

# GERANIACEAE

牻牛儿苗科 mang niu er miao ke

Xu Langran (徐朗然 Xu Lang-rang)<sup>1</sup>; Carlos Aedo<sup>2</sup>

Herbs, annual or perennial [rarely shrublets or shrubs]. Stipules present. Leaves alternate or opposite, palmately or pinnately divided, petiolate. Flowers in cymes, pseudumbels, rarely flowers solitary, usually bisexual, actinomorphic, or ± zygomorphic. Sepals 5, usually distinct, imbricate. Petals usually 5, distinct. Fertile stamens 5 or 10, usually in 2 whorls, sometimes a whorl reduced to staminodes; filaments basally connate or distinct; anthers 2-locular, longitudinally dehiscent. Ovary superior; carpels 5, connate; ovules 1 or 2 per locule, pendulous, anatropous. Fruit a schizocarp with 5 1-seeded awned mericarps which separate elastically from a central beak. Seeds usually with little or no endosperm; embryo folded.

Six genera and ca. 780 species: widely distributed in temperate, subtropic, and tropical mountains; two genera and 54 species (18 endemic, three introduced) in China.

*Pelargonium*, including *P. × domesticum* Bailey, *P. × graveolens* L'Héritier, *P. × hortorum* Bailey, *P. peltatum* (Linnaeus) L'Héritier, *P. radens* H. E. Moore (*P. radula* (Cavanilles) L'Héritier), and *P. zonale* (Linnaeus) L'Héritier, treated in FRPS (43(1): 83–86. 1998), are only cultivated as garden and potted plants in China and so are not treated here.

Xu Langran, Huang Chengchui & Huang Baoxian. 1998. Geraniaceae (excluding *Biebersteinia*). In: Xu Langran & Huang Chengchui, eds., Fl. Reipubl. Popularis Sin. 43(1): 18–89.

- 1a. Fertile stamens 10 (5 in *G. pusillum*); leaves palmately divided ..... 1. *Geranium*  
1b. Fertile stamens 5; leaves pinnately divided ..... 2. *Erodium*

## 1. GERANIUM Linnaeus, Sp. Pl. 2: 676. 1753.

老鹳草属 lao guan cao shu

Herbs, annual, biennial, or perennial [rarely shrublets or shrubs]. Leaves simple, usually palmately divided or cleft, sometimes entire or pinnately lobed, petiolate. Basal leaves usually forming a rosette. Cauline leaves opposite or alternate. Inflorescence terminal or axillary, cymose, bracteate. Flowers usually paired or occasionally solitary, actinomorphic, rarely somewhat zygomorphic. Sepals 5, imbricate, apex obtuse to caudate. Petals 5, distinct, sometimes clawed, apex rounded, retuse, or emarginate. Stamens 10, in 2 whorls, outer ones opposite to petals, inner ones alternating with petals, all with anthers or very rarely (in *G. pusillum*) 5 reduced to staminodes. Nectaries usually 5 and alternate with petals, rarely (in *G. sinense*) united into a ring. Ovary 5-locular, with 2 superposed ovules per locule; style distinctly 5-cleft. Fruit a schizocarp, long beaked, splitting into 5 1-seeded mericarps.

About 380 species: cosmopolitan, especially in temperate and tropical mountains; 50 species (18 endemic, three introduced) in China.

Primary leaf blade divisions are named segments and second ones lobes. The middle segment is measured from leaf blade apex to the insertion of the petiole with the leaf blade. The main sinus is measured from the leaf blade apex to the junction between the middle segment and the adjacent lateral segments. The second sinus is the deeper of the middle segment. Sepal length does not include mucro length. Fruit length is measured from the mericarp base to the apex of the stigmatic remains. The fruit rostrum length is measured from the mericarp apex to the base of the stigmatic remains including, when present, a narrowed apical part.

Five species recorded from China are of uncertain identity or are too poorly known to be treated here and are discussed unnumbered at the end of the generic treatment.

*Geranium schrenkianum* Trautvetter (Bull. Soc. Imp. Naturalistes Moscou 57: 53. 1882) is widespread in Kazakhstan and is expected to be found in Xinjiang. This species is a small annual, easily recognized by its palmately divided leaves, petals 3–4 mm with emarginate apex, and antrorsely appressed trichomes on stem, petioles, peduncle, and pedicels.

- 1a. Plants annual or rarely biennial.  
2a. Leaves palmately divided ..... 1. *G. robertianum*  
2b. Leaves palmately cleft.  
3a. Petals purplish, with a dark basal spot ..... 2. *G. ocellatum*  
3b. Petals white, pale purple, or dark purple, without a basal spot.  
4a. Cymules umbelliform, in dense aggregates at apex of each branch; mericarps densely covered with  
0.5–1.8 mm nonglandular and sometimes glandular trichomes ..... 12. *G. carolinianum*  
4b. Cymules solitary, axillary; mericarps glabrous or with 0.2–0.5 mm nonglandular trichomes.  
5a. Mericarps smooth.  
6a. External whorl of stamens lacking anthers and with shorter filaments; petal apices emarginate ..... 10. *G. pusillum*

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- 6b. Both whorls of stamens with anthers and filaments of similar length; petal apices rounded ..... 13. *G. rotundifolium*
- 5b. Mericarps with transverse ribs.
- 7a. Sepal mucros 0.7–1 mm; mericarps with to 0.5 mm appressed nonglandular trichomes ..... 8. *G. divaricatum*
- 7b. Sepal mucros 0.1–0.2 mm; mericarps glabrous ..... 9. *G. molle*
- 1b. Plants perennial.
- 8a. Mericarp reticulated.
- 9a. Basal cauline leaves opposite or whorled.
- 10a. Petals (1–)1.2–1.5 cm; leaves deeply divided, ratio of main sinus/middle segment length =  
(0.69–)0.8–0.88 ..... 5. *G. strictipes*
- 10b. Petals 0.9–1(–1.1) cm; leaves not deeply divided, ratio of main sinus/middle segment length =  
(0.55–)0.67–0.76(–0.8) ..... 4. *G. hispidissimum*
- 9b. Basal cauline leaves alternate.
- 11a. Flowers in solitary 2-flowered cymules; sepal mucros 1.7–1.8 mm ..... 6. *G. moupinense*
- 11b. Flowers in several cymules at least partly arranged in pseudoubels; sepal mucros 0.4–0.9(–1.4) mm.
- 12a. Cymules 2(or 3)-flowered, in dense umbel-like aggregates at apex of each branch, peduncle usually  
absent; fruit rostrum without narrowed apex or rarely with narrowed apex to 1 mm ..... 3. *G. polyanthes*
- 12b. Cymules (2 or)3(or 4)-flowered, in loose umbel-like aggregates at apex of each branch, peduncle  
2.5–6.7 cm; fruit rostrum with narrowed apex ca. 2 mm ..... 7. *G. umbelliforme*
- 8b. Mericarp smooth or with some transverse veins.
- 13a. Cymules usually with 1 flower.
- 14a. Petals (1.2–)1.4–1.8(–2) cm; stipules broadly ovate, connate ..... 48. *G. hayatanum*
- 14b. Petals (0.4–)0.5–0.8(–1.3) cm; stipules lanceolate to subulate, distinct.
- 15a. Leaf blade middle segment obtriangular, 3–5-lobed; petals (5.2–)7.2–8.4(–12.7) mm ..... 47. *G. suzukii*
- 15b. Leaf blade middle segment rhombic, 6–14-lobed; petals 4–5.9(–6.3) mm.
- 16a. Leaf blade middle segment narrowly rhombic; sepal mucros long, ratio of mucro length/sepal  
length = (0.17–)0.23–0.28(–0.34) ..... 15. *G. sibiricum*
- 16b. Leaf blade middle segment broadly rhombic; sepal mucros short, ratio of mucro length/sepal  
length = (0.09–)0.14–0.21 ..... 16. *G. nepalense*
- 13b. Cymules usually with 2(or 3) flowers.
- 17a. Petals reflexed.
- 18a. Pedicel glandular trichomes purple, coarse, dense ..... 18. *G. refractum*
- 18b. Pedicel glandular trichomes colorless or with purple heads, fine, dense to sparse or absent.
- 19a. Nectaries forming a ring around flower; petal basal margin with very few trichomes ..... 19. *G. sinense*
- 19b. Nectaries 5, separate; petal basal margin with numerous trichomes.
- 20a. Petals with trichomes only on basal margin ..... 20. *G. shensianum*
- 20b. Petals with trichomes on basal margin and inside base.
- 21a. Filaments almost glabrous or with a few 0.3–0.8(–1.2) mm trichomes; petals (0.6–)0.8–1(–1.2)  
cm, with an evident whitish basal zone ..... 21. *G. delavayi*
- 21b. Filament base with numerous 1–1.8 mm trichomes; petals (1.2–)1.3–1.7 cm, without a  
whitish basal zone ..... 22. *G. pogonanthum*
- 17b. Petals not reflexed.
- 22a. Stem arising from subglobose tubercles connected together by thin rootstock; cauline leaves alternate.
- 23a. Petal apices deeply emarginate; leaves palmately divided; mericarps without a basal callus ..... 11. *G. linearilobum*
- 23b. Petal apices rounded or rarely shallowly emarginate; leaves palmately cleft; mericarps with  
a basal callus.
- 24a. Petals 0.6–1.2 cm; sepals 5.3–6.3 mm ..... 25. *G. canopurpureum*
- 24b. Petals 1.6–1.8 cm; sepals 7.1–10.9 mm ..... 24. *G. pylzowianum*
- 22b. Stem arising from rootstock without tubercles; cauline leaves opposite or alternate.
- 25a. Cauline leaves alternate (upper usually opposite).
- 26a. Staminal filaments with 1.5–3.2 mm nonglandular trichomes; rostrum narrowed apex 4.8–9.8 mm.
- 27a. Stem and petioles with retrorse appressed trichomes; leaves deeply divided ..... 29. *G. erianthum*
- 27b. Stem and petioles with patent trichomes; leaves not deeply divided ..... 30. *G. platyanthum*
- 26b. Staminal filaments with 0.1–0.9 mm nonglandular trichomes; rostrum narrowed apex 0.9–3 mm.
- 28a. Petals 4–6.2(–6.9) mm; leaf blade usually with 3 segments ..... 14. *G. wilfordii*
- 28b. Petals 8.1–12.6(–15.6) mm; leaf blade with 5(or 7) segments.
- 29a. Petals white, apex emarginate ..... 31. *G. albiflorum*
- 29b. Petals purplish, apex rounded.
- 30a. Leaf blade deeply divided, ratio of main sinus/middle segment length =  
(0.81–)0.87–0.91; leaf blade middle segment 8–22-lobed in distal half ..... 32. *G. pseudosibiricum*

- 30b. Leaf blade not deeply divided, ratio of main sinus/middle segment length = 0.78–0.82;  
leaf blade middle segment 7–13-lobed in distal half ..... 50. *G. franchetii*
- 25b. Cauline leaves opposite.
- 31a. Petals 0.4–0.8(–0.9) cm; anthers 0.3–1.1 mm.
- 32a. Leaf blade of cauline leaves with 3 segments ..... 14. *G. wilfordii*
- 32b. Leaf blade of cauline leaves with 5 segments.
- 33a. Sepals with glandular trichomes; petals (6.8–)7.3–8.3(–9) mm ..... 17. *G. thunbergii*
- 33b. Sepals without glandular trichomes; petals 5.1–5.9(–6.3) mm ..... 16. *G. nepalense*
- 31b. Petals (0.8–)1–2(–2.8) cm; anthers (0.9–)1.4–3.4 mm.
- 34a. Staminal filaments with a broadly triangular base and an abruptly narrowed apex.
- 35a. Immature fruit reflexed.
- 36a. Leaf blade (4.2–)6.2–11.5 cm, deeply divided, ratio of main sinus/middle segment length =  
(0.81–)0.86–0.94; sepal with a (1.7–)2.2–3.9 mm mucro ..... 33. *G. pratense*
- 36b. Leaf blade 2.2–3.8(–5.5) cm, not deeply divided, ratio of main sinus/middle segment  
length = 0.65–0.79(–0.86); sepal with a 0.7–1.3(–1.9) mm mucro ..... 34. *G. himalayense*
- 35b. Immature fruit erect.
- 37a. Petals (1.6–)1.8–2.8 cm, apex emarginate; sepals (8.4–)9–10.3(–11.3) mm ..... 36. *G. saxatile*
- 37b. Petals (0.8–)1–1.6(–1.8) cm, apex rounded; sepals 4.8–7.3(–9.3) mm ..... 35. *G. collinum*
- 34b. Staminal filaments lanceolate or sometimes slightly dilated at base.
- 38a. Staminal filaments and stigma blackish.
- 39a. Petals 1.2–1.4(–1.6) cm; staminal filaments with 0.2–0.8 mm trichomes ..... 38. *G. christensenianum*
- 39b. Petals 2–2.4 cm; staminal filaments with 1.5–2 mm trichomes ..... 37. *G. lambertii*
- 38b. Staminal filaments and stigma white or purplish.
- 40a. Stipules ovate, connate for most of their length.
- 41a. Petals with trichomes inside only at base, apex rounded; plants erect ..... 43. *G. koreanum*
- 41b. Petals with trichomes inside on basal 1/3, apex emarginate; plants trailing to  
ascending ..... 39. *G. wallichianum*
- 40b. Stipules lanceolate or broadly lanceolate, distinct or sometimes connate for part of their  
length.
- 42a. Dwarf alpine plants 4–20(–40) cm tall; stipules distinct.
- 43a. Rootstock with several napiform roots clustered around it; leaf blade abaxially with  
glandular trichomes ..... 26. *G. napuligerum*
- 43b. Rootstock without napiform roots clustered around it; leaf blade without glandular  
trichomes.
- 44a. Petals very pale pink, claw 2.3–6.1 mm, apex rounded ..... 28. *G. farreri*
- 44b. Petals deep pink, without claw, apex emarginate ..... 27. *G. donianum*
- 42b. Plants with an erect stem (21–)50–129 cm tall; stipules connate or distinct.
- 45a. Petal apices emarginate; stipules distinct ..... 49. *G. rectum*
- 45b. Petal apices rounded; stipules usually connate or connate at least at base.
- 46a. Rootstock horizontal or vertical, long, with thickened roots along it.
- 47a. Petals (1.3–)1.6–1.9(–2.1) cm, outside with trichomes only at base; anthers  
blackish ..... 23. *G. yunnanense*
- 47b. Petals (1–)1.2–1.4 cm, outside with trichomes on basal 1/3–1/2; anthers purplish ... 46. *G. rosthornii*
- 46b. Rootstock vertical, short, with a fascicle of long and thickened roots.
- 48a. Leaf blade deeply divided, ratio of main sinus/middle segment length =  
(0.81–)0.86–0.96.
- 49a. Petals (1.3–)1.4–2 cm ..... 42. *G. soboliferum*
- 49b. Petals (0.8–)0.9–1.3(–1.5) cm.
- 50a. Stigmatic remains 4.6–6.6 mm; nectaries apically with a tuft of trichomes;  
sepals (6.2–)7–10 mm; middle leaf blade segment (4.3–)5.4–8.8 mm wide  
at base ..... 41. *G. krameri*
- 50b. Stigmatic remains 2.8–4.5 mm; nectaries usually glabrous; sepals 5.5–6.9(–9)  
mm; middle leaf blade segment 1.6–4.8(–5.7) mm wide at base ..... 40. *G. dahuricum*
- 48b. Leaf blade not deeply divided, ratio of main sinus/middle segment length =  
0.7–0.81(–0.84).
- 51a. Sepals (7.9–)9.4–11.2 mm; petals (1.5–)1.6–2.1 cm; leaf blade shallowly  
divided, ratio of second sinus/middle segment length = (0.13–)0.2–  
0.24(–0.25); nectaries apically with a tuft of trichomes;  
stigmatic remains 5–6.9 mm ..... 44. *G. wlassovianum*

- 51b. Sepals 5.6–7.5(–7.9) mm; petals 1.1–1.4(–1.5) cm; leaf blade shallowly divided, ratio of second sinus/middle segment length = (0.11–)0.15–0.17(–0.21); nectaries glabrous; stigmatic remains 3.5–4.4 mm ..... 45. *G. maximowiczii*

**1. *Geranium robertianum*** Linnaeus, Sp. Pl. 2: 681. 1753.

汉荭鱼腥草 han hong yu xing cao

*Geranium eriophorum* H. Léveillé.

Biennials or sometimes annuals. Stem 10–55 cm tall, erect, not rooting at nodes, with 0.4–1 mm  $\pm$  patent glandular trichomes. Stipules ovate, distinct. Leaves opposite; petiole with 0.3–0.5 mm retrorse not appressed nonglandular trichomes and 0.4–2.4 mm patent glandular trichomes; leaf blade 3–9 cm, palmately divided, pilose with  $\pm$  appressed glandular trichomes; segments 5, rhombic, with a petiolule on middle segment 0.2–0.4  $\times$  as long as its segment, 16–46-lobed in distal half, ratio of second sinus/middle segment length = 0.26–0.5. Cymules solitary, 2-flowered; peduncle 1–6 cm. Pedicel 0.5–2 cm, with 0.4–1.5 mm patent glandular trichomes and 0.3–0.5 mm retrorse not appressed nonglandular trichomes; bracteoles lanceolate. Sepals 6–8 mm, mucro 1.8–2.5 mm, ratio of mucro/sepal length = ca. 0.3, outside with 0.3–0.5 mm  $\pm$  patent nonglandular trichomes and 0.4–3.2 mm patent glandular trichomes, inside glabrous. Petals purplish, 7.5–9.7(–10.4) mm, erect to patent, glabrous, apex rounded. Staminal filaments pinkish, lanceolate with an abruptly narrowed apex, glabrous; anthers purplish, 0.4–0.6 mm. Nectaries 5, hemispheric, glabrous. Stigma pinkish. Fruit 1.9–2.3 cm, erect when immature; mericarps reticulate, ridges sparse and scarcely anastomosing in basal half but denser apically and forming 1 or 2(or 3) overlapping collar-like keels at apex, without a basal callus, glabrous or sometimes with ca. 0.2 mm nonglandular trichomes, small glands, or both; rostrum 1.7–1.9 cm, with a 4–5 mm narrowed apex; stigmatic remains 1–1.3 mm. Seeds 2.1–2.2 mm. Fl. Apr–Jun, fr. May–Aug. *2n* = 64.

Forests; 900–3300 m. Guizhou, Hubei, Hunan, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Japan, Kazakhstan, Korea, Kyrgyzstan, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; Africa, W Asia, Europe].

Petals of Chinese specimens of *Geranium robertianum* are unusually short. In other areas, petals vary from 0.9 to 1.4 cm. *Geranium purpureum* Villars, which is not recorded from China, is quite similar to *G. robertianum* and has short petals. However, it can be separated by its yellow anthers and by its mericarps closely ribbed. *Geranium purpureum* is widespread in N Africa, Europe, and W Asia as far as Iran.

**2. *Geranium ocellatum*** Cambessèdes in Jacquemont, Voy. Inde 4(Bot.): 33. 1835–1844.

二色老鹳草 er se lao guan cao

*Geranium kweichowense* C. C. Huang; *G. ocellatum* var. *yunnanense* R. Knuth; *G. tapintzense* C. C. Huang.

Annuals. Stem 9–37 cm tall, erect or ascending, not rooting at nodes, with 0.4–2.4 mm patent nonglandular trichomes, 0.1–0.3 mm uncinatate nonglandular trichomes, and usually 0.2–0.4 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.5–2.7 mm patent nonglandular trichomes, 0.1–0.3 mm uncinatate non-

glandular trichomes, and usually 0.2–0.3 mm patent glandular trichomes; leaf blade 1.3–6.7 cm, palmately cleft, ratio of main sinus/middle segment length = 0.63–0.83, pilose with  $\pm$  appressed nonglandular and glandular trichomes; segments 5–7, rhombic, 3–11 mm wide at base, 3–19-lobed in distal half, ratio of second sinus/middle segment length = 0.14–0.29. Cymules solitary, (1 or)2-flowered, sometimes grouped at nodes with short or no peduncles; peduncle (0–)1–9.4 cm. Pedicel 0.5–2.2 cm, with 0.1–0.3 mm patent to uncinatate nonglandular trichomes and usually 0.3–0.5 mm patent glandular trichomes; bracteoles lanceolate. Sepals 3.4–7.2 mm, mucro 0.2–1 mm, ratio of mucro/sepal length = 0.05–0.21, outside with 0.1–2.2 mm  $\pm$  patent nonglandular trichomes and 0.3–0.6 mm patent glandular trichomes, inside glabrous. Petals purplish with a dark basal spot, 3.1–7.5 mm, erect to patent, both surfaces glabrous, margin basally ciliate, apex rounded. Staminal filaments white with dark purplish apex, lanceolate, glabrous; anthers purplish, 0.7–1.1 mm. Nectaries 5, hemispheric, glabrous. Stigma dark purplish. Fruit 1–1.7 cm, erect when immature; mericarps transversely wrinkled, without a basal callus, glabrous; rostrum 0.8–1.4 cm, without a narrowed apex; stigmatic remains 0.2–0.7 mm. Seeds 1.3–2.4 mm. Fl. Feb–Apr, fr. Apr–May. *2n* = 56.

Meadows, farmland; (700–)1600–2200 m. Guangxi, Guizhou, S Sichuan (Huili), Yunnan [Afghanistan, NE India, Kashmir, Nepal, Pakistan; Africa, W Asia].

Mericarps of *Geranium ocellatum* are quite similar to those of *G. molle*, although they have deeper transverse wrinkles. The spotted petals and dark anthers and stigma unequivocally identify *G. ocellatum*.

**3. *Geranium polyanthes*** Edgeworth & J. D. Hooker in J. D. Hooker, Fl. Brit. India 1: 431. 1874.

多花老鹳草 duo hua lao guan cao

Perennials. Rootstock  $\pm$  vertical, 4–10 mm in diam., not tuberculate, without thickened roots. Stem 7–64 cm tall, erect, not rooting at nodes, subglabrous or with a variable indumentum composed of 0.1–0.3 mm uncinatate nonglandular trichomes, 0.8–2.2 mm patent nonglandular trichomes, and 0.2–1.3 mm patent glandular trichomes in different combinations. Stipules ovate, distinct. Leaves 1(or 2) alternate but opposite at inflorescence; petiole subglabrous or with a variable indumentum composed of 0.1–0.3 mm uncinatate nonglandular trichomes, 0.4–1.9 mm patent nonglandular trichomes, and 0.5–1.2 mm patent glandular trichomes in different combinations; leaf blade 2.1–5.6 cm, palmately cleft, ratio of main sinus/middle segment length = 0.68–0.81, pilose with  $\pm$  appressed nonglandular and glandular trichomes; segments 5–7, obtriangular, 3.8–8.9 mm wide at base, 3–9-lobed in distal half, ratio of second sinus/middle segment length = 0.12–0.23. Cymules in dense umbel-like aggregates at apex of each branch, 2(or 3)-flowered; peduncle absent (to 7.3 cm). Pedicel 0.2–2.5 cm, with 1–2.3 mm patent nonglandular trichomes, 0.2–0.3 mm uncinatate nonglandular trichomes, and usually 0.4–0.7 mm patent glandular trichomes; bracteoles lanceolate. Sepals 4.9–8.2 mm, mucro 0.4–1 mm, ratio of mucro/sepal length = 0.06–0.13, outside with

0.2–2.6 mm ± patent nonglandular trichomes and 0.4–1.1 mm patent glandular trichomes, inside glabrous. Petals pinkish, (0.8–)1–1.4 cm, erect to patent, outside glabrous, inside basally with trichomes, margin basally ciliate, apex rounded or retuse. Staminal filaments white, lanceolate, adaxially pilose and proximal half ciliate, trichomes 0.3–0.7 mm; anthers yellow, 0.6–1.1 mm. Nectaries 5, hemispheric, glabrous. Stigma pinkish. Fruit 1.3–2.1 cm, erect when immature; mericarps reticulate, without a basal callus, with ± appressed 0.1–0.2 mm nonglandular trichomes; rostrum 0.9–1.4 cm, without a narrowed apex or with a 0.5–1 mm narrowed apex; stigmatic remains 0.7–1.7 mm. Seeds 1.9–2.6 mm. Fl. Jul–Aug, fr. Aug–Oct.

Forests, scrub, meadows; 2900–4000 m. Sichuan (Kangding), SE Xizang, NW Yunnan [Bhutan, N India, Nepal].

This species is well characterized by its 2(or 3)-flowered cymules in dense umbel-like aggregates at the apex of each branch and its short or absent peduncles. *Geranium carolinianum* is an annual with similar inflorescences but with smooth mericarps. Rootstock of *G. polyanthes* is usually vertical, sometimes knotty (probably when growing in difficult soils), but not tuberose. This species can produce cleistogamic flowers of less size, which are not considered in the description.

**4. *Geranium hispidissimum*** (Franchet) R. Knuth in Engler, Pflanzenr. 53(IV. 129): 183. 1912.

刚毛紫地榆 gang mao zi di yu

*Geranium strigosum* Franchet var. *hispidissimum* Franchet, Pl. Delavay. 113. 1889; *G. platylobum* (Franchet) R. Knuth; *G. strigosum* var. *platylobum* Franchet.

Perennials. Rootstock ± vertical, 0.6–1.6 cm in diam., not tuberculate, without thickened roots. Stem 16–72 cm tall, erect or ascending, not rooting at nodes, with 0.1–0.3 mm uncinat nonglandular trichomes, 0.3–3.5 mm patent glandular trichomes, and usually 0.5–3.3 mm patent nonglandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.1–0.3 mm uncinat nonglandular trichomes, 0.4–3.2 mm patent glandular trichomes, and usually 0.4–3.1 mm patent nonglandular trichomes; leaf blade 2.4–5.3 cm, palmately cleft, ratio of main sinus/middle segment length = (0.55–)0.67–0.76 (–0.8), pilose with ± appressed nonglandular and glandular trichomes; segments 5, obtriangular, 4.8–11.7 mm wide at base, 9–16-lobed in distal half, ratio of second sinus/middle segment length = 0.14–0.28. Cymules solitary, 2-flowered; peduncle 1.1–14.5 cm. Pedicel 0.8–3.2 cm, with 0.1–0.3 mm uncinat nonglandular trichomes, 0.6–2 mm patent glandular trichomes, and usually 0.2–2.2 mm patent nonglandular trichomes; bracteoles lanceolate. Sepals 4.9–7.3 mm, mucro 0.8–2.4 mm, ratio of mucro/sepal length = 0.17–0.35, outside with 0.1–0.5 mm ± patent nonglandular trichomes and 1–3.4 mm patent glandular trichomes, inside glabrous adaxially. Petals white or pinkish, 8.6–9.8(–10.6) mm, erect to patent, outside usually glabrous, inside basally with trichomes, margin basally ciliate, apex rounded. Staminal filaments whitish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.2–0.9 mm; anthers brownish purple, 1.2–1.7 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma pinkish. Fruit 2.3–2.8 cm, erect when immature; mericarps reticulate, without a basal callus, glabrous or with 0.1–0.2 mm ± appressed

nonglandular trichomes; rostrum 1.6–2 cm, without a narrowed apex or with a 0.5–1 mm narrowed apex; stigmatic remains 1.5–2.4 mm. Seeds 2.2–3.3 mm. Fl. Jun–Jul, fr. Jul–Sep.

- Secondary forests, scrub, meadows; 1500–3000 m. NW Yunnan.

Plants that have gone under the name *Geranium platylobum* represents a form with more rounded leaf blade segments, otherwise indistinguishable from *G. hispidissimum*. Indumentum of *G. hispidissimum* is variable. In some specimens, glandular trichomes can densely cover stems, petioles, or pedicels, although they can be scattered in others. Patent nonglandular trichomes are not always present.

**5. *Geranium strictipes*** R. Knuth in Engler, Pflanzenr. 53(IV. 129): 581. 1912.

紫地榆 zi di yu

*Geranium strictipes* var. *grandiflorum* (Franchet) C. Y. Wu ex H. W. Li; *G. strigosum* Franchet (1887), not N. L. Burman (1768); *G. strigosum* var. *gracile* Franchet; *G. strigosum* var. *grandiflorum* Franchet.

Perennials. Rootstock ± vertical, 0.6–2.8 cm in diam., not tuberculate, without thickened roots. Stem 20–76 cm tall, erect or ascending, not rooting at nodes, with 0.3–2.2 mm patent nonglandular trichomes and usually 0.4–3.4 mm patent glandular trichomes or sometimes subglabrous. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.4–2 mm patent nonglandular trichomes, 0.1–0.3 mm uncinat nonglandular trichomes, and usually 0.2–2.7 mm patent glandular trichomes; leaf blade 1.8–4.9 cm, palmately cleft, ratio of main sinus/middle segment length = (0.69–)0.8–0.88, pilose with ± appressed nonglandular and glandular trichomes; segments 5, rhombic, 3.2–8.3 mm wide at base, 8–16-lobed in distal half, ratio of second sinus/middle segment length = 0.24–0.46. Cymules solitary, 2-flowered; peduncle 4.1–10.9 cm. Pedicel 0.5–2.4 cm, with 0.2–1.9 mm patent nonglandular trichomes, 0.2–0.3 mm uncinat nonglandular trichomes, and 0.4–1.7 mm patent glandular trichomes; bracteoles lanceolate. Sepals 6–7.8 mm, mucro 0.8–2.3 mm, ratio of mucro/sepal length = 0.11–0.35, outside with 0.2–1.9 mm patent nonglandular trichomes and 0.8–2.8 mm patent glandular trichomes, inside glabrous. Petals pinkish, (1–)1.2–1.5 cm, erect to patent, both surfaces basally with trichomes, margin basally ciliate, apex rounded or with a 0.5–1 mm notch. Staminal filaments yellowish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.2–0.8 mm; anthers yellowish, 1–2.7 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma yellowish. Fruit 2.8–4.6 cm, erect when immature; mericarps reticulate, without a basal callus, with 0.1–0.2 mm ± appressed nonglandular trichomes; rostrum 1.9–3.7 cm, with a 1–2.6 mm narrowed apex; stigmatic remains 1.9–2.7 mm. Seeds 3.3–4.4 mm. Fl. Jul–Aug, fr. Aug–Sep.

- Secondary forests, scrub, meadows; 2500–3000 m. SW Sichuan, Yunnan.

*Geranium strictipes* shares reticulate mericarps and opposite leaves with *G. hispidissimum*. They are close species and difficult to distinguish, although *G. strictipes* has more deeply divided leaves (see primary and secondary division of middle segment and its narrower base). Additionally, the middle segment is rhombic in *G. strictipes* and ± obtriangular

in *G. hispidissimum*. Leaf indumentum is denser in *G. hispidissimum*, which also has shorter petals.

The rhizomes are a local medicine for indigestion.

**6. *Geranium moupinense*** Franchet, Nouv. Arch. Mus. Hist. Nat., sér. 2, 8: 208. 1886.

宝兴老鹳草 bao xing lao guan cao

*Geranium ascendens* Z. M. Tan.

Perennials. Rootstock ± vertical, 3–5 mm in diam., not tuberculate, without thickened roots. Stem 12–25 cm tall, erect, not rooting at nodes, with 0.1–0.3 mm uncinete nonglandular trichomes and 0.7–1.1 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves alternate; petiole with 0.1–0.2 mm uncinete nonglandular trichomes and 0.8–1.1 mm patent glandular trichomes; leaf blade 3.6–5.8 cm, palmately cleft, ratio of main sinus/middle segment length = 0.76–0.81, pilose with ± appressed nonglandular and glandular trichomes; segments 5, obtriangular, 3.8–7 mm wide at base, 3–7-lobed in distal half, ratio of second sinus/middle segment length = 0.14–0.18. Cymules solitary, 2-flowered; peduncle 4.8–7.2 cm. Pedicel 2.5–2.8 cm, with 0.2–0.3 mm uncinete retrorse nonglandular trichomes and 0.7–1.1 mm patent glandular trichomes; bracteoles lanceolate. Sepals 7.9–8.9 mm, mucro 1.7–1.8 mm, ratio of mucro/sepal length = 0.19–0.22, outside with 0.1–0.3 mm ± patent nonglandular trichomes and 1.4–1.8 mm patent glandular trichomes, inside glabrous. Petals pinkish, ca. 1.2 cm, erect to patent, both surfaces basally with trichomes, margin basally ciliate, apex rounded. Staminal filaments whitish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.4–1 mm; anthers brown, 1.6–1.7 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma color unknown. Fruit ca. 2.3 cm, erect when immature; mericarps reticulate, without a basal callus, with 0.1–0.2 mm ± appressed nonglandular trichomes; rostrum ca. 1.6 cm, with a ca. 1.7 mm narrowed apex; stigmatic remains ca. 1.9 mm. Seeds ca. 2 mm. Fl. Jun–Jul, fr. Aug–Sep.

• Secondary forests, scrub, meadows; 2200–3000 m. W Sichuan.

Description of *Geranium moupinense* is in some points incomplete because only a few collections are known. However, this species is well characterized by its reticulate mericarps, alternate leaves, and solitary cymules.

**7. *Geranium umbelliforme*** Franchet, Bull. Soc. Bot. France 33: 443. 1887.

伞花老鹳草 san hua lao guan cao

Perennials. Rootstock ± vertical, 6–11 mm in diam., not tuberculate, without thickened roots. Stem 28–45 cm tall, erect, not rooting at nodes, with 0.3–3.9 mm patent nonglandular trichomes and 0.7–1.8 mm patent glandular trichomes. Stipules ovate, distinct. Leaves alternate; petiole with 0.4–3.9 mm patent nonglandular trichomes and 0.6–1.8 mm patent glandular trichomes; leaf blade 3.7–8.4 cm, palmately cleft, ratio of main sinus/middle segment length = 0.66–0.73, pilose with ± appressed nonglandular and glandular trichomes; segments 5 or 7, obtriangular, 0.8–1.4 cm wide at base, 7–15-lobed in distal half, ratio of second sinus/middle segment length = 0.16–0.19.

Cymules in loose umbel-like aggregates at apex of each branch, (2 or)3(or 4)-flowered; peduncle 2.5–6.7 cm. Pedicel 0.6–3.5 cm, with 0.4–3.5 mm patent nonglandular trichomes and 0.6–1.8 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 6.1–7.6 mm, mucro 0.7–1.4 mm, ratio of mucro/sepal length = 0.11–0.18, outside with 0.3–3.2 mm patent nonglandular trichomes and 0.6–1.6 mm patent glandular trichomes, inside glabrous. Petals pinkish, 1.3–1.5 cm, erect to patent, both surfaces basally with trichomes but mainly inside, margin basally ciliate, apex rounded or retuse. Staminal filaments whitish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.3–0.9 mm; anthers brownish, 0.9–1.6 mm. Nectaries 5, hemispheric, glabrous. Stigma reddish. Fruit ca. 1.8 cm, erect when immature; mericarps reticulate, without a basal callus, with 0.1–0.2 mm ± appressed nonglandular trichomes; rostrum ca. 1.2 cm, with a ca. 2 mm narrowed apex; stigmatic remains ca. 1.5 mm. Seeds not known. Fl. Jun–Aug, fr. Aug–Oct.

• Meadows in forest zone; 2800–3200 m. S Sichuan, NW Yunnan.

This species somewhat resembles *Geranium polyanthes*, although its inflorescence is more lax because cymules always have a well-developed peduncle. Differences in rostrum shape should be checked with more fruiting material of *G. umbelliforme*, because only one mature fruit has been studied. Ovate stipules are shared with *G. polyanthes* and *G. wardii* Yeo. The latter is an endemic from C Myanmar and has opposite leaves.

**8. *Geranium divaricatum*** Ehrhart, Beitr. Naturk. 7: 164. 1792.

叉枝老鹳草 cha zhi lao guan cao

Annuals. Stem 20–50 cm tall, erect, not rooting at nodes, with 1–3 mm patent nonglandular trichomes and 0.2–0.5 mm patent glandular and nonglandular trichomes. Stipules lanceolate, distinct. Leaves alternate; petiole with 1–2.8 mm patent nonglandular trichomes and 0.2–0.5 mm glandular and nonglandular trichomes; leaf blade 2.5–7 cm, palmately cleft, ratio of main sinus/middle segment length = 0.65–0.85, pilose with ± appressed nonglandular and glandular trichomes; segments 5(or 7), rhombic, 4–9 mm wide at base, 7–12(–15)-lobed in distal half, ratio of second sinus/middle segment length = 0.16–0.26. Cymules solitary, 2-flowered; peduncle 0.6–3.5 cm. Pedicel 1–2.8 cm, with 1–2.5 mm patent nonglandular trichomes and 0.2–0.5 mm patent glandular and nonglandular trichomes; bracteoles lanceolate. Sepals 4–4.5 mm, mucro 0.7–1 mm, ratio of mucro/sepal length = 0.17–0.22, outside with 0.2–0.8 mm patent nonglandular trichomes and 0.3–0.7 mm patent glandular trichomes, inside glabrous. Petals bright purple, 4–6.5 mm, erect to patent, margin basally ciliate or not, apex emarginate with a ca. 1 mm notch. Staminal filaments white, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.1–0.2 mm; anthers purple, 0.4–0.6 mm. Nectaries 5, hemispheric, glabrous. Stigma pale pink. Fruit 7–11 mm, erect when immature; mericarps with 3 or 4 transverse ribs, without a basal callus, with 0.2–0.5 mm appressed nonglandular trichomes, base not ciliate; rostrum 5–8 mm, without a narrowed apex; stigmatic remains 0.5–1 mm. Seeds 2.4–2.6 mm. Fl. May–Jun, fr. Jun–Jul.  $2n = 28$ .

Slopes of lower mountains, plains; 900–1200 m. N Xinjiang [Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan; W Asia, Europe].

The poorly developed rostrum is a good feature to identify *Geranium divaricatum*, as it is not shared by any other species from this area. This short and thin rostrum reduces the effectiveness of the seed discharge mechanism.

**9. *Geranium molle*** Linnaeus, Sp. Pl. 2: 682. 1753.

软毛老鹳草 ruan mao lao guan cao

Annuals. Stem 10–45 cm tall, erect or decumbent, not rooting at nodes, with 1–1.7 mm patent nonglandular trichomes and 0.2–0.5 mm patent glandular and nonglandular trichomes. Stipules lanceolate, distinct. Leaves alternate; petiole with 1–1.5 mm patent nonglandular trichomes and 0.2–0.5 mm glandular and nonglandular trichomes; leaf blade 0.9–4 cm, palmately cleft, ratio of main sinus/middle segment length = 0.5–0.75, pilose with appressed nonglandular trichomes; segments 5, obtriangular, 1.5–5 mm wide at base, 3(or 4)-lobed at apex, ratio of second sinus/middle segment length = 0.14–0.25. Cymules solitary, 2-flowered; peduncle 0.5–8 cm. Pedicel 0.5–1.5 cm, with 1–1.8 mm patent nonglandular trichomes and 0.2–0.5 mm patent glandular and nonglandular trichomes; bracteoles lanceolate. Sepals (1–)2.5–5.5(–6) mm, mucro 0.1–0.2 mm, ratio of mucro/sepal length = 0.03–0.1, outside with 1–1.5 mm patent nonglandular trichomes and 0.2–0.5 mm  $\pm$  patent nonglandular and glandular trichomes, outside glabrous. Petals bright purple, 3–8.5(–10.5) mm, erect to patent, both surfaces glabrous, margin basally ciliate, apex emarginate with a 1–2.5 mm notch. Staminal filaments whitish, lanceolate, glabrous except proximal half with some 0.1–0.2 mm cilia; anthers purplish, 0.7–1.5 mm. Nectaries 5, hemispheric, glabrous. Stigma purplish. Fruit 0.8–1.4 cm, erect when immature; mericarps transversely wrinkled, without a basal callus, glabrous but with a few cilia at base; rostrum 6–11 mm, with a 1–3 mm narrowed apex; stigmatic remains 1–2 mm. Seeds 1.4–1.8 mm. Fl. May, fr. May.  $2n = 26$ .

Waste places, open habitats, dry grasslands, roadsides; 1800–1900 m. Naturalized in Taiwan [native to Afghanistan, N Africa, W Asia, Europe, Kashmir, Russia].

Although found as a naturalized weed in Taiwan, this species could be found as a native plant near the W boundaries of China, because its natural area includes the W Himalayas. This species also grows as an introduced weed in America and Australia.

**10. *Geranium pusillum*** Linnaeus, Syst. Nat., ed. 10, 2: 1144. 1759.

矮老鹳草 ai lao guan cao

Annuals. Stem 10–50 cm tall, erect or decumbent, not rooting at nodes, with 0.1–0.3 mm patent nonglandular trichomes and 0.1–0.2 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.1–0.3 mm patent nonglandular trichomes and 0.1–0.2 mm patent glandular trichomes; leaf blade 1.5–3.8 cm, palmately cleft, ratio of main sinus/middle segment length = 0.3–0.75, pilose with appressed nonglandular trichomes; segments 5, obtriangular, 2–4 mm wide at base, 3(–5)-lobed at apex, ratio of second sinus/middle segment length = 0.16–0.29. Cymules solitary, 2-flowered; peduncle 0.5–3.2 cm. Pedicel 0.6–1.6 cm, with 0.1–0.3 mm patent nonglandular trichomes and 0.1–0.2 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 3–4.5 mm, mucro

ca. 0.1 mm, ratio of mucro/sepal length = 0.02–0.03, outside with 0.6–1 mm patent nonglandular trichomes and 0.2–0.5 mm  $\pm$  patent nonglandular and glandular trichomes, outside glabrous. Petals pale purple, 2–3 mm, erect to patent, both surfaces glabrous, margin basally ciliate, apex emarginate with a 0.2–0.5 mm notch. Stamens external whorl lacking anthers and reduced to 5 staminodes; filaments white, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.1–0.2 mm; anthers purplish, ca. 0.3 mm. Nectaries 5, hemispheric, glabrous. Stigma yellowish. Fruit 0.9–1.1 cm, erect when immature; mericarps smooth, without a basal callus, with 0.2 mm appressed nonglandular trichomes, base with a few cilia; rostrum 7–9 mm, without a narrowed apex; stigmatic remains 0.5–0.7 mm. Seeds 1.7–1.8 mm. Fl. Jun–Jul, fr. Aug–Oct.  $2n = 26$ .

Open habitats, dry grassland, cultivated and waste places; 1800–2300 m. Naturalized in Taiwan [native to Afghanistan, W Asia, Europe, Kashmir, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, Uzbekistan].

Although found as a naturalized weed in Taiwan, this species could be found as a native plant near the W boundaries of China, because its natural area includes the W Himalayas. This species also grows as an introduced weed in America and Australia.

**11. *Geranium linearilobum*** Candolle in Lamark & Candolle, Fl. Franç. ed. 3, 5: 629, in note. 1815.

球根老鹳草 qiu gen lao guan cao

*Geranium transversale* (Karelin & Kirilov) Vvedensky; *G. tuberosum* Linnaeus var. *transversale* Karelin & Kirilov.

Perennials. Rootstock tubercles subglobose, 6.2–13.7  $\times$  6.1–13.7 mm, with nontuberous separations 0.1–4.8 cm, 0.6–2.1 mm in diam., without thickened roots. Stem 19–46 cm tall, erect, not rooting at nodes, with 0.1–0.8 mm patent to retrorse nonglandular trichomes. Stipules lanceolate, distinct. Leaves 1(or 2) alternate but opposite at inflorescence; petiole with 0.1–0.8 mm patent to retrorse nonglandular trichomes; leaf blade 2.3–6.6 cm, palmately divided, pilose with appressed nonglandular trichomes; segments 5 or 7, rhombic to rarely linear-lanceolate, (1–)3–15-lobed at apex, ratio of second sinus/middle segment length = 0.23–0.84. Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle (0–)0.3–5.6 cm. Pedicel 0.4–2.2 cm, with 0.3–1.1 mm patent nonglandular trichomes; bracteoles linear-lanceolate. Sepals 4.4–6.8 mm, mucro 0.2–2.7 mm, ratio of mucro/sepal length = 0.05–0.42, outside with 0.3–2.2 mm  $\pm$  patent nonglandular trichomes, inside glabrous. Petals purplish, (0.8–)1–1.4(–1.5) cm, erect to patent, both surfaces glabrous, margin basally ciliate, apex emarginate with a 0.9–4.8 mm notch. Staminal filaments pinkish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.3–2.7 mm; anthers yellowish, 1.1–2.4 mm. Nectaries 5, hemispheric, glabrous. Stigma dark purplish. Fruit 2.1–2.9 cm, erect when immature; mericarps smooth, without a basal callus, with 0.3–2.2 mm  $\pm$  patent nonglandular trichomes; rostrum 1.5–2.4 cm, with a 1.7–3 mm narrowed apex; stigmatic remains 1.1–2.3 mm. Seeds 2–2.5 mm. Fl. May–Jun, fr. Jun.

Stony slopes, sandy deserts, sandy steppes, fields; 500–800 m. NW Xinjiang [Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, Uzbekistan; W Asia].

Some authors recognized two subspecies under *Geranium linearilobum*: plants with deeply dissected leaf blade segments into few linear lacinae may be considered as subsp. *linearilobum*, while specimens with incised or pinnatifid leaf blade segments belong to subsp. *transversale*. The variability of leaf shape in *G. linearilobum* is really remarkable, and it has not been possible to relate to any geographical area or other characters, such as trichome length or staminal filaments shape. A detailed discussion of this question is found in Aedo and Estrella (Israel J. Pl. Sci. 54: 19–54. 2006).

## 12. *Geranium carolinianum* Linnaeus, Sp. Pl. 2: 682. 1753.

野老鹳草 *ye lao guan cao*

Annuals. Stem 10–65(–70) cm tall, erect, not rooting at nodes, with abundant 0.2–1.1 mm patent to retrorse nonglandular trichomes and scattered 0.2–0.7 mm patent glandular trichomes. Stipules lanceolate to subulate, distinct. Leaves 1–3 alternate but opposite at inflorescence; petiole with usually 0.2–1.1 mm patent nonglandular trichomes and scattered glandular trichomes; leaf blade 2.2–6.5 cm, palmately cleft, ratio of main sinus/middle segment length = 0.7–0.9, pilose with appressed nonglandular trichomes; segments 5(or 7), rhombic, 2–5 mm wide at base, 5–12-lobed in distal half, ratio of second sinus/middle segment length = 0.27–0.31. Cymules in dense aggregates at apex of each branch or solitary in forks, 2(or 3)-flowered; peduncle 0–2.5(–6) cm. Pedicel 3–11 mm, with 0.2–0.7 mm patent or sometimes retrorse but not appressed nonglandular trichomes and 0.3–0.6 mm patent glandular trichomes; bracteoles lanceolate. Sepals 5–6.5 mm, mucro 1.5–2 mm, ratio of mucro/sepal length = ca. 0.3, outside with 0.1–0.6 mm antrorse to patent nonglandular trichomes and 0.2–0.5 mm patent glandular trichomes, inside glabrous. Petals white or pale purple, 5.5–6 mm, erect to patent, inside glabrous, margin basally ciliate, apex rounded or slightly notched. Staminal filaments whitish, lanceolate to lanceolate with an abruptly narrowed apex, abaxially sparsely pilose and basal half ciliate, trichomes 0.1–0.3 mm; anthers yellowish, 0.4–0.6 mm. Nectaries 5, hemispheric, glabrous. Stigma pinkish. Fruit 1.9–2.5 cm, erect when immature; mericarps smooth, with a basal callus, with 0.5–1.8 mm patent to antrorse nonglandular trichomes and sometimes 0.4–1 mm patent glandular trichomes; rostrum 1.5–1.9 cm, with a 1–2 mm narrowed apex; stigmatic remains 0.7–1.4 mm. Seeds 2–2.2 mm. Fl. Apr–Jul, fr. May–Sep.  $2n = 46–48, 52$ .

Plains, weedy areas; sea level to 800 m. Naturalized in Anhui, Chongqing, Fujian, Guangxi, Hubei, Hunan, S Jiangsu, Jiangxi, Sichuan (Yanyuan), Taiwan, Yunnan, Zhejiang [native to North America].

This species has distinctive mericarps that are blackish when ripe and that have long patent trichomes. Presence of glandular trichomes is rather variable along plant. The whole plant is used in Chinese medicine for relieving rheumatic pains and colds.

This species is also a naturalized weed in South America, N Europe, and Japan.

## 13. *Geranium rotundifolium* Linnaeus, Sp. Pl. 2: 683. 1753.

圆叶老鹳草 *yuan ye lao guan cao*

Annuals. Stem 10–40 cm tall, erect, not rooting at nodes, with 0.2–1.2 mm patent nonglandular trichomes and 0.2–0.6 mm

patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.2–1 mm patent nonglandular trichomes and 0.2–0.6 mm patent glandular trichomes; leaf blade 1.2–3.3 cm, palmately cleft, ratio of main sinus/middle segment length = 0.55–0.65, pilose with appressed nonglandular and sometimes glandular trichomes; segments 5, obtriangular, 5–10 mm wide at base, (3–)6–8-lobed at apex, ratio of second sinus/middle segment length = 0.13–0.2. Cymules solitary, 2-flowered; peduncle 1.8–3 cm. Pedicel 0.7–2 cm, with 0.3–1 mm patent nonglandular trichomes and 0.3–0.6 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 4.5–6 mm, mucro 0.3–0.6 mm, ratio of mucro/sepal length = 0.06–0.1, outside with 0.4–1 mm patent nonglandular trichomes and 0.4–0.9 mm patent glandular trichomes, inside glabrous. Petals purplish, 6–7 mm, erect to patent, both surfaces glabrous or sometimes inside with scattered trichomes, apex rounded. Staminal filaments whitish, lanceolate, basally slightly dilated, glabrous except proximal half with some 0.1–0.2 mm cilia; anthers yellowish, ca. 0.5 mm. Nectaries 5, hemispheric, glabrous. Stigma reddish. Fruit 1.6–1.8 cm, erect when immature; mericarps smooth, with a basal callus, with 0.2–0.3 mm  $\pm$  patent nonglandular trichomes; rostrum 1.2–1.3 cm, with a 2–3 mm narrowed apex; stigmatic remains 1–1.2 mm. Seeds 1.8–2 mm. Fl. May–Jun, fr. Jun–Jul.  $2n = 26$ .

Steppes; 900–1400 m. NW Xinjiang [Afghanistan, Kashmir, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan, Uzbekistan; N Africa, W Asia, Europe].

The general appearance of this species is much like *Geranium molle* or *G. pusillum*, and it occasionally has been misidentified with these species. However, its rounded petals and smooth mericarps permit an easy identification, which also could be supported by its subspherical and remarkably reticulate seeds.

## 14. *Geranium wilfordii* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 26: 453. 1880.

老鹳草 *lao guan cao*

*Geranium chinense* Migo (1935), not *G. sinense* R. Knuth (1912); *G. wilfordii* var. *chinense* H. Hara; *G. wilfordii* var. *glandulosum* Z. M. Tan; *G. wilfordii* var. *schizopetalum* F. Z. Li.

Perennials. Rootstock  $\pm$  horizontal, 4.3–8.7 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 24–86 cm tall, erect, not rooting at nodes, with 0.3–0.7 mm retrorse  $\pm$  appressed nonglandular trichomes. Stipules subulate, distinct. Leaves opposite or sometimes alternate toward base; petiole with 0.2–0.9 mm retrorse  $\pm$  appressed nonglandular trichomes; leaf blade 3.7–8.1 cm, palmately cleft, ratio of main sinus/middle segment length = 0.72–0.92, pilose with appressed nonglandular trichomes; segments 3(or 5), rhombic, 0.7–1.5 cm wide at base, 7–19-lobed in distal half, ratio of second sinus/middle segment length = 0.04–0.19. Cymules solitary, (1 or)2-flowered; peduncle 1.4–4.7 cm. Pedicel 0.8–1.9 cm, with 0.1–0.5 mm retrorse  $\pm$  appressed nonglandular trichomes and usually 0.2–1.1 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 3.5–7.1 mm, mucro 0.8–2.3 mm, ratio of mucro/sepal length = 0.14–0.33, outside with 0.1–0.7 mm antrorse appressed nonglandular trichomes and 0.2–1.1 mm patent glandular trichomes, inside almost glabrous. Petals pale



pink or white, 4–6.2(–6.9) mm, erect to patent, both surfaces basally with a few trichomes, margin with a few cilia, apex rounded or retuse. Staminal filaments yellowish, lanceolate with an abruptly narrowed apex, expanded base of inner whorl usually auriculate, abaxially pilose and proximal half ciliate, trichomes 0.1–0.4 mm; anthers violet-blue, 0.7–1 mm. Nectaries 5, hemispheric, glabrous. Stigma pale pink to crimson. Fruit 2–2.2 cm, erect when immature; mericarps smooth, with a basal callus, with 0.7–1.2 mm  $\pm$  patent nonglandular trichomes and sometimes 0.6–1.2 mm patent glandular trichomes; rostrum 1.3–1.7 cm, with a 0.9–1.7 mm narrowed apex; stigmatic remains 1.3–2.7 mm. Seeds 2.4–2.9 mm. Fl. Jun–Jul, fr. Jul–Aug.  $2n = 28$ .

Scrub, meadows, by water, weedy areas; 100–1800 m. Anhui, Fujian, S Gansu, Guizhou, Hebei, S Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, E Nei Mongol, S Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, E Yunnan, Zhejiang [Japan, Korea, Russia; Europe (introduced)].

Leaves permit a quick identification of *Geranium wilfordii*, because the blade is triangular in outline with 3 segments. In some specimens, the blade of basal leaves can have 2 more very short segments at the base, producing leaves with a  $\pm$  pentagonal outline. These plants could be confused with *G. thunbergii*, which has longer petals. Basal cauline leaves are usually alternate in *G. wilfordii* but few herbarium specimens with whole plants are available to ascertain the variability of this feature. Glandular indumentum is variable, sometimes even in the same specimen.

### 15. *Geranium sibiricum* Linnaeus, Sp. Pl. 2: 683. 1753.

鼠掌老鹳草 shu zhang lao guan cao

Perennials. Rootstock  $\pm$  vertical, 2–5.3 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 15–95 cm tall, erect or ascending, not rooting at nodes, with 0.3–1 mm patent or retrorse nonglandular trichomes. Stipules lanceolate to subulate, distinct. Leaves opposite; petiole with 0.3–1.5 mm patent to retrorse nonglandular trichomes; leaf blade 1.7–5.8 cm, palmately cleft, ratio of main sinus/middle segment length = 0.83–0.92, pilose with appressed nonglandular trichomes; segments 5, narrowly rhombic, 3.2–5.5 mm wide at base, 7–14-lobed in distal half, ratio of second sinus/middle segment length = 0.18–0.28. Cymules solitary, 1(or 2)-flowered; peduncle (0–)0.9–8.8 cm. Pedicel 1.8–3.5 cm, with 0.2–0.8 mm patent to retrorse nonglandular trichomes; bracteoles linear-lanceolate. Sepals 3.7–6.4 mm, mucro 0.9–1.6 mm, ratio of mucro/sepal length = 0.17–0.34, outside with 0.2–1.1 mm patent to antrorse  $\pm$  appressed nonglandular trichomes, inside glabrous. Petals white or pink with purplish veins, 4–5.4(–5.8) mm, erect to patent, both surfaces glabrous, margin basally ciliate, apex rounded or slightly notched. Staminal filaments yellowish, lanceolate with an abruptly narrowed apex, both sides glabrous but proximal half ciliate with 0.1–0.3 mm trichomes; anthers bluish, 0.3–0.7 mm. Nectaries 5, hemispheric, glabrous. Stigma yellowish. Fruit 1.4–1.9 cm, erect when immature; mericarps smooth with 1 transversal vein at apex, with a basal callus, with 0.1–1.5 mm  $\pm$  patent nonglandular trichomes; rostrum 0.8–1.4 cm, with a 0.4–1 mm narrowed apex; stigmatic remains 0.8–1.3 mm. Seeds 2–2.8 mm. Fl. Jun–Jul, fr. Jul–Aug.  $2n = 28$ .

Forest margins, scrub, meadows, weedy areas; 2000–3900 m. Gansu, NE Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei,

Hunan, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, N Japan, Kazakhstan, Korea, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; W Asia, Europe].

This species is characterized by 1-flowered cymules and by leaves with narrow segments. Some specimens occasionally have 2-flowered cymules, although most of the inflorescences have 1-flowered cymules. Some authors have suggested that European plants are characterized by pink to pinkish violet petals and villous vegetative parts and Siberian plants by white to pale pink petals and short and appressed trichomes. In Chinese specimens, these characters appear mixed in different combinations, which does not support such a division. Note also the discussion under *Geranium nepalense*.

### 16. *Geranium nepalense* Sweet, Geraniaceae 1: t. 12. 1820.

尼泊尔老鹳草 ni bo er lao guan cao

*Geranium fangii* R. Knuth; *G. jinchuanense* Z. M. Tan; *G. lavgneanum* H. Léveillé; *G. lavgneanum* var. *cinerascens* H. Léveillé; *G. nepalense* var. *oliganthum* (C. C. Huang) C. C. Huang & L. R. Xu; *G. oliganthum* C. C. Huang.

Perennials. Rootstock  $\pm$  vertical, 2–5.8 mm in diam., not tuberculate, without thickened roots. Stem 27–72 cm tall, trailing or ascending, sometimes rooting at nodes, with 0.2–1.4 mm patent or retrorse appressed nonglandular trichomes. Stipules lanceolate to subulate, distinct. Leaves opposite; petiole with 0.2–1.5 mm patent to retrorse nonglandular trichomes; leaf blade 2.3–4.1 cm, palmately cleft, ratio of main sinus/middle segment length = 0.78–0.89, pilose with appressed nonglandular trichomes; segments 5, broadly rhombic, 3.7–6.5 mm wide at base, 6–12-lobed in distal half, ratio of second sinus/middle segment length = 0.15–0.27. Cymules solitary, (1 or)2-flowered; peduncle 1.2–8.3 cm. Pedicel 1.1–2.5 cm, with 0.2–1 mm patent to retrorse nonglandular trichomes; bracteoles linear-lanceolate. Sepals 4.1–5.8 mm, mucro 0.4–1 mm, ratio of mucro/sepal length = 0.09–0.21, outside 0.4–1.1 mm with  $\pm$  patent nonglandular trichomes, inside glabrous. Petals white, pale pink, or rarely deep pink, 5.1–5.9(–6.3) mm, erect to patent, both surfaces and margin with a few trichomes, apex rounded or slightly notched. Staminal filaments whitish, lanceolate with an abruptly narrowed apex, abaxially pilose and proximal half ciliate, trichomes 0.1–0.4 mm; anthers violet, 0.3–0.9 mm. Nectaries 5, hemispheric, glabrous. Stigma reddish. Fruit 1.4–1.8 cm, erect when immature; mericarps smooth with 1 transversal vein at apex, with a basal callus, with 0.3–1.3 mm  $\pm$  patent nonglandular trichomes; rostrum 0.9–1.2 cm, with a 1–2 mm narrowed apex; stigmatic remains 0.8–1.4 mm. Seeds 1.9–2.3 mm. Fl. Apr–Sep, fr. May–Oct.  $2n = 26, 28$ .

Forest margins, scrub, meadows, weedy areas; (100–)1000–3600 m. Gansu, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Qinghai, Shaanxi, Shanxi, Sichuan, E Xizang, Yunnan [Afghanistan, Bhutan, NE and S India, Indonesia (N Sumatra), Kashmir, Laos, N Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, N Vietnam].

This species is sometimes difficult to distinguish from *Geranium sibiricum*. Normally, at least some cymules in each plant of *G. nepalense* are 2-flowered, but 1-flowered cymules are not infrequent. In extreme forms, 2-flowered cymules can be difficult to locate. Information from herbarium specimens is not enough to understand this variability, and further field studies could be necessary. *Geranium nepalense* has leaves with broader segments than in *G. sibiricum* (with the widest point nearest

to the apex), shorter narrowed apex of the rostrum, and longer sepal mucro. Additionally, *G. nepalense* is sometimes rooting at the nodes, which has not been observed in *G. sibiricum*. Distribution of *G. nepalense* seems to be more southern than that of *G. sibiricum*. Questionable provincial records need to be checked, as some records from N China may actually be *G. sibiricum* and some from E China may actually be *G. thunbergii*.

The whole plant is used for Chinese medicine.

**17. *Geranium thunbergii*** Siebold ex Lindley & Paxton, Paxton's Fl. Gard. 1: 186. 1851.

中日老鹳草 zhong ri lao guan cao

*Geranium nepalense* Sweet var. *thunbergii* (Siebold ex Lindley & Paxton) Kudô.

Perennials. Rootstock vertical, 2–10 mm in diam., not tuberculate, without thickened roots. Stem 20–70 cm tall, trailing or ascending, sometimes rooting at nodes, with 0.3–1.4 mm patent or retrorse appressed nonglandular trichomes and sometimes 0.8–1.3 mm patent glandular trichomes. Stipules lanceolate to subulate, distinct. Leaves opposite; petiole with 0.3–1.2 mm patent to retrorse nonglandular trichomes and sometimes 0.5–1.2 mm patent glandular trichomes; leaf blade 2.4–6.4 cm, palmately cleft, ratio of main sinus/middle segment length = 0.73–0.91, pilose with appressed nonglandular trichomes; segments 5, rhombic, 4–12 mm wide at base, 5–8-lobed in distal half, ratio of second sinus/middle segment length = 0.11–0.21. Cymules solitary, 2-flowered; peduncle 2.2–13.9 cm. Pedicel 0.8–3.3 cm, with 0.2–1 mm patent nonglandular trichomes and usually 0.6–1.1 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 5.1–8.1 mm, mucro 0.8–1.9 mm, ratio of mucro/sepal length = 0.12–0.25, outside with 0.1–0.9 mm patent to antrorse nonglandular trichomes and 0.2–1.2 mm patent glandular trichomes, inside glabrous. Petals white or purplish, (6.8–)7.3–8.3(–9) mm, erect to patent, outside glabrous, inside basally with trichomes, margin basally ciliate, apex rounded or retuse. Staminal filaments whitish, lanceolate with an abruptly narrowed apex, abaxially pilose and proximal half ciliate, trichomes 0.1–0.7 mm; anthers bluish, 0.8–1.1 mm. Nectaries 5, hemispheric, glabrous. Stigma pink. Fruit 1.9–2.7 cm, erect when immature; mericarps smooth, with a basal callus, with 0.2–0.7 mm  $\pm$  patent nonglandular trichomes and 0.6–1.5 mm glandular trichomes; rostrum 1.3–2 cm, with a 0.5–1.8 mm narrowed apex; stigmatic remains 1.6–2.3 mm. Seeds 1.7–2.2 mm. Fl. Apr–Sep, fr. May–Oct.  $2n = 28$ .

Roadsides, meadows, weedy areas; near sea level to 2200 m. Anhui, Fujian, Guangdong, Hebei, Hubei, Hunan, Jiangxi, Shaanxi, Taiwan, Zhejiang [Japan, Korea, Russia].

This species has sometimes been submerged in *Geranium nepalense*. However, it is well characterized by the presence of glandular trichomes (sometimes restricted to sepals) and by longer petals, sepals, and fruit. Additionally, leaves of *G. thunbergii* have few lobes, and its mericarps are darker. Distribution of *G. thunbergii* seems to be more eastern than those of *G. nepalense*, being alone in Taiwan, Japan, and Korea.

**18. *Geranium refractum*** Edgeworth & J. D. Hooker in J. D. Hooker, Fl. Brit. India 1: 428. 1874.

反瓣老鹳草 fan ban lao guan cao

*Geranium angustilobum* Z. M. Tan; *G. batangense* Pax & K. Hoffmann; *G. melanandrum* Franchet; *G. refractoides* Pax & K. Hoffmann.

Perennials. Rootstock  $\pm$  vertical, 5–12 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 16–50 cm tall, erect, not rooting at nodes, with 0.2–1.3 mm retrorse to patent nonglandular trichomes and rarely 0.7–0.8 mm patent glandular trichomes. Stipules broadly lanceolate, connate at least at base. Leaves opposite; petiole with 0.3–1.3 mm patent to retrorse nonglandular trichomes and rarely 0.7–0.8 mm patent glandular trichomes; leaf blade 3.4–6.8 cm, palmately cleft, ratio of main sinus/middle segment length = 0.73–0.89, pilose with appressed nonglandular trichomes and rarely patent glandular trichomes; segments 5, rhombic, 3.5–7.5 mm wide at base, 6–18-lobed in distal half, ratio of second sinus/middle segment length = 0.17–0.28. Cymules solitary, 2-flowered; peduncle 3.9–10.3(–20) cm. Pedicel 0.4–4 cm, with 0.4–0.9 mm uncinat patent nonglandular trichomes and purplish 0.4–0.8 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 8.4–10.8 mm, mucro 0.8–2.2 mm, ratio of mucro/sepal length = 0.09–0.22, outside with 0.3–1.4 mm antrorse  $\pm$  appressed nonglandular trichomes and purplish 0.3–1.1 mm patent glandular trichomes, inside glabrous. Petals white or pale pink, (1–)1.2–1.5(–2) cm, reflexed, basally sometimes outside and also usually inside with trichomes, margin basally with a dense tuft of trichomes, apex rounded. Staminal filaments reddish purple to pink, lanceolate, abaxially sparsely pilose and proximal half ciliate, trichomes 0.2–1.1(–1.6) mm; anthers blackish, 1.8–2.6 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma pale pink to purplish. Fruit 2.5–3.2 cm, nodding when immature; mericarps smooth, with a basal callus, with 0.5–1 mm  $\pm$  patent nonglandular trichomes; rostrum 1.7–2.2 cm, with a 5.2–6.2 mm narrowed apex; stigmatic remains 2.6–3.3 mm. Seeds 2.7–3 mm. Fl. and fr. Jul–Aug.  $2n = 28$ .

Scrub, meadows; 1800–4500 m. Sichuan, S Xizang (Yadong), Yunnan [Bhutan, N India, N Myanmar, Nepal].

Purplish glandular trichomes on the inflorescence are usually enough to identify this species unequivocally. In old herbarium specimens, sometimes purplish pigment is restricted to the apical cell and septa of the glandular trichomes. Yeo (Edinburgh J. Bot. 49: 165. 1992) suggested that plants from Xizang have whitish flowers, whereas those from Sichuan and Yunnan have pinkish flowers. *Geranium melanandrum* and *G. refractoides* have been differentiated on this basis and by their more obscure stamens and styles. However, these color features are very variable and do not allow the recognition of different species.

**19. *Geranium sinense*** R. Knuth in Engler, Pflanzenr. 53(IV. 129): 577. 1912.

中华老鹳草 zhong hua lao guan cao

*Geranium platypetalum* Franchet, Pl. Delavay. 111. 1889, not Fischer & C. A. Meyer (1835); *G. mairei* H. Léveillé; *G. pinetorum* Handel-Mazzetti; *G. terminale* Z. M. Tan.

Perennials. Rootstock  $\pm$  horizontal, 0.9–1.3 cm in diam., not tuberculate, with thickened roots along rootstock. Stem 34–89 cm tall, erect, not rooting at nodes, with 0.3–0.8(–1.7) mm retrorse  $\pm$  appressed nonglandular trichomes and sometimes

0.4–1.5 mm patent glandular trichomes. Stipules broadly lanceolate, connate at least at base. Leaves opposite; petiole with 0.3–0.6(–2.3) mm retrorse appressed nonglandular trichomes; leaf blade 4.2–12 cm, palmately cleft, ratio of main sinus/middle segment length = 0.76–0.9, pilose with appressed nonglandular trichomes; segments 5, rhombic, 5.1–11.1 mm wide at base, 9–25-lobed in distal half, ratio of second sinus/middle segment length = 0.06–0.2. Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle (0–)1.7–8.2 cm. Pedicel 1.4–2.9 cm, with 0.3–0.5 mm uncinately nonglandular trichomes and 0.3–1.6 mm patent glandular trichomes; bracteoles filiform. Sepals 5.6–9.2 mm, mucro 0.8–2 mm, ratio of mucro/sepal length = 0.13–0.26, outside with 0.3–0.7 mm antrorse ± appressed nonglandular trichomes and 0.4–1.6 mm patent glandular trichomes, inside glabrous. Petals blackish red with a pale pink base, (6.7–)7–8.1(–9.3) mm, reflexed, both surfaces glabrous or rarely outside with a few trichomes, margin with sparse cilia, apex rounded. Staminal filaments dark red, lanceolate, abaxially sparsely pilose and proximal half ciliate, trichomes 0.2–0.4(–0.8) mm; anthers blackish, 2.1–2.5 mm. Nectaries forming a ring around flower, glabrous. Stigma dark red. Fruit 2.4–3 cm, nodding when immature; mericarps smooth, with a basal callus, with 0.4–1.7 mm ± patent nonglandular trichomes; rostrum 1.6–2.2 cm, with a 5.2–6.6 mm narrowed apex; stigmatic remains 1.9–2.5 mm. Seeds 2.7–3 mm. Fl. Jun–Jul, fr. Sep–Oct.  $2n = 28^*$ .

• Secondary forests, meadows; 2300–3500(–4600) m. SW Sichuan, NW Yunnan.

This is the only species in the genus with a nectary forming a ring all around the flower. Flower features such as blackish, reflexed petals as long as wide, with sparse trichomes on the margin, and almost glabrous staminal filaments further help to identify *Geranium sinense*. Glandular trichomes are finer than in *G. refractum* and are not purple except for the head. The type of *G. pinetorum* shows all of these characters. Pollen has no deformation and fruit are well developed, which does not support Yeo's view (Edinburgh J. Bot. 49: 169. 1992) that *G. pinetorum* could be a hybrid. For these reasons, it is here considered as synonym of *G. sinense*.

The rhizomes are used as a Chinese medicine for dysentery.

**20. *Geranium shensianum*** R. Knuth, Repert. Spec. Nov. Regni Veg. 28: 5. 1930.

陕西老鹳草 shan xi lao guan cao

*Geranium resectum* Yeo.

Perennials. Rootstock ± horizontal, 1–1.1 cm in diam., not tuberculate, with many fibrous roots. Stem 80–85 cm tall, erect, not rooting at nodes, with 0.3–0.4 mm patent to retrorse nonglandular trichomes. Stipules lanceolate, connate at least at base. Leaves opposite; petiole with 0.2–0.5 mm patent nonglandular trichomes and sometimes 0.8–1.1 mm patent glandular trichomes; leaf blade 9–10.9 cm, palmately cleft, ratio of main sinus/middle segment length = 0.76–0.84, pilose with appressed nonglandular trichomes; segments 5 or 7, rhombic, 1.3–2 cm wide at base, 17–21-lobed in distal half, ratio of second sinus/middle segment length = 0.05–0.18. Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle 1.4–9.5 cm. Pedicel 1.8–2.6 cm, with 0.3–0.5 mm patent nonglandular

trichomes and 0.4–1.9 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 7.2–7.8 mm, mucro 0.4–1.5 mm, ratio of mucro/sepal length = 0.05–0.18, outside with 0.3–0.4 mm antrorse ± appressed nonglandular trichomes and 0.4–1.6 mm patent glandular trichomes, inside glabrous. Petals whitish, 7.3–8.6 mm, reflexed, both surfaces glabrous, margin basally with a dense tuft of trichomes, apex rounded. Staminal filaments reddish, lanceolate, abaxially sparsely pilose and proximal half ciliate, trichomes 2.1–2.9 mm; anthers bluish, 2.4–2.7 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma green. Fruit 2.4–2.9 cm, erect when immature; mericarps smooth, with a basal callus, with 0.5–0.7 mm ± patent nonglandular trichomes and 0.3–0.9 mm patent glandular trichomes; rostrum 1.8–2.2 cm, with a 5–6 mm narrowed apex; stigmatic remains 1.7–1.8 mm. Seeds 1.9–2 mm. Fl. Jun–Jul, fr. Jul–Aug.

• Secondary forests, meadows; 1800–2800 m. Shaanxi, N Sichuan.

This species resembles *Geranium platyanthum* at first sight by the leaf aspect, long trichomes of staminal filaments, and cymules partially in aggregates at the top of each branch. However, *G. shensianum* has reflexed and shorter petals, nectaries with trichomes, and connate stipules, which are never present in the former.

**21. *Geranium delavayi*** Franchet, Bull. Soc. Bot. France 33: 442. 1887.

五叶老鹳草 wu ye lao guan cao

*Geranium calanthum* Handel-Mazzetti; *G. forrestii* R. Knuth; *G. kariense* R. Knuth; *G. limprichtii* Lingelsheim & Borza.

Perennials. Rootstock ± horizontal, 0.7–1.8 cm in diam., not tuberculate, with thickened roots along rootstock. Stem 23–85 cm tall, erect, not rooting at nodes, with 0.2–0.7 mm retrorse to patent nonglandular trichomes and rarely 1–1.1 mm patent glandular trichomes. Stipules lanceolate, connate at least at base. Leaves opposite; petiole with 0.3–0.6 mm patent to retrorse nonglandular trichomes and rarely 0.4–0.5 mm patent glandular trichomes; leaf blade 3.2–10.2 cm, palmately cleft, ratio of main sinus/middle segment length = 0.81–0.93, pilose with appressed nonglandular trichomes; segments 5, rhombic, 3.4–11 mm wide at base, 9–26-lobed in distal half, ratio of second sinus/middle segment length = 0.13–0.32. Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle 2–11.9 cm. Pedicel 0.7–3.4 cm, with 0.2–0.5 mm patent to retrorse nonglandular trichomes and sometimes 0.9–2.1 mm patent glandular trichomes; bracteoles filiform. Sepals 6.5–10 mm, mucro 0.9–2.6 mm, ratio of mucro/sepal length = 0.12–0.34, outside with 0.3–1.1 mm antrorse ± appressed nonglandular trichomes and sometimes 0.6–2.2 mm patent glandular trichomes, inside glabrous. Petals blackish red to pink with a whitish base, (6.1–)8–9.8(–12.3) mm, reflexed, basally with trichomes sometimes outside and also usually inside, margin basally with a dense tuft of trichomes, apex rounded. Staminal filaments reddish, lanceolate, abaxially sparsely pilose and proximal half ciliate, trichomes 0.3–1.2 mm; anthers blackish, 1.9–2.5 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma reddish. Fruit 2.4–3 cm, nodding

when immature; mericarps smooth, with a basal callus, with 0.2–0.8 mm  $\pm$  patent nonglandular trichomes; rostrum 1.7–2.2 cm, with a 3.6–6.2 mm narrowed apex; stigmatic remains 1.8–3.4 mm. Seeds 2.2–2.8 mm. Fl. Jun–Aug, fr. Aug–Oct.

- Forest margins, scrub, meadows; 2300–4100 m. S Sichuan, Yunnan.

Petals of *Geranium delavayi* are shorter than in *G. refractum* and *G. pogonanthum*, and they have a whitish base. Petals are sometimes blackish, as in *G. sinense*, but with abundant trichomes inside at base. The almost glabrous filaments are also useful to differentiate *G. delavayi* from *G. pogonanthum*, and filiform bracteoles from *G. refractum*. The glandular trichomes of the inflorescence, when present, are similar to those of *G. sinense*. *Geranium calanthum* is sometimes differentiated by petals pale yellow. However, neither original description nor type specimen support this opinion. *Geranium kariense* and *G. limprichtii* are differentiated by the nonglandular pedicels and petal size, which are variable features in *G. delavayi*.

## 22. *Geranium pogonanthum* Franchet, Pl. Delavay. 111. 1889.

髯毛老鹳草 ran mao lao guan cao

*Geranium lankongense* H. W. Li; *G. meiguense* Z. M. Tan; *G. palustre* Linnaeus var. *stipulaceum* Franchet.

Perennials. Rootstock  $\pm$  horizontal, 4.2–15.6 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 22–59 cm tall, erect, not rooting at nodes, with 0.4–1.1 mm retrorse to patent nonglandular trichomes and rarely 1–1.9 mm patent glandular trichomes. Stipules broadly lanceolate, connate at least at base. Leaves opposite; petiole with 0.4–1.1 mm patent to retrorse nonglandular trichomes; leaf blade 3.9–7.6 cm, palmately cleft, ratio of main sinus/middle segment length = 0.68–0.92, pilose with  $\pm$  appressed nonglandular trichomes; segments 5, rhombic, 4.7–10.1 mm wide at base, 7–29-lobed in distal half, ratio of second sinus/middle segment length = 0.17–0.34. Cymules solitary, 2-flowered; peduncle 5–11 cm. Pedicel 1–3.4 cm, with 0.3–0.6 mm patent to retrorse nonglandular trichomes and sometimes 0.2–0.5 mm patent glandular trichomes; bracteoles filiform to lanceolate. Sepals 6.9–11.1 mm, mucro 1.1–2.3 mm, ratio of mucro/sepal length = 0.1–0.2, outside with 0.6–1.7 mm  $\pm$  patent nonglandular trichomes and sometimes 0.8–1.4 mm patent glandular trichomes, inside glabrous. Petals white to pink or purplish, (1.2–)1.3–1.4(–1.7) cm, reflexed, basally with a dense tuft of trichomes on inside surface, margin, and sometimes outside surface, apex rounded. Staminal filaments pink to purplish, lanceolate, abaxially densely pilose and proximal half ciliate, trichomes 1–1.8 mm; anthers blackish, 1.7–3.1 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma purplish. Fruit 2.4–3.6 cm, nodding when immature; mericarps smooth, with a basal callus, with 0.4–0.8 mm  $\pm$  patent nonglandular trichomes; rostrum 1.6–2.8 cm, with a 5.9–6.2 mm narrowed apex; stigmatic remains 2.3–3.1 mm. Seeds 2.5–3.5 mm. Fl. Jul–Aug, fr. Aug–Oct.

- Forest margins, scrub, meadows; 3000–3500 m. Sichuan, Yunnan.

This species is difficult to differentiate from *Geranium delavayi* when fresh petals are not available to observe their colors. However, *G. pogonanthum* has staminal filaments with longer and abundant tri-

chomes and longer petals. Glandular indumentum is also variable in *G. pogonanthum*, being sometimes just present on the stem base and other times only on the inflorescence. Bracteoles are sometimes filiform, like in *G. delavayi*, and other times lanceolate as in *G. yunnanense*.

## 23. *Geranium yunnanense* Franchet, Pl. Delavay. 114. 1889.

云南老鹳草 yun nan lao guan cao

*Geranium candicans* R. Knuth.

Perennials. Rootstock  $\pm$  vertical, 0.8–1.3 cm in diam., not tuberculate, with thickened roots along rootstock. Stem 28–54 cm tall, erect, not rooting at nodes, with 0.3–0.6 mm retrorse  $\pm$  appressed nonglandular trichomes. Stipules broadly lanceolate, connate at least at base. Leaves opposite; petiole with 0.3–0.7 mm retrorse  $\pm$  appressed nonglandular trichomes; leaf blade 2.6–6 cm, palmately cleft, ratio of main sinus/middle segment length = 0.71–0.86, pilose with appressed nonglandular trichomes; segments 5, rhombic, 3.9–10.7 mm wide at base, 5–16-lobed in distal half, ratio of second sinus/middle segment length = 0.19–0.31. Cymules solitary, 2-flowered; peduncle 3.7–7.9(–12.8) cm. Pedicel 1.1–3.6 cm, with 0.3–0.7 mm retrorse  $\pm$  appressed nonglandular trichomes; bracteoles lanceolate. Sepals 6.6–13.2 mm, mucro 1–1.9 mm, ratio of mucro/sepal length = 0.09–0.25, outside with 0.6–1.3 mm antrorse  $\pm$  appressed nonglandular trichomes and rarely 0.9–1 mm patent glandular trichomes, inside glabrous. Petals pink to purple, (1.3–)1.6–1.9(–2.1) cm, erect to patent, basally with a dense tuft of trichomes on both surfaces and margin, apex rounded. Staminal filaments purplish or white, lanceolate, abaxially densely pilose and proximal half ciliate, trichomes 1.2–2 mm; anthers blackish, 1.9–2.7 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma purplish. Fruit 2.2–3.3 cm, nodding when immature; mericarps smooth, with a basal callus, with 0.4–1 mm  $\pm$  patent nonglandular trichomes; rostrum 1.4–2.4 cm, with a 2.3–7.7 mm narrowed apex; stigmatic remains 2.4–4.2 mm. Seeds 2.4–3 mm. Fl. Jun–Aug, fr. Aug–Sep.

- Forests, scrub, mid-elevation to alpine meadows; 3200–4300 m. SW Sichuan, NW Yunnan.

*Geranium yunnanense* shares blackish anthers and fruit nodding when immature with *G. refractum*, *G. sinense*, *G. delavayi*, and *G. pogonanthum*. However, it has longer and not reflexed petals with abundant trichomes. Other important characters of this species are its broad bracteoles and its staminal filaments with long abundant trichomes.

## 24. *Geranium pylzowianum* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 26: 466. 1880.

甘青老鹳草 gan qing lao guan cao

*Geranium orientalitibeticum* R. Knuth.

Perennials. Rootstock tubercles subglobose, 3.7–6.9(–17.5)  $\times$  2.4–7 mm, with nontuberous separations 0.6–5.2 cm, 0.4–0.8 mm in diam., without thickened roots. Stem 8–29(–48) cm tall, erect, not rooting at nodes, with 0.2–0.5 mm retrorse to appressed nonglandular trichomes and usually 0.5–1.6 mm patent glandular trichomes. Stipules lanceolate to ovate, distinct. Leaves 1 alternate but opposite at inflorescence; petiole with 0.2–0.6 mm retrorse to appressed nonglandular trichomes and

sometimes 0.5–1.2 mm patent glandular trichomes; leaf blade 1.5–5.1 cm, palmately cleft, ratio of main sinus/middle segment length = 0.77–0.95, pilose with appressed nonglandular trichomes; segments 5, rhombic to obtriangular, 1.2–4.3 mm wide at base, 3–8-lobed in distal half, ratio of second sinus/middle segment length = 0.26–0.46. Cymules solitary, 2-flowered; peduncle 4–10.3(–15.5) cm. Pedicel 2.7–5.9(–7) cm, with 0.2–0.6 mm retrorse to appressed nonglandular trichomes; bracteoles lanceolate. Sepals 7.1–10.9 mm, mucro 0.7–1.2 mm, ratio of mucro/sepal length = 0.08–0.15, outside with 0.5–1 mm antrorse to patent nonglandular trichomes, inside glabrous. Petals deep rose pink with a whitish base, 1.6–1.8 cm, erect to patent, outside glabrous, inside basally with trichomes, margin basally ciliate, apex rounded or rarely emarginate with a 0.2–0.3 mm notch. Staminal filaments distally pink but paler at base, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.3–0.9 mm; anthers whitish tinged with blue, 1.7–2.4 mm. Nectaries 5, hemispheric, glabrous. Stigma pink to orangish red. Fruit 2.3–2.9 cm, erect when immature; mericarps smooth, with a basal callus, with 0.3–1.1 mm erect to patent nonglandular trichomes; rostrum 1.6–2.2 cm, with a 1.6–4.5 mm narrowed apex; stigmatic remains 2.8–3.5 mm. Seeds 1.7–2.2 mm. Fl. Jul–Aug, fr. Sep–Oct.  $2n = 28^*$ .

- Coniferous forest margins, subalpine meadows, alpine meadows; 2500–5000 m. S Gansu, Ningxia, Qinghai, S Shaanxi, W Sichuan, E Xizang, N Yunnan.

*Geranium orientaltibeticum* has been recognized by its broad leaf blade segments, petals with a paler base, and longer stigmatic remains. These features are included in the variability of *G. pylzowianum*. The latter has usually 1(or 2) alternate leaves along the stem and some opposite at the inflorescence. In some specimens, cauline leaves are all opposite, and then the inflorescence is branched from the basal node monochasially. *Geranium donianum* and *G. farreri* are quite similar in appearance but with rootstock without tubers and leaves always opposite. Additionally, in *G. pylzowianum* there are glandular trichomes on the stem base, stipule base, or inflorescence.

The whole plant is used as a local medicine for pharyngitis and cough.

**25. *Geranium canopurpureum*** Yeo, Edinburgh J. Bot. 49: 138. 1992.

灰紫老鹳草 hui zi lao guan cao

Perennials. Rootstock tubercles subglobose, 3.7–4 × 2.9–3.5 mm, with nontuberous separations 0.4–1.6 cm, 0.6–1 mm in diam., without thickened roots. Stem 7–9 cm tall, erect, not rooting at nodes, with 0.2–0.3 mm retrorse to appressed nonglandular trichomes. Stipules lanceolate to ovate, distinct. Leaves 1 alternate but opposite at inflorescence; petiole with 0.2–0.4 mm retrorse to appressed nonglandular trichomes; leaf blade 0.7–1.4 cm, palmately cleft, ratio of main sinus/middle segment length = 0.73–0.8, pilose with appressed nonglandular trichomes; segments 5, obtriangular, 1.2–1.5 mm wide at base, 1–3-lobed in distal half, ratio of second sinus/middle segment length = 0.19–0.26. Cymules solitary, 2-flowered; peduncle 2.9–4.7 cm. Pedicel 2–3.4 cm, with 0.2–0.3 mm retrorse to appressed nonglandular trichomes; bracteoles lanceolate. Sepals 5.3–6.3 mm, mucro 0.7–0.8 mm, ratio of mucro/sepal length = 0.11–0.15, outside with 0.1–0.4 mm antrorse to patent nonglandular

trichomes, inside glabrous. Petals pink, 0.8–1.2 mm, erect to patent, margin basally ciliate, apex rounded. Staminal filaments pinkish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.3–0.8 mm; anthers purple, 1.1–1.3 mm. Nectaries 5, hemispheric, glabrous. Stigma dark purplish. Fruit unknown. Seeds unknown. Fl. Aug.

- Sparse forests; ca. 3500 m. SW Sichuan (Muli).

This species is known only by the type specimen. The protologue was based on the holotype at A (*T. T. Yü 7742*) on which the labels incorrectly indicated the collection was from Yunnan. The correct information based on records at PE is that the collection was made in Muli, Sichuan (H. N. Qin, pers. comm.). At first sight, *Geranium canopurpureum* could be considered as a reduced form of *G. pylzowianum*. However, it has leaves that are not as divided as *G. pylzowianum* and ± sericeous on the abaxial side, petals that are attenuate (without a claw) and without trichomes on the adaxial surface, and stipules and bracteoles that are dark purplish. In small specimens of *G. pylzowianum*, petal length is not reduced, and these other characters of *G. canopurpureum* are not present, which also supports the independence of the latter.

**26. *Geranium napuligerum*** Franchet, Pl. Delavay. 115. 1889.

萝卜根老鹳草 lu bo gen lao guan cao

Perennials. Rootstock ± vertical, 2–3.3 mm in diam., not tuberculate, with thickened and napiform roots along rootstock. Stem 4–17(–25) cm tall, erect, not rooting at nodes, with 0.2–0.6 mm retrorse appressed nonglandular trichomes and rarely 0.3–0.7 mm patent glandular trichomes. Stipules lanceolate to ovate, distinct. Leaves opposite; petiole with 0.3–0.7 mm retrorse ± appressed nonglandular trichomes and usually 0.4–0.7 mm patent glandular trichomes; leaf blade 0.7–2.1 cm, palmately cleft, ratio of main sinus/middle segment length = 0.79–0.85, pilose with appressed nonglandular trichomes and adaxially with ± patent glandular trichomes; segments 5, obtriangular, 1–2 mm wide at base, 3- or 4(–7)-lobed in distal half, ratio of second sinus/middle segment length = 0.28–0.47. Cymules solitary, 2-flowered; peduncle 1.3–6.9 cm. Pedicel 1.1–4.2 cm, with 0.3–0.6 mm retrorse appressed nonglandular trichomes and rarely 0.2–0.3 mm patent glandular trichomes; bracteoles lanceolate. Sepals 6–7.6 mm, mucro 0.6–0.8 mm, ratio of mucro/sepal length = 0.09–0.11, outside with 0.2–0.7 mm antrorse ± appressed nonglandular trichomes and 0.7–1.6 mm patent glandular trichomes, inside glabrous. Petals deep pink, 1.1–1.4(–1.5) cm, erect to patent, both surfaces basally with trichomes, margin basally ciliate, apex rounded or slightly retuse with a 0.1–0.3 mm notch. Staminal filaments yellowish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.4–1.1 mm; anthers yellowish, 1.4–1.7 mm. Nectaries 5, hemispheric, glabrous. Stigma red. Fruit 1.7–2 cm, reflexed when immature; mericarps smooth, with a basal callus, with 0.4–0.8 mm ± patent nonglandular trichomes and sometimes 0.4–0.5 mm glandular trichomes; rostrum 1–1.2 cm, with a 2.1–2.8 mm narrowed apex; stigmatic remains 3.1–3.8 mm. Seeds 1.8–1.9 mm. Fl. Jul–Aug, fr. Sep–Oct.  $2n = 28^*$ .

- Forests, scrub, alpine meadows; 1800–4500(–5000) m. S Gansu, S Qinghai, W Sichuan, NW Yunnan.

This dwarf plant is well characterized by its short, thickened, and napiform roots. The short rootstock is usually covered by the roots. In

this feature it resembles *Geranium dahuricum*, but the latter has roots in a fascicle and they are appreciable longer. Glandular trichomes seem to be restricted to stipules, sepal and bracteole bases, mericarps, and the abaxial side of leaves. More rarely there are glandular trichomes on the stem, peduncles, and pedicels.

**27. *Geranium donianum*** Sweet, Geraniaceae 4: ad t. 338. 1827.

长根老鹳草 chang gen lao guan cao

*Geranium stapfianum* Handel-Mazzetti; *G. stenorrhizum* Stapf.

Perennials. Rootstock ± horizontal, 1.4–4.1(–5.7) mm in diam., not tuberculate, with thickened roots along rootstock. Stem 8–20(–40) cm tall, erect, not rooting at nodes, with 0.2–0.6 mm retrorse to appressed nonglandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.3–0.9 mm retrorse to appressed nonglandular trichomes; leaf blade 1.4–3.3 cm, palmately cleft, ratio of main sinus/middle segment length = 0.76–0.89, pilose with appressed nonglandular trichomes; segments 5, rhombic to obtriangular, 1.5–3 mm wide at base, 3–9-lobed in distal half, ratio of second sinus/middle segment length = 0.23–0.44. Cymules solitary, 2-flowered; peduncle (2.6–)3–10.3(–11) cm. Pedicel 1.2–4.7(–6.9) cm, with 0.2–0.6 mm retrorse to appressed nonglandular trichomes; bracteoles linear-lanceolate. Sepals (6.9–)7.5–9.6 mm, mucro (0.4–)0.6–1.2 mm, ratio of mucro/sepal length = 0.04–0.15, outside with 0.3–1.2 mm antrorse to patent nonglandular trichomes, inside almost glabrous. Petals deep purplish, (1.4–)1.5–2.3 cm, erect to patent, margin basally ciliate, apex emarginate with a 0.7–4.5 mm notch. Staminal filaments dark red distally but paler at base, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.4–0.8(–1.2) mm; anthers reddish, 2–2.9 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma dark red. Fruit 2.2–2.6 cm, erect when immature; mericarps smooth, with a basal callus, with 0.4–0.6 mm erect to patent nonglandular trichomes; rostrum 1.6–1.9 cm, with a 2.7–4.1 mm narrowed apex; stigmatic remains 2.8–4.5 mm. Seeds 2.2–2.3 mm. Fl. Jul–Aug, fr. Aug–Sep.

Scrub, alpine meadows; 2500–4500 m. S Gansu, SE Qinghai, W Sichuan, E Xizang, NW Yunnan [Bhutan, India (Sikkim), Nepal].

*Geranium stapfianum* is considered by some authors to be a different species endemic to Sichuan and Yunnan, *G. donianum* thus being a Himalayan plant. For supporting such a distinction, a more robust rootstock and habit is attributed to western specimens of *G. donianum*. However, a great variability in these features has been observed along the whole area of *G. donianum*, and this does not support such a division.

The rootstock rarely could have some thickened areas that are not clearly differentiated, which should not be mistaken with the tubercles of *Geranium pylzowianum*.

**28. *Geranium farreri*** Stapf, Bot. Mag. 151: t. 9092. 1926.

圆柱根老鹳草 yuan zhu gen lao guan cao

Perennials. Rootstock ± vertical, 3.7–6.7 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 9–16 cm tall, erect, not rooting at nodes, with sparse 0.2–0.3 mm retrorse not appressed nonglandular trichomes. Stipules lanceolate to ovate, distinct. Leaves opposite; petiole with 0.3–0.4 mm

retrorse ± appressed nonglandular trichomes; leaf blade 1.3–1.9 cm, palmately cleft, ratio of main sinus/middle segment length = 0.73–0.82, pilose with appressed nonglandular trichomes; segments 5, rhombic, 1.8–2.5 mm wide at base, 3–5-lobed in distal half, ratio of second sinus/middle segment length = 0.23–0.32. Cymules solitary, 2-flowered; peduncle 3.2–6.9 cm. Pedicel 2.4–3.5 cm, with 0.2–0.5 mm retrorse not appressed nonglandular trichomes; bracteoles lanceolate. Sepals 7.9–9.2 mm, mucro 0.4–0.7 mm, ratio of mucro/sepal length = 0.05–0.08, outside with 0.4–0.6 mm antrorse ± appressed nonglandular trichomes, inside almost glabrous. Petals pale pink, 1.5–1.7 cm, erect to patent, outside glabrous, inside basally with trichomes, margin basally ciliate, apex rounded or retuse. Staminal filaments white, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.2–0.4 mm; anthers dull purple to blackish, 2.1–2.4 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma pink. Fruit ca. 2.3 cm, erect when immature; mericarps smooth, with a basal callus. Seeds 2.8–3 mm. Fl. Aug, fr. Aug–Sep.

• Scrub, alpine meadows; ca. 4500 m. S Gansu, NW Sichuan.

*Geranium farreri* is obviously related to *G. donianum*, although it is well characterized by its rounded or retuse petals with a longer claw. Fruit features are poorly known because of the scarcity of available material.

**29. *Geranium erianthum*** Candolle, Prodr. 1: 641. 1824.

东北老鹳草 dong bei lao guan cao

*Geranium eriostemon* Fischer ex Candolle var. *orientale* Maximowicz; *G. gorbizense* Aedo & Muñoz Garmendia; *G. orientale* (Maximowicz) Freyn (1902), not Miller (1768).

Perennials. Rootstock ± horizontal, 5–10 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 10–50 cm tall, erect, not rooting at nodes, with 0.2–0.6 mm retrorse appressed nonglandular trichomes. Stipules lanceolate, distinct. Leaves 1(or 2) alternate but opposite at inflorescence; petiole with 0.2–0.5 mm retrorse appressed nonglandular trichomes; leaf blade 3–11.7 cm, palmately cleft, ratio of main sinus/middle segment length = (0.8–)0.82–0.91, pilose with appressed nonglandular trichomes; segments 7, rhombic, 4.4–8.7(–16.9) mm wide at base, 10–34-lobed in distal half, ratio of second sinus/middle segment length = 0.18–0.35. Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle (0–)1.1–5.5 cm. Pedicel 0.3–1.8 cm, with 0.2–0.6 mm patent to retrorse nonglandular trichomes and usually 0.3–2.5 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 0.6–1 cm, mucro 0.9–2.7 mm, ratio of mucro/sepal length = 0.14–0.32, outside with 0.2–0.8 mm antrorse appressed nonglandular trichomes and 0.3–2 mm patent glandular trichomes, inside glabrous. Petals purplish, 1.2–1.8(–2) cm, erect to patent, outside basally with trichomes, inside glabrous, margin basally ciliate, apex rounded. Staminal filaments purplish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 1.5–3.2 mm; anthers bluish, 2.1–3 mm. Nectaries 5, hemispheric, glabrous. Stigma purplish. Fruit 2.7–3.7 cm, erect when immature; mericarps smooth, with a basal callus, with 0.1–1.1 mm ± patent nonglandular trichomes and 0.8–1.4 mm patent glandular trichomes; rostrum 2.2–3 cm, with a 5–7.4 mm narrowed apex; stigmatic

remains 1.6–2.3 mm. Seeds 2–2.9 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Forests, scrub, meadows. Heilongjiang, E Jilin [Japan, Russia (Far East, Siberia); North America].

Leaves of *Geranium erianthum* permit a quick identification from *G. platyanthum* because they are more deeply divided. The main and the second sinus are deeper, and the middle segment is narrower at the base. Additionally, the sepal mucro is longer in *G. erianthum*, and trichomes of the stem and of the staminal filament are shorter. Usually *G. erianthum* has glandular trichomes restricted to the inflorescence.

**30. *Geranium platyanthum*** Duthie, Gard. Chron., ser. 3, 39: 52. 1906.

毛蕊老鹳草 mao rui lao guan cao

*Geranium eriostemon* Fischer ex Candolle (1824), not Poiret (1812).

Perennials. Rootstock ± horizontal, 6–11 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 29–66 cm tall, erect, not rooting at nodes, with 0.6–1.5 mm patent nonglandular trichomes and usually 0.4–1 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves 1(or 2) alternate but opposite at inflorescence; petiole with 0.4–1.7 mm patent nonglandular trichomes and usually 0.5–1.2 mm patent glandular trichomes; leaf blade 4.8–13 cm, palmately cleft, ratio of main sinus/middle segment length = 0.6–0.75(–0.78), pilose with ± appressed nonglandular trichomes; segments 5, rhombic, (1–)1.7–2.3(–3.4) cm wide at base, 6–23-lobed in distal half, ratio of second sinus/middle segment length = 0.08–0.18. Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle (0–)1.6–5.4 cm. Pedicel 2.8–16.8 mm, with 0.3–1.4 mm patent to retrorse nonglandular trichomes and 0.3–1.1 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 6.4–10.8 mm, mucro 0.4–1.6 mm, ratio of mucro/sepal length = 0.06–0.19, outside with 0.2–1.2 mm antrorse appressed nonglandular trichomes and 0.5–1.8 mm patent glandular trichomes, inside glabrous. Petals purplish or white, (1–)1.2–1.9 cm, erect to patent, outside basally with trichomes, inside glabrous, margin basally ciliate, apex rounded. Staminal filaments purplish, lanceolate, abaxially pilose and proximal half ciliate, trichomes 2–3 mm; anthers bluish, 2.3–2.9 mm. Nectaries 5, hemispheric, glabrous. Stigma greenish to dull red. Fruit 2.8–4 cm, erect when immature; mericarps smooth, with a basal callus, with 0.1–1.4 mm ± patent nonglandular trichomes and 0.6–0.9 mm patent glandular trichomes; rostrum 2.3–3.4 cm, with a 4.8–9.8 mm narrowed apex; stigmatic remains 2.1–2.6 mm. Seeds 2.6–3.2 mm. Fl. Jun–Jul, fr. Aug–Sep.  $2n = 28$ .

Forests, scrub, meadows; 1000–2700 m. S Gansu, Hebei, Heilongjiang, W Hubei, Jilin, Liaoning, Nei Mongol, Ningxia, E Qinghai, Shanxi, Sichuan [Korea, Mongolia, E Russia].

In *Geranium platyanthum*, the presence of glandular trichomes is almost constant along the whole plant. *Geranium reinii* Franchet & Savatier is a species endemic to Japan that is quite similar to *G. platyanthum* but with leaves slightly more divided.

**31. *Geranium albiflorum*** Ledebour, Fl. Altaic. 3: 230. 1831.

白花老鹳草 bai hua lao guan cao

Perennials. Rootstock ± horizontal, 5.5–9.6 mm in diam., not tuberculate, with thickened roots along rootstock. Stem (17–)40–60(–100) cm tall, erect, not rooting at nodes, with 0.2–0.5 mm retrorse ± appressed nonglandular trichomes. Stipules lanceolate, distinct. Leaves 1(or 2) alternate but opposite at inflorescence; petiole with 0.2–0.6 mm retrorse ± appressed or uncinately nonglandular trichomes; leaf blade 3.2–6.3(–9) cm, palmately cleft, ratio of main sinus/middle segment length = (0.65–)0.77–0.83(–0.84), pilose with appressed nonglandular trichomes; segments 5, rhombic, 4–14.8 mm wide at base, 9–22-lobed in distal half, ratio of second sinus/middle segment length = 0.17–0.25. Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle 1.3–3(–11.5) cm. Pedicel 0.4–2.7 cm, with 0.1–0.4 mm retrorse uncinately nonglandular trichomes and 0.2–0.7 mm patent glandular trichomes; bracteoles lanceolate. Sepals 4–7.1 mm, mucro 0.6–2.7 mm, ratio of mucro/sepal length = 0.15–0.38, outside with 0.2–0.9 mm erect to patent nonglandular trichomes and 0.2–0.8 mm patent glandular trichomes, inside glabrous. Petals white or pale lilac, 0.8–1.3 cm, erect to patent, outside glabrous, inside basally with trichomes, margin basally ciliate, apex retuse with a 0.4–1.1 notch. Staminal filaments white, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.2–0.4 mm; anthers bluish, 1.1–1.7 mm. Nectaries 5, hemispheric, glabrous. Stigma pale pink. Fruit 1.8–2 cm, erect when immature; mericarps smooth, with a basal callus, with 0.1–0.4 mm ± patent nonglandular trichomes and sometimes apically with 0.3–0.4 mm glandular trichomes; rostrum 1.4–1.6 cm, with a 1.9–2.5 mm narrowed apex; stigmatic remains 1.1–1.5 mm. Seeds 2.3–2.5 mm. Fl. Jun–Jul, fr. Jul–Aug.  $2n = 26, 28$ .

Meadows in forests, meadows in valleys; 800–1800 m. N Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Russia (Siberia); E Europe].

*Geranium albiflorum* is easy to distinguish from *G. pseudosibiricum* by its emarginate and usually white petals and by its leaves not so deeply divided as the latter. Specimens of *G. albiflorum* usually have glandular trichomes on the inflorescence. Gynodioecious specimens have shorter petals (2–3 mm) and anthers not well developed.

**32. *Geranium pseudosibiricum*** J. Mayer, Abh. Böhm. Ges. Wiss. 1786: 238. 1786.

蓝花老鹳草 lan hua lao guan cao

Perennials. Rootstock ± horizontal, 5–8 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 26–60 cm tall, erect, not rooting at nodes, with 0.2–0.4 mm retrorse ± appressed nonglandular trichomes. Stipules lanceolate, distinct. Leaves 1(or 2) alternate but opposite at inflorescence; petiole with 0.2–0.5 mm retrorse ± appressed nonglandular trichomes; leaf blade 3.9–7.4 cm, palmately cleft, ratio of main sinus/middle segment length = (0.81–)0.87–0.91, pilose with appressed nonglandular trichomes; segments 5 or 7, rhombic, 1.7–4.5 mm wide at base, 8–22-lobed in distal half, ratio of second sinus/middle segment length = 0.18–0.29(–0.41). Cymules solitary or in aggregates at apex of each branch, 2-flowered; peduncle 1.4–5.6(–11.5) cm. Pedicel 0.8–2.1 cm, with 0.2–0.5 mm retrorse not appressed nonglandular trichomes and sometimes 0.2–0.4 mm patent glandular trichomes; bracteoles lanceolate. Sepals 3.4–5.8 mm, mucro 0.7–1.7 mm, ratio of mucro/sepal length = 0.12–0.31, outside

with 0.4–1.2 mm  $\pm$  patent nonglandular trichomes and sometimes 0.2–0.6 mm patent glandular trichomes, inside glabrous. Petals purplish, 1–1.1 cm, erect to patent, outside glabrous, inside basally with trichomes, margin basally ciliate, apex rounded. Staminal filaments white, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.2–0.4 mm; anthers bluish, 1.2–1.4 mm. Nectaries 5, hemispheric, glabrous. Stigma purplish. Fruit 2.3–2.5 cm, erect when immature; mericarps smooth but sometimes with 1 or 2 transversal veins at apex, with a basal callus, with 0.1–0.3 mm  $\pm$  appressed nonglandular trichomes and 0.6–0.8 mm patent glandular trichomes; rostrum 1.7–1.8 cm, with a 2–3 mm narrowed apex; stigmatic remains 1.5–2.2 mm. Seeds 2.3–2.4 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Forest margins, meadows; 1000–1500 m. Xinjiang [Kazakhstan, Mongolia; NE Europe].

Specimens of *Geranium pseudosibiricum* usually have glandular trichomes restricted to fruit. Gynodioecious specimens have shorter petals (5–6 mm) and anthers not well developed.

### 33. *Geranium pratense* Linnaeus, Sp. Pl. 2: 681. 1753.

草地老鹳草 cao di lao guan cao

*Geranium affine* Ledebour (1831), not Poiret (1812); *G. pratense* var. *affine* C. C. Huang & L. R. Xu; *G. transbaicalicum* Sergievskaja.

Perennials. Rootstock  $\pm$  horizontal, 0.7–2 cm in diam., not tuberculate, with thickened roots along rootstock. Stem 23–100(–150) cm tall, erect, not rooting at nodes, with 0.1–1.7 mm retrorse to patent nonglandular trichomes and sometimes 0.2–1.2 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.3–0.9 mm retrorse to patent nonglandular trichomes and sometimes 0.5–1.1 mm patent glandular trichomes; leaf blade (4.2–)6.2–11.5 cm, palmately cleft, ratio of main sinus/middle segment length = (0.81–)0.86–0.94, pilose with appressed nonglandular trichomes; segments (5 or)7(or 9), rhombic, 2.2–7.5 mm wide at base, 10–30-lobed in distal half, ratio of second sinus/middle segment length = 0.15–0.48. Cymules solitary, 2-flowered; peduncle 1.3–12 cm. Pedicel 0.3–2.5 cm, with 0.2–0.4 mm patent to retrorse nonglandular trichomes and 0.4–1.2 mm patent glandular trichomes; bracteoles lanceolate. Sepals (0.7–)1–1.2 cm, mucro (1.7–)2.2–3.9 mm, ratio of mucro/sepal length = 0.16–0.39, outside with 0.2–0.9 mm patent nonglandular trichomes and 0.3–1 mm patent glandular trichomes, inside glabrous. Petals bluish or sometimes purplish or white, (1.3–)1.5–1.9(–2.4) cm, erect to patent, both surfaces glabrous, margin basally ciliate, apex rounded. Staminal filaments pinkish, lanceolate with a broadly triangular base and an abruptly narrowed apex, both sides glabrous but proximal third with 0.2–0.6 mm cilia; anthers dark violet to bluish black, 1.8–3.1 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma green to pinkish. Fruit 3–3.7 cm, reflexed when immature; mericarps smooth but usually with 1 or 2 transversal veins at apex, with a basal callus, with 0.3–0.7 mm  $\pm$  appressed nonglandular trichomes and usually only apically with 0.2–0.9 mm patent glandular trichomes; rostrum 2.1–2.9 cm, with a 7–9 mm narrowed apex; stigmatic remains 2–3 mm. Seeds 3–3.6 mm. Fl. Jun–Jul, fr. Jul–Aug.  $2n = 28$ .

Meadows, subalpine meadows; 1400–4000 m. Gansu, Nei Mongol, Qinghai, Shanxi, NW Sichuan, Xinjiang, E Xizang [Afghanistan, Kashmir, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; Europe].

*Geranium pratense* shares with species 34–36 staminal filaments with a broadly triangular base and an abruptly narrowed apex. The triangular base is as wide as long and should not be confused with slightly dilated bases of other Chinese species, which are distinctively longer than wide. Leaf blades of *G. pratense* are deeply divided with a deeper main and second sinus. The extreme leaf-divided forms have been segregated as *G. affine* or *G. transbaicalicum*. However, these plants can be found along the area of *G. pratense* intermixed with normal forms. Petal color is usually bluish but it can also be white or purplish. Petal color is not related to leaf division or other characters and seems to have little taxonomic importance. The variability of this species in the Himalayas should be studied more deeply.

### 34. *Geranium himalayense* Klotzsch in Klotzsch & Garcke, Bot. Ergebn. Reise Waldemar, 122. 1862.

大花老鹳草 da hua lao guan cao

*Geranium grandiflorum* Edgeworth (1846), not Linnaeus (1753); *G. meeboldii* Briquet.

Perennials. Rootstock  $\pm$  horizontal, 7.4–11 mm in diam., not tuberculate; roots unknown. Stem 9–32 cm tall, erect, not rooting at nodes, with 0.2–0.8 mm retrorse to patent nonglandular trichomes and sometimes 0.2–0.7 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.2–0.6 mm retrorse to patent nonglandular trichomes and sometimes 0.2–0.8 mm patent glandular trichomes; leaf blade 2.2–3.8(–5.5) cm, palmately cleft, ratio of main sinus/middle segment length = 0.65–0.79(–0.86), pilose with appressed nonglandular trichomes; segments 5, rhombic, 2.9–9.8 mm wide at base, 8–19-lobed in distal half, ratio of second sinus/middle segment length = 0.17–0.33. Cymules solitary, 2-flowered; peduncle 2.5–10.8 cm. Pedicel 0.2–2.1 cm, with 0.2–0.5 mm patent to retrorse nonglandular trichomes and 0.2–1.2 mm patent glandular trichomes; bracteoles lanceolate. Sepals 6.7–11.3 mm, mucro 0.7–1.3(–1.9) mm, ratio of mucro/sepal length = 0.09–0.16, outside with 0.1–0.5 mm patent nonglandular trichomes and 0.3–1.1 mm patent glandular trichomes, inside glabrous. Petals deep blue to whitish, (1.2–)1.4–2.1 cm, erect to patent, both surfaces glabrous, margin basally ciliate, apex rounded. Staminal filaments purplish, lanceolate with a broadly triangular base and an abruptly narrowed apex, both sides glabrous but proximal third with 0.2–0.3 mm cilia; anthers dark blue, 1.9–2.7 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma pink to purplish. Fruit 2.7–3 cm, reflexed when immature; mericarps smooth but usually with 1 or 2 transversal veins at apex, with a basal callus, with 0.2–0.3 mm  $\pm$  appressed nonglandular trichomes and usually only apically with 0.6–0.7 mm patent glandular trichomes; rostrum 2.1–2.4 cm, with a 7–8.9 mm narrowed apex; stigmatic remains 1.9–2.2 mm. Seeds 3–3.2 mm. Fl. Jun–Jul, fr. Aug–Sep.

Subalpine and alpine meadows; 3700–4400 m. S and W Xizang [Afghanistan, N India, Kashmir, Nepal, Pakistan].

This species is quite similar to *Geranium pratense*. In addition to characters mentioned in the key, *G. himalayense* has leaf blades with 5 sometimes overlapped segments and relatively shorter pedicels.



**35. *Geranium collinum*** Stephan ex Willdenow, Sp. Pl. 3: 705. 1800.

丘陵老鹳草 qiu ling lao guan cao

Perennials. Rootstock ± horizontal, 0.6–1.4 cm in diam., not tuberculate, with thickened roots along rootstock. Stem 18–70(–100) cm tall, erect, not rooting at nodes, with 0.2–0.6 mm retrorse appressed nonglandular trichomes and sometimes 0.2–0.6 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.2–0.6 mm retrorse appressed nonglandular trichomes and sometimes 0.5–0.6 mm patent glandular trichomes; leaf blade 2.4–4.5(–9.4) cm, palmately cleft, ratio of main sinus/middle segment length = 0.76–0.85, pilose with appressed nonglandular trichomes; segments 5(or 7), rhombic, 2–7.4(–10) mm wide at base, 4–13-lobed in distal half, ratio of second sinus/middle segment length = 0.19–0.48. Cymules solitary, 2-flowered; peduncle 3.2–15.3(–16) cm. Pedicel 0.5–5.2 cm, with 0.2–0.6 mm retrorse appressed nonglandular trichomes and sometimes 0.2–0.7 mm patent glandular trichomes; bracteoles linear-lanceolate. Sepals 4.8–7.3(–9.3) mm, mucro 0.8–1.4(–2.5) mm, ratio of mucro/sepal length = 0.11–0.37, outside with 0.2–0.5 mm antrorse ± appressed nonglandular trichomes and sometimes 0.3–0.7 mm patent glandular trichomes, inside glabrous. Petals purplish, (0.8–)1–1.6(–1.8) cm, erect to patent, both surfaces glabrous, margin basally ciliate, apex rounded. Staminal filaments pinkish, lanceolate with a broadly triangular base and an abruptly narrowed apex, glabrous except proximal half with some 0.1–0.6 mm cilia; anthers yellowish or pinkish, 0.9–3.4 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma pinkish. Fruit 2.1–3.1 cm, erect when immature; mericarps smooth but usually with 1 or 2 transversal veins at apex, with a basal callus, with 0.2–0.6 mm ± appressed nonglandular trichomes and rarely 0.7–0.8 mm patent glandular trichomes; rostrum 1.6–2.2 cm, with a 2.8–4.5 mm narrowed apex; stigmatic remains 1.3–2.2 mm. Seeds 2.6–2.9 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Subalpine and alpine meadows; 2200–4200 m. Xinjiang [Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; W Asia, Europe].

This species is usually difficult to differentiate from *Geranium pratense* if fruit are not available. Leaves of *G. collinum* are usually with 5 segments, and they are shorter and less divided; staminal filaments and fruit are a bit shorter than those of *G. pratense*. The variability of this species along its whole area is remarkable and it should be studied more deeply. Montane forms in Asia have a general appearance quite different from plants in the lowlands of Europe, but no consistent character to differentiate them has been found.

**36. *Geranium saxatile*** Karelin & Kirilov, Bull. Soc. Imp. Naturalistes Moscou 15: 177. 1842.

岩生老鹳草 yan sheng lao guan cao

Perennials. Rootstock ± horizontal, short, 7.1–10.2 mm in diam., not tuberculate, with many fibrous long roots. Stem 9–48 cm tall, erect, not rooting at nodes, with 0.2–0.4 mm retrorse appressed nonglandular trichomes and rarely 0.3–0.4 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.2–0.5 mm retrorse appressed nonglandular

trichomes and sometimes 0.4–0.5 mm patent glandular trichomes; leaf blade 1.7–6.2 cm, palmately cleft, ratio of main sinus/middle segment length = 0.72–0.84, pilose with appressed nonglandular trichomes; segments 5, rhombic, 2.5–8.8 mm wide at base, 6–15-lobed in distal half, ratio of second sinus/middle segment length = 0.19–0.31. Cymules solitary, 2-flowered; peduncle 4.1–14(–23) cm. Pedicel 0.1–8.3 cm, with 0.2–0.5 mm retrorse uncinately nonglandular trichomes and usually 0.2–0.6 mm patent glandular trichomes; bracteoles lanceolate. Sepals (8.4–)9–10.3(–11.3) mm, mucro 0.7–1.9(–2.5) mm, ratio of mucro/sepal length = 0.08–0.24, outside with 0.2–0.6 mm antrorse ± appressed nonglandular trichomes and usually 0.3–0.5 mm patent glandular trichomes, inside glabrous. Petals purplish, (1.6–)1.8–2.8 cm, erect to patent, both surfaces glabrous, margin basally ciliate, apex emarginate with a 0.3–1.4 mm notch. Staminal filaments pinkish, lanceolate with a broadly triangular base and an abruptly narrowed apex, glabrous except proximal half with some 0.1–0.3 mm cilia; anthers brownish when dry, 2.1–2.9 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma purple when dry. Fruit 3.4–4 cm, erect when immature, with white hyaline glandular trichomes and pubescences. Seeds 3–3.5 × 1.4–1.8 mm. Fl. Jul–Aug, fr. Aug–Sep.

Subalpine and alpine meadows; 2200–3100 m. Xinjiang (Tian Shan) [Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan].

The long petals with emarginate apex of *Geranium saxatile* are unique among species that have filaments with a broadly triangular base. *Geranium sophiae* Fedorov, a poorly known species endemic to Fergana Range in Uzbekistan, also has long and emarginate petals. However, its leaves (including an obtriangular middle segment with 3(–5) deep lobes at the apex) are very different from those of *G. saxatile*.

**37. *Geranium lambertii*** Sweet, Geraniaceae 4: t. 338. 1827 [“*lamberti*”].

吉隆老鹳草 ji long lao guan cao

*Geranium chumbiense* R. Knuth; *G. grevilleanum* Wallich.

Perennials. Rootstock ± vertical, short, thick, subwoody, not tuberculate, with long thin fusiform roots. Stem 50–60 cm tall, trailing or ascending, rooting at nodes, with 0.2–0.7 mm patent to retrorse nonglandular trichomes. Stipules broadly lanceolate, distinct. Leaves opposite; petiole with 0.4–0.6 mm patent to retrorse nonglandular trichomes; leaf blade ca. 7.5 cm, palmately cleft, ratio of main sinus/middle segment length = ca. 0.76, pilose with appressed nonglandular trichomes; segments 5, rhombic, ca. 1.2 cm wide at base, 9- or 10-lobed in distal half, ratio of second sinus/middle segment length = ca. 0.21. Cymules solitary, 2-flowered; peduncle 5–18.5 cm. Pedicel 1.5–4.4 cm, with 0.2–0.7 mm patent to retrorse nonglandular trichomes; bracteoles broadly lanceolate. Sepals 0.9–1.4 cm, mucro 1.8–2 mm, ratio of mucro/sepal length = ca. 0.13, outside with 0.2–0.9 mm antrorse to patent nonglandular trichomes and 1–1.2 mm ± patent glandular trichomes, inside glabrous. Petals pale pink or white, 2–2.4 cm, erect to patent, inside basally with trichomes, margin basally ciliate, apex rounded. Staminal filaments blackish except base, lanceolate, abaxially densely covered with 1.5–2 mm trichomes but glabrous toward tip; anthers black. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma blackish. Fruit ca. 4 cm, erect when immature; mericarps

smooth, with a basal callus; rostrum 2.6–3 cm, with a ca. 4 mm narrowed apex; stigmatic remains 5–6 mm. Seeds unknown. Fl. and fr. Jul–Sep.  $2n = 30$ .

Scrub; 2300–4200 m. S Xizang (Gyirong, Yadong) [Bhutan, N India, Kashmir, Nepal, Pakistan].

This species shares with *Geranium wallichianum* blackish filaments and stigma and distinctively broad bracteoles. However, *G. lambertii* has more narrow stipules and staminal filaments with longer trichomes. *Geranium kishvariense* R. Knuth is a close species from NW India with shorter stigmatic remains and staminal trichomes. Available material of *G. lambertii* from China is scarce, and some details of fruit and indumentum description are incompletely known for Chinese plants.

**38. *Geranium christensenianum*** Handel-Mazzetti, Symb. Sin. 7: 621. 1933.

大姚老鹤草 da yao lao guan cao

Perennials. Rootstock 5–6 mm in diam., not tuberculate, with many fibrous roots. Stem 48–100 cm tall, trailing, rooting at nodes, with 0.3–1.3 mm patent nonglandular trichomes and 0.5–1.1 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.2–1 mm patent nonglandular trichomes and 0.2–1.4 mm patent glandular trichomes; leaf blade 3.9–5.3 cm, palmately cleft, ratio of main sinus/middle segment length = 0.72–0.78, pilose with appressed nonglandular trichomes and  $\pm$  patent glandular trichomes; segments 3 (or 5), rhombic, 8.6–10.7 mm wide at base, 5–13-lobed in distal half, ratio of second sinus/middle segment length = 0.15–0.21. Cymules solitary, 2-flowered; peduncle 2.1–15.3 cm. Pedicel 0.8–1.7 cm, with 0.2–0.6 mm patent nonglandular trichomes and 0.3–1.2 mm patent glandular trichomes; bracteoles lanceolate. Sepals 0.8–1.2 cm, mucro 1.6–2.7 mm, ratio of mucro/sepal length = 0.18–0.22, outside with 0.2–0.8 mm antrorse to patent nonglandular trichomes and 0.5–1.6 mm  $\pm$  patent glandular trichomes, inside glabrous. Petals whitish with fine dark purple veins, 1.2–1.4(–1.6) cm, erect to patent, outside basally with trichomes, margin basally ciliate, apex rounded. Staminal filaments blackish except base, lanceolate, abaxially densely covered with 0.2–0.8 mm trichomes but glabrous toward tip; anthers black, 2.1–2.5 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma blackish. Fruit ca. 3.2 cm, erect when immature; mericarps smooth, with a basal callus, with 0.3–1 mm  $\pm$  patent nonglandular trichomes and 0.6–1.5 mm patent glandular trichomes; rostrum 2.1–2.2 cm, with a 4–5 mm narrowed apex; stigmatic remains 5.9–6.2 mm. Seeds unknown. Fl. Jul–Aug, fr. Sep–Oct.

• Forests, scrub, meadows; 2300–2800 m. SW Sichuan (Liangshan), NE Yunnan.

This species has leaf blades mostly with 3 segments, although some cultivated specimens could have basal leaves with 5 segments. According to Yeo (Hardy Geraniums, 92. 2002), *Geranium christensenianum* has been found in Sichuan (Longzhou Shan) and from this source is cultivated in United States and United Kingdom.

**39. *Geranium wallichianum*** D. Don ex Sweet, Geraniaceae 1: t. 90. 1821.

宽托叶老鹤草 kuan tuo ye lao guan cao

Perennials. Rootstock  $\pm$  vertical, 5.8–8.8 mm in diam., not

tuberculate, with many fibrous roots. Stem 24–50 cm tall, trailing or ascending, not rooting at nodes, with 0.3–1.7 mm patent to retrorse nonglandular trichomes and sometimes scattered 1.4–2 mm patent glandular trichomes. Stipules broadly ovate, connate. Leaves opposite; petiole with 0.4–1.5 mm patent to retrorse nonglandular trichomes and sometimes scattered 1.5–2 mm patent glandular trichomes; leaf blade 3.8–7.2 cm, palmately cleft, ratio of main sinus/middle segment length = 0.75–0.86, pilose with appressed nonglandular trichomes; segments 3 or 5, rhombic, 0.8–1.4 cm wide at base, 9–17-lobed in distal half, ratio of second sinus/middle segment length = 0.14–0.23. Cymules solitary, 2-flowered; peduncle 3.3–15.3 cm. Pedicel 3.1–8.4 cm, with 0.2–1.5 mm patent to retrorse nonglandular trichomes and sometimes scattered 1.5–2.1 mm patent glandular trichomes; bracteoles broadly lanceolate. Sepals 6.4–10.1 mm, mucro 2.3–4.6 mm, ratio of mucro/sepal length = 0.24–0.58, outside with 0.3–1.2 mm antrorse  $\pm$  appressed nonglandular trichomes, inside glabrous. Petals deep pink, purplish, or blue, (1.2–)1.4–2.2 cm, erect to patent, inside basally with trichomes, margin basally ciliate, apex emarginate with a 0.4–1.4 mm notch. Staminal filaments blackish at least at tip, lanceolate, base slightly dilated, abaxially pilose and proximal half ciliate, trichomes 0.3–0.6 mm; anthers black, 2.2–3 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma blackish. Fruit 3–3.9 cm, erect when immature; mericarps smooth, with a basal callus, with 0.6–1.6 mm  $\pm$  patent nonglandular trichomes; rostrum 2–2.6 cm, with a 2.9–4.6 mm narrowed apex; stigmatic remains 5–7.6 mm. Seeds 3.6–3.9 mm. Fl. Jun–Jul, fr. Aug–Sep.  $2n = 26, 28$ .

Broad-leaved forests; 2500–3400 m. S Xizang [Afghanistan, N India, Kashmir, Nepal, Pakistan].

*Geranium wallichianum* shares with *G. koreanum* distinctive broadly ovate stipules. They have very separate areas of distribution, and some other important differentiating morphological features mentioned in the key. Additionally, *G. wallichianum* has blackish filaments, anthers, and stigma, and broad bracteoles, not found in *G. koreanum*.

**40. *Geranium dahuricum*** Candolle, Prodr. 1: 642. 1824.

粗根老鹤草 cu gen lao guan cao

*Geranium dahuricum* var. *baiheense* Z. H. Lu & Y. C. Zhu; *G. dahuricum* var. *paishanense* (Y. L. Chang) C. C. Huang & L. R. Xu; *G. paishanense* Y. L. Chang.

Perennials. Rootstock  $\pm$  vertical, 4–8 mm in diam., not tuberculate, with a fascicle of long and thickened roots. Stem 23–48(–72) cm tall, erect, not rooting at nodes, with 0.3–1 mm retrorse appressed nonglandular trichomes. Stipules lanceolate, connate at least at base. Leaves opposite; petiole with 0.2–1 mm retrorse appressed nonglandular trichomes; leaf blade 3.7–5.9 cm, palmately cleft, ratio of main sinus/middle segment length = (0.83–)0.86–0.95, pilose with appressed nonglandular trichomes; segments 5, rhombic, 1.6–5.7 mm wide at base, 4–7(–10)-lobed in distal half, ratio of second sinus/middle segment length = 0.23–0.46. Cymules solitary, 2-flowered; peduncle 2.2–6.4(–10) cm. Pedicel 1.8–4.4 cm, with 0.2–0.5 mm retrorse appressed nonglandular trichomes; bracteoles lanceolate. Sepals 5.5–6.9(–9) mm, mucro 0.9–1.5(–2) mm, ratio of mucro/sepal length = 0.13–0.28, outside with 0.3–1.6 mm antrorse  $\pm$  appressed nonglandular trichomes, inside glabrous.

Petals light pink, (0.8–)0.9–1.3(–1.4) cm, erect to patent, outside basally with trichomes, inside basal 1/3–1/2 or rarely to apex with trichomes, margin basally ciliate, apex rounded. Staminal filaments pinkish, lanceolate with an abruptly narrowed apex, abaxially pilose and proximal half ciliate, trichomes 0.2–0.8 mm; anthers bluish, 1.4–2 mm. Nectaries 5, hemispheric, usually glabrous. Stigma reddish. Fruit 1.7–2.6 cm, erect when immature; mericarps smooth, with a basal callus, with 0.2–0.7 mm  $\pm$  patent nonglandular trichomes and apically with 0.9–1.2 mm patent glandular trichomes; rostrum 1–1.8 cm, with a 1.5–2.1 mm narrowed apex; stigmatic remains 2.8–4.5 mm. Seeds 1.6–2 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Meadows, subalpine meadows, alpine meadows; 1500–3500 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, W Sichuan, NE and SE Xinjiang, Xizang (Gongbo'gyamda) [Korea, Mongolia, Russia (Baikal, E Siberia)].

*Geranium dahuricum* is quite similar to *G. soboliferum*. The latter is usually a more robust plant with longer and more deeply divided leaf blades, longer sepals, and petals and nectaries with trichomes. *Geranium krameri* is also close to *G. dahuricum*. In addition to characters mentioned in the key, the former is more robust and its leaf blade segments have a tendency to show  $\pm$  straight sides. *Geranium dahuricum* has nectaries usually glabrous, although sometimes scattered trichomes can be found.

**41. *Geranium krameri*** Franchet & Savatier, Enum. Pl. Jap. 2: 306. 1878.

突节老鹳草 tu jie lao guan cao

*Geranium sieboldii* Maximowicz.

Perennials. Rootstock  $\pm$  vertical, 5–12 mm in diam., not tuberculate, with a fascicle of long thickened roots. Stem (25–)50–129 cm tall, erect, not rooting at nodes, with 0.4–0.8 mm retrorse appressed or patent nonglandular trichomes. Stipules lanceolate, distinct or connate at least at base. Leaves opposite; petiole with 0.3–0.8 mm retrorse appressed or patent nonglandular trichomes; leaf blade 5.6–11.9 cm, palmately cleft, ratio of main sinus/middle segment length = (0.81–)0.83–0.87, pilose with appressed nonglandular trichomes; segments 5 or 7, rhombic, 4.3–8.8 mm wide at base, 5–14-lobed in distal half, ratio of second sinus/middle segment length = 0.18–0.32. Cymules solitary, 2-flowered; peduncle 1.2–8.8 cm. Pedicel 2.3–5.5 cm, with 0.1–0.7 mm retrorse appressed or patent nonglandular trichomes; bracteoles lanceolate. Sepals (6.2–)7–10 mm, mucro 0.6–1.3 mm, ratio of mucro/sepal length = 0.1–0.15, outside with 0.3–0.7 mm antrorse  $\pm$  appressed nonglandular trichomes, inside glabrous. Petals light pink, (1–)1.1–1.4(–1.5) cm, erect to patent, outside basally with trichomes, inside basal 1/3–1/2 with trichomes, margin basally ciliate, apex rounded. Staminal filaments pinkish, lanceolate, base slightly dilated, abaxially pilose and proximal half ciliate, trichomes 0.2–0.7 mm; anthers brown, 1.6–2.1 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma brown. Fruit 2.6–3.1 cm, erect when immature; mericarps smooth, with a basal callus, with 0.1–0.4 mm  $\pm$  patent nonglandular trichomes and apically usually with 0.4–0.7 mm patent glandular trichomes; rostrum 1.6–2 cm, with a 1.6–2.6 mm narrowed apex; stigmatic remains 4.6–6.6 mm. Seeds 1.6–2.2 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Scrub, meadows, weedy areas in farmlands; 600–1200 m. Heilongjiang, Jilin, Liaoning [Japan, Korea, Russia (Far East)].

The indumentum of this species is variable, with patent trichomes in some specimens and retrorse and appressed in others. As in *Geranium dahuricum* and *G. soboliferum*, trichomes of petals are  $\pm$  dense on the base of the inside and extending upward on veins. *Geranium yesoense* Franchet & Savatier is a related species endemic to Japan, Sakhalin, and Kurile Islands, with nectaries glabrous, longer petals, similar leaf blade divisions, and rootstock with thickened and not fasciculate roots.

**42. *Geranium soboliferum*** Komarov, Trudy Imp. S.-Peterburgsk. Bot. Sada 18: 433. 1901.

线裂老鹳草 xian lie lao guan cao

Perennials. Rootstock  $\pm$  vertical, 8–9 mm in diam., not tuberculate, with a fascicle of long thickened roots. Stem 49–89 cm tall, erect, not rooting at nodes, with 0.2–0.5 mm retrorse appressed nonglandular trichomes. Stipules lanceolate, connate at least at base. Leaves opposite; petiole with 0.2–0.5 mm retrorse appressed nonglandular trichomes; leaf blade 4.1–9.5 cm, palmately cleft, ratio of main sinus/middle segment length = 0.89–0.96, pilose with appressed nonglandular trichomes; segments 5, rhombic, 1.6–4.4 mm wide at base, 8–18-lobed in distal half, ratio of second sinus/middle segment length = 0.3–0.58. Cymules solitary, 2-flowered; peduncle 4.7–10.4(–13.7) cm. Pedicel 1.1–4.1 cm, with 0.2–0.6 mm retrorse appressed or rarely patent nonglandular trichomes; bracteoles lanceolate. Sepals 7.3–10.8 mm, mucro 1.2–2.5 mm, ratio of mucro/sepal length = 0.13–0.26, outside with 0.2–0.4 mm antrorse appressed nonglandular trichomes, inside glabrous. Petals deep reddish purple, (1.3–)1.4–1.8(–2) cm, erect to patent, outside basally with trichomes, inside basal 1/3–1/2 with trichomes, margin basally ciliate, apex rounded. Staminal filaments purplish, lanceolate, base slightly dilated, abaxially pilose and proximal half ciliate, trichomes 0.2–0.6 mm; anthers bluish, 1.5–2.3 mm. Nectaries 5, hemispheric, with a tuft of trichomes at apex, abaxially glabrous. Stigma reddish. Fruit 2.8–3.5 cm, erect when immature; mericarps smooth, with a basal callus, with 0.1–0.7 mm  $\pm$  patent nonglandular trichomes and sometimes apically with 0.7–1.1 mm patent glandular trichomes; rostrum 1.8–2.3 cm, with a 1.9–3.4 mm narrowed apex; stigmatic remains 5–6.7 mm. Seeds 2.3–2.6 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Broad-leaved forests, meadows; ca. 400 m. Heilongjiang, Jilin [Japan, Korea, Russia (Far East)].

The name of *Geranium soboliferum* refers to its ability to produce soboles, that are underground stolons. Yeo (Hardy Geraniums, 108. 2002) cultivated this species and stated that this feature was not present in these plants. Among the studied material no trace of soboles was found. The stipules are usually longer than in *G. dahuricum*.

**43. *Geranium koreanum*** Komarov, Trudy Imp. S.-Peterburgsk. Bot. Sada 18: 433. 1901.

朝鲜老鹳草 chao xian lao guan cao

*Geranium lauschanense* R. Knuth; *G. tsingtauense* Y. Yabe; *G. tsingtauense* f. *album* F. Z. Li.

Perennials. Rootstock  $\pm$  vertical, 0.8–1.5 cm in diam., not tuberculate, with thickened roots along rootstock. Stem 30–87 cm tall, erect, not rooting at nodes, with 0.1–1.8 mm retrorse

appressed or patent nonglandular trichomes. Stipules broadly ovate, usually connate. Leaves opposite; petiole with 0.2–1.7 mm retrorse appressed or patent nonglandular trichomes; leaf blade 6.3–9.9 cm, palmately cleft, ratio of main sinus/middle segment length = 0.65–0.81, pilose with appressed nonglandular trichomes; segments 5, rhombic, 1.1–2.6 cm wide at base, 8–14-lobed in distal half, ratio of second sinus/middle segment length = (0.08–)0.13–0.15(–0.21). Cymules solitary, 2-flowered; peduncle 2.5–10.3 cm. Pedicel 1.4–3.5 cm, with 0.1–0.6 mm retrorse appressed or patent nonglandular trichomes; bracteoles lanceolate. Sepals 7.4–10.9 mm, mucro 1.3–3.8 mm, ratio of mucro/sepal length = 0.15–0.38, outside with 0.1–0.9 mm antrorse ± appressed nonglandular trichomes, inside glabrous. Petals bright pink, (1.2–)1.3–1.6(–2.1) cm, erect to patent, outside basally with trichomes, inside basal ca. third with trichomes, margin basally ciliate, apex rounded. Staminal filaments pinkish, lanceolate, base slightly dilated, almost glabrous but with scattered 0.1–0.4 mm trichomes; anthers bluish, 1.9–2.8 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma dull red. Fruit 2.7–3 cm, erect when immature; mericarps smooth, with a basal callus, with 0.2–0.4 mm ± patent nonglandular trichomes and apically rarely with 0.6–0.8 mm patent glandular trichomes; rostrum 1.7–1.8 cm, with a 2.3–3.3 mm narrowed apex; stigmatic remains 5–6.3 mm. Seeds 2.6–2.9 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Forests, meadows; 500–800 m. E Liaoning, NE Shandong [Korea].

Broadly ovate stipules are a distinctive feature of this species and are also shared by *Geranium shikokianum* Matsumura, an endemic from Japan and Korea. However, the latter has leaf blades more deeply divided, nectaries with trichomes, and petals almost glabrous on both sides.

**44. *Geranium wlassovianum*** Fischer ex Link, Enum. Hort. Berol. Alt. 2: 197. 1822.

灰背老鹳草 hui bei lao guan cao

Perennials. Rootstock ± vertical, 0.7–1.7 cm in diam., not tuberculate, with a fascicle of long thickened roots. Stem 25–86 cm tall, erect, not rooting at nodes, with 0.3–0.9 mm patent or rarely retrorse and appressed nonglandular trichomes. Stipules lanceolate, distinct or connate at least at base. Leaves opposite; petiole with usually 0.2–0.9 mm patent nonglandular trichomes; leaf blade 3.7–8.1 cm, palmately cleft, ratio of main sinus/middle segment length = 0.7–0.81(–0.84), pilose with appressed nonglandular trichomes; segments 5, rhombic, 6–13(–19.1) mm wide at base, 7–10-lobed in distal half, ratio of second sinus/middle segment length = (0.13–)0.2–0.24(–0.25). Cymules solitary, 2-flowered; peduncle 4.3–12.3 cm. Pedicel 2–6.2 cm, with 0.2–0.6 mm patent or retrorse ± appressed nonglandular trichomes; bracteoles lanceolate. Sepals (0.8–)0.9–1.1 cm, mucro 1.1–3.9 mm, ratio of mucro/sepal length = 0.1–0.3, with 0.1–0.3 mm antrorse ± appressed nonglandular trichomes and 0.2–1 mm ± patent nonglandular trichomes on abaxial side, glabrous adaxially. Petals 1.6–2.1 cm, erect to patent, entire, adaxial base with trichomes, margin basally ciliate, deep purplish magenta. Staminal filaments pinkish, lanceolate, base slightly dilated, abaxially densely pilose and proximal half ciliate, trichomes 0.6–1.5 mm; anthers bluish, 1.6–2.6 mm. Nectaries 5, hemispheric, abaxially glabrous, apex

with a tuft of trichomes. Stigma deep red to pink. Fruit 3–3.4 cm, erect when immature; mericarps smooth, with a basal callus, with 0.3–0.7 mm ± patent nonglandular trichomes and apically usually with 0.6–1 mm patent glandular trichomes; rostrum 2.1–2.5 cm, with a 3–4.8 mm narrowed apex; stigmatic remains 5–6.9 mm. Seeds 2–2.5 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28, 56$ .

Forests, meadows; 1800–3400 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shandong, Shanxi [Korea, Mongolia, Russia (Baikal to Far East)].

*Geranium wlassovianum* and *G. maximowiczii* share shallowly divided leaves, paler on the abaxial side. Both species are difficult to differentiate, and the main characters are referred to in the key. Additionally, in *G. wlassovianum*, the anthers, gynoecium, fruit, and staminal filaments are longer (and with a dense tuft of trichomes). Trichomes on the stem and inflorescence are also longer and usually patent.

**45. *Geranium maximowiczii*** Regel & Maack in Regel, Tent. Fl.-Ussur. 39. 1861.

兴安老鹳草 xing an lao guan cao

*Geranium hattae* Nakai; *G. wlassovianum* Fischer ex Link var. *hattae* (Nakai) Z. H. Lu.

Perennials. Rootstock ± vertical, 0.5–1.3 cm in diam., not tuberculate, with a fascicle of long thickened roots. Stem 35–75 cm tall, erect, not rooting at nodes, with 0.5–1.6 mm patent or rarely retrorse and appressed nonglandular trichomes. Stipules lanceolate, free or connate at least at base. Leaves opposite; petiole with usually 0.5–1.6 mm patent nonglandular trichomes; leaf blade 5.7–9.7 cm, palmately cleft, ratio of main sinus/middle segment length = 0.58–0.77(–0.8), pilose with appressed nonglandular trichomes; segments 5, rhombic, 1.2–1.9 cm wide at base, 7- or 8-lobed in distal half, ratio of second sinus/middle segment length = (0.11–)0.15–0.17(–0.21). Cymules solitary, 2-flowered; peduncle 3.5–14.6 cm. Pedicel 2.2–6.7 cm, with 0.1–1.1 mm usually retrorse ± appressed nonglandular trichomes; bracteoles lanceolate. Sepals 5.6–7.5(–7.9) mm, mucro 0.9–3.2 mm, ratio of mucro/sepal length = 0.1–0.4, outside with 0.1–0.3 mm antrorse ± appressed nonglandular trichomes and 0.3–2.2 mm ± patent nonglandular trichomes, inside glabrous. Petals deep purplish magenta, 1.1–1.4(–1.5) cm, erect to patent, inside basally with trichomes, margin basally ciliate, apex rounded. Staminal filaments pinkish, lanceolate, base slightly dilated, abaxially sparsely pilose and proximal half ciliate, trichomes 0.1–0.6(–1.1) mm; anthers bluish, 1.1–1.8 mm. Nectaries 5, hemispheric, glabrous. Stigma reddish. Fruit 2.2–2.9 cm, erect when immature; mericarps smooth, with a basal callus, with 0.2–0.7 mm ± patent nonglandular trichomes and apically usually with 0.5–0.9 mm patent glandular trichomes; rostrum 1.4–2 cm, with a 3.4–3.9 mm narrowed apex; stigmatic remains 3.5–4.4 mm. Seeds 2.2–2.6 mm. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 28$ .

Forests. Heilongjiang, Jilin, NE Nei Mongol [Korea, Russia (Far East)].

**46. *Geranium rosthornii*** R. Knuth in Engler, Pflanzenr. 53(IV. 129): 180. 1912.

湖北老鹳草 hu bei lao guan cao

*Geranium bockii* R. Knuth; *G. butuoense* Z. M. Tan; *G. duclouxii* Yeo; *G. fargesii* Yeo; *G. henryi* R. Knuth; *G. hupehanum* R. Knuth; ?*G. pseudofarreri* Z. M. Tan; *G. wilsonii* R. Knuth; *G. yuexiense* Z. M. Tan.

Perennials. Rootstock ± horizontal, 5.2–14 mm in diam., not tuberculate, with thickened and napiform roots along rootstock. Stem 21–80 cm tall, erect, not rooting at nodes, with 0.1–0.5 mm patent to retrorse nonglandular trichomes. Stipules broadly lanceolate, distinct or connate at least at base. Leaves opposite; petiole with 0.3–1.4 mm patent to retrorse nonglandular trichomes; leaf blade 2.5–9.6 cm, palmately cleft, ratio of main sinus/middle segment length = 0.71–0.85, pilose with appressed nonglandular trichomes; segments 5, rhombic, 0.3–1.7 cm wide at base, 7–13-lobed in distal half, ratio of second sinus/middle segment length = 0.16–0.42. Cymules solitary, 2-flowered; peduncle 1.6–15.8 cm. Pedicel 0.7–4.4 cm, with 0.1–1.1 mm patent to retrorse nonglandular trichomes; bracteoles lanceolate. Sepals 6.3–7.9(–8.4) mm, mucro 0.7–3.2 mm, ratio of mucro/sepal length = 0.11–0.49, outside with 0.2–1.7 mm antrorse to patent nonglandular trichomes, inside glabrous. Petals pink to purplish, (1–)1.2–1.4 cm, erect to patent, outside basally with trichomes, inside basal 1/3–1/2 with trichomes, margin basally ciliate, apex rounded. Staminal filaments purplish, lanceolate, base slightly dilated, abaxially densely covered with 0.4–2 mm trichomes but glabrous toward tip; anthers purplish, 1.6–2.4 mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma reddish. Fruit 1.9–2.4 cm, erect when immature; mericarps smooth, with a basal callus, with 0.2–1 mm ± patent nonglandular trichomes; rostrum 1.1–1.5 cm, with a 2–3.2 mm narrowed apex; stigmatic remains 2.3–5 mm. Seeds 1.8–2.8 mm. Fl. Jun–Jul, fr. Aug–Sep.

• Forests, meadows; 800–3900 m. S Anhui (Dabie Shan, Huang Shan), S Gansu (Wenxian), Guizhou, W Henan, W Hubei, S Shaanxi, S Shandong, Sichuan, Yunnan.

This species resembles some specimens of *Geranium dahuricum*, although it can be distinguished by its rootstock with thickened and usually short napiform roots along the rootstock (not long and fasciculate), its leaves with a broad middle segment, its longer stipules, and its denser indumentum on petals and staminal filaments. The type of *G. bockii* has leaf blades with segments more rhombic than those of *G. rosthornii*; otherwise they are undistinguishable. It is mentioned in the original protologue that *G. pseudofarreri* may have glandular trichomes, which has not been observed in any specimen of *G. rosthornii*. Unfortunately, the original material of the former is not available, and consequently its synonymization remains provisional.

**47. *Geranium suzukii*** Masamune, J. Soc. Trop. Agric. 3: 392. 1931.

黄花老鹳草 huang hua lao guan cao

Perennials. Rootstock ± horizontal, 2–3 mm in diam., not tuberculate, without thickened roots. Stem 18–45 cm tall, trailing, rooting at nodes, with 0.2–0.5 mm retrorse ± appressed nonglandular trichomes. Stipules linear-lanceolate, distinct. Leaves opposite; petiole with 0.2–0.4 mm retrorse ± appressed nonglandular trichomes; leaf blade 1.1–3.3 cm, palmately cleft, ratio of main sinus/middle segment length = 0.74–0.84, pilose with appressed nonglandular trichomes; segments 5,

obtriangular, 1.4–4.6 mm wide at base, 3(–5)-lobed in distal half, ratio of second sinus/middle segment length = 0.13–0.3. Cymules solitary, 1-flowered; peduncle 2.5–7.2 cm. Pedicel 1.1–3.6 cm, with 0.1–0.4 mm retrorse ± appressed nonglandular trichomes; bracteoles linear-lanceolate. Sepals 4.1–6.4 mm, mucro 0.9–1.8 mm, ratio of mucro/sepal length = 0.14–0.43, outside with 0.1–0.9 mm antrorse appressed nonglandular trichomes and scattered 0.5–1.3 mm patent glandular trichomes, inside ± with trichomes. Petals white or pale pink with purplish veins, (5.2–)7.2–8.4(–12.7) mm, erect to patent, basally both surfaces and margin with few trichomes, apex rounded. Staminal filaments white, lanceolate with an abruptly narrowed apex, abaxially pilose and proximal half ciliate, trichomes 0.1–0.3 mm; anthers violet, 0.5–1 mm. Nectaries 5, hemispheric, glabrous. Stigma greenish. Fruit 1.7–2 cm, erect when immature; mericarps smooth, with a basal callus, with 0.2–0.6 mm ± patent nonglandular trichomes; rostrum 1.2–1.6 cm, with a 0.5–1.5 mm narrowed apex; stigmatic remains 0.4–1.9 mm. Seeds 1.8–2 mm. Fl. Jul, fr. Aug.

• Trailsides on mountain slopes, moist stony soil on semiexposed stream banks; 2500–3200 m. Taiwan.

According to some authors, this species is related to *Geranium nepalense* and *G. sibiricum*, from which it differs by the leaf and petal characters mentioned in the key. *Geranium suzukii* is a trailing herb, constantly rooting at the nodes. It usually has glandular trichomes restricted to the sepals and sometimes to the fruit. The petals are white or pale pink, not yellow as some authors have mentioned. This was stated in the protologue and has been observed in cultivated specimens.

**48. *Geranium hayatanum*** Ohwi, Acta Phytotax. Geobot. 2: 152. 1933.

单花老鹳草 dan hua lao guan cao

*Geranium uniflorum* Hayata, J. Coll. Sci. Imp. Univ. Tokyo 25(19): 65. 1908, not Pacho (1827).

Perennials. Rootstock ± horizontal, 3.6–8 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 18–60 cm tall, trailing or ascending, not rooting at nodes, with 0.2–1 mm patent to retrorse nonglandular trichomes. Stipules broadly ovate, connate. Leaves opposite; petiole with 0.3–1 mm patent to retrorse nonglandular trichomes; leaf blade 2.8–7.2 cm, palmately cleft, ratio of main sinus/middle segment length = 0.75–0.92, pilose with appressed nonglandular trichomes; segments 5, rhombic, 3.4–9.8 mm wide at base, 5–11-lobed in distal half, ratio of second sinus/middle segment length = 0.21–0.38. Cymules solitary, 1-flowered; peduncle (0.9–)2.4–7.6(–15.4) cm. Pedicel 1.5–3(–5) cm, with 0.2–0.8 mm patent to retrorse sometimes uncinat nonglandular trichomes; bracteoles lanceolate. Sepals 6.5–10.1 mm, mucro 1.1–2.5 mm, ratio of mucro/sepal length = 0.14–0.24, outside with 0.2–1.4 mm antrorse to patent nonglandular trichomes, inside glabrous. Petals light purplish with a whitish base, (1.2–)1.4–1.8(–2) cm, erect to patent, both surfaces basally with trichomes, margin basally ciliate, apex rounded or rarely emarginate with a 0.2–0.4 mm notch. Staminal filaments purplish distally but paler at base, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.2–0.6 mm; anthers bluish, 1.7–2.1

mm. Nectaries 5, hemispheric, abaxially glabrous, apex with a tuft of trichomes. Stigma deep pink. Fruit 2.4–3.2 cm, erect when immature; mericarps smooth, with a basal callus, with 0.3–1.2 mm erect to patent nonglandular trichomes; rostrum 1.5–2.3 cm, with a 1.6–3.4 mm narrowed apex; stigmatic remains 3.5–5.6 mm. Seeds 2.3–3.5 mm. Fl. Jul, fr. Aug.

• Forest floors, rocky slopes, trailsides, exposed scree slopes; 2700–3800 m. Taiwan.

This species shares with *Geranium suzukii* the trailing habit and 1-flowered cymules. Both are also endemics from Taiwan. However, *G. hayatanum* is very easy to recognize by its long petals, its long and connate stipules (similar to those of *G. koreanum*), and its decumbent but not rooting stems.

**49. *Geranium rectum*** Trautvetter, Bull. Soc. Imp. Naturalistes Moscou 33: 459. 1860.

直立老鸛草 zhi li lao guan cao

Perennials. Rootstock ± horizontal, 6–11 mm in diam., not tuberculate, without thickened roots. Stem 22–84 cm tall, erect, not rooting at nodes, with 0.4–1.2 mm retrorse appressed nonglandular trichomes and rarely 1.8–2.6 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves opposite; petiole with 0.3–0.8 mm retrorse appressed nonglandular trichomes and rarely 1.4–1.9 mm patent glandular trichomes; leaf blade 4.3–10.1 cm, palmately cleft, ratio of main sinus/middle segment length = 0.69–0.87, pilose with appressed nonglandular trichomes; segments 5, rhombic, 0.7–1.4 cm wide at base, 13–23-lobed in distal half, ratio of second sinus/middle segment length = 0.14–0.24. Cymules solitary, 2-flowered; peduncle 3.5–15.9 cm. Pedicel 2–4 cm, with 0.2–0.5 mm retrorse appressed or uncinat nonglandular trichomes and sometimes 0.9–1.9 mm patent glandular trichomes; bracteoles lanceolate. Sepals 5.7–8.5 mm, mucro 1.1–2.8 mm, ratio of mucro/sepal length = 0.18–0.33, outside with 0.2–0.5 mm antrorse ± appressed nonglandular trichomes and usually 1.5–3.1 mm patent glandular trichomes, inside glabrous. Petals bright rose-pink, (1.3–)1.4–1.6(–1.8) cm, erect to patent, outside usually glabrous, inside basally with trichomes, margin basally ciliate, apex emarginate with a 0.3–0.7 mm notch. Staminal filaments white, lanceolate, abaxially pilose and proximal half ciliate, trichomes 0.2–0.4 mm; anthers whitish with a blue margin, 1.4–2.1 mm. Nectaries 5, hemispheric, glabrous. Stigma pinkish. Fruit 2.8–3.1 cm, erect when immature; mericarps smooth, with a basal callus, with 0.4–0.7 mm ± appressed nonglandular trichomes; rostrum 2–2.2 cm, with a 4–4.5 mm narrowed apex; stigmatic remains 2.3–2.6 mm. Seeds 2.2–2.6 mm. Fl. Jul–Aug, fr. Aug–Sep.

Forests, meadows; 1400–2400 m. Xinjiang (Tian Shan) [Kashmir, Kazakhstan, Kyrgyzstan, Pakistan].

This species is well characterized by its long and narrow petals and by its long glandular trichomes, sometimes restricted to sepals and more frequently present on all of the inflorescence.

**50. *Geranium franchetii*** R. Knuth in Engler, Pflanzenr. 53(IV. 129): 177. 1912.

灰岩紫地榆 hui yan zi di yu

*Geranium franchetii* var. *glandulosum* Z. M. Tan; *G. strigellum* R. Knuth.

Perennials. Rootstock ± horizontal, 4.5–7.9 mm in diam., not tuberculate, with thickened roots along rootstock. Stem 25–60 cm tall, erect, not rooting at nodes, with scattered 0.2–0.5 mm retrorse appressed nonglandular trichomes and sometimes scattered 1–1.2 mm patent glandular trichomes. Stipules lanceolate, distinct. Leaves 1(or 2) alternate but opposite at inflorescence; petiole with 0.3–0.6 mm retrorse ± appressed nonglandular trichomes; leaf blade 3.4–7.2 cm, palmately cleft, ratio of main sinus/middle segment length = 0.78–0.82, pilose with appressed nonglandular trichomes and rarely ± patent glandular trichomes; segments 5, rhombic, 7.3–9.4 mm wide at base, 7–13-lobed in distal half, ratio of second sinus/middle segment length = 0.18–0.27. Cymules solitary, 2-flowered; peduncle 6–11.9 cm. Pedicel 2.2–3.3 cm, with 0.2–0.6 mm retrorse ± appressed nonglandular trichomes; bracteoles lanceolate. Sepals 6.6–7.8 mm, mucro 1.6–2.5 mm, ratio of mucro/sepal length = 0.22–0.37, outside with 0.1–1.2 mm antrorse to patent nonglandular trichomes, inside glabrous. Petals 1.1–1.6 cm, erect to patent, basal 1/3–1/2 of both surfaces with trichomes, margin basally ciliate, pink to purplish, apex rounded. Staminal filaments pinkish, lanceolate, base slightly dilated, abaxially densely covered with 0.4–0.7 mm trichomes but glabrous toward tip; anthers brownish, 1.6–2 mm. Nectaries 5, hemispheric, abaxially glabrous, apex usually with a tuft of trichomes. Stigma reddish. Fruit 1.8–1.9 cm, erect when immature; mericarps smooth, with a basal callus, with 0.3–0.4 mm ± patent nonglandular trichomes; rostrum 1.1–1.2 cm, with a 1.9–2.2 mm narrowed apex; stigmatic remains 3.6–3.8 mm. Seeds 2.4–2.5 mm. Fl. Jun–Aug, fr. Sep–Oct.

• Forests, scrub, meadows; 700–3000 m. Chongqing, Guizhou, W Hubei, N Yunnan.

This seems to be an isolated species with no obvious resemblance to other *Geranium* species in China. *Geranium franchetii* is well characterized by its cauline alternate leaves, distinct stipules, and short rootstock, along which are thickened roots. The nectary indumentum is variable. Among the studied specimens no material with glandular trichomes was observed.

### Species incertae sedis

The following species have been described from Chinese material, or recorded in China, but are imperfectly known as no specimens have been seen.

***Geranium camaense*** C. C. Huang in S. Y. Jin, Cat. Type Spec. Herb. China, 301. 1994.

This species is only known from the type collected in Xizang (Dinggyê Xian) at ca. 4000 m. According to the original description, this

species is similar to *Geranium lucidum* Linnaeus but differs in having leaves and flowers glabrous. *Geranium lucidum* is a European species that reaches the W Himalayas and Nepal. It is an annual and very easy to recognize by its calyx with lengthwise keels and transverse flaps between these. Unfortunately, it has not been possible to examine the type specimen of *G. camaense*.

**Geranium platyrenifolium** Z. M. Tan, Bull. Bot. Res., Harbin 6(2): 52. 1986.

*Geranium tani* Aedo & Muñoz Garmendia; *G. trifoliatum* Z. M. Tan (1994), not Andrews (1805).

According to the original description, this species has roots bearing 1 or 2 tubers at distances up to several cm from their origin, opposite leaves deeply divided, stipules distinct, cymules 2-flowered, petals 1.5–1.8 cm, with rounded base and with trichomes, and indumentum nonglandular. It is found in meadows of SW Sichuan. Unfortunately, it has not been possible to examine any specimens belonging to this species.

**Geranium rubifolium** Lindley, Edwards's Bot. Reg. 26: t. 67. 1840.

This species was reported in forests at ca. 2700 m in Xizang (Yadong) by L. R. Xu & C. C. Huang (Fl. Reipubl. Popularis Sin. 43(1): 72. 1998). This area is on the S side of the Himalayas between India (Sikkim) and Bhutan, but the species was previously considered endemic from N Pakistan and Kashmir far to the West. This Chinese report mentioned the plant as having petals with a basal spot. This feature does match *Geranium rubifolium*, which has uniform petals, and would correspond to *G. procurrens* Yeo (Bot. Mag. 179: t. 644. 1973), a species

widespread in the Himalayas but not recorded from China. Unfortunately, it has not been possible to examine the specimen reported from China.

**Geranium solitarium** Z. M. Tan, Acta Phytotax. Sin. 33: 608. 1995.

According to the original description, this species has roots long and thickened, opposite leaves not deeply divided, stipules distinct, cymules 1-flowered, petals ca. 1.8 cm, with rounded apex and basally with trichomes, and indumentum nonglandular. The fruit and seed are unknown. It is found in alpine habitats of N Sichuan. Unfortunately, it has not been possible to examine any specimens belonging to this species.

**Geranium yaanense** Z. M. Tan, Acta Phytotax. Sin. 33: 611. 1995.

According to the original description, this species has opposite leaves not deeply divided, stipules distinct, cymules 2-flowered, petals ca. 9 mm, with rounded apex and basally with trichomes, and indumentum glandular. It has been considered a synonym of *Geranium moupinense*. However, the latter has alternate leaves and reticulate mericarps. Unfortunately, it has not been possible to examine any specimens belonging to this species.

## 2. ERODIUM L'Héritier ex Aiton, Hort. Kew. 2: 414. 1789.

牻牛儿苗属 mang niu er miao shu

Herbs, annual, biennial, or perennial. Leaves simple, petiolate; leaf blade usually pinnately divided, sometimes entire; basal leaves usually forming a rosette; cauline leaves opposite or alternate. Inflorescence terminal or axillary, cymose, bracteate. Flowers usually in pseudoubels, actinomorphic, rarely somewhat zygomorphic. Sepals 5, imbricate, apex obtuse to caudate. Petals 5, distinct. Stamens 5, alternating with 5 staminodes. Nectaries 5, alternate with petals. Ovary 5-locular, with 2 superposed ovules per locule; style distinctly 5-cleft. Fruit a schizocarp, long beaked, splitting into 5 1-seeded mericarps with a spirally twisted and trichome-covered awn.

About 75 species: N Africa, temperate Asia, Australia, Europe, North and South America; four species in China.

The European species *Erodium moschatum* (Linnaeus) L'Héritier has been reported as naturalized in Taiwan (J. C. Ou & M. T. Kao, Taiwania 38: 19. 1993), but no specimens from Taiwan have been seen by the authors.

- 1a. Perennials, 20–50 cm tall ..... 4. *E. stephanianum*  
 1b. Annuals, less than 15 cm tall.  
 2a. Stems well developed; plants canescent; mericarp awn plumose ..... 1. *E. oxyrhinchum*  
 2b. Stems reduced, inconspicuous to 3–5 cm tall; plants green; mericarp awn not plumose.  
 3a. Peduncle with 2 or 3 flowers, pubescent ..... 2. *E. tibetanum*  
 3b. Peduncle with (2 or)3–10 flowers, glandular ..... 3. *E. cicutarium*

**1. Erodium oxyrhinchum** M. Bieberstein, Fl. Taur.-Caucas. 2: 133. 1808.

尖喙牻牛儿苗 jian hui mang niu er miao

*Erodium hoeffianum* C. A. Meyer.

Annuals 6–40 cm tall, canescent. Stems several to numerous, ascending. Stipules 1–3 mm, subulate. Leaves opposite; leaf blade ovate to triangular-ovate, 1–3 cm, pinnately cleft, pinnately parted, or rarely with basal pair distinct, abaxially velutinous, adaxially pubescent. Pseudoubels with 3–5 hermaphrodite flowers; peduncle spreading pilose. Pedicel ± as long as to 1/2 as long as flowers. Sepals elliptic-ovate, 5–6 mm, densely pubescent, apex awned. Petals purple with a darker base, obovate, 4–5 mm. Mericarp 5–8 mm, without apical pit and ridges; awn plumose. Fl. Apr–May, fr. May–Jun.  $2n = 18$ .

Gullies in deserts, semiconsolidated sand dunes; 600–1200 m. N and W Xinjiang [Afghanistan, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan, Uzbekistan; W Asia].

**2. Erodium tibetanum** Edgeworth in J. D. Hooker, Fl. Brit. India 1: 434. 1875.

藏牻牛儿苗 zang mang niu er miao

Annuals 3–15 cm tall. Stems decumbent. Stipules lanceolate, 2–3 mm. Leaves in a crowded basal rosette; leaf blade ovate to broadly ovate, 1–1.6 cm, pinnately cleft to pinnately parted or sometimes basal pair distinct, both surfaces pubescent. Pseudoubels with 2 or 3 hermaphrodite flowers; peduncle 0.6–1.5(–2) cm, pubescent. Pedicel slightly shorter than peduncle. Sepals narrowly elliptic, 2–3 mm, densely hirsute, apex mucronate. Petals usually white without a basal spot, obovate,

3.5–4 mm. Mericarp 5–6 mm, with apical pit, without ridges or furrows; awn not plumose. Fl. Jul–Aug, fr. Aug–Sep.

Meadows; 3200–4300 m. Gansu, W Nei Mongol, Xinjiang, Xizang [Kashmir, Mongolia, Tajikistan].

**3. *Erodium cicutarium*** (Linnaeus) L'Héritier ex Aiton, Hort. Kew. 2: 414. 1789.

芹叶牻牛儿苗 qin ye mang niu er miao

*Geranium cicutarium* Linnaeus, Sp. Pl. 2: 680. 1753.

Annuals 10–15(–40) cm tall. Stems numerous, erect to decumbent. Stipules triangular-lanceolate, 2–6 mm. Leaves opposite or alternate; leaf blade triangular-lanceolate to oblong-lanceolate, 5–18 cm, pinnately divided to pinnately cleft, 5–12-lobed with basal ones more deeply incised, both surfaces appressed pilose. Pseudoumbels conspicuously longer than leaves, with (2 or)3–10 hermaphrodite flowers; peduncle with glandular and nonglandular trichomes. Pedicel 0.8–1.7 cm. Sepals ovate, 3–6 mm, glandular and hirsute, apex acute. Petals uniformly purple or 2 with a basal black spot, obovate, 5–12 mm. Mericarp 3–7 mm, with apical pit, with or without ridges or furrows; awn not plumose. Fl. Jun–Jul, fr. Jul–Oct.  $2n = 20, 36, 40, 48, 54$ .

Meadows, flood plains, gravel areas, disturbed areas; 700–2200 m. Anhui, Fujian, Gansu, Hebei, Heilongjiang, Henan, Jiangsu, Jilin, Liao-

ning, Nei Mongol, Shaanxi, Shandong, Shanxi, W Sichuan, Taiwan, Xinjiang, W Xizang [Afghanistan, NW India, Kazakhstan, Kyrgyzstan, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; N Africa, SW Asia, Europe].

This species is naturalized as a weed in many temperate areas.

**4. *Erodium stephanianum*** Willdenow, Sp. Pl. 3: 625. 1800.

牻牛儿苗 mang niu er miao

*Erodium stephanianum* var. *atranthum* Nakai ex Kitagawa.

Perennials 20–50(–120) cm tall. Stems numerous, ascending to decumbent. Stipules triangular-lanceolate, 3–8 mm. Leaves opposite; leaf blade 4–7 cm, ovate to triangular-ovate, pinnately parted with basal pair of lobes distinct, both surfaces sparsely appressed pilose. Pseudoumbels conspicuously longer than leaves, with 2–5 hermaphrodite flowers; peduncle both spreading pilose and retrorsely pubescent. Pedicel 1/4–1/3 as long as peduncle. Sepals oblong-ovate, 6–9 mm, hirsute, apex awned. Petals purple, without a basal spot, obovate, 5–7 mm. Mericarp 8–11 mm, with apical pit, without ridges or furrows; awn not plumose. Fl. Jul–Aug, fr. Aug–Sep.

Meadows, steppes, flood plains, farmlands; 400–4000 m. Anhui, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang [Afghanistan, Kashmir, Korea, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia].