glabrous, slender, straight or strongly recurved and fruit appearing geocarpic, 4–9(–13) mm. Sepals oblong, 1.2–2 × 0.8–1 mm, persistent, membranous at margin, sparsely pubescent distally. Petals white, obovate or spatulate, 2.5–4(–6) × 1.5–2.5(–3.5) mm, attenuate to base, apex slightly emarginate. Filaments white, 1.5–2 mm, median pairs dilated at base; anthers ovate, 0.2–0.4 mm. Ovules 4–12 per ovary. Fruit ovoid or oblong, latiseptate, not torulose, (2–)4–8(–10) × (1.5–)2–3.4(–4) mm, obtuse at both ends; valves membranous, sparsely puberulent with papillae to 0.5 mm, rarely subglabrous, obscurely veined; replum widely expanded throughout; septum absent; style slender, 0.5–1(–1.2) mm. Seeds (2–)6–8(–12), brown, oblong, 1–1.5 × 0.8–1 mm; cotyledons obliquely accumbent. Fl. Jun–Aug, fr. Jul–Sep.

Rocky grounds on exposed slopes, scree, deep rich soils, muddy slopes, streambeds, sandy beds, moist granite ledges, alpine pastures and dwarf scrub, *Kobresia* turf, under *Juniperus* trees; 3600–5200 m. Qinghai, Xizang [Bhutan, India, Nepal].

3. *Taphrospermum fontanum* (Maximowicz) Al-Shehbaz & G. Yang in Al-Shehbaz, Harvard Pap. Bot. 5(1): 104. 2000.

泉沟子芥 *quan gou zi qi*

Herbs (2–)5–14(–20) cm tall, sparsely to moderately pubescent, rarely glabrous. Root narrowly fusiform-linear, fleshy, base with minute scalelike leaves usually less than 2 mm. Stems solitary from fleshy root then producing a few prostrate or rarely ascending or erect branches, sparsely to densely pubescent with retrorse to spreading trichomes to 0.5 mm, rarely glabrous. Leaves not rosulate; petioles of basal and lowermost leaves (0.3–)0.6–2(–3) cm, gradually shorter upward; leaf blade ovate or oblong, (2–)4–10(–13) × (1–)2–4(–7) mm, gradually reduced in size upward, base obtuse or cuneate, margin entire or repand, apex obtuse or rounded. Racemes densely flowered, elongated slightly

to considerably in fruit, bracteate throughout; bracts leafy, smaller than cauline leaves. Fruiting pedicels glabrous or pubescent adaxially, slender, straight or curved, (1.5–)3–10(–20) mm. Sepals oblong, 1.5–3 × 0.8–1.5 mm, persistent, membranous at margin, sparsely ciliolate near apex with trichomes ca. 0.05 mm, sparsely pubescent distally with trichomes to 0.5 mm. Petals white or lavender, obovate or spatulate, 2–6 × (0.5–)0.7–3.5(–4) mm, attenuate to base, apex slightly emarginate. Filaments white or lavender, 1.5–3 mm, dilated at base; anthers ovate, 0.3–0.4 mm. Ovules 4–8 per ovary. Fruit broadly to narrowly obcordate, strongly to slightly angustiseptate, not torulose, (2–)3–5 × (4–)5–7 mm, obtuse or cuneate at base; valves membranous, sparsely to densely puberulent with trichomes to 0.5 mm, rarely subglabrous, often distinctly veined, smooth or tuberculate; replum widely and evenly expanded throughout; septum absent; style slender, (1–)2–3 mm. Seeds 3–8, brown, oblong, foveolate, compressed, 1.2–2.2 × 0.8–1.5 mm; cotyledons accumbent.

• Slopes with dwarf bushes, disturbed alpine meadows, degraded alpine pastures, moist turf, *Kobresia* turf and cushions, alpine permafrost swamps, damp shingle by rivers, open gravel, slate and schist screes; (3200–)3600–5300 m. Gansu, Qinghai, Sichuan, Xinjiang, Xizang.

- 1a. Petals 4.5–6 × 2.5–3.5(–4) mm; fruit valves glabrous or sparsely puberulent, smooth, not tuberculate; seeds (1.5–)1.8–2.2 × (1.1–)1.2–1.5 mm 3a. subsp. *fontanum*
- 1b. Petals 2–3 × (0.5–)0.7–1.2(–1.4) mm; fruit valves densely or rarely sparsely puberulent, often tuberculate; seeds 1.2–1.6 × 0.8–1.1 mm ... 3b. subsp. *microspermum*

3a. *Taphrospermum fontanum* subsp. *fontanum*

泉沟子芥(原亚种) *quan gou zi qi (yuan ya zhong)*

Dilophia fontana Maximowicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 3, 26: 423. 1880; *D. macrosperma* O. E. Schulz.

Sepals 2.5–3 mm; petals 4.5–6 mm, 2.5–3.5(–4) mm wide; filaments 2.5–3 mm. Fruit valves glabrous or sparsely puberulent, smooth, not tuberculate. Seeds 3 or 4 per fruit, (1.5–)1.8–2.2 × (1.1–)1.2–1.5 mm. Fl. Jun–Sep, fr. Jul–Oct.

• Moist turf, alpine permafrost swamps, damp shingle by rivers, open gravel, slate and schist screes; (3200–)3600–5300 m. Gansu, Qinghai, Sichuan, Xizang.

3b. *Taphrospermum fontanum* subsp. *microspermum* Al-Shehbaz & G. Yang in Al-Shehbaz, Harvard Pap. Bot. 5(1): 105. 2000.

小籽泉沟子芥 *xiao zi quan gou zi qi*

Dilophia fontana Maximowicz var. *trichocarpa* W. T. Wang.

Sepals 1.5–2 mm; petals 2–3 × (0.5–)0.7–1.2(–1.4) mm; filaments 1.5–2 mm. Fruit valves densely or rarely

sparsely puberulent, often tuberculate. Seeds 2–8 per fruit, 1.2–1.6 mm × 0.8–1.1 mm. Fl. Jul–Aug, fr. late Jul–Sep.

• Slopes with dwarf bushes, disturbed alpine meadows, degraded alpine pastures, *Kobresia* turf and cushions; 3900–5000 m. Qinghai, Xinjiang, Xizang.

4. *Taphrospermum verticillatum* (Jeffrey & W. W. Smith) Al-Shehbaz, Harvard Pap. Bot. 5(1): 106. 2000.

轮叶沟子芥 *lun ye gou zi qi*

Cardamine verticillata Jeffrey & W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 8: 120. 1913; *Braya verticillata* (Jeffrey & W. W. Smith) W. W. Smith; *Staintoniella verticillata* (Jeffrey & W. W. Smith) H. Hara.

Herbs (4–)6–15(–23) cm tall, sparsely to moderately pubescent, rarely glabrous. Root narrowly fusiform-linear, fleshy, base with oblong or ovate scalelike leaves 3–7 × 1–2.5 mm. Stems erect, often solitary from fleshy root, lowermost leafless part (0.5–)4–10(–15) cm. Leaves glabrous, lowermost cauline leaves verticillate, others opposite or alternate; petioles (0.4–)0.6–2 cm, gradually shorter upward; leaf blade oblong, rarely oblanceolate, 0.5–1.5(–2.5) cm × 2–7(–9) mm, gradually reduced in size upward, base obtuse or rarely attenuate, margin entire, apex rounded. Racemes densely flowered, elongated considerably in fruit, bracteate throughout; bracts leafy, smaller than cauline leaves; rachis sparsely pubescent with retrorse trichomes 0.4–0.6 mm. Fruiting pedicels glabrous, slender, straight or curved, (4–)6–12(–18) mm. Sepals oblong, 2.5–3.5 (–4) × 1.5–2 mm, caducous, membranous at margin, sparsely ciliolate near apex with trichomes 0.05–0.1 mm, glabrous or distally sparsely pubescent with trichomes to 0.5 mm. Petals white or rarely lavender, broadly obovate, (7–)8–9(–10) × (3.5–)4.5–6 mm, cuneate or clawlike base to 4 mm, apex emarginate. Filaments white or lavender, (3–)3.5–4.5 mm, dilated at base; anthers ovate, 0.6–0.8 mm. Ovules 4–8 per ovary. Fruit ovate or oblong, strongly latiseptate, not torulose, 7–13 × 4–7 mm, obtuse or cuneate at base; valves membranous, glabrous, often distinctly veined, smooth; replum widely and evenly expanded throughout; septum absent; style slender, (1–)2–3 mm. Seeds 3–8, brown, oblong, foveolate, compressed, 1.8–2.2 × 1.2–1.4 mm; cotyledons accumbent. Fl. Jun–Jul, fr. Jul–Aug.

• Scree, cliff ledges, glaciers, open stony moorland, siliceous scree slopes; 3800–5200 m. Xizang, Yunnan.

This species was recorded in FRPS (as *Staintoniella verticillata*) from Qinghai and Sichuan, but the present authors have seen no material from those provinces.

5. *Taphrospermum lowndesii* (H. Hara) Al-Shehbaz, Harvard Pap. Bot. 5(1): 107. 2000.

郎氏沟子芥 *lang shi gou zi qi*

Glaribraya lowndesii H. Hara, J. Jap. Bot. 53: 136. 1978.

Herbs 5–12 cm, glabrous throughout or puberulent with papillae 0.05–0.2 mm. Root slender, slightly fleshy, base with a whorl of oblong scalelike leaves ca. 2–5 × 0.5–1 mm. Stems erect, 1–3 from root, lowermost leafless part 2–9 cm. Leaves glabrous, fleshy, lowermost cauline ones verticillate, others alternate; petioles 2–5 mm, gradually shorter upward; leaf blade spatulate, 3–15 × 1–5 mm, gradually reduced in size upward, base attenuate, margin entire, apex retuse or rounded. Racemes densely flowered, elongated considerably in fruit, bracteate throughout; bracts leafy, smaller than cauline leaves; rachis glabrous or papillate. Sepals oblong, 1.5–2.5 × ca. 1 mm, persistent well after fruit dehiscence, distal margin and apex membranous, not ciliolate, glabrous or papillate. Petals white, narrowly obovate, 3–5 × 1.5–2 mm, attenuate to clawlike base to 1.5 mm, apex obtuse. Filaments white, 1.5–2.5 mm; anthers broadly ovate, 0.2–0.3 mm. Ovules 4–6 per ovary. Fruiting pedicels glabrous, slender, straight or curved, 4–8 mm. Fruit oblong or narrowly so, strongly latiseptate, not torulose, 0.7–1.5 cm × 3–5 mm, obtuse or cuneate at base; valves membranous, glabrous, often distinctly veined, smooth; replum widely and evenly expanded throughout; septum complete, membranous; style slender, (1–)2–3 mm. Seeds 3–8, brown, oblong, compressed, 1.9–2.1 × 1.2–1.4 mm, with dense papillae 0.1–0.2 mm; cotyledons accumbent. Fl. Jul, fr. Jul–Aug.

Scree slopes; 5000–5200 m. Xizang [Nepal].

6. *Taphrospermum tibeticum* (O. E. Schulz) Al-Shehbaz, Harvard Pap. Bot. 5(1): 107. 2000.

西藏沟子芥 *xi zang gou zi qi*

Dipoma tibeticum O. E. Schulz, Repert. Spec. Nov. Regni Veg. 38: 32. 1935.

Herbs, 4–12 cm, densely hirsute with simple trichomes 0.5–1 mm. Root conical, slightly fleshy, base with a whorl of oblong, scalelike leaves to 5 × 2 mm. Stems erect, 1–3 from fleshy root, lowermost leafless part 1–9 cm. Leaves densely hirsute, not fleshy, lowermost cauline verticillate, others opposite or alternate; petioles 3–5 mm, gradually shorter upward, densely hirsute; leaf blade oblong or spatulate, 4–7 × 1–3 mm, gradually reduced in size upward, base attenuate, margin entire or 2-toothed, apex retuse. Racemes densely flowered, elongated slightly in fruit, bracteate throughout; bracts leafy, smaller than cauline leaves, hirsute; rachis retrorsely or spreading hirsute. Fruiting pedicels hirsute, slender, straight, 3–6 mm. Sepals oblong, 1.7–2.5 × 1–1.5 mm, distal margin and apex membranous, ciliolate with trichomes to 0.1 mm, densely hirsute outside with trichomes ca. 0.5 mm. Petals white, broadly obovate, 4.5–5 × 2.5–3 mm, attenuate to clawlike base to 1.5 mm, apex emarginate. Filaments white, 2–2.5 mm, slightly dilated at base; anthers broadly ovate, ca. 0.5 mm. Ovules 4–6 per ovary. Immature fruit ovate, apparently latiseptate; valves

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membranous, densely puberulent; replum widely and evenly expanded throughout; septum absent; style subconical, 1–1.5 mm. Immature seeds oblong, ca. 1 mm, foveolate. Fl. Jun–Jul.

• Stony slopes, turf, earth slides, shale along streamsides; 4200–500 m. Xizang.

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