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A REVISION OF *GERANIUM* L. IN SOUTH-WEST CHINA

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Forty-two species of *Geranium* from Yunnan, Sichuan, Gansu, W Hubei and adjacent territories are keyed and described. Four new species are published: *G. canopurpureum* Yeo, *G. duclouxii* Yeo, *G. fargesii* Yeo and *G. retectum* Yeo. One previously described species is reduced to varietal rank (as *G. hupehanum* var. *wilsonii* (Knuth) Yeo) and many others are reduced to synonymy. The name *G. platyanthum* Duthie is taken up for *G. eriostemon* Fischer ex DC., which is a later homonym of *G. eriostemum* Poiret. A catalogue of collectors' numbers is supplied.

HISTORY

In Linnaeus' *Species Plantarum* (ed. 1, 1753) there appear fifteen species of what we now call *Geranium* and, of these, three (*G. pratense*, *G. robertianum* and *G. sibiricum*) occur in the area covered by this revision. By 1824, according to De Candolle's *Prodromus*, the number of known species had grown to 66. In this work, seven of those included in the present revision were covered, the additions being *G. wlassovianum*, *G. platyanthum* (as *G. eriostemon*), *G. dahuricum* and *G. nepalense*. The next full treatment of the genus was that of Knuth (1912), in *Das Pflanzenreich*. Among the 260-odd species included in this monograph were several from China that had been described by A. Franchet, working in Paris with the collections sent from Yunnan by French missionaries, and others newly described by Knuth himself, based mainly on further specimens from French missionaries, and collections by the Irish customs officer Augustine Henry, the Scots plant collector George Forrest and his English contemporary Ernest Wilson. Knuth continued to describe new *Geranium* species based on Chinese specimens until 1936, but almost all the specimens concerned were collected before the 1912 monograph was published, and many had been cited in that work under other names. His 1936 publication, however, cited new material as the basis of one species, *G. fangii*. Only two of these are accepted in the present treatment. In the period 1914–1933 one new Chinese species was described by Lingelsheim and Borza, three by Handel-Mazzetti, two by Pax and Hoffmann, and two by Stapf. However, the only ones that I accept as distinct species are the two described by Stapf (one of which had to be re-named by Handel-Mazzetti) and one described by Handel-Mazzetti.

In 1945 the Berlin herbarium was burned and the types of some names published by Knuth were destroyed (indicated in the present work by 'B†').

In 1972, the account of Geraniaceae in *Iconographia Cormophytorum Sinicorum*, vol. 2, was published. This covered 19 species from the region of my revision; one of these is *G. carolinianum*, an introduction from North America, and two others are reduced to synonymy by me. The species of sect. *Polyantha*, however, were not covered at all.

In 1975 I pointed out (Yeo, 1975) that a number of taxa from SW China should be added to sect. *Polyantha*, though they had been placed elsewhere by Knuth (1912). My publication dealt with three species collected by Kingdon-Ward on Mount Victoria in

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West Central Burma. One of these (not belonging to sect. *Polyantha*), which is in cultivation in Britain, was identified as *G. yunnanense*. However, it is now considered (Yeo, 1983) that this plant is *G. pogonanthum*, a species to which only one specimen had been assigned (incorrectly as it happened), in the herbaria studied by me, since its original description from Chinese material by Franchet in 1889.

Although there is evidence of considerable interest in the taxonomy of *Geranium* in SW China in the first half of the present century, several species described in this period are not upheld by me. However, there remain specimens, some of early date, which cannot be assigned to the previously available taxa. Some of these are the basis of new species described here, but others, rather fragmentary, suggest that the description of yet more species will eventually be necessary. Additionally, while the present revision, begun in 1978, has been in progress, I have prepared a new infra-generic classification of *Geranium* (Yeo, 1984a), and this is adopted here.

In 1985 Huang described two new species in the place formerly occupied by *G. ocellatum*. However, I still accept only *G. ocellatum* here. Recently eight further new species and two varieties have been described by Z. M. Tan (1986, 1988). These are carefully described and well illustrated, but some important data on most of the new species are absent, which has made it very difficult to evaluate them. I have not been able to see types or other authentic material. Two of the new species are almost certainly synonymous with previously described species; the other six seem to be distinct but one is insufficiently characterized to be treated except as 'incertae sedis'.

TAXONOMIC CHARACTERS

My ideas on the taxonomically important characters in the infrageneric classification of *Geranium* have by now been aired in various publications (Yeo, 1973, 1984a, 1985). The system of fruit-discharge is treated as of primary importance and is used to define three subgenera (Yeo, 1984a), two of which occur in China, namely subgenus *Geranium*, in which the seeds are ballistically thrown from the mericarps, and subgenus *Robertium* (Picard) Rouy & Fouc., in which the carpels themselves are thrown off with the seed inside, while the awn becomes detached and falls to the ground, leaving the columella of the rostrum naked. Most species of subgenus *Robertium*, including all the Chinese ones, have a sculptured mericarp with at most minute hairs. In subgenus *Geranium* the mericarp is smooth but strongly hirsute. Three variants of the seed-ejecting mechanism of subgenus *Geranium* exist, providing the basis for classification into sections; only one of these, sect. *Geranium*, is found in China and it constitutes the majority of the genus. Various characters are used to divide up subgenus *Robertium*.

Of the taxonomically significant ways in which Geranium varies, the following are some of the more important but less obvious. For the characterization of species the roots have always been considered important in *Geranium*. The overall impression given by the aerial parts is strongly influenced by the number and arrangement of the leaves (though number is rarely indicated in my descriptions) and whether the inflorescence is diffuse, with a long flowering period, or condensed and with a short flowering period, in which case it is probably more showy. The posture of the flowers is significant, as is

that of the sepals, petals and stamens in relation to the floral axis. The posture of the pedicels is also important, both at anthesis and afterwards during the growth of the fruit. At maturity the fruit is usually erect. The posture of the developing fruit has to be considered separately from that of the pedicel that bears it because the latter may be geniculate just below the fruit. The disposition of hairs on the petals and stamens is also very important. It is a great help if attention is paid to representing and displaying these features when collecting and pressing specimens. In sect. *Polyantha* the types of hairs on the herbaceous parts are taxonomically significant.

DEFINITIONS, TERMINOLOGY AND CONVENTIONS

All plants are perennial unless otherwise stated. The rootstock is the condensed basal part of the stem which produces basal leaves, flowering stems and roots; in perennials it is the perennating part of the plant.

Occasionally the first internode of the stem is short and has a different indumentum from that of the succeeding ones; this may not always be covered by the description.

The orders of leaf-cutting are three, firstly division, secondly lobe and thirdly tooth. These are illustrated in Fig. 1, which also shows how the length and breadth of segments are measured. In simplified leaves (usually in alpine plants) there may be no teeth. Some large shade-loving plants have rather evenly serrate divisions; here the lobes are treated as obsolete and the serrations as composed of teeth. If the lamina has 5 or 7 divisions I recognize a median or middle division, one or two pairs of lateral divisions and a pair of basal divisions flanking the basal (petiolar) sinus; however, if there are only three divisions, I describe them as a median and two laterals. The sinuses on either side of the median division are the central sinuses, while other non-basal sinuses are termed lateral. Fructescent refers to the interval between petal-fall and the beginning of the drying-out of the nearly ripe fruit. Stigma is used to refer to the whole of a stigmatic branch of the style. The style is measured from the base of the ovary after divergence of stigmas and the rostrum from the apex of ovary to the bases of the stigmas. The Latin descriptions of the new species include slightly less detail than the English.

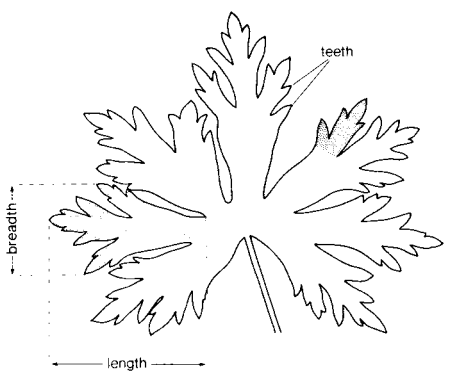

FIG. 1. Lobing and measurement of leaves. The shaded area on the left is termed a division, that on the right a lobe; both are measured in the same way.

SPECIMEN CITATIONS

Where collectors have given enough detail of locality I have divided the information into major and minor levels and placed the major first; in some cases I have employed guesswork in doing this. Provinces are named on the Pin-Yin system, as are all major

FIG. 2. Map of China with some Pin-Yin spellings. The less obvious Wade-Giles (or other) equivalents are (from North to South): Tachienlu for Dajian Lu (also called Kangting); (Lower) Yangtze for Chiang Jiang; Omei Shan for Emei Shan; (Upper) Yangtze for Jinsha Jiang; Likiang for Lijiang; Mekong for Lancang Jiang; Salween for Nu Jiang; and Red River for Yuan Jiang.

towns and geographical features as far as I could ascertain from a list prepared at Kew by C. Jeffrey in 1981. The greatest dissimilarity in the two systems affects the rivers; these and some other features are shown in Fig. 2. Other localities are as on the labels except for the introduction of a small amount of standardization. However, where a range of altitudes is given I have given an approximate median figure, preceded by 'c.' None of this applies to types, where I have kept as far as possible to what is written either on the sheets or, where I have not seen the specimen, in the protologue.

Specimens from French collectors labelled 'Kouy Tchéou' (Kweichow) have been assigned to Yunnan in accordance with advice from the Edinburgh herbarium. Specimens destroyed in Berlin in 1945 are marked with †.

SYNOPSIS OF CLASSIFICATION

Subgenus Geranium

Section Geranium

1. dahuricum DC.*
2. krameri Franchet & Sav.*
3. pylzowianum Maxim.*
4. orientali-tibeticum Knuth*
5. canopurpureum Yeo
6. henryi Knuth
   - var. henryi
   - var. wilsonii (Knuth) Yeo
7. bockii Knuth
8. pseudofarreri Z. M. Tan
9. franchetii Knuth
   - var. franchetii
   - var. glandulosum Z. M. Tan
10. duclouxii Yeo
11. fargesii Yeo
12. platyrenifolium Z. M. Tan
13. butuoense Z. M. Tan
14. rosthornii Knuth
15. napuligerum Franchet
16. wlassovianum Fisch. ex Link*
17. stapfianum Hand.-Mazz.*
18. donianum Sweet*
19. refractum Edgew. & Hook. f.
20. delavayi Franchet
21. sinense Knuth*
22. pogonanthum Franchet*
23. yunnanense Franchet*
24. farreri Stapf*
25. christensenianum Hand.-Mazz.
26. platyanthum Duthie*
27. retectum Yeo
28. pratense L.*
29. nepalense Sweet*
30. thunbergii Siebold ex Lindley & Paxton*
31. yuexiense Z. M. Tan
32. wilfordii Maxim.*
33. sibiricum L.*
34. carolinianum L.*

Subgenus Robertium (Picard) Rouy & Fouc.

Section Polyantha Reiche

35. polyanthes Edgew. & Hook. f.*
36. umbelliforme Franchet
37. moupinense Franchet
38. ascendens Z. M. Tan
39. strictipes Knuth*
40. hispidissimum Franchet*

Section Trilopha Yeo

41. ocellatum Camb.*

Section Ruberta Dumort.

42. robertianum L.*

*Seen by the author alive in cultivation, though not necessarily plants of Chinese origin

DIAGNOSTIC KEY

1. Leaves divided to base, middle division stalked ____ **42. robertianum**
+ Leaves not divided to base or, if seemingly so, the middle division not stalked ____ 2

2. Fructescent pedicels not erect ____ 3
+ Fructescent pedicels erect ____ 29

3. Pedicels less than half as long as sepals; leaf-divisions broadly ovate, shallowly lobed and toothed ____ **13. butuoense**
+ Pedicels mostly more than half as long as sepals; if any of them are shorter the leaf-divisions are long, narrow, and deeply and finely lobed and toothed ____ 4

4. Developing fruits deflexed, on deflexed, approximately straight, pedicels (erect only when ripe) ____ 5
+ Developing fruits erect on divaricate or reflexed, distally geniculate (hooked), pedicels ____ 10

5. Stamen-filaments abruptly dilated at the base; petals blue (not reflexed) **28. pratense**
+ Stamen-filaments evenly and only weakly enlarged towards the base; petals not blue (often reflexed) ____ 6

6. Glandular hairs of inflorescence coarse, dense, purple; (leaf lobes and teeth usually curving outwards and obtusish; petals (1¾–) 2–3 times as long as broad, white to purplish pink) ____ **19. refractum**
+ Glandular hairs of inflorescence colourless or with purple heads, fine, dense to sparse, or none ____ 7

7. Nectaries confluent; petals with very few hairs on margin at base; usually the leaf divisions rather evenly toothed and scarcely lobed; (flowers inverted; petals 6–9mm long, blackish apart from pale base; intermediates between this and *G. delavayi* occur) ____ **21. sinense**
+ Nectaries separate; hairs on margins of petal bases copious ____ 8

8. Filaments almost without hairs; petals white to pink, plum-coloured or nearly black, with evident whitish basal zone and often a differently tinted sub-basal zone; stigmas 1.5–3mm long; (plant often glandular-hairy; flowers ±inverted; petals reflexed, 1¼–1½ (–3½) times as long as broad) ____ **20. delavayi**
+ Filaments copiously hairy at base; petals rose-pink (to white or purplish), not zoned; stigmas 2.5–4mm long ____ 9

9. Petals 15–20mm long, not more than 1⅓ times as long as wide, not recurved or reflexed ____ **23. yunnanense**
+ Petals 8–16 (–20)mm long, about twice as long as wide, often recurved or reflexed **22. pogonanthum**

10. Flowers small, sepals not more than 8.5mm, petals not more than 10.5mm, style (from base of ovary to bases of stigmas) not more than 4.5mm, stigmas not more than 2mm long ____ 11
+ Flowers larger, at least one of the listed parts clearly exceeding the dimensions given above ____ 15

11. Dwarf alpine plant with basal leaves present at flowering time and inflorescence of only about 4 cymules; (flowers purple) ____ **5. canopurpureum**
+ Diffusely branching plant with the basal leaves disappearing soon after onset of flowering, cymules numerous; (flowers white, pink or rarely purple) ____ 12

12. Cauline leaves, except sometimes the lowest, with 3 divisions which are not lobed but toothed (crenate-serrate or crenate-biserrate) and acuminate; (petals about 7mm long) ____ **32. wilfordii**
+ Cauline leaves, except the upper, with 5 divisions which are lobed and toothed and not acuminate ____ 13

13. Lower cauline leaves with the divisions rhombic or narrowly rhombic and pinnately lobed, the lobes up to 2 or 3 times as long as broad; (flowers solitary; petals to 5.5mm) ____ **33. sibiricum**
+ Lower cauline leaves with the divisions broadly rhombic or broadly obovate and palmately lobed, the lobes about as long as broad ____ 14

14. Sepals with glandular hairs; petals 7mm long or more; (flowers paired; petals white) ____ **30. thunbergii**
+ Sepals without glandular hairs; petals not more than 6mm long; (flowers paired or solitary) ____ **29. nepalense**

15. Roots evidently thickened beyond their origins ____ 16
+ Roots sometimes thick but not dilated ____ 18

16. Dwarf alpine plants not more than 12cm tall; rootstock with several napiform roots clustered round it; undersides of leaves with long glandular hairs **15. napuligerum**
+ Plants more than 12cm tall; roots with fusiform thickenings; leaves eglandular beneath ____ 17

17. Divisions of lower leaves more or less rhombic; style c.5mm long ____ **14. rosthornii**
+ Divisions of lower leaves mainly cuneate; style 6.5–9mm long ____ **7. bockii**

18. Stems and leaves arising from round or ovoid tubers 5–10mm long, these connected together by thin rhizomes; stems little branched, with the first one or two leaves solitary and with only 1–4(–5) cymules ____ 19
+ Plant without such an underground system; stems opposite-leaved, sometimes robust ____ 20

19. Leaf divisions with the lobes mostly 1–2½ times as long as broad; flowers with a well-marked white centre; stigmas 3–6mm long _____ **4. orientali-tibeticum**
+ Leaf divisions with the lobes mostly 2½–5 times as long as broad; flowers without a distinct white centre; stigmas 2.3–2.8mm long _____ **3. pylzowianum**

20. Dwarf alpine plants not more than c.12cm tall _____ 21
+ Large or medium-sized plants, more than 12cm tall _____ 22

21. Floral axis horizontal; petals very pale pink, rounded; style 10–13mm; rhizomes absent _____ **24. farreri**
+ Floral axis upwardly inclined; petals strongly coloured, emarginate; style not more than 9mm; plant rhizomatous _____ **17. stapfianum**

22. Leaf divisions with the lobes lanceolate; 2–4 or more times as long as broad ____ 23
+ Leaf divisions with the lobes ovate or ovate-lanceolate, 1–2 (–3) times as long as broad _____ 24

23. Leaf divisions flabellate, with the lobes all about equal _____ **18. donianum**
+ Leaf divisions pinnately or palmato-pinnately lobed, tapered distally, with very unequal lobes _____ **1. dahuricum**

24. Lower leaves with 7 long-cuneate, acutely toothed and lobed divisions; stigmas 2–2.5mm long _____ **7. bockii**
+ Lower leaves not with this combination of characters; stigmas 3mm long or more 25

25. Style 7–10mm long; hairs on basal adaxial surface of petals not extending more than ⅙ of the length of the petal _____ 26
+ Style not more than 6mm long; hairs on basal adaxial surface of petals extending ⅓ or more of the length of the petal _____ 27

26. Plant tall, lax; lower petioles 2½ times as long as lamina; indumentum of lamina more or less sparse _____ **6. henryi**
+ Plant usually more or less compact and bushy; lower petioles 1½–2½ times as long as lamina; lamina often velutinous on both sides _____ **16. wlassovianum**

27. Leaf-divisions scarcely tapered proximally, with highly asymmetric and strongly decurrent lobes and teeth; stigmas 4.5–5mm long _____ **2. krameri**
+ Leaf-divisions broadly rhombic, with mostly symmetrically ovate lobes and teeth; stigmas not more than 4.5mm long _____ 28

28. Cauline stipules with a strong median rib, excurrent as a mucro; petals not more than 15mm; anthers not more than 2mm; stigmas not more than 3.5mm long **9. franchetii**
+ Cauline stipules with ribs not prominent, apex merely acuminate; petals 15–17mm; anthers 2.5–3mm; stigmas 4–4.5mm _____ **10. duclouxii**

29. Dwarf alpine plant; floral axis horizontal at anthesis; petals 13–17mm long, very pale pink; style at anthesis from base of ovary to bases of stigmas 10–13mm **24. farreri**
+ Plant not having this combination of characters ____ 30

30. Leaves mostly with 3 acuminate divisions; sepals 6.5 - 8.5mm; petals about equalling the sepals; style at anthesis from base of ovary to bases of stigmas 3–4.5mm ____ **32. wilfordii**
+ Plant not having this combination of characters ____ 31

31. Annual; petals not more than 8mm long ____ 32
+ Perennial; petals 9mm or more long ____ 33

32. Sepals 4mm long; petals 8mm long, suborbicular or subcordate, deep pink with a very dark mark at base; many flowers cleistogamous; mericarps transversely ribbed ____ **41. ocellatum**
+ Sepals about 5mm long, enlarging to 7mm or more in fruit; petals 5–7mm long, narrowly cuneate, white or pale pink; no flowers cleistogamous; mericarps not ribbed ____ **34. carolinianum** (N America)

33. Main leaves with 3 divisions; stigmas 5mm long; stigmas and filaments nearly black; (flower probably nodding) ____ **25. christensenianum**
+ Main leaves with 5 or more divisions; stigmas not more than 3.5mm long; stigmas and filaments not nearly black ____ 34

34. Style at anthesis from base of ovary to bases of stigmas 6.5–10.5mm long ____ 35
+ Style at anthesis from base of ovary to bases of stigmas not more than 6mm long 39

35. Leaves very sparsely appressed-pubescent above ____ **38. ascendens**
+ Leaves finely and densely strigose above ____ 36

36. Style at anthesis from base of ovary to bases of stigmas 6.5–9mm long; floral axis erect ____ 37
+ Style at anthesis from base of ovary to bases of stigmas 8.5–10.5mm; floral axis horizontal or nodding ____ 38

37. Plant without glandular hairs ____ **7. bockii**
+ Plant with glandular hairs ____ **8. pseudofarreri**

38. Petals 11.5–13.5mm long and almost as wide, violet-blue; stamen-filaments 10–11mm long ____ **26. platyanthum**
+ Petals 9mm long and about half as wide, apparently white; stamen-filaments about 14mm long ____ **27. retectum**

39. Stigmas 2.5–3.5mm ____ 40
+ Stigmas less than 2mm long ____ 41

40. Lower leaves divided as far as ¾ or ⅘ of the radius, divisions with the lobes broader than long; peduncles (4–) 7–12cm, pedicels 1.5–3cm long ... **9. franchetii**
+ Lower leaves divided as far as 6/7 or ⅞ of the radius, divisions with the lobes mostly 1½–2 times as long as broad; peduncles 2–7cm, pedicels 0.7–1.6cm long ... **11. fargesii**

41. Sepals 5–6mm long; petals 5–8mm long ... **31. yuexiense**
+ Sepals and/or petals larger than this ... 42

42. Mericarps without raised ribs or reticulations; roots bearing abruptly swollen tubers several cm from their origin ... **12. platyrenifolium**
+ Mericarps with raised ribs or reticulations; roots without such tubers ... 43

43. Leaves opposite or whorled ... 44
+ Leaves alternate (except the upper) ... 45

44. The long glandular hairs with distinct small swollen heads, stalks 1– 6-celled; basal leaves divided as far as ⅗–⅞ of the radius; leaf divisions mainly palmato-pinnately lobed, lobes and teeth often curving outwards; sepals (6.5–) 8–11.5mm long ... **39. strictipes**
+ The long glandular hairs with the short terminal cell not swollen or sometimes swollen, but always very minute and difficult to see at ×12, clear at ×25, stalks 3–10-celled; basal leaves divided as far as ½–⅘ of the radius; leaf divisions palmately lobed; lobes and teeth usually not curving outwards; sepals 6.5–7.5mm long ... **40. hispidissimum**

45. Plant without long hairs or almost so ... **38. ascendens**
+ Plant with scattered long hairs with minute glandular heads ... 46

46. Flowers paired; sepals with mucro 1.5–2.5mm long ... **37. moupinense**
+ Flowers at least partly in umbels; sepal mucro 1mm long or less ... 47

47. Flowers in tight umbels closely subtended by leaves; leaves almost glabrous beneath; no style present ... **35. polyanthes**
+ Flowers in clusters of 2–4 in an open inflorescence; leaves moderately hairy beneath; style 2mm long ... **36. umbelliforme**

Geranium L., Sp. Pl. 676 (1753); Knuth, Geran., Pflanzenr. IV.129: 43 (1912); Yeo in Bot. J. Linn. Soc. 89: 8 (1984).
Type: *G. sylvaticum* L.

Subgenus *Geranium*; Yeo in Bot. J. Linn. Soc. 89: 8 (1984)
Section *Geranium*; Yeo in Bot. J. Linn. Soc. 89: 10 (1984)

1. Geranium dahuricum DC., Prodr. 1: 642 (1824); Knuth, Geran., Pflanzenr. IV.129: 141 (1912); Lingelsheim et al. in Feddes Repert. Beih. 12: 431 (1922); Hand.-Mazz., Symb. Sin. 7(3): 620 (1933). Type: In turfosis Daouriae, circa Pagum Ouroulga, 5/16 Julio 1785, [*Patrin*, teste De Candolle, 1824] (holo. G-DC), seen in microfiche).

Icones: Schischkin, Fl. URSS 14: 49 (fol.) (1949); Iconogr. Cormophyt. Sinic. 2: 519 (1972); Yeo, Hardy Geraniums 109 (fol.) (1985); Fl. Hebei. 2: 7 (1988).

*Rootstock up to c.12mm thick, compact, covered with brown stipules, with fibrous roots and sometimes also with long thick or shortly thickened and napiform roots. *Stems* at first erect, often becoming decumbent with divaricating branches, rather thin (up to 3.5mm thick) with rather long internodes, opposite-leaved, with paired lower branches; either with coarse pubescence of retrorsely divergent white hairs or finely appressed-pubescent. *Basal leaves* few, soon withering, similar to the lower cauline, but divisions subtruncate and tips of lobes (but not teeth) subacute. Middle and lower *cauline leaves* with the lamina up to c.7cm wide, divided as far as 4/5–9/7 into 5–7, its outline suborbicular or weakly angled, the basal divisions relatively small and the basal sinus wide, except in the lowermost leaves; divisions more or less rhombic, palmato-pinnately lobed in the distal half; lobes 2–4 times as long as broad, the lateral more or less divergent, each with one or two rather small teeth; tips of teeth and lobes acute; upper surface green, sometimes red-edged, with veins impressed, rather finely strigose; lower surface much paler, with very prominent veins, finely hirsute, the hairs denser than those of the upper surface; petioles up to 2½ times as long as lamina, decreasing rapidly upwards so that the upper leaves are sessile, clothed as the stem; stipules up to 7mm long, brown, pilose, free or united: when free lanceolate to ovate-lanceolate. *Inflorescence* diffuse, many-flowered; peduncles mostly 3–8cm long, much longer than the leaves, slender, their indumentum similar to that of the stem; pedicels mostly 2–3.5cm long, slender, clothed as the peduncles; bracteoles up to 5.5mm long, linear-lanceolate; fructescent pedicels reflexed or divaricate, geniculate under the flower. *Flowers* nodding in bud, upwardly inclined at anthesis. *Sepals* 6–10.5mm long including mucro 0.75–1.75mm long (strongly variable), green, flushed with red, increasingly so in age, divergent, becoming patent at end of anthesis, with subappressed hairs on the veins, sometimes appressed-pubescent between them and sometimes with additional very long hairs distally. *Petals* 13–14 x 9–10mm, divergent to subpatent, ⅔ as broad as long or more; apex rounded; base broadly cuneate; colour bright pink, whitish at extreme base, with several fine, scarcely branched, dark red veins about ⅘ the length of the petal; adaxial surface hairy over ⅓–½ its length, abaxial less extensively so; margin ciliate for c.½ length of petal, sometimes with scattered hairs almost all round. *Filaments* c. 7.5mm long, abruptly dilated at the base, pilose for c.½ their length, pink with white base. *Anthers* c.1.5–1.8mm long, bluish. *Style* 6–7mm long, tomentose or setulose, the indumentum sometimes extending along whole or part of the stigmas. *Stigmas* 3–3.5mm long, reddish. *Fruit* erect; rostrum 14–17mm, closely pubescent; mericarps c.2.5mm long, pubescent and with some longer hairs distally, brown when mature, with bristly tubercle at base. *Seeds* c.2mm long, finely reticulate.

SICHUAN. Dajian Lu & distr.: rec'd vi 1898, *Mussot* 72 (P) and 73 (P); outside N gate, 28 vi 1923, *Cunningham* 7 (E); 1923, *Cunningham* 197 (E). Pao Hing, 1963, *Kuan & Wang* 2941 (K).

General distribution. Continental NE Asia from Transbaikalia eastwards.

G. dahuricum is a distinct species in our area on account of its slender habit, deeply cut leaves with pale under-surface, medium-sized pink flowers and geniculate fructescent pedicels. However, it has been pointed out (Yeo, 1985) that only minor characters distinguish it from the Japanese *G. yesoense* Franchet & Sav. The species was introduced from China to cultivation at the Uppsala Botanic Garden, Sweden, by Harry Smith (no. 21569). This stock is cultivated at Cambridge and was used in preparing the above description.

Supplementary long hairs sometimes present on the tips of the sepals recall *G. henryi* and related species.

2. Geranium krameri Franchet & Sav., Enum. Pl. Jap. 2: 306 (1878). Type: ?

Syn.: *G. sieboldii* Maxim. in Bull. Acad. Imp. Sci. Pétersburg 26: 458 (1880). Types: Japan: pratis circa Yokohama, floret a Julio in autumnum, *Siebold*; Nagasaki, in horto bot. jap. Motoski, Junio fl. incip., *Siebold*; Manchuria: ad fl. Tumen Koreae finitimum, prope oppidum Hun-tschun, Julio fl. incip., *F. Schmidt*; ad fl. Suifun prope Nikolskoje, Aug. Septembri fl., *Goldenstädt*; pratis siccioribus ad lacum Hanka, Augusto fl. cum fr. immat., *Przewalski* (syn., presumably all in LE, non vidi).

Icones: Schischkin, Fl. URSS 14: 49 (fol.) (1949); Makino, Ill. Fl. Japan, revised edn, 397 (as *G. japonicum*) (1961); Kitamura & Murata, Col. Illus. Herb. Pl. Japan 1: t.21, fig. 177 (1961); Iconogr. Cormophyt. Sinic. 2: 522 (as *G. sieboldii*) (1972); Yeo, Hardy Geraniums 108 (fol.) (1985).

*Rootstock short and thick. *Stems* erect with long internodes, retrorsely strigose or with spreading recurved hairs; branches of a pair unequal. *Basal leaves* few or none at flowering time (only three available for description), 7.5–13cm wide, divided as far as 4/5–6/7 into 7, outline broader than long, the basal sinus sometimes very wide, divisions narrowly to broadly rhomboidal, deeply and coarsely lobed in the distal half, the lobes oblong, oblong-lanceolate or narrowly triangular, the laterals highly asymmetric and decurrent, sometimes curved outwards, with a few coarse or obsolescent teeth; apices acute. *Cauline leaves* up to 10cm wide, similar to the basal (as far as known), the lower divided as far as 7/8 into 5 or 7, the divisions narrowly rhomboidal or oblong, lobed in the distal half, the lobes mostly 2–3½ times as long as broad and bearing a few obsolescent incised teeth, lobes and teeth highly asymmetric and decurrent, with tips acute or subacute; upper stem leaves with the base more or less truncate, the divisions oblong, the lobes tooth-like and the teeth few or none; all the leaves with narrowly recurved margins, dark green and strigose above, much paler and strigose on the veins beneath; lower petioles much longer than lamina, length decreasing rapidly upwards, the upper leaves subsessile; petioles retrorsely strigose or with stiff recurved hairs; cauline stipules up to c.4mm long, partly or completely fused in pairs or free, more or less hairy. *Inflorescence* diffuse, copious, leafy; peduncles mostly 2–6cm; pedicels mostly 2–5cm; peduncles and pedicels retrorsely strigillose or with spreading, recurved, hairs; fructescent pedicels reflexed and geniculate; bracteoles 2–3mm. *Flowers* nodding

in bud, apparently strictly erect at anthesis, nearly flat. *Sepals* 7–9mm long, excluding the very short mucro (less than 1mm long), appressed-pubescent, mainly on the veins; inner sepals obtuse at the apex with pink-tinged margins. *Petals* 11–14(–18)mm long, c.1⅓ times as long as broad, patent, apex rounded, base cuneate; colour pale pink, with darker veins, probably these sometimes feathered distally; base with a very dense tuft of short white hairs on either side and scattered long hairs on the adaxial surface extending ⅓–½ the length of the petal, some hairs present on the abaxial side between the tufts (see also discussion). *Filaments* 8–9mm long, pink, rather evenly dilated towards the base, strongly arcuate in the first stage of anthesis, with a dense tuft of small white hairs and usually some divergent marginal hairs in the basal ⅓, the tufts probably extending on to the tops of the nectaries. *Anthers* c.1⅔–2⅓mm, probably pale in colour. *Style* c.5mm long, puberulous. *Stigmas* 4.5–5mm long, pink. *Fruit* erect; rostrum 18–22mm, puberulent; mericarps c.2.5–3mm long, hispidulous or puberulent, with copiously bristly tubercle at base, apparently pale in colour when ripe. *Seeds* c.1.8mm long, subglobose, smooth (reticulations very fine).

HUBEI. Yichang distr., [in triangle, Yichang, Fang, Patung], vii 1901, *Wilson* 2545 (W).

General distribution. N China, Manchuria, Far East USSR, Korea, Japan.

This description is based mainly on Japanese material (including a cultivated sample), as the species is known in our area only from one gathering, which has larger petals than usual (bracketed dimension in the description). The leaf-shape of *G. krameri* is alone sufficient to enable it to be distinguished from other species; other noticeable characteristics are the lax inflorescence, medium-sized flattish flowers and rather large fruits with small seeds. In the sample cultivated at Cambridge the tufts of hairs on the petal-bases are joined across the front surface of the petal and together form a 5-angled palisade standing erect around the passages leading between the petal-bases to the nectaries. I am using the name *G. krameri* in the same sense as Ohwi (1965); it was formerly misapplied to *G. wilfordii*.

3. Geranium pylzowianum Maxim. in Bull. Acad. Imp. Sci. Pétersburg 26: 452, 466 (1880); Knuth, Geran., Pflanzenr. IV.129: 144 (1912); Lingelsheim et al. in Feddes Repert. Beih. 12: 431 (1922); Stapf in Curtis's Bot. Mag. 151: sub t. 9092 (1926); Hand.-Mazz., Symb. Sin. 7(3): 620 (1933); Yeo in Kew Mag. 1: 115 et t. 18 (1984). Type: China occidentalis, prov. Kansu, in vallibus rivulorum alpium secus fl. Tetung, *Przewalski* (LE?, non vidi).
Icones: Garden 85: 345 (1921) (as *G. stapfianum*); Iconogr. Cormophyt. Sinic. 2: 526 (1972); Kew Mag. 1: t. 18 (as *G. orientali-tibeticum*) (1984); Yeo, Hardy Geraniums 111 (fol.) (1985).

*Rootstock a small tuber, c.5 x 3mm, or larger and apparently composite, joined to neighbouring tubers by very slender rhizomes up to 15mm (in cultivation up to 25mm) long, so as to form chains below ground level. *Stems* slender, flexuous at the base (which is underground); internodes few, long, with solitary leaves or, on strong growths, paired leaves above, retrorsely strigose. *Basal leaves* with the lamina up to c.3.5cm wide (to

5.5cm in cultivation), divided as far as 7/8 or more into 5 or 7 and reniform to oblate in outline; divisions truncate or subtruncate, cuneate, pinnato-palmately lobed in the distal 1/2–2/3; lobes usually lanceolate, 2½–5 times as long as broad, the lateral often divergent and often with one or two teeth similar to the lobes in shape, their tips acute or occasionally ÿobtuse; upper surface strigose (with long or short hairs); lower surface rather pale, strigose or with somewhat spreading hairs, the indumentum often less dense than that of the upper surface; petioles (1½–)2½–4 times as long as lamina, the underground part flexuous, retrorsely pubescent or strigose; stipules c. 2mm long, rounded, pubescent. *Cauline leaves* similar, the first sometimes larger than the basal, otherwise decreasing in size and relative length of petiole upwards; stipules mostly 3–5mm long, suborbicular to lanceolate, entire or toothed, brown, pubescent, the lowest sometimes approaching in shape those of the basal leaves. *Inflorescence* of only 1–4 cymules, very lax; peduncles 3–20cm long; pedicels 1.5–4cm long; peduncles and pedicels retrorsely more or less appressed-hairy; bracteoles linear, mostly 3–6mm long; flowering pedicels erect; fructescent pedicels divaricate or reflexed and geniculate under the flower. *Flowers* nodding in bud, erect or inclined in flower, funnel-shaped. *Sepals* 8–10(–11)mm long including mucro (which is 0.5–1mm long), divergent, green, with rather prominent veins and fine loose hairs, especially on the lateral veins and margins of the outer sepals and near the base of the inner sepals; the inner sepals more or less tomentulose. *Petals* c.16–23 x 10–15mm, 1½ times to nearly twice as long as wide; apex rounded to retuse; base strongly contracted into a cuneate claw, whitish; lamina suborbicular, deep rose-pink with fine dark, almost unbranched veins; rather densely hairy at base on the margins and both surfaces, the hairs on the adaxial surface extending more sparsely distally for 1/4 the length of the petal or slightly more, not especially wavy. *Filaments* 6–8mm long, usually shorter than the sepals, slightly dilated towards the base, white, sometimes tinged with pink distally, diverging distally when functional, finely and rather densely hairy in the basal half. *Anthers* c.2.2mm long, whitish, tinged with bluish. *Style* c.5–7mm, from merely setulose at the base to rather densely hairy. *Stigmas* c.2.3–2.8mm long, pink to orange-red, often so only on the stigmatic surface. *Fruit* erect; rostrum 16–18mm long, patently hairy; mericarps c.2.5mm long, hirsute, with bristly tubercle at base, light brown. *Seeds* c.1.7mm long.

GANSU. Tangut, 1872, *Przewalski* s.n. (P) and 1880 idem (K). W Gansu, Sin Long Chan and Ma Ho Chan, 10 vii 1918, *Licent* 4196 (P). SHANXI. Taipei Shan, 1910, *Purdom* s.n. (K). SICHUAN. Dajian Lu & distr.: vii 1938, *McLaren* (AC) 64 (C, E); 1924, *Cunningham* 369 (E); c.3400m, rec'd xii 1890, *Pratt* 33 (BM, K); towards Dawo, Tschin Tschuan valley, 3900m, 1 vii 1914, *Limpricht* 1892 (WRSL); Djesi La and Djesi Longba, vii 1929, *Rock* 17542 (GH). Lieng Ho Kou, 3650m, viii 1938, *Kang & Wen* 855 (GH); 3650m, viii 1938, *Kang & Wen* 622 (GH). Sungpan Hsien, 8 viii 1928, *Fang* 4024 (E, GH, K, P) and 25 viii 1928, Fang 4349 (K). Sungpan mts, vi/viii 1914, *Weigold* s.n. (W). Tongolo, viii 1891, *Soulié* 58 (P) and 1893, *Soulié* 386 (K). TIBET, E. Nu Jiang/Kiu Jiang divide, Tsarong, 28°20'N 98°27'E, 4250m, vii 1921, *Forrest* 19889 (K, P). YUNNAN. Adunzi, vii 1911, *Ward* s.n. (E). Lancang Jiang, Tsa Wa Rung, 3500m, ix 1935, *Wang* s.n. (GH).

General distribution. Qinghai.

G. pylzowianum shares its distinctive rhizome system with the next two species but it is easily recognized by its long narrow leaf-divisions and by its short stamens, styles and

stigmas nestling in the somewhat funnel-shaped base of the flower. The rhizome system gives rise to stems and petioles originating below the surface of the soil and becoming flexuous as they ascend; the stems are very slender and comparatively few-flowered.

4. Geranium orientali-tibeticum Knuth in Feddes Repert. 19: 230 (1923); Yeo in Kew Mag. 1: 117 et t. 17 (1984). Type: Sichuan ('Ost-Tibet'), Ta-tsien-lu, 1894, *Soulié* 2041 (holo. B†); Sichuan ('Thibet Oriental'), Ta-tsien-lou (Principauté de Kiala), 1893, *Soulié* 616 (neo. K [Yeo, 1984b]).
Icones: Kew Mag. 1: t. 17 (as *G. pylzowianum*) (1984); Yeo, Hardy Geraniums 112, 113 & t. 19 (1985).

*Rootstock a small tuber, c.5–10mm long and 4–6(–9)mm wide, joined to neighbouring tubers by a slender rhizome up to c.3cm long, so as to form chains below ground level. *Stems* slender, flexuous at the base (which is underground); internodes few, long, with the first one or two leaves solitary and later ones paired, retrorsely strigose. *Basal leaves* with the lamina up to 5cm wide, divided as far as 4/5–9/10 into 5(–7); outline pentagonal; divisions rhombic-obovate, shortly tapered distally, pinnato-palmately lobed in the distal half; lobes oblong or oblong-lanceolate, mostly 1–2½ times as long as broad, the lateral often divergent, each lobe with 1–2(–3) ovate or oblong teeth; tips of lobes and teeth obtuse to acute; upper surface bright green with yellow-green marbling (which becomes faint on drying), usually edged with reddish, strigose; lower surface pale green, slightly marbled, hirsute, especially on the veins, the hairs antrorse and sometimes denser or longer than on the upper surface; petioles c.2– 4 times as long as lamina, flexuous, retrorsely strigose; stipules c. 4–6mm long, ovate, acuminate or sometimes obtuse and mucronate, glabrous or pubescent. *Cauline leaves* similar, decreasing in size and relative length of petiole upwards; tips of lobes and teeth sometimes more acute; stipules mostly 6–9mm long, linear-lanceolate with fine tip and enlarged base, entire, pubescent, sometimes united. *Inflorescence* of 2–3(–5) cymules, very lax; peduncles mostly 3–22cm long; pedicels 1.5–6cm long; peduncles and pedicels retrorsely strigose; bracteoles linear, 6–9mm long; flowering pedicels erect; fructescent pedicels divaricate and geniculate under the flower. *Flowers* nodding in bud, erect or nearly so in flower, bowl-shaped in the centre with a nearly flat limb. *Sepals* 8–10.5mm long, including mucro (which is c.0.5–0.8mm long), divergent, with rather prominent veins and rather loose straight or curled hairs, these confined on the inner sepals to the base and midrib; inner sepals otherwise tomentulose. *Petals* usually 16–22 x 12–17mm, c.1¼–1⅓ times as long as broad; base lightly contracted into a broadly cuneate and extensively white claw, blade rounded, deep reddish pink with translucent colourless or pink veins; hairs rather dense on margins and both surfaces, strongly waved, only the distal ones on the adaxial surface straight, those on adaxial surface coinciding with the white area or extending beyond it over c.⅓–½ the length of the petal. *Filaments* 7.5–9.5mm long, about as long as the sepals, slightly dilated towards the base, white, tinged with pink, curving outwards strongly when functional, later erect, finely and rather densely hairy in the basal half. *Anthers* 2.5mm long, whitish with blue sutures. *Style* 6mm long, setose, the hairs often extending on to the bases of the stigmas. *Stigmas* 3–6mm long, flesh-pink

(receptive surface deep pink, rest of stigmatic arm much paler). *Fruit* erect; rostrum 19–21mm, patently hairy; mericarps 3–4mm long, hirsute, with bristly tubercle at base, light brown. *Seeds* c.2.3mm long, rugulose.

SICHUAN–Selected specimens. Dajian Lu: 15 vi 1898, *Mussot* 73 (P); (as Kangtin Hsien) c.2670m, 28 ix 1928, *Fang* 3659 (E, GH, K, P); (as Kangting), 13 vii 1963, *Kuan & Wang* 28 (K) and 1 viii 1963, *Kuan & Wang* 1211 (K); N of Ta, 7 vii 1923, *Cunningham* 179 (E). Dajian Lu to Batang, ix/x 1904, *Hosie* s.n. (K). Dajian Lu to Tung valley, 2290m, 14 vii 1903, *Wilson* 3300 (BM, GH, K). SW slope of Ya Chou Fu, Ma An Shan near Pan Gou, 2600m, 10 vi 1914, *Limpricht* 1606 (WRSL).

General distribution. Endemic.

This species has the same underground system and above-ground habit as *G. pylzowianum*. It differs in its larger tubers, taller stature, larger, more acute, stipules, broader, less truncate, leaf divisions with broader and blunter lobes and teeth, marbled leaf surface, longer bracteoles, darker-coloured flower with distinct white centre, flat corolla with bowl-shaped centre, petals with wider claw and more extensive indumentum of curly hairs, concolorous petal-veins, longer filaments, anthers and stigmas and larger fruit. The form of the flower seems to indicate a different mode of functioning: the central white bowl is filled up with hairs and is overarched first by the stamens and later by the stigmas; probably it is adapted to cause contact of the sexual organs with a long proboscis lowered into the flower by a relatively large insect, whereas the narrow throat of *G. pylzowianum* with its small, crowded anthers and stigmas, suggests that a small insect with short tongue simply nuzzles the genitalia with its head.

The identification of this species has been difficult. The type of *G. orientali-tibeticum* was at Berlin and presumably destroyed, and I have not been able to find other specimens with the same collecting number. The protologue does not describe the rhizome system as it really is, nor the strikingly marbled leaves, and it gives only scanty information about the floral characters. However, specimens in which the stem is broken off just above a tuber, and carries some basal stipules, agree well with the description except for the stated height of 50cm. Soulié collected a number of specimens of this species at Tatsien-lou (Dajian lu) around 1894 (the date of the type) and they were distributed with labels headed 'Thibet-Oriental'. Circumstantial details thus support the identification with Knuth's *G. orientali-tibeticum*. As this epithet is difficult both to read and to write without the hyphen, I have abstained from observing the rule (ICBN, Art. 73.9) that hyphens after compounding forms in epithets are to be deleted. A fuller discussion and further details of the history of this plant are given by Yeo (1984b).

5. Geranium canopurpureum Yeo, **spec. nov.**

Type: Yunnan, 193?, *Yü* 7742 (holo. A). Fig. 3.

Herba alpina pumila perennis, usque ad 10cm alta; rhizoma subterranea, ut videtur, partium filiformium et partium tuberosarum alternantium, modo *G. pylzowiani*, composito. Caules filiformes, retrorse appresso-pubescentes, in partibus subterraneis flexuosis, parce ramosi foliatique, foliis solitariis vel binatis. Laminae foliorum basalium ambitu reniformi, supra strigosae, infra subsericeae, usque ad 3/5 partem septemfidae, divisionibus subtruncatis cuneatis integris vel trilobatis incisae. Folia caulina pauca, quam basalia simplicius incisa. Inflorescentiae cymuli pauci, pedunculi inferiores 2.5–4.5cm longi, folia aequantes vel excedentes, pedicelli 2.1–3.3cm longi; pedunculi pedicellique graciles, retrorse appresso-pubescentes. Pedicelli fructescentes reflexi sub flore geniculati. Flores erecti. Sepala 6.5–7cm longa, mu-

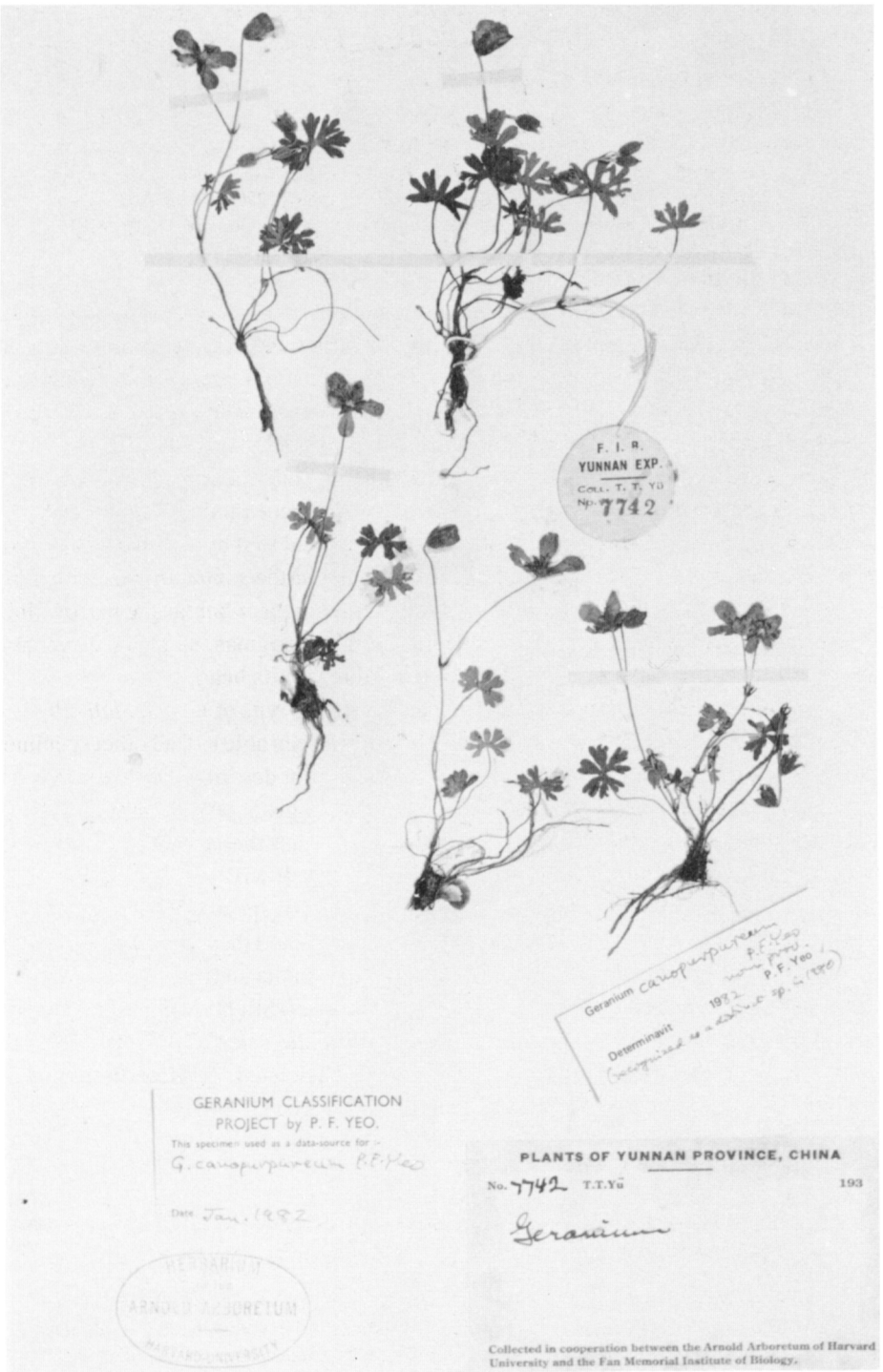

FIG. 3. *Geranium canopurpureum*, holotype, *T. T. Yü* 7742.

crone 0.5mm longe incluso, subsericea, obscure purpurea, certe ad margines. Petala 7.5–9 x c.5mm, cuneato-rotundata, basin plus minusve breviter unguiculata, colore rubro-purpurea ad basem pallente, versus basem in marginibus longe ciliata et in superficiebus ambabus sparsim et longe pilosa. Filamenta staminum c.5mm longa. Stylus c.4mm et stigmata c.1.5mm longa. Fructus ignotus.

Rootstock a small tuber up to 7 or 8 x 3–4mm, joined to neighbouring tubers by slender, elongated rhizomes below ground, apparently in the manner of *G. pylzowianum*. *Stems* very slender, flexuous in the basal underground part, with few, rather short internodes, forked at the base or with solitary branches at one-leaved or two-leaved nodes, retrorsely appressed-pubescent. Plant height from tuber to flower 10cm. *Basal leaves* with the lamina up to 2cm wide, divided as far as 3/5 or nearly to the base into 7; outline reniform, usually with wide basal sinus; divisions subtruncate, cuneate, entire to trilobate; lobes untoothed, themselves tooth-like or up to 1½ times as long as broad and then oblong; all the tips ±obtuse; upper surface shortly strigose, lower pale, subsericeous (indumentum much denser than that of the upper); petioles 2¼–4 times as long as the lamina, very slender, their underground part flexuous, rather densely retrorsely strigose; stipules 2–3.5mm, ovate or triangular-ovate, obtuse or acute, pubescent. *Cauline leaves* few, smaller than basal, with reduced lobing; stipules c.3.5mm long, linear-lanceolate, probably entire, dark purple. *Inflorescence* of up to c.4 cymules, more if stem is forked at base, the first then arising from ground level; peduncles (only the lower available) 2.5–4.5cm long, equalling or far exceeding the leaves; pedicels 1.2–3.3cm long; peduncles and pedicels very slender, retrorsely appressed-pubescent; bracteoles c.2.5mm long, linear-lanceolate, dark purple; fructescent pedicels reflexed and geniculate under the flower. *Flowers* nodding in bud, erect at anthesis, probably saucer-shaped or widely funnel-shaped. *Sepals* 6.5–7.5mm long including mucro, which is only c.0.5mm long, divergent, dark purple, at least on the margins, subsericeous. *Petals* 7.5–9 x c.5mm, c.1¾ times as long as broad, cuneate; apex rounded; base more or less contracted into a short claw; colour reddish purple, probably fading evenly near the base to almost white; margins long-ciliate towards the base; both surfaces with scattered long hairs restricted to the basal 1/6 or thereabouts; hairs not especially wavy. *Filaments* c.5mm long, usually shorter than the sepals, slightly dilated towards the base, pink or perhaps purple, with long hairs on about the basal 1/3, diverging when functional. *Anthers* c.1.2mm long. *Style* c.4mm long, with appressed white hairs (ovary densely white-hairy). *Stigmas* c.1.5mm long, dark purplish red. *Fruit* unknown.

YUNNAN. Known only from the type.

General distribution. Endemic.

On the type sheet there are two pieces with two tubers connected by an internode (respectively c.5mm and 16mm long); in the second piece one tuber gives rise to a solitary leaf and the other to leaves and an inflorescence. In this the plant resembles the two preceding species and it is therefore assumed to be related to them. It differs from them in its small size throughout, its flabellate basal leaves with entire or 3-lobed divisions, its cuneate petals and its vegetative and floral indumentum.

6. Geranium henryi Knuth in Feddes Repert. 19: 228 (1923).
Type: Hupeh, [Yichang:] Fang [place obtained from specimen in K], before March 1889, *Henry* 6752 (holo. B†, lecto. P, chosen here, isolecto. K).

Rootstock (known for var. *henryi* only) c.2cm thick, barely reaching up to ground surface, covered with fibres and fibrous roots, also with some roots that are thickened at the base and with few to many brown stipules. *Stems* erect, usually forking below, sometimes monopodial above; internodes, except sometimes the first, very long, the first up to 35cm, middle ones (9–)12–17 cm long, with sparse recurved or retrorsely appressed setae, these denser above, also sometimes dense on the first internode and there accompanied by short tomentum. Basal leaves (known for var. *henryi* only) c.6.5–10cm wide, divided as far as ¾–⅘ into 5 or 7, orbicular or reniform in outline; divisions rhomboidal, lobed in distal ⅓; lobes up to almost twice as long as broad, with 1–3 teeth; teeth about as long as broad, the lower sometimes curving outwards; lobes and teeth acute; upper surface sparsely strigillose or additionally strigose (with much longer hairs); indumentum of lower surface sparse; petioles 2½–3 times as long as lamina, finely reflexed-pilose below, reflexed-tomentose at apex. *Cauline leaves* decreasing in size upwards gradually, divided as far as ⅔ or ¾ into 5; divisions lobed in distal ⅓–⅖ , broadly to narrowly rhombic, the median and laterals becoming increasingly predominant upwards compared with the basal and the median sometimes becoming lanceolate; lobes and teeth becoming rather longer and narrower; indumentum much as in lower leaves and sparser beneath than above; petioles decreasing rapidly upwards so that the upper leaves are subsessile; middle stipules united in pairs, ovate, 1–2-dentate at apex, up to c.11mm long, glabrous or ciliate, more or less glossy, deep or light brown. Inflorescence lax; peduncles 3–15cm long; pedicels 0.7–3.5cm long; peduncles and pedicels slender, retrorsely strigillose or retrorsely more or less appressed-pubescent; bracteoles mostly 3–6mm long, narrowly ovate or triangular to linear-lanceolate; pedicels erect at anthesis, afterwards divaricate or reflexed with ascending tips. *Flowers* erect. *Sepals* 7–10mm long, including mucro c.0.75–1.7mm long, hairy, moderately to widely divergent. *Petals* c.11.5–16(–20)mm long, almost twice as long as broad; base cuneate; apex rounded or subtruncate; colour purplish red or pink, with feathered darker veins; adaxial surface with very long hairs extending over ½–⅔ of its length, densest at base but not forming marginal tufts. *Stamens* about as long as sepals, evenly tapered from the base, pilose. *Style* c.7mm long, pubescent to more or less glabrous. *Stigmas* 3–4mm long, red. *Fruit* with rostrum 11–15(–20)mm; mericarps c.3mm long, with spreading hairs or merely short pubescence. *Seeds* unknown.

General distribution. Endemic.

G. henryi is a large, lax plant with large leaves; the leaves have rhomboidal divisions with rather few teeth and lobes, all the tips being acute. It differs from *G. franchetii* in the more elongate and acutely tipped leaf divisions, the appressed hairs of the petioles and the rapid diminution of the petiole length upwards. Two varieties are recognized here.

G. terminale Z. M. Tan, here assigned to 'species incertae sedis', is probably closely related to *G. henryi*.

var. henryi

Syn.: *G. hupehanum* Knuth in Feddes Repert. 19: 229 (1923). Type: C China [Hubei: Yichang]. Fang, vii 1901, *Wilson* 2287 (holo. B†, lecto. K, chosen here).

Icones: Iconogr. Cormophyt. Sinic. 2: 521 (1972)

Lobes of main leaves up to twice as long as broad; lobes and teeth more restricted to apices of divisions than in var. *wilsonii*. Lower surface of leaves moderately pale with long curved setae mainly on the veins, sparse overall but sometimes close on the veins. *Inflorescence* very diffuse; lower peduncles 10–15cm long, upper c.4cm long. *Flowers* larger than in var. wilsonii. *Sepals* 9–10mm, including mucro c.1.3–1.7mm long, green, flushed with deep purple at the apex, sometimes less strongly purple-flushed proximally, strigillose with unequal-sized small hairs or appressed-tomentose, sometimes also with very long hairs on veins and margins. *Petals* 14–16(–20)mm long. *Stamens* curving outwards distally when functional, purplish pink or red, divergently hirsute for ½–⅔ of their length and with a dense tuft of hairs at the extreme base or on top of the nectaries. *Anthers* 2–2.5mm long, probably red. *Rostrum* 13–15(–20)mm long, shortly pubescent.

HUBEI. Xingshan, vi 1901, *Wilson* 2201 (K). SICHUAN. Chengkou Tin distr., *Farges* 112 (P).

G. henryi var. *henryi* differs from var. *wilsonii* principally in the possession of curved setae on the undersides of the leaves, in the deeper teeth and lobes of the leaves that are more restricted to the apices of the divisions, and in its laxer inflorescence, larger flowers with purple, long-haired sepals and larger rostrum. The isotype of *G. henryi* in K has relatively small leaves and flowers, whereas in that in P they are like those of the isotype of *G. hupehanum* (K). I assume that the K specimen of *G. henryi* grew under unfavourable conditions, because in other respects it is the same as the one in P. The Paris specimen of *G. henryi* shows the plant to be conspecific with *G. hupehanum*. The names were simultaneously published; I have adopted the one commemorating the plants's earliest discoverer, Augustine Henry.

var. wilsonii (Knuth) Yeo, **comb. nov.**

Syn.: *G. wilsonii* Knuth in Feddes Repert. 19: 231 (1923). Type: C China [Hubei, Yichang:] Fang, vii 1901, *Wilson* 2405 (holo. B†, lecto. W, chosen here, isolecto. K).

Lobes of main leaves about as broad as long, with some of the teeth much reduced in size; divisions with lobes and teeth extending nearer base than in var. *henryi*. Lower surface of leaves sparsely setose, not with long curved setae. *Inflorescence* with more numerous but smaller flowers; peduncles 3–6(–10)cm long; pedicels 0.7–1.8cm long. *Sepals* 7mm long including mucro c.0.75mm long, green with brownish base, appressed-tomentose. *Petals* 11.5mm long, pink. *Stamens* with filaments ciliate. *Style and stigmas*

much as in var. *henryi* but style more or less glabrous and fruit with rostrum only 11mm long.

HUBEI. Known only from the type.

The only known gathering of *G. henryi* var. *wilsonii* lacks rootstock and basal leaves. Comparison is therefore not comprehensive. The name *G. wilsonii* is of the same date as *G. henryi* and *G. hupehanum* but the imperfect state of the type ruled it out for adoption as the name of the species.

7. Geranium bockii Knuth, Geran., Pflanzenr. IV.129: 180 (1912). Type: Szetschuan, Nanchuan, 1891, *Bock & Rosthorn* 902 (holo. B†) and Setchuen, Chu sha ch'i, Wald, Ialu-ch'ih [? name of Chinese collector], Nanch'uan, 21 ix 1891, *Bock & Rosthorn* 992 (neo. O, designated here). Fig. 4.

Rootstock stout, up to 2cm in diameter; roots apparently with fusiform thickenings near their origins. *Stems* erect, furrowed, mainly opposite-leaved but branches solitary or paired; one or both of the two lowest internodes 10cm or more long and either up to 23cm long; hairs long and fine, few and retrorsely appressed or more numerous and recurved or spreading. *Basal leaves* with petioles to 32(–40, teste Knuth)cm long, few or none present at flowering time. *Basal and/or lower cauline leaves* with the lamina 4–10.5cm wide, divided for about ⅔ or nearly to the base into 7, angled or transversely subrectangular in outline; divisions rhomboidal or broadly cuneate with shortly tapered apex, pinnately or palmato-pinnately lobed in the distal ⅓–½; lobes c.1½–3 times as long as broad, with 1–2 ovate to lanceolate teeth or sometimes up to 4 teeth but some then obsolescent; tips of teeth and lobes acute; upper surface finely and densely strigose with uniform or unequal hairs; lower surface with numerous much longer spreading and curved hairs, mainly on the veins; petioles clothed like the stems or sometimes more densely; stipules up to c.11mm long, ovate-acuminate with a subulate tip continuing from a more or less conspicuous midrib, their outer surface with very small sparse to dense appressed hairs and the margin sometimes with slightly larger hairs. *Upper cauline leaves* decreasing upwards gradually in size and rapidly in petiole length so that many are subsessile; lamina divided into 3 or 5, rounded or angular in outline, with lobes c.1½–4 times as long as broad; stipules united except at the tips which are bifid. *Inflorescence* diffuse (only young specimens available); peduncles 4–12cm long; pedicels 0.6–2cm long; peduncles and pedicels densely retrorsely pubescent and sometimes also with few to many long spreading or recurved hairs; pedicels erect or divaricate and weakly geniculate in flower (not available in later stages); bracteoles 5–7mm long, lanceolate to linear, puberulous on outer surface, their margins sometimes with longer hairs. *Flowers* nodding in bud, approximately erect at anthesis. *Sepals* 8–11.5mm long including mucro 1.2–2mm long, flushed with purple at base and apex, widely divergent with more or less recurved tips, with fine appressed hairs and long spreading hairs; margins ciliate with intermediate-sized hairs; smaller hairs restricted to inner sepals and longer to outer, or hairs mixed. *Petals* 16 x c.11mm (measurable in only one flower), obovate, rounded at apex, densely beset with long hairs on margins and front surface at

FIG. 4. *Geranium bockii*, *Wilson* 2240, W Hupeh, vii 1907 (A). This specimen is very similar to the neotype.

the base for c.1/5 of their length and with scattered hairs on the veins and margins to near or beyond the middle; back surface with a few long hairs at the base; colour deep purplish pink with darker veins. *Filaments* 9.5–11mm, moderately but gradually dilated at base, more or less curving outwards distally, reddish; base with a dense tuft of long erect hairs concentrated towards the margins; margins above this sparsely ciliate to the middle or beyond with long widely divergent hairs. Anthers unknown. *Style* 6.5–9mm long, tomentose at base or throughout. *Stigmas* 2–2.5mm long, glabrous or nearly so. *Fruit* with rostrum (only one, immature, available) tomentose. *Seeds* unknown.

SICHUAN. See citation of types. HUBEI. sine loc., vii 1901, *Wilson* 2348 (K, W); sine loc., vii 1901, *Wilson* 2281 (K): sine loc., (Arn. Arb. Exp.), vii 1907, *Wilson* 2440 (K).

General distribution. Endemic.

G. bockii and *G. rosthornii* were simultaneously described by Knuth, each from one specimen collected on the same expedition. These types were destroyed in Berlin in 1945. Some specimens of Bock & Rosthorn's expedition to China in 1891, unannotated by Knuth, survive at Oslo, but no type of *G. bockii*. However, no. 992 agrees well with the original description and is here designated as a neotype. It was listed by Knuth (1912) as *G. wlassovianum*, which it certainly is not. This specimen resembles the isotypes of *G. rosthornii* in the fusiform root thickenings, a character not noted by Knuth for either species. The Wilson specimen in Fig. 4 shows a strong resemblance to the neotype.

G. bockii is characterized by its long lower internodes and lower petioles, the union of its stipules except at the apex, the generally lanceolate lobes and teeth of the palmato-pinnately cut leaf-divisions, the long peduncles and short pedicels, and the hairy stamens and petals. It has certain major characters in common with *G. henryi* but it differs in many details, most importantly in the more deeply divided leaves with more deeply lobed divisions and in the less extensively hairy petals and shorter stigmas. It stands between *G. henryi* and *G. fargesii*. *Wilson* 2348 in W was named *G. yesoense* Franchet & Sav., a Japanese species, by Handel-Mazzetti. The two taxa are probably not distantly related, but the Japanese plant has abundant divaricate branching giving rise to a bushy habit, and generally shorter closely retro-appressed axial indumentum. The long hairs on the calyx and the type of hair on the underside of the leaf are points of similarity.

8. Geranium pseudofarreri Z. M. Tan in Bull. Bot. Res. 6: 50 (1986). Type: Sichuan: Lixian, Miyaluo, 3100m, 14 vii 1982, *Z. M. Tan* 25 (holo. SZ, n.v.).
Icones: Bull. Bot. Research 6: 60 (1986).

Rootstock c.1cm thick, oblique or erect, with some of the roots thickened up to 9mm. *Stems* 20–45cm long, 2–3mm thick, asscending, opposite-leaved, retrorsely pilose and with spreading glandular hairs. *Basal and lower cauline leaves* with petioles 3–16cm long, with eglandular and glandular hairs; lamina 3–10cm wide, broadly reniform, divided 3/4–4/5(–6/7 according to illustration) into 5 or 7; divisions obovate-cuneate to broadly rhombic, palmato-pinnately lobed in the distal half; lobes 1–2 times as long as broad, more or less spreading and overlapping their neighbours, acute with about 2–5

oblong or ovate, acute, teeth; upper surface dark green, sparsely appressed-pubescent; lower surface pale green, hirsute with long hyaline hairs; cauline stipules 3–6 x 1.5–2.5mm, deltoid-acuminate, yellowish, long-ciliate and sometimes glandular. *Upper cauline leaves* with petioles 1–2cm long. *Inflorescence* diffuse; peduncles 5–18cm long; pedicels 2–6cm long; peduncles and pedicels retrorsely pilose and sparsely spreading-glandular; pedicels erect in flower and probably in fruit; bracteoles 4–6mm long, linear-lanceolate, appressed-pubescent, long-ciliate and sometimes also with glandular hairs. *Sepals* 7–10cm long, including mucro c.1mm long, purple at base, long-pilose, sometimes glandular-pilose, ciliate. *Petals* 12–16 x 7–10mm, rounded or emarginate at apex; base narrowed and shortly unguiculate, white-villous (how far?) and ciliate; colour purple. *Filaments* 6–8mm long, white, villous below. *Anthers* blackish purple. *Style* shorter than or about as long as the stamens. Stigmas very short (c.1mm?). *Fruit* with rostrum 18–23mm long; mericarps pilose. *Seeds* brown, obscurely favose.

SICHUAN. At altitudes from 3000 to 3650m from the following localities given by Z. M. Tan (1986). Lixian: Dabanshao; Songpan: Matann and Huanglong; Honyuang: Mount Zhegu and Shuajingshi; Jinchuan: Kachexiang.

General distribution. Endemic.

The above description is based on the text and illustration that form the protologue. This is a tall-growing species with thick roots and distinctive many-toothed leaves with overlapping divisions. It is further marked by its partly glandular indumentum and (as illustrated) very short stigmas. In the key to species it has been assumed that the fructescent pedicels are erect.

9. Geranium franchetii Knuth, Geran., Pflanzenr. IV.129: 177 (1912); Hand.-Mazz., Symb. Sin. 7(3): 620 (1933). Type: Szetschuan, Nanchuan, 1891, *Rosthorn* 124 (syn. B†); Hupeh, S Patung, 1888 (teste Morley, 1979), *Henry* 6154 (syn. B†, isosyn. and lecto., K, chosen here); Yunnan, 1904, *Maire* (see comments below).

Syn.: *G. strigellum* Knuth in Feddes Repert. 19: 230 (1923). Type: [E Sichuan], S Wushan, vi 1901, *Wilson* 666 (5700) (holo. B†, isolecto. K, lecto. W, chosen here. Note: S. Wushan is locality on K and W specimens, whereas Knuth gives Chang-yang, which is the locality of *Wilson* 1967 in K, also this species).

Rootstock usually up to 8mm thick, sometimes with short sections of stolon, its apex at ground level, covered with light brown stipules; roots rather thick and slightly swollen. *Stems* erect or decumbent, thin (1.5–3.5mm thick in pressed specimens), with long internodes, sometimes unbranched; essentially glabrous or retrorsely appressed-pubescent or recurved-setulose, rarely also with long glandular hairs at the base, with or without glandular hairs above. *Basal leaves* with the lamina 3.5–6.5cm wide (or less in alpine form), divided as far as ¾–⅘ into 5(–7), in outline rather regularly pentagonal or reniform-suborbicular; divisions more or less contiguous, shortly and broadly rhombic or sometimes subtruncate, entire (without teeth) in the proximal half or more, palmato-pinnately lobed in the distal ¼–⅓; lobes usually broader than long, with

1–2(–3) shallow teeth; tips of lobes and teeth obtuse; upper surface apparently dark green, strigillose; lower surface much paler, often suffused with purple, setulose, usually sparsely so and the hairs then clearly confined to the veins (the hairs sparser than those of the upper surface), sometimes with glandular hairs; petioles up to c.3 times as long as lamina, retrorsely setose and more or less villous, the indumentum usually dense towards the apex, rarely (like the stem) with glandular hairs at the base; stipules up to 1cm long, ovate, brown, pubescent on veins and margins. *Cauline leaves* similar to the basal, the lowest usually larger than the basal (up to 9cm wide), then decreasing upwards gradually; shape little altered upwards but sinuses between the divisions more open and sometimes with the divisions more tapered at the apex and with an acute central tooth, upper with only three divisions; petioles decreasing in length gradually upwards; stipules up to c.8mm long, pale brown, glabrous or pubescent, joined or free, ovate to lanceolate, pluridentate when joined, awned. Inflorescence diffuse, few-flowered; cymules arising from nodes bearing foliage-leaves; peduncles (4–)7–12cm long, much longer than the leaves and at anthesis usually far overtopping the stem apex; pedicels mostly 1.5–3cm long; peduncles and pedicels sparsely to densely hirsute with retrorsely appressed to patent hairs, the two hair-types sometimes mixed, sometimes also with glandular hairs; bracteoles up to 7mm long, linear or linear-lanceolate; pedicels erect or sometimes divaricate in fruit and then flexed beneath the flower. *Flowers* erect, apparently broadly funnel-shaped. *Sepals* 6–8mm long including mucro c.1.5mm long (c.⅕–¼ length of whole sepal), green, usually more or less greyish-tomentose and with long setae or abundant long hairs. *Petals* 11–15mm long, c.1½–1¾ times as long as wide; apex subtruncate or retuse; base cuneate; colour pink to purplish red with darker simple or branched veins; both surfaces and margins with long crisped hairs on the basal half or more, the hairs on the margins forming tufts at the base. *Filaments* 6–9mm long, slightly dilated at the base, probably pink or red, hirsute for c.⅔ of their length, diverging distally in the early stages of anthesis; nectaries with hairs on the upper margin. *Anthers* c.1.8–2mm long, narrow, probably pale in colour. *Style* 5–6mm long, setulose, the hairs extending (sparsely or densely) more or less the full length of the stigmas. *Stigmas* (2.5–)3–3.5mm long, red. *Fruit* erect; rostrum 14–17mm, pubescent, sometimes also setose towards the base; mericarps 2.5–3.5mm long, spreadingly hirsute, with bristly tubercle at base. *Seeds* c.2mm long, finely reticulate (*Wilson* 666).

General distribution. Endemic.

As accepted here, *G. franchetii* is a somewhat variable species with a wide geographical and altitudinal range, descending lower than most species of the genus in our area. It has a noticeably solid leaf outline. The petals are extensively hirsute and have lateral hair-tufts at the base; the sepals and stamens are rather small. The identity of *G. franchetii* has not been easy to ascertain. There are three syntype collections but the specimens seen by Knuth were probably destroyed in Berlin; however, there is a sheet of *Henry* 6154 at Kew (K), now the lectotype. There is one specimen from Maire which I assign to this species but it is dated only as to its accession at Edinburgh (E). There is conflict of evidence about the locality of the type of *G. strigellum* (see citation above).

var. franchetii

Without glandular hairs except sometimes on the lowest internode of the stem and the bases of the basal petioles.

HUBEI. W of Yichang, Changyang, vi 1901, *Wilson* 1967 (K). Sine loc., [1886], *Henry* 61 (W). SICHUAN. Tong Ho basin, Sai(?) Kang, 3500m, 25 vi 1912, *Legendre* 1518 (P). Wushan, S, vi 1901, *Wilson* 666 (K, W). YUNNAN. Kunming: Chang Chung Shan, 2150m, 14 v 1916, *Schoch* 90 (K); (as Kouy Tchéou), *Cavalerie* 2952 (P); (as Kouy Tchéou), Chomang Chan Po, v 1901, *Esquirol* s.n. (P); (as Kouy Tchéou), Houang Tsai Pa, rec'd ii 1921, *Cavalerie* s.n. (P); Ta P'u Chi, Miao Kao Szu, 2320m, v 1939, *Tsiang & Wang* (A) 16477 (GH) and 1250m, v 1939, *Tsiang & Wang* (B) 16477 (GH). Lo Shweli mt i.e. Longchuan Jiang, x 1937, *McLaren V.* 31, (E). Loping distr., Beling Shan, 2100m, 10 vi 1917, *Handel-Mazzetti* 10143 (W). Mengzi: c.1980m, 15 vii 1894, *Hancock* 166 (K); 2150m, 1896, *Henry* 10558 (K); beyond Nochoa, 26 vii 1896, *Hancock* ('Kew') 90 (K). Tohai Tse high plateau, 3200m, v, *Maire* s.n. (E).

var. glandulosum Z. M. Tan in Bull. Bot. Res. 6: 53 (1986). Type: Sichuan: Pengshui, Tiaotuo, Shizidong, 1350m, 15 vi 1979, *Pengshui Exped.* 572 (holo. ICD, non vidi). Icones: Bull. Bot. Research 6: 62 (1986).

Glandular hairs present on stems, undersides of lamina, peduncles and pedicels.

This variety is known only from the type locality.

10. Geranium duclouxii Yeo, **spec. nov.**

Type: Yunnan, Lou pou près Tong tchouan, x 1909, *S. Tén* (*Ducloux* 1440) (holo. E). Fig. 5.

Herba perennis, caulorhiza usque ad 1cm lata, eius apex planitie terrae insidens, stipulis parvis vestitus. Radices non incrassati. Caules verosimiliter serpentes vel scandentes, folia opposita sed ramos solitarios gerentes, internodiis longissimis, raro infimi brevi, parce recurvato-setosi. Folia basalia florescentia pauca, cum caulina inferiores longe petiolati. Laminae foliorum basalium et caulinorum inferiorium usque ad 4.5cm latae, supra dense strigosae, infra in venis antrorse pilosi, usque ad ¾ partem quinquefidae vel septemfidae, divisionibus rhomboideis, quibus in partem distalem ⅓ palmato-pinnate lobatis sunt. Lobi uni- vel bidentati, dentibus recte ovatis, subacutis vel acutis instructi. Stipulae plerumque 6–8mm longae, hirsutae, brunneae. Folia caulina superiores parum diminuta sed petiolis multo abbreviatis et stipulis in paribus bidentatis plerumque conjunctis. Inflorescentia diffusa, foliacea. Pedunculi et pedicelli graciles, villosuli vel patenti-hirsuti, priores 4–10cm longi, posteriores 1–2cm longi, ante maturitatum fructus divaricati vel reflexi et prope calycem inflexi. Flores erecti, plus minusve tubaeformes. Sepala 8.5–11mm longa, mucrone 1mm longo incluso, pubescentes et in venis elevatis longe setosae. Petala 15–17mm longa, 1½–1¾-plo longiora quam latiora, basi cuneato, apice rotundato, colore roseo, verosimiliter obscuriore penninervata, in dimidio basali superficiei adaxialis hirsuta et in marginibus basi pilosa. Filamenta staminum 8–10mm longa, basi valde dilatata, basi vel usque ad ¾ partem subpatente setosa, initio divergentes, ultimo recurvata. Antherae 2.5–3mm longae. Stylus c. 5mm longus. Stigmata 4–4.5mm longa. Rostrum fructus ex apicibus loculorum ad bases stigmatorum 12–18mm longum, puberulum. Mericarpia c. 3.5mm longa, parce patente pilosa, basi tuberculo setoso instructa.

Rootstock c.1cm thick, abbreviated, its apex at about ground level, covered with small stipules; roots relatively slender, not thickened. *Stems* probably trailing or scrambling ('rampant' on two of Maire's sheets), opposite-leaved but usually with only one branch at each node; internodes very long (in relation to leaf-size) or the lowest one sometimes very short, thin, pale brown when dry, sparsely recurved-setose. *Basal leaves* few at

FIG. 5. *Geranium duclouxii*, holotype, *Ducloux (Tén)* 1440.

flowering time; basal and lower cauline leaves up to c.4.5cm wide, divided as far as ¾ in to 5 or 7; divisions rhombic, palmato-pinnately lobed in the distal ⅓; lobes 1(–2) times as long as broad, with 1 or 2 teeth; lobes and teeth ovate, subacute or acute, not curved; upper surface apparently dark green, closely strigose with unequal-sized hairs; lower surface paler (not conspicuously pale), with antrorsely curved hairs on the veins, these sometimes very sparse but otherwise graded in size according to the importance of the veins that bear them; petioles many times longer than the laminae, with spreading white hairs, mainly near the apex; stipules mostly 6–8mm long, hirsute, brown. *Upper cauline leaves* not much smaller, their petioles rapidly decreasing upwards, uppermost subsessile with few lobes and teeth; stipules 6–7mm long, hirsute, usually united into bidentate pairs, brown. *Inflorescence* diffuse, composed of cymules arising from nodes bearing foliage leaves; peduncles mostly 4–10cm long; pedicels relatively short (1–2cm long); peduncles and pedicels slender, villosulous or spreading-hirsute; fructescent pedicels divaricate or reflexed and geniculate under the flower. *Flowers* nodding in bud, erect at anthesis, more or less trumpet-shaped, with recurved edges. *Sepals* c.8.5–11mm long including mucro 1mm long, green, more or less flushed with pink, appressed-pubescent, chiefly on the veins, and with in addition long spreading setae on the veins; veins prominent. *Petals* c.15–17mm long, c.1½–1¾ times as long as wide, divergent from the base and apparently recurved distally; base cuneate; apex rounded; hirsute on the adaxial surface over the basal half and pilose on the margins at the base; colour pink, probably with darker feathered veins. *Filaments* 8–10mm long, often apparently longer than the body of the sepals, rather strongly dilated at base, divergently setose at base or for up to ¾of their length, strongly curved outwards distally when functional and more or less recurved afterwards; nectaries with a few hairs. *Anthers* 2.5–3mm long. *Style* c.5mm long, appressed-pubescent to setulose, the hairs sometimes extending on to stigmas. *Stigmas* 4–4.5mm long. *Fruit* with rostrum 12–18mm, puberulous; mericarps c.3.5mm long, sparsely spreading-hairy, with bristly tubercle at base. Seeds unknown.

?PROVINCE. Io Chan, 3300m, rec'd iii 1913, *Maire* s.n. (E). SICHUAN. Chengkou distr., *Farges* s.n. (P). Chengkou Tin distr., *Farges* s.n. (P (4 sheets)). YUNNAN. Dongchuan, Lou Pou, x 1909, *Ducloux* (*Tén*) 6425 (P).

General distribution. Endemic.

This species has leaves somewhat like those of *G. henryi* but smaller, perhaps in correspondence with the apparently trailing habit; the flower appears to be trumpet-shaped, the sepals and stamens are large, the petals extensively hirsute and the stigmas long. The smaller fruits covered by the description are found in Maire's specimens. A specimen that looks very similar to *G. duclouxii* is Maire from Ta-hai, 3200m, 'vivace', but it has glandular hairs on the calyx, smaller petals and stigmas only 2.5mm long.

11. Geranium fargesii Yeo, **spec. nov.** Type: Su-tchuen [Sichuan] oriental, district de Tchen-kéou-tin, *Farges* (holo. P, iso. P, three sheets). Fig. 6.

Herba perennis, caulorhiza usque ad 1.5cm lata, stipulis et basibus petiolorum obtecta. Radices in regionibus prope caulorhizam napiformiter incrassati per c. 6mm longitudinis et ad latitudinem aequantem saltem dimidium longitudinis. Caules erecti, internodio primo et interdum secundo longissimo (11–30cm), pilis tenuibus dense vel parce, plerumque et patentibus et

FIG. 6. *Geranium fargesii*, holotype, *Farges*.

retro-appressis instructi. Folia opposita vel infimum solitarium. Folia basalia florescentia pauca, quantum cognita lamina usque 4.5cm lata, ambitu pentagona vel transverse oblonga, supra marmorata et tenue appresso-pubescentia, infra pallida, interdum purpureo-tincta, minus dense pilosa quam supra, usque ad 6/7–7/8 partem quinque- vel septemfida. Divisiones laminae in partem distalem pinnatilobati, lobis divergentibus 1–2(–3)-dentatis lobos divisionum adjacentium obtegentibus. Lobi et dentes loborum acuti; dentes ovato-lanceolati, vulgo 1½–2-plo longiores quam latiores. Petioli foliorum basali 2½-plo vel multo longior quam laminis. Folia caulina similes, divisionibus 5, interdum sese non obtegentibus, petiolis sursum valde abbreviatis, stipulis 3–7mm longis, ovatis, acuminatis, liberis vel fere liberis. Infloresentia pauciflora, corymbiformia. Pedunculi pedicellique semper erecti, dense et breve recurvato-pubescenti, priores 2–7cm, posteriores, 7–16mm longa. Flores ut videtur erecti. Sepala 7–9mm longa, mucrone 0.8–1.5mm longo incluso, divergentes et interdum apice patenti, intus sicco brunnea, extus virides vel purpurea et cinereo-tomentosa. Petala 11–12 x 5.5–6.5mm, basi cuneato, apice rotundato vel retuso, colore obscure purpureo vel pallide roseo, et figuram reticulatam vel pinnatam plus minusve intensiorem formante, superficiebus ambabus usque ad medium et marginibus fere toto flexuoso-hirsutis. Filamenta staminum 6.5–8mm longa, basi abrupte dilatata, versus apicem divergentes, in dimidio inferiore prominenter ciliata. Antherae c .2mm longae. Stylus c.5mm longa, setulosus. Stigmata c.3 vel 3.5mm longa, extus strigosi. Fructus matura et semina ignota.

Rootstock usually 1–1.5cm thick, shortly horizontal, well covered with stipules and petiole-bases; roots with small napiform thickenings close to the rootstock (up to c.6mm long and not less than ½ as thick as long). *Stems* erect; first and sometimes higher internodes very long (11cm in a condensed plant, 30cm in an etiolated one), sparsely to densely clothed with fine hairs, these either spreading and flexuous or more or less retrorsely appressed (both types usually present but differently distributed), opposite-leaved or with a single leaf at the first node. *Basal leaves* few or none at flowering time, up to 4.5cm wide (few available), divided as far as c.6/7–7/8 into 5 or 7, pentagonal or transversely subrectangular in outline; divisions pinnately or palmato-pinnately lobed in the distal half or slightly more; lobes mostly 1½–2 times as long as broad, divergent and overlapping those of adjacent divisions, with 1–2(–3) teeth; teeth ovate-lanceolate, often divergent; tips of lobes and teeth acute; upper surface marbled, more or less densely and finely appressed-pubescent; lower surface pale, sometimes flushed purple, finely pilose, especially on the veins, the hairs somewhat spreading, less dense than those of the upper surface; petioles 2½–many times as long as the lamina, clothed with fine recurved hairs and sometimes patent hairs in addition; stipules c.4–8mm long, ovate, brown, pubescent. *Cauline leaves* similar; divisions 5, not always overlapping; petiole-length decreasing sharply upwards so that upper leaves are sessile; stipules 3–7mm long, ovate, acuminate, free or nearly so. Infloresence few-flowered, the flowers all borne at nearly the same level; peduncles 2–7cm long; pedicels 7–16mm long; pedicels and peduncles densely and shortly recurved-pubescent, erect in flower and when fructescent; bracteoles 3–4mm long, lanceolate, tomentulose or ciliate. *Flowers* nodding in bud, apparently erect in anthesis. *Sepals* 7–9mm long including mucro 0.8–1.5mm long, green or purple, brownish inside when dry, divergent, sometimes with the tip or mucro patent, greyish-tomentulose. *Petals* 11–12 x 5.5–6.5mm; base cuneate; apex rounded or retuse; colour dark purplish pink to pale pink, overlaid with a more or less strong pattern of darker-coloured feathered or reticulate veins; base densely and coarsely hairy on both surfaces and the margins, the hairs flexuous, extending sparsely almost half way along

the adaxial surface and sometimes nearly all round the margin. *Filaments* 6.5–8mm long, abruptly dilated at the base, curving outwards when functional; with numerous rather coarse divergent hairs on and near the margins towards the base, these extending sparsely about half the length of the filament or more, and with short fine pubescence above or on top of the nectaries. *Anthers* c.2mm long, probably red. *Style* c.5mm long, densely setulose. *Stigmas* c.3–3.5mm long, strigose on outer surface for most of their length. *Fruit* with rostrum hirsute (mature rostrum not available). *Seeds* unknown.

SICHUAN. Known only from the type.

General distribution. Endemic.

G. fargesii is a rather distinct species on account of the following combination of characters: napiform swellings of the roots, long lower stem internodes, indumentum of fine hairs, deeply divided leaves, short pedicels, erect when fructescent, hirsute petals and dilated filament-bases.

12. Geranium platyrenifolium Z. M. Tan in Bull. Bot. Res. 6: 52 (1986). Type: Sichuan: Muli, Hetaowan, 28 vi 1978, *Muli Exped.* 260 (holo. ICD, non vidi).
Icones: Bull. Bot. Research 6: 61 (1986).

Rootstock 5–10mm thick, up to 14cm long; roots mainly rather thin but bearing one or two tubers at distances up to several cm from their origin; tubers to c.7mm long and 6mm wide. Stems up to 30cm, decumbent or ascending, reflexed-pilose. *Basal leaves* present at flowering time, with lamina up to 10cm wide, broadly reniform, divided as far as 2/3–3/4 into 5, divisions broadly obovate-cuneate or cuneate-flabelliform, 2–3-lobed in the distal half, the lobes laciniate with oblong teeth which are sometimes themselves toothed, teeth about as long as broad, acute, mucronulate; upper surface dark green, appressed-pilose; lower surface greyish white, more densely appressed-hirsute; petiole 6–13cm long, densely spreading-pilose, especially densely below the lamina. *Cauline* leaves with 3 or 5 divisions; petioles 1–3cm, but the uppermost very short; stipules 4–5 x 1–1.5mm, membranous, oblong-lanceolate, acuminate, pilose. *Peduncles* 3–9cm long, white-pilose. *Pedicels* 1.5–2.2cm long, pilose, especially densely so below the calyx. *Bracts* 5–6 x 1–1.5mm, oblong-lanceolate, white-pilose. *Sepals* 8–10 x 3–4mm, with a membranous margin and mucro 1mm long, 3–5-nerved, long-hirsute on the nerves. *Flowers* erect. *Petals* 15–18 x 10–13mm, broadly obovate with rounded apex, purple; base shortly unguiculate, long-ciliate and villous. *Filaments* 5–6mm long, long-pilose below the middle. *Style* a little longer than the filaments, densely white-hirsute. Stigmas apparently very short. *Fruit* c.2cm long, erect, with glabrous rostrum and white-pilose carpels.

SICHUAN. Muli, Hetaowan, Nanjiacun, 2550m, 23 viii 1978, *Zhao & Yang* 8269, and 20 vi 1978, *Yang* 7003 (SZ?, non vidi).

General distribution. Endemic.

The above description is a paraphrase of the original, amplified from the illustration. This species is known only from the type locality. The author compared it with *G.*

yunnanense, but I do not see any resemblance. It seems very close to *G. fargesii*, and may turn out to be conspecific with it. However, presentation of both taxa with their special attributes seems the course less likely to create confusion. *G. platyrenifolium* differs from *G. fargesii* in the greater distance between the tuberous swellings of the roots and the rootstock (those of *G. fargesii* being clustered near the rootstock), the larger petals, shorter stamens and stigmas and glabrous rostrum.

13. Geranium butuoense Z. M. Tan, Bull. Bot. Res.10: 26 (1990). Type: Sichuan, Butuo County, Zeluo Commune, alt. 2400m, 9 viii 1979, *Butuo Exped.* 716 (holo. ICD, non vidi).
Icones: Bull. Bot. Research 10: 24 (1990).

Rootstock short, 6–10mm thick, horizontal or oblique. *Stems* 20–30cm tall, c.2mm thick, retrorsely hairy below, densely spreading-hairy above, opposite-leaved and with paired branches. *Basal leaves* mostly lost by flowering time. *Cauline leaves* with the lamina 1.5–2.5 x 3–4cm, pentagonal suborbicular in outline, divided as far as ¾–⅘ into 5; divisions broadly rhombic-ovate, overlapping, entire in the basal half, shallowly lobed and coarsely toothed in the distal half; teeth broadly ovate-oblong, acute; upper surface dark green, lower greyish white, both very densely hirsute; petioles to 8cm long, hairy, more densely so above; stipules 6–10mm long, free or united, deltoid-lanceolate to ovate-oblong, acuminate, puberulous and ciliate. *Inflorescence* diffuse; peduncles 2–3.5cm long, densely spreading hairy; pedicels only 1–2mm long; bracts c.4mm long, linear lanceolate. *Flowers* possibly nodding. *Sepals* c.9mm long, with mucro c.1mm long, puberulous, appressed-hairy on the veins, green. *Petals* 11–13 x c.4mm, rounded at apex, narrowed, villous and ciliate below the middle, clawed at the base, pale pink. *Stamens* a little shorter than the sepals; filaments dilated at the base, pilose below; anthers yellow. *Style* shorter than the filaments, shortly hirsute; stigmas apparently not more than 2mm long. *Fruit* c.2cm long, with a distinct narrow stylar portion probably not more than 5mm long.

SICHUAN. Known only from the type.

General distribution. Endemic.

The above description is based on the text and illustration that form the protologue. The species is known only from the type; it is stated to be related to *G. yunnanense* and to differ in the leaf-shape (pentagonal suborbicular with very broad overlapping divisions), dense foliar indumentum, very short pedicels, rose-coloured petals and yellow anthers. It is indeed strikingly distinct in these characters but as there is no evidence that the flowers are nodding I have not placed it near *G. yunnanense* in my sequence.

As the fruit is not fully described the placing of the species in subgenus *Geranium* is speculative. The illustration shows that the flowers have more or less erect sepals and petal claws and spreading petal laminae. If this is a correct representation it would constitute an interesting parallel with *G. robertianum* and its allies.

14. Geranium rosthornii Knuth Geran., Pflanzenr. IV.129: 180 (1912). Type: Setchuen, Lao Kuan ts'ao, am Wege, Heinan-ai [? name of Chinese collector], Nanch'uan, 25 ix 1891, Bock & Rosthorn 1014 (holo. B†, iso. and lecto. O, chosen here).

Syn.: *G. fusiforme* Yeo, nom. nud., in annot. Figs 7, 8.

Rootstock up to c.10mm thick, sometimes rhizomatous, the main rooting zone with a cluster of roots with fusiform thickenings 1–2cm long near their origins. *Stems* erect or ascending; first internode 6–10cm long or stem branching near the base; stem mainly opposite-leaved and with paired branches, finely retrorsely strigose or sometimes with the lower internodes shortly pubescent. *Basal leaves* few or none at flowering time, with lamina up to 7.5cm wide, divided as far as (⅔–)¾–⅘ into 5; outline pentagonal, transversely subrectangular or sometimes reniform; divisions rhomboidal, palmato-pinnately lobed in the distal ⅓–⅖; lobes c.1–1½ times as long as broad, with 1–2 ovate teeth; tips of teeth and lobes usually acute or subobtuse but with a prominent mucro, rarely obtuse; upper surface marbled, appressed-pubescent; lower surface pale, with sparse long fine hairs on the veins and margins; petioles retrorsely pubescent or strigose; stipules 5–8mm long, ovate to lanceolate, brown, glabrescent. *Cauline leaves* up to c.7.5cm wide, decreasing in size and relative length of petiole gradually upwards, the lower divided as far as ⅚, the uppermost sometimes sessile; outline pentagonal with the middle division relatively large and often separated from the laterals by rather wide sinuses; stipules free or almost fully united. *Inflorescence* diffuse; peduncles 3–13cm long, pedicels 1.2–2.2cm long; peduncles and pedicels densely retrorsely pubescent; peduncles erect; flowering pedicels erect; fructescent pedicels reflexed and geniculate; bracteoles 5–9mm long, linear-lanceolate, pilose. *Flowers* nodding in bud, possibly with axis horizontal at anthesis. Sepals 8.5–11.5mm long including mucro (0.5–)1.5–2mm long, green, probably patent or subpatent, the inner tomentulose and finely ciliate, the outer sparsely setose. *Petals* 13–15(–17) x 7–10(–13)mm, obovate; colour pink with well-marked and somewhat feathered darker veins; margins densely hairy at the base and with more scattered hairs extending about ⅓–⅔ the length of the petal from the base; both surfaces with some hairs extending across the base but the abaxial with fewer. *Filaments* 6–8.5mm long, curving outwards when functional; moderately and rather abruptly dilated at base, ciliate with long divergent hairs in approximately the basal half and with a dense tuft at either side at the extreme base shielding the top of the nectary. *Anthers* 1.6–2mm long. *Style* 4.5–5mm long, densely setose. *Stigmas* 3–4.5mm long, strigose on the non-receptive surface for up to half their length or more. *Fruit* erect; rostrum c.14mm long, setose like the sepals; mericarps c.3mm long, puberulous and loosely clothed with long fine hairs. Seeds unknown.

SICHUAN. Chengkou Tin distr., 2500m, viii, *Farges* 112 (P, 4 sheets), and (without alt. or month) s. n. (P).

General distribution. Endemic.

G. rosthornii is somewhat similar to *G. fargesii*, differing in the fusiform root-thickenings, less deeply divided leaves, shorter-lobed leaf-divisions, more dispersed and larger flowers, green sepals, less veiny petals, shorter petal-hairs, much more restricted in

FIG. 7. *Geranium rosthornii*, *Farges* (P). This specimen is very similar to the lectotype.

FIG. 8. *Geranium rosthornii*, *Farges* 112, with a leaf spectrum different from that of the specimen shown in Fig. 7 and with larger flowers.

distribution, denser hairs over nectaries, longer stigmas and reflexed fructescent pedicels.

As I was initially unaware of the existence of Bock & Rosthorn's collection in Oslo, and Knuth's description of *G. rosthornii* did not mention the fusiform root-thickenings, I did not recognize the Paris specimens as belonging to this species and annotated them with the provisional name *G. fusiforme*. The Oslo and Paris specimens have different but overlapping leaf-spectra; the former lack petals.

15. Geranium napuligerum Franchet, Pl. Delav. 115 (1889); Knuth, Geran., Pflanzenr. IV.129: 143 (1912); Lingelsheim et al. in Feddes Repert. Beih. 12: 431 (1922); Stapf in Curtis's Bot. Mag. 151: sub t. 9092 (1926). Type: Yun-nan, au col de Yen tze hay (Lan Kong), 3200m, 27 viii 1886, Delavay 2328 (lecto. P, chosen here, isolecto. P, K). Icones: Iconogr. Cormophyt. Sinic. 2: 527 (1972).

Rootstock c.0.5–2.5cm thick, situated at ground level or below, bearing remains of many leaves; roots thickened near the base into napiform tubers 5–6 x 3–4mm. *Stems* up to c.25cm long, slender, weak and flexuous, with rather long internodes for the size of the plant, opposite-leaved, only occasionally branched, deeply furrowed, reflexed-pubescent. *Basal leaves* rather numerous, with lamina up to c.3cm wide, divided as far as 5/6 into 7, suborbicular or reniform in outline and with the basal sinus narrow or closed; divisions subtruncate, palmately lobed in the distal third or half, sometimes overlapping; lobes 1–2 times as long as broad, with 1 or 2 ovate or ovate-lanceolate lateral teeth; tips of lobes acute or occasionally obtuse, upper surface dark green, clothed with long fine silky hairs or with hairs only on the margin; lower surface much paler, with sparse to dense very fine silky hairs and slightly coarser, very long, spreading hairs on the veins, those towards the bases of the veins tipped with red glands; petioles several times longer than lamina, flexuous, with retrorsely appressed hairs and, at the apex, dense recurved hairs and scattered long glandular hairs; stipules c.2mm long, triangular, pubescent. *Cauline leaves* similar to basal, up to 2.5cm wide; divisions 5 or 7, with slightly deeper and narrower lobes and teeth; petioles much shorter upwards but evident, sometimes with more extensive unilateral pubescence and denser glandular hairs; stipules 3–4mm long, free, triangular-acuminate, densely hirsute. *Inflorescence* diffuse, few-branched, with up to about 6 flowers; peduncles 4–6cm long; pedicels 2–3cm long; peduncles and pedicels retrorsely strigillose and unilaterally pubescent; bracteoles 4–5mm long, lanceolate, hirsute; fructescent pedicels reflexed and geniculate under the calyx. *Flowers* nodding in bud, more or less erect at anthesis, shallowly funnel-shaped. *Sepals* 6–8mm long excluding mucro about 0.5mm long, divergent, flushed and bordered with purple, silky-pubescent and with long red-tipped glandular hairs. *Petals* c.12–13mm long, c.1½ times as long as broad, divergent; apex subtruncate or retuse; base contracted into a short claw or cuneate; colour deep pink; both surfaces and margins densely long hairy at the base and with scattered long hairs extending about half way along the petal. *Filaments* c.7mm long, shorter than the sepals, red distally, quite uniformly tapered from base to apex, rather densely long-hairy at the base. *Anthers* c.1.75mm long. *Style* 4.5–5.5mm long, glabrous or sparsely hairy. *Stigmas* c.2.5–3mm long, red. *Fruit* erect;

rostrum 11–12mm, pubescent and with scattered long glandular hairs; mericarps c.3mm long, pubescent, with bristly tubercle at base. Seeds unknown.

SICHUAN/YUNNAN. 'E Tibet and SW China', 1931, *Forrest* 30872 (BM, E).
YUNNAN. Chien Chuan/Lancang Jiang divide, 26°30'N, 99°40'E, viii 1922, *Forrest* 21989 (E). Fang Yang Tchan, 3000m, 5 ix 1887, *Delavay* 2969 (P). Lan Kong: above col of Yen Tze Hay, 3400m, 27 viii 1886, *Delavay* s.n. (P); col of Yen Tze Hay, 3200m, 27 viii 1887, *Delavay* 2328 (K). Upper Kiukiang Valley (Clulung), Lungtsahmuru, 3700m, 9 viii 1938, *Yü* 19848 (E, GH).

General distribution. Endemic.

G. napuligerum is a dwarf alpine species. It differs from other such species in its napiform roots, partly glandular indumentum and the extensive hairiness of its petals, and additionally from *G. canopurpureum* in its deeper and more numerous leaf-divisions and lobes and larger flowers, from *G. stapfianum* in its lack of rhizomes and smaller flowers and from *G. farreri* in its darker-coloured petals and shorter style.

16. Geranium wlassovianum Fischer ex Link, Enum. Horti Berol. Alt. 2. 197 (1822); Knuth, Geran., Pflanzenr. IV.129: 178 (1912); Lingelsheim et al. in Feddes Repert. Beih. 12: 431 (1922). Type: Imgoda [probably Ingoda (sic) River, Chitinskaya Oblast, USSR, E of Lake Baikal], *Fischer* (B [teste Knuth, 1912]†).
Icones: Schischkin, Fl. URSS 14: 49 (fol.) (1949); Iconogr. Cormophyt. Sinic. 2: 528 (1972); Yeo, Hardy Geraniums 103 (fol.) (1985); Fl. Hebei. 2: 11 (1988).

*Rootstock compact, c.1.3cm thick. *Stems* ascending, sometimes flexuous, opposite-leaved, monopodial or forking, sparsely to densely hairy with rather uniform retrorsely divergent shortish hairs. *Basal leaves* few, up to 12cm wide, divided as far as ⅔–⅚ into 7, heptangular to almost transversely rectangular in outline, with the basal sinus closed and others closed or narrow; divisions almost oblong with somewhat tapered 3(–5)-lobed apex; lobes about as long as broad, with 1–2 coarse triangular-ovate teeth, the lateral sometimes with additional teeth extending to below the middle of the division and often turned outwards; tips of lobes and teeth acute; upper surface often flushed with purple, velutinous and with scattered coarser hairs; lower surface much paler, velutinous and with coarser hairs on the veins; petioles c.1½–2½ times as long as the lamina, more or less densely clothed with hairs like those of the stem; stipules up to c.1.3cm long, lanceolate, ciliate. *Cauline leaves* similar to basal, decreasing in size gradually and in relative petiole-length rapidly upwards, so that upper leaves are sessile; divisions 5 or 7, sometimes rhombic or obovate; petioles with indumentum usually dense; stipules up to c.8mm long, united, with two or more teeth at the apex, ovate, pubescent. *Inflorescence* diffuse, with rather few flowers; peduncles mostly 3–8cm long; pedicels 1.8–2.5cm long; peduncles and pedicels velutinous with patent or slightly retrorse hairs; peduncles erect; fructescent pedicels divaricate or reflexed, geniculate under the flower; bracteoles 3.5–11mm long, lanceolate and with a subulate tip c.⅕–¼ the length of the whole. *Flowers* nodding in bud, more or less erect at anthesis, funnel-shaped. *Sepals* 8–11mm long at anthesis, up to 14mm in fruit, including mucro 1–1.5mm long, divergent, velutinous or shortly pubescent, with scattered long hairs in

addition, green with a brown flush at the base, the scarious parts of the margins flushed with purple. *Petals* 16–20 x 9–14mm, obovate with rounded apex; colour purplish pink to deep reddish purple with paler base, and with much darker feathered and reticulate veins; base with a tuft of hairs on each side and both surfaces; margins ciliate above the tufts for ¼–½ their length. *Filaments* 10–12mm long, more or less abruptly dilated at the base, curving outwards distally when functional, pink or purplish red, fading to white at base, finely ciliate for up to half their length, the outer also with coarse hairs at the sides of the extreme base usually forming a tuft over the nectary, and the inner with a median band of coarse hairs on the dilated part. *Anthers* c.2–2.6mm long, bluish. *Style* 7.5–10mm long, setulose. *Stigmas* 3mm to nearly 5mm long, flesh-pink to purplish red. Fruit erect; rostrum 22–25mm, densely pubescent; mericarps c.3.5mm long, shortly pubescent and coarsely setose, with bristly tubercle at base, brown at maturity. *Seeds* c.2.5mm long.

HUBEI. Recorded by Knuth (1912: 179).
SICHUAN. Recorded by Knuth (1912: 179).

General distribution. Hebei, Shaanxi, Shandong, Manchuria, Inner Mongolia, E Siberia to Far East USSR (Iconographia Cormophytarum Sinicarum 2: 528 [1972] and Flora URSS 14 [1949]).

It is not certain that *G. wlassovianum* occurs in our area. Knuth (1912: 179) cited Henry 1885–8, no. 6154, from Hubei, under both the present species and under *G. franchetii* (l. c.: 178) without comment, and the only specimen I have seen represents the latter. All the other examples that he cites for Hubei were later transferred to other species. Of the four specimens cited by Knuth (l. c.) from Sichuan one is cited (again without comment) as the type of *G. rosthornii* (l. c.: 180), one agrees with the description of *G. bockii* and is here made the neotype of that name, and one I have not seen, while *Soulié* 2041 has been identified by me as another species. *G. wlassovianum* is also indicated for Hubei and Sichuan by *Iconographia Cormophytarum Sinicarum* 2: 528 (1972), but this may be based on Knuth (1912).

My description is drawn up from four herbarium sheets from elsewhere in China and one from Mongolia, and plants of two stocks cultivated in Cambridge. The species is recognizable by its coarse and angular leaf-cutting, tendency to velvety pubescence, large obovate and veiny petals and long stigmas.

17. Geranium stapfianum Hand.-Mazz., Symb. Sin. 7(3): 620 (1933), based on *G. forrestii* Stapf

Syn.: *G. forrestii* Stapf in Curtis's Bot. Mag. 151: sub t. 9092 (1926), non Knuth. Type: Yunnan, western flank of Lichiang Range, lat. 27° 25'N, 12000ft, vii 1910, *Forrest* 6198 (lecto. K, chosen here, isolecto. BM, E, P).

Icones: Gard. Chron., ser. 3, 90: 361 (as *G. pylzowianum*) (1931); Yeo, Hardy Geraniums 106 (fol.) & t. 21 (1985).

*Rootstock a far-creeping underground rhizome c.2mm thick with more compact flowering shoots 5–8mm thick which are apparently perennial. *Stems* c.5–25cm long, flexuous, opposite-leaved, with only one or two nodes, reddish, retrorsely hirsute. *Basal leaves* few or many, with lamina 1.5–3(–3.5)cm wide, divided as far as 4/5 or more, suborbicular, reniform or pentagonal in outline with the basal sinus wide to narrow; divisions sometimes overlapping, truncate or subtruncate, palmately lobed in the distal 1/4 to nearly 1/2; lobes shorter than broad or up to twice as long as broad, sometimes with 1 or 2 ovate teeth; tips of lobes and teeth obtuse or acute; upper surface dark green, sometimes faintly marbled with paler green (strongly so in specimens cultivated in Europe), edged with red, strigose; lower surface much paler, sometimes flushed with red, strigose or spreadingly hirsute; petioles 2–several times as long as the lamina, flexuous, retrorsely pubescent, most densely at the tip; stipules 3–6mm long, ovate, mucronate, pubescent. *Cauline leaves* similar, with shorter petioles and lanceolate, sometimes glabrous, stipules. *Inflorescence* usually of 1 or 2 cymules, which sometimes emerge directly from the rosette; peduncles 2–10cm long; pedicels 3–4cm long; peduncles and pedicels reddish, retrorsely strigose or retrorsely hirsute; bracteoles 5–7mm long, linear-lanceolate, reddish, pubescent; fructescent pedicels divaricate or reflexed and geniculate under the flower. *Flowers* nodding in bud, approximately erect at anthesis, bowl-shaped. *Sepals* 8–9.5mm long including mucro c.0.5mm long, divergent, the inner obtusish, all more or less flushed with dark red, the inner tomentose, with long wavy hairs on the margins and coarser loose hairs at the base, the outer with coarser loose hairs all over. *Petals* 12–20(–22) x 11–14mm; apex deeply emarginate; base broadly cuneate; colour deep purplish red with dark red, somewhat feathered veins which converge to form a dark base to the petal; a dense tuft of hairs present on either side at the base. *Filaments* 7–9mm long, dark red distally, paler at base, uniformly tapered from base to apex, apparently curving outwards distally when functional, finely hairy on the margins at the base; nectaries each surmounted by a tuft of hairs. *Anthers* c.2–2.5mm long, reddish. *Style* 6–9mm long, deep red, hairy below, glabrous above. *Stigmas* 3.5–4mm long, dark red. Fruit erect; rostrum up to 16mm but not mature (only to 15mm when mature in cultivation); mericarps (in cultivation) c.2.5mm long, pubescent, with bristly tubercle at base. *Seeds* (in cultivation) c.2mm long, minutely reticulate.

SICHUAN. Doola, Tsa Wa Rung, 3600m, viii 1935, *Wang* 65528 (GH). Lancang/Nu divide, Tsarong, Donker La, 28°20'N, 3950m, viii 1917, *Forrest* 14675 (K). Litang River divide, Glacier Lake camp, c.4100m, 18 vi 1921, *Ward* 4220 (E). Muli: Siga mt, NE of Kulu, 4400m, vi/vii 1929, *Rock* 17949 (E, GH); Muli Gomba to Baurong and Wa Erh Dje, 4300m, vii 1928, *Rock* 16626 (E, GH, K); Mutirong, Muti Konka range, c.4400m, v/vi 1932, *Rock* 23673 (BM, E, GH). Sungpan Hsien, 25 viii 1928, *Fang* 4349, *?stapfianum* (E, GH, P). Tsarung, N of Sikitung, Kenichunpo mt, N slopes, v/vi 1932, *Rock* 22165 (E). N of Yungning, above Muli monastery, 3900m, 29 vii 1915, *Handel-Mazzetti* 7271 (E, W).

YUNNAN - SELECTED SPECIMENS. Adunzi, 3950m, 30 vii 1913, Ward 922 (E); Hu Hu or Hu Ssu valley, 4250m, 14 vii 1922, *Gregory & Gregory* s.n. (BM); towards Pungtzera, Peimashan mt, 4550m, vii 1923, *Rock* 10001 (E, GH, P). Chienchuan/Lancang divide, 99°40'E 26°30'N, c.4100m, viii 1919, *Forrest* 23172 (K) and viii 1922, *Forrest* 23172 (BM, E). Clulung, Kiukiang Valley, Chilahmuto, 3500m, 7 viii 1938, *Yü* 19716 (E, GH). Lijiang distr. & range: E slope, 4550m, 13 vii 1922, *Rock* 5018 (BM, E, K) and up to 5150m, ll viii

1922, *Rock* 5725 (E); Yuling Shan, 3700m, 1914/1918, *Handel-Mazzetti* 3796 (W); 100°10'E 27°30'N, c.3500m, vii 1929, *Forrest* 27844 (BM, E); E flank, 3500m, 20 vii 1914, *Schneider* 1938 (GH, K); E, 27°30'N, c.3350m, vii 1906, *Forrest* 2637 (BM, E, K); W slope, Ashi road, vii 1922, *Rock* 5399 (E, GH, P); NE, Ta Koo (Ta Chi), 24 vii 1939, *Ching* 21209 (GH). Nu/Kanchiang divide, Tsarong, 98°75'E 28°40'N, vii 1919, *Forrest* 19037 (K). Yung Pa, rec'd iii 1934, *McLaren (N.)* 146 (BM, E).

General distribution. Endemic.

G. stapfianum is a dwarf alpine species, easily recognized by its system of slender rhizomes and large, intensely coloured flowers with emarginate petals. The distinguishing characters of *G. canopurpureum* and *G. napuligerum* have already been given. *G. farreri* differs in its lack of rhizomes, horizontal floral axis and extremely pale-coloured petals with rounded apex and attenuate base. Stapf was in error in supposing the filaments of this species to be glabrous; he indicated this condition on the type sheets but in two of the three the hairs can be seen.

18. **Geranium donianum** Sweet, Geraniaceae 4: sub t. 338 (1827), based on *G. multifidum* D. Don; Knuth, Geran., Pflanzenr. IV.129: 141 (1912).

Syn.: *G. multifidum* D. Don, Prodr. Fl. Nepal. 207 (1825) non Andrews, Geraniaceae 1: t. 52 (1805), nec Sweet, Geraniaceae 3: t. 245 (1825). Type: Gossaingsthan, *Wallich* 8565A (lecto. number, teste Hara & Williams, 1979).

G. stenorrhizum Stapf in Curtis's Bot. Mag. 151: sub t. 9092 (1926). Type: West (sic) Himalaya, Sikkim, 12 - 14000 ped, *Hooker f. & Thomson* Herb. Ind. Or. 7: [four localities represented on two sheets: (1) Lama Kengua [?], 24 vii 49, (2) Lachoung [or Laichoong], 11–12000 ft, Aug. 30/49, (3) Tunga, October, (4) Yeumting [?], 12000 ft, 6 ix 49 (syn. K); Clakthang, 1888, *King's* collector (syn. B†?); Chumbi and Phari, 1879, *Dungboo* (syn. B†?).

Icones: Polunin & Stainton, Flow. Himal. t. 21, fig. 235 (1984); Yeo, Hardy Geraniums 104 (fol.) (1985).

*Rootstock thick. *Stem* slender, 10–40cm tall, more or less silky-hairy with finely pointed hairs. *Main leaves* to c.3.5cm wide; divisions more or less truncate, deeply palmately lobed; lobes with few teeth; lobes and teeth up to 4 or more times as long as broad, acute; stipules lanceolate. *Inflorescence* diffuse; lowest peduncles arising low on stem, up to 18cm long; pedicels mostly 2–3.5cm long, erect at anthesis, divaricate or reflexed and geniculate under the flower after anthesis. *Flowers* erect at anthesis, funnel-shaped. *Sepals* up to 10.5mm long, including mucro up to 1mm long, suberect. *Petals* c.16mm long, deep reddish purple; base hairy on margins and both surfaces. *Stamens* about as long as sepals. *Style* 5mm long. *Stigmas* nearly 3mm long. *Fruit* with rostrum 10mm long, densely pubescent.

SICHUAN. Dajian Lu, *Mussot* 71 (P).

General distribution. Widespread in the Himalaya; Tibet.

G. donianum is known to me from China from a single specimen, and the description here is based on that, with the addition of the lower height limit, the distribution of petaline hairs and length of style and rostrum from Himalayan material. In cultivation the plant is low-growing.

Stapf (1926) recognized a species, *G. stenorrhizum*, distinct from *G. donianum*, which he equated with Knuth's (1912) account of *G. donianum*. None of the specimens cited by Knuth could have been known to Don and all are therefore syntypes of *G. stenorrhizum*. They were presumably in Berlin and destroyed in 1945. Stapf doubtless formed his opinion of the distinctness of *G. stenorrhizum* on the basis of the specimens in K; I have therefore cited these in detail as syntypes.

19. Geranium refractum Edgew. & Hook. f. in J. D. Hooker, Fl. Brit. India 1: 428 (1874); Knuth, Geran., Pflanzenr. IV.129: 135 (1912). Type: Sikkim, Regio temp., Tungu, 12–13000 ped., 23 vii 49, 15. Geranium refractum, Edgew. & H. f., *J. D. Hooker* (lecto. K, proposed here); Sikkim, Regio temp., 12–13000 ped., 15. Geranium refractum, Edgew. & H. f., *J. D. Hooker* (isolecto. K).

Syn.: *G. melanandrum* Franchet., Pl. Delav. 112 (1889); Knuth, Geran., Pflanzenr. IV.129: 129 (1912); Hand.-Mazz., Symb. Sin. 7(3): 618 (1933). Type: Yunnan, col de Yen-tze-hay, 18 & 19 vii 1887, *Delavay* (syn. P, four sheets, syn. K, two sheets).

G. batangense Pax & Hoffm. in Lingelsheim et al. in Feddes Repert. Beih. 12: 430 (1922). Type: [Sichuan] ('Ost-Tibet'), Beju-Batang, Nadelwälder des Passes Ngu pa la to li, zwischen Isama und Maoschi, 4200m, 16 viii 1914, *Limpricht* 2184 (holo. WRSL).

G. refractoides Pax & Hoffm. in Lingelsheim et al. in Feddes Repert. Beih. 12: 430 (1922). Type: [Sichuan] ('Ost-Tibet'), Tatsien lu - Dawo: Gata (Tai ling), im Tschin tschuan tale norwestlich des Dshara (Tara ri), 3800m, 2 vii 1914, *Limpricht* 1895 (syn. WRSL, two sheets).

G. angustilobum Z. M. Tan in Bull. Bot. Res. 6: 48 et 59 (1986). Type: Sichuan: Xiangcheng, on grassland near Rewo, alt. 4500m, 28 vii 1973 (holo. CDBI, non vidi).

Icones: Engler, Pflanzenreich IV.129: 134 (1912); Iconogr. Cormophyt. Sinic. 2: 524 (as *G. batangense* and *G. refractoides*) (1972); Ohashi, Fl. East. Himal., third report, t. 4e (1975); Bull. Bot. Res. 6: 59 (as *G. angustilobum*) (1986).

Rootstock up to 1(–1.5)cm thick, appearing thicker if branched, abbreviated, situated at ground level, clothed with brown stipules and producing numerous large fusiform roots. *Stems* erect or flexuous, grooved on one side; internodes long or the basal ones short, tinged with purple, glabrous or retrorsely setose below, setose or setulose above with crisped pubescence in the grooves, also increasingly and ultimately densely glandular-hairy upwards; gland-hairs coarse, easily visible with the naked eye, purple, with large heads. *Basal leaves* not numerous at flowering time; lamina 2.5–8cm wide, divided as

far as 5/6–9/10 into 5; median division slightly smaller than those on either side of it, sometimes making the leaf broader than long; outline pentagonal or sometimes reniform, with more or less open sinuses between the divisions; divisions subflabellate and subtruncate or, more usually, cuneiform with shortly tapered apex, the latter type palmato-pinnately lobed in the distal ½–⅗; lobes mostly 1–2½ times as long as broad, with 1–3 teeth about as long as broad or less; lobes and teeth usually curving outwards, sometimes not lying flat, their tips subobtuse, or sometimes acute or obtuse; upper surface rather light green, often flushed with reddish at margins, sometimes lightly marbled, more or less sparsely strigillose; lower surface much paler, the veins sparsely strigose or strigillose, occasionally with sparse purple glandular hairs; petioles several times as long as the lamina, retrorsely setose, at least distally, and with a band of pubescence, sometimes also with purple or purple-tipped glandular hairs; stipules usually 10–15mm long, brown, oblong, acuminate, pilose or glabrous. *Cauline leaves* similar, decreasing in size gradually upwards, mostly petiolate; petioles and underside of lamina more or less glandular-hairy; stipules light brown, the middle ones free, lanceolate, c.8–12(–14)mm long, the upper ovate or ovate-lanceolate, sometimes joined. *Inflorescence* open and few-branched; peduncles mostly 3–8cm long; pedicels mostly 1.2–2.5cm long; peduncles and pedicels densely clothed with large purple glandular hairs (as on the stem) and with a band of short crisped pubescence; stipules of the uppermost leaves and the bracteoles 5–10mm long, linear, acute; pedicels bent under the flower at anthesis, reflexed when fructescent. *Flowers* nodding at anthesis (through flexure of pedicels). *Sepals* (7–)9–11(–12)mm long including mucro 0.8–1.5 mm long, reflexed at anthesis, green, flushed with purple, dark purple at the base outside, dark purple sub-basally inside, pubescent (especially the inner), eglandular-setose and with large purple glandular hairs (as on the stem), especially the outer. *Petals* (10–)12–16(–18)mm long, (1¾–)2–3 times as long as broad, reflexed just above the base, rounded at apex, white or pale pink, more rarely darker red-purple; base with a dense tuft of silvery, slightly crisped hairs, thickest on the margins but sometimes extending over the adaxial surface (sometimes, however, glabrous here). *Filaments* (9–)11–14mm long, rather evenly tapered from the base, connivent at first, reddish purple distally (with paler base) to pink (probably rather uniformly so), finely pilose on the margins and basal one third (or less) to almost glabrous; nectaries (separate) each with a tuft of hairs on top (visible when the petals have dropped). *Anthers* 2.5mm long, blue-black, with yellow pollen. *Style* 7.5–12(–13)mm, antrorsely setose at the base or throughout (and the setae then sometimes extending on to the stigmas). *Stigmas* 2–3(–3.5)mm long, pale pink to deep purplish red. *Fruit* nodding during development, erect at maturity; rostrum 15–22mm, pubescent, its stylar portion 5–8mm long (in Himalayan specimens); mericarps 3.3–4mm long, pilose, their hairs not appressed, with basal tubercle bearing long bristles. *Seeds* 2.5mm long, faintly reticulate, mottled (in one example).

QINGHAI. Recorded in *Icon. Cormophyt. Sin.* 2: 524 (1972) ('*batangense*').
SICHUAN. Bozu to Batang, Mala pass, S, Rum Tung, 4000m, 13 viii 1914, *Limpricht* 2209, ?*refractum* (WRSL). Beju-Batang, Ngu pa la to li pass, zwischen Isama und Maoschi, 4200m, 16 viii 1914, *Limpricht* 2184 (WRSL). Konkaling, Risonquemba, Konka mt, 3960–5335m, vi 1928, *Rock* 16316, ?*refractum* (E).

YUNNAN. Adunzi, Huann Fu Ping, 3700m, viii 1935, *Wang* 68810 (GH). Chungtien plateau, 5 vii 1939, *Feng* 1489 (GH). Chungtien, SE of, Bödö to Alo, 4300m, 7 viii 1914, *Handel-Mazzetti* 4533 (E, W, WRSL). Jingo La summit, 27 vii 1922, *Gregory & Gregory* s.n. (BM). Lancang/Nu Jiang divide: Sewalongba, 3400m, 27 viii 1938, *Yü* 22527 (E, GH); Sila, 3800m, 5 viii 1938, *Yü* 22166 (E) and 4000m, 19 viii 1938, *Yü* 22423 (E, GH); E of Yuragan, 3800m, viii 1932, *Rock* 23418 (E). S of Lungtsahmuru,, Kiukiang Valley (Clulung), 3700m, 10 viii 1938, *Yü* 19883 (E, GH). Mo So Yn, Fang Yang Tchang, 11 x 1887, *Delavay* s.n. (P). Nu/Kiu Jiang divide, Netahtsu, 3600m, 20 x 1938, *Yü* 20804 (E, GH). Wei Si Hsien, Yeh Chih, 3600m, viii 1935, Wang 68642 (GH). Y. Weihsi, Tungchuling, Tsidang, 4000m, 14 vii 1937, *Yü* 8983 (KUN). Col de Yen Tze Hay, n. d., *Delavay* (K, P).

General distribution. Nepal to Bhutan; N Burma.

G. refractum is easily recognized by its nodding flowers with narrow, reflexed, usually pale pink petals, and coarse purple glandular hairs. Himalayan material is usually white-flowered. The diagnosis of *G. angustilobum* Z. M. Tan contrasts it with *G. refractum*, but the differences do not seem to be of specific significance. Although much-collected, *G. refractum* does not appear to have been cultivated in Europe until very recently; I have not yet seen it in flower in cultivation.

The sheet that I have designated as an isolectotype has previously been labelled as the 'type specimen' but it seems better to choose as the lectotype one bearing a label giving place and date (Tungu and July 23/49).

20. Geranium delavayi Franchet in Bull. Soc. Bot. France 33: 442 (1886); Franchet, Pl. Delav. 108 (1889); Knuth, Geran., Pflanzenr. IV.129: 135 (1912); Limpricht in Feddes Repert. Beih. 12: 430 (1922). Type: Yunnan, Hokin, col de Koua-la-po, 3000m, 4 viii 1885, *Delavay* 1945 (holo. P).

Syn.: *G. kariense* Knuth, Geran., Pflanzenr. IV.129: 577 (1912); Hand.-Mazz., Symb. Sin. 7(3): 620 (1933). Type: Yunnan, Mekong/Yangtse divide, western slope of Kari pass, 11000–13000ft, *Forrest* 797 (copied as 97) (holo. E).

G. forrestii Knuth, Geran., Pflanzenr. IV.129: 578 (1912). Type: W Yunnan, eastern flank of Tali Range, lat. 25°24' N, 9000–10000ft, *Forrest* 4282 (holo. E, iso. P).

G. limprichtii Lingels. & Borza in Feddes Repert. 13: 387 (1914); Limpricht in Feddes Repert. Beih. 12: 430 (1922); Hand.-Mazz., Symb. Sin. 7(3): 621 (1933). Type: Yunnan, Tali fu, Tsang schan, 2800 - 3000m, 9 viii 1913, *Limpricht* 1081 (holo. WRSL).

G. calanthum Hand.-Mazz. in Anz. Akad. Wiss. Wien, Math.-Nat. 62: 224 (1925); Hand.-Mazz., Symb. Sin. 7(3): 618 (1933). Type: Setschuan austro-occid., supra monasterium Muli ad septentr. pagi Yúnnanensis, Yungning, Bädö, 3900m, 29 vii 1915, *Handel-Mazzetti* 7289 (holo. W, iso. E).

Icones: Engler, Pflanzenr. IV.129: 134 (1912); Iconogr. Cormophyt. Sinic. 2: 523 (1972).

Rootstock to c.1cm thick, horizontal to erect, clothed with stipules at the apex, producing tapered roots. *Stems* erect, internodes usually long, furrowed, pale green or pinkish and

retrorsely appressed-puberulent or appressed-pubescent at base, the first internode sometimes villous in addition, otherwise retrorsely strigose and unilaterally pubescent, upper internodes often with very long fine spreading glandular hairs with colourless stalks and dark glands. *Basal leaves* with the lamina up to 10(–17)cm wide, divided as far as ⅔–⅞ into 5 or 7; outline pentagonal or heptagonal; basal sinus usually acute; divisions broadly rbombic, often slightly overlapping their neighbours, pinnately incised in the distal half or ⅔; lobes 1(–1½) times as long as broad, few- to several-toothed; teeth obtuse or acute; sinuses other than the basal usually more or less closed; upper surface rather dark green, lightly marbled, scabridulous to strigose; lower surface paler, frequently flushed with purple, strigose to setulose on the veins; petioles several times as long as the lamina, their indumentum like that of the lower stem but apically much denser; stipules c.10–15mm long, appressed-pubescent, lanceolate, brown. *Cauline leaves* similar, decreasing in size gradually upwards for 2 or 3 nodes, then abruptly, the upper with 3 or 5, usually narrower, divisions, mostly petioled; middle stipules brown, usually united into broadly ovate pairs, each with 2 or more teeth with subulate tips; upper stipules also mostly united, smaller. *Inflorescence* diffuse; peduncles mostly 2.5–8cm long, sometimes the upper suppressed resulting in a sessile cymule or groups of more than 2 flowers; pedicels 1–3cm long; peduncles and pedicels frequently with glandular hairs (as described for stems), with short unilateral pubescence as well, if eglandular then often reflexed-strigose above; bracteoles filiform; fructescent pedicels either divaricate and decurved or reflexed. *Flowers* nodding in bud and in anthesis. *Sepals* 7–10mm long including mucro 0.5–1(–2)mm long, reflexed at anthesis, green with a small dark purple zone at the base, appressed-puberulent and with bristly hairs towards the margins and on veins, usually also with glandular hairs (as described for stems). *Petals* 8–12(–14)mm long, broadly obovate to narrowly oblong-obovate, 1¼–1½(–3½) times as long as broad, entire or shallowly lobulate at apex, contracted into a very short claw at base, reflexed above the claw; base with marginal tufts of hairs, these dense and straight or less dense and more crisped, the space between the tufts on adaxial side glabrous or hairy; colour blackish red to pale pink with a whitish base, rarely white generally, though pink and white forms sometimes have a darker zone distal to the white base. *Filaments* 8–10mm long in young flowers, finally becoming 10–12(–13)mm long and then c.1¼ times as long as sepals, evenly tapered to the apex from a narrow base, straight, dark red at apex, paler towards base, with very few hairs near base or with a small basal tuft and more scattered fine short or long hairs on the basal quarter; nectaries separate, usually surmounted by erect white hairs. *Anthers* c.2mm long, blackish red or blue-black. *Style* 8–9mm long, subglabrous or setulose or setose at the base or throughout. *Stigmas* 1.5–3mm long, red. Fruit nodding during development, erect at maturity; rostrum 15–22mm, hirsute; mericarps 5mm long, hirsute. *Seeds* finely reticulate.

SICHUAN. 10 mi S of Muli, 4270m, 17 vii 1921, *Ward* 4827 (E). Muli: c.2900m, 9 viii 1921, *Ward* 4778 (E); Litang/Shou-Chu rivers, Wa-Ehr-Dje to Garu, 4250m, vii/viii 1928, *Rock* 16747 (E, GH); SW of, Kaushu shan, on trail to Lerong, 3800m, v/vii 1932, *Rock* 24104 (E, GH, K). Yen Yuan Hsien to Yung Ning, near Hunko, 1800m, 12 vi 1914, *Schneider* 1171 (K).

YUNNAN – SELECTED SPECIMENS. S of Chungtien, Hs a Chungtien, 25 vi 1939, *Feng* 1402 (GH). SE of Chungdien, between Bödö (Peti) & Alo, 4100m, 7 viii 1914, *Handel-Mazzetti* 4523, *?delavayi* (E). Dali, middle of Yu Chü mt, n. d., *McLaren B.* 172 (BM, E, K). Dali Fu, Diancang Shan, 3000m, 9 viii 1913, *Limpricht* 984 (WRSL). Dongchuan, 2800m, vii, *Maire* s.n. (E, Léveillé). Hokin, Koua La Po, 3000m, 4 viii 1885, *Delavay* 1945 (P). Lancang/Nu Jiang divide, Sewalongba, 3400m, 26 viii 1938, *Yü* 22498 (E, GH, KUN). Lijiang (range): Lung Yu mt of Mung Hua, rec'd v 1935, *McLaren L.* 95 (BM, E, K); 27°40'N, viii 1910, *Forrest* 6302 (BM, E, K); NW, Ah-s-shi, 25 vi 1939, *Ching* 20890 (GH). Mengzi, mountains to N, c.1980m, 1896, *Henry* 10228A (E) and 2440m, *Henry* 10228 (K). Muli mountains, 28°12'N, c.3350m, viii 1918, *Forrest* 16793 (E, K). NW Yunnan and E Tibet, c.3800m, 10 vii 1913, *Ward* 745 p. p. (E). Nu Jiang/Kiukiang divide, Parolaka, c.3450m, x 1938, *Yü* 20635 (E, GH). Wei Si Hsien, 2800m, viii/ix 1935, *Wang* 67815 (GH). Yungning, near town, under Fongkou ridge, 3300m, 16 vii 1915, *Handel-Mazzetti* 7063 (W).

General distribution. Endemic.

G. delavayi resembles *G. refractum* in the form and posture of its flowers but the leaf-divisions are rhombic and its glandular hairs, when present, are finer and not purple except for the head; the flower has zones of colour near the base and usually smaller sepals. The flower colour is in fact very variable, but is probably usually a 'plummy' (greyed) shade of pink. However, in *Forrest* 16793 it is 'black-crimson, base dull yellow'; what is apparently this plant was cultivated in Ireland, 1933, under the number *Forrest* 28521 (K), which is *G. refractum*. This species is also variable in other characters; for example, *Forrest* 4282 and *Ward* 640 (1913) have copiously long-hairy filaments, *Forrest* 4282 has particularly small petals and Ward 745 (1913; mixed with *G. refractum*) has small pedate leaves with sparse lobes and teeth and long, very narrow petals. Apparent hybrids between *G. delavayi* and *G. sinense* are mentioned under the latter species.

21. Geranium sinense Knuth, Geran., Pflanzenr. IV.129: 577 (1912), based on *G. platypetalum* Franchet.

Syn.: *G. platypetalum* Franch., Pl. Delav. 111 (1889); Knuth, Geran., Pflanzenr. IV.129: 133 (1912) non Fisch. & Mey. Type: Yunnan, Fang yang tchang, 5 ix 1887, *Delavay* s. n. (holo. P).

G. mairei Lévl., Feddes Repert. 12: 282 (1913). Type: [Yunnan], hauts sommets a Tong-tch'ouan, 2800m, herbages, vii 1912, *Maire* (teste Lauener (1967)) (holo. E, iso. BM, E).

Icones: Yeo, Hardy Geraniums 106 (fol.) & t. 21 (1985).

*Rootstock massive, to 1½(–2)cm thick, horizontal to erect, emitting thick roots, clothed with stipules at the apex. *Stems* erect, with usually long internodes, furrowed, retrorsely appressed-puberulent or retrorsely strigose at base, retrorsely strigose above and abruptly becoming additionally more or less densely glandular-hairy, the gland-hairs long, with colourless stalks and dark heads. *Basal leaves* few at flowering time, with the lamina up to 7(–11)cm wide, divided as far as ⅘–⅞ into 5 or 7, usually more or less pedate; basal sinus usually obtuse, those between divisions usually open; divisions rhombic-ovate, sometimes pinnately incised in the distal half with the lobes 1–1½ times as long as broad, but second order leaf-cutting usually weak; teeth more or

less numerous, ovate, acute, so that margin is relatively evenly crenate-serrate; upper surface dark green, slightly marbled (in cultivation), strigose; lower surface paler, sometimes flushed with purple, moderately strigose on the veins (usually a little more so than upper surface); petioles several times as long as the lamina, their indumentum like that of the lower stem, becoming very dense and sometimes more spreading at the apex; stipules c.10–35mm long, brown, linear-lanceolate, appressed-pubescent. *Cauline leaves* similar to basal, decreasing in size gradually, the upper with usually 3, sometimes attenuate, divisions, the median much the largest; petioles becoming abruptly shorter at about the third node; middle stipules c.8–18mm long, brown, usually united into ovate or ovate-lanceolate pairs, each terminating in 3 subulate points, the upper also mostly united, smaller. *Inflorescence* diffuse, many-flowered; peduncles 3–6(–8)cm long, the upper frequently suppressed, resulting in sessile cymules or groups of more than 2 flowers; peduncles and pedicels more or less shortly villous and rather densely glandular (as described for stems); bracteoles mostly filiform; fructescent pedicels deflexed or divaricate and decurved, erect in ripe fruit, at least at apex. *Flowers* nodding in bud and nodding vertically at anthesis. *Sepals* 7–8.5mm long including mucro 1–1.5mm long, reflexed at anthesis, green with a small dark purple zone at base, appressed-puberulent, ciliate on margins towards base, glandular-hairy (as described for stems) on veins. *Petals* 6–9mm long, obovate or broadly obovate, up to 1½ times as long as broad, irregularly and shallowly lobulate at the apex, contracted into a very short claw at the base, reflexed above the claw, sparsely or very sparsely ciliate in the region of the claw, glabrous on both surfaces or the adaxial with a handful of hairs; colour blackish red with pale pink base composed of a fleshy-textured extreme basal portion and a normal-textured sub-basal zone (observed in cultivation). *Filaments* 9–12mm long, c.1¼ times as long as sepals, evenly tapered to the apex from a narrow base, straight, dark red distally, gradually paler towards base, glabrous or shortly ciliate and slightly hairy on the surface towards the base; nectaries united into an annulus, glabrous, greenish (in cultivation). *Anthers* c.1.5–2mm long, blackish red with yellow pollen. *Style* 8–9mm long, setulose at the base or throughout. *Stigmas* 1.5–2mm long, dark red. *Fruit* nodding during development, erect at maturity; rostrum (16–)18–22mm, hirsute; mericarps 3.5mm long, hirsute, with bristly tubercle at base. *Seeds* 2.5mm long, very finely reticulate.

SICHUAN. Huei Li Hsien, 2850m, 17 ix 1932, *Yü* 1537 (GH). Huili distr., Lungschu Schan, c.3200m, 16 ix 1914, *Handel-Mazzetti* 5152 (W).
YUNNAN. Beyendjing, Pe Tsao Lin (Betsaoling), 24 ix 1919, *Tén* 1368 (C, W). Dali Fu/range/distr.: Tsang Shan, 3000m, 9 viii 1913, *Limpricht* 948 (WRSL); 2600m, ix 1914, *Schneider* 2878 (GH, K); [viii 1929], *Forrest* 28195 (BM, E); E flank, 25°40'N, 2750m, viii /ix 1906, *Forrest* 4283 (E) and 3650m, ix 1910, *Forrest* 6829 (BM, E, K). Fang Yang Tchang, *Delavay* s.n. 3 ix 1888, idem (K, P). Col de Hee Chan Men, 4 ix 1888, *Delavay* s.n. (P). Lijiang distr./range: E slopes, Peshwe R., 1 viii 1922, *Rock* 5288 (E); on Kung Hsien bridge, rec'd v 1935, *McLaren (L.)* 98 (BM, K). Linag Shan, Chio Kia Hsien, 13 ix 1933, *Tsai* 52023 (GH). Lou Choei Tang, Yuntze?, 1920, *Tén* 89 (E). Lou Pin Chao, 24 viii 1919, *Tén* 1237 (C, W). Teng Chuan valley or Sung Kwei valley, c.3050m, ix 1904, *Forrest* 66 (E, K). Tong Chuan: mt & plateau, rec'd iv 1914, *Maire* s.n. (E, P); vii 1909, *Ducloux (Tén)* 1441 (E) and vii 1909, idem 6426 (P); 2650m, viii, *Maire* s.n. (W); Lou Pou, viii 1906, *Ducloux (Tén)* 330 (E). Yunnan Fu to Sui Fu, behind Tung Schan, 2600m, 4 ix 1914, *Mell* s.n. (W).

General distribution. Endemic.

G. sinense is immediately distinguished from other Chinese species by its single annular nectary. It is extremely closely related to *G. delavayi* but differs from typical forms of that in its less incised leaf-divisions which are less dilated at the middle, and less likely to overlap, in its smaller sepals, in its smaller, nearly black, petals and in the near-absence of hairs on the corolla and androecium. Both species have large brown stipules and in both the flower is nodding during and after anthesis.

Some plants occur that are intermediate between this species and *G. delavayi* and these may be hybrids; they include plants looking like *G. sinense* but with the nectaries just separate, and plants looking like *G. delavayi* but with the nectaries just joined. The type of *G. pinetorum* Hand.-Mazz. shows this variation in the nectaries within the individual and is probably this hybrid, though it also has more finely cut leaves than usual. I cite it here as a binary name probably applicable to hybrids between *G. delavayi* and *G. sinense*.

G. x *pinetorum* Hand.-Mazz., Symb. Sin. 7(3): 619 (1933), p.p. Type: Yunnan, prope urbem Yungbei inter vic. Dschao-ping et Boloti, 2700 –3000m, 30 vi 1914, *Handel-Mazzetti* 3353 (holo. W, iso. E).

Citations of other intermediate specimens follow.

YUNNAN. Dongchuan, 2600m, rec'd 1914, *Maire* s.n. (E); Lao Kouy Chan, My Li, near, 8 vii 1906, *Ducloux (Ngneou)* 329 (E); Lijiang range, on Kung Hsien bridge over Yueh Hsien, rec'd v 1935, *McLaren (L.)*, p.p. 98 (E, K); Lo Shweli mt i.e. Longchuan Jiang, 3900m, x 1936, *McLaren (V.)* 84 (E); Pin Tchouan region, Se Tse Ou Dy, 31 viii 1911, *Ducloux (Ty)* 7158 (P); nearYo Lin Chan, ix 1895, *Delavay* 6681 (P); Yunnan Sen, high mountains, 30 ix 1908, *Ducloux* 481 (K).

22. Geranium pogonanthum Franchet, Pl. Delav. 111 (1889); Knuth, Geran., Pflanzenr. IV.129: 184 (1912); Yeo in Garden 109: 36, 37 (1983, '1984'). Type: Yun-nan, in monte Fang-yang-tchang, before v 1888, *Delavay* s.n. (lecto. P, chosen here, isolecto. K, P).

Syn.: *G. palustre* var. *stipulaceum* Franch., Pl. Delav. 109 (1889) Type: Yunnan, in monte Hee-chan-man, n.d., *Delavay* (holo. P).

G. yunnanense sensu Yeo in Notes RBG Edinb. 34: 198 (1975).

G. meiguense Z. M. Tan in Bull. Bot. Res. 6: 47 et 58 (1986). Type: Sichuan: Meigu, Dafending, alt. 3300m, 11 vii 1979, Meigu Exped. 410 (holo. ICD, non vidi).

Icones: Notes RBG Edinb. 34: 198 (as *G. yunnanense*) (1975); Garden 109: 37 (1983, '1984'); Yeo, Hardy Geraniums 99 (fol.) (1985); Bull. Bot. Res. 6: 58 (as *G. meiguense*) (1986).

*Rootstock stout, up to 1.5cm thick, abbreviated, horizontal or ascending, situated at ground level and below, producing numerous thin or fusiform roots, crowned at its apex by long brown stipules. *Stems* erect, pale in colour, retrorsely appressed-puberulent or densely pubescent with recurved hairs, occasionally with long fine spreading glandular hairs above (these colourless or only the gland coloured); eglandular hairs often denser upwards; internodes, except rarely the first, long. *Basal leaves* few at flowering time, with the lamina up to 10(–14)cm wide, divided as far as ⅔–9/10 into 5 or 7; lamina often

arranged as a funnel; lobes and teeth occasionally few and short or as in *G. yunnanense* (q.v.) but more usually the lamina is as in *G. delavayi*, with broadly rhombic divisions tapered to a rather long acute or acuminate apex and the lobes numerous, mostly 1–2 times as long as broad and with 1–4 porrect or (the lowest) somewhat divergent teeth; outline then pentagonal or heptagonal and not much dissected because of the narrowness of the sinuses; upper surface probably medium to dark green, strigillose or strigose; lower surface paler but not usually so pale as in *G. yunnanense*, strigose on the veins or all over, or loosely hirsute; petioles several times as long as the lamina, sparsely retrorsely strigose at the base or throughout, or densely retrorsely hirsute at the apex or throughout; stipules 1–2cm long, brown, pubescent, awned. *Cauline leaves* similar, decreasing in size upwards, often increasing in density of indumentum, petioled; stipules more or less ovate-lanceolate, the middle ones often fused in pairs and then more or less ovate, pluridentate, 8–12mm long, with awned apices. *Inflorescence* moderately branched, flowers commonly more than 10; peduncles mostly 4–8cm long; pedicels 1.5–3cm long, recurved near the flower at anthesis, reflexed from the base during ripening of fruit; peduncles and pedicels recurved-hirsute or retrorsely strigose, sometimes with some long glandular hairs like those of the stem; bracteoles linear or filiform, 4–9mm long. *Flowers* 1.9–3cm in diameter, nodding at anthesis (vertically or nearly so), and afterwards. *Sepals* 8–11mm long including mucro 1–1.5(–2)mm long, reflexed, green, sometimes flushed with purple, blotched with purple at base, finely appressed-pubescent and with long hairs on the margin; veins more or less setose or with very long fine glandular hairs which are not pigmented unless in the head. *Petals* patent and recurving distally or, apparently, reflexed, 8–16(–20)mm long, usually c. twice as long as broad (sometimes narrower), rounded at apex; colour almost white to pink or purple; base with dense marginal tufts of long, white, somewhat wavy hairs, and with even longer, only slightly less dense, hairs on adaxial surface; abaxial face of base with some shorter hairs. *Filaments* (6–)8–10(–12)mm long, about as long as the sepals, diverging distally when the anthers are functional, evenly tapered from a rather narrow base, purplish red distally, paler towards base, or merely pale pink, bearing long white subpatent hairs for c.⅓–⅔ of their length, the hairs usually moderately copious, at least at the base, and sometimes dense; nectaries separate, pilose at the top. *Anthers* 1.5–2.5mm long, blue-black, with yellow pollen. *Style* (7–)8–11mm long, setose or setulose, sometimes distally glabrous or puberulent, the hairs sometimes extending on to the stigmas. *Stigmas* 2.5–4mm long, purplish red. *Fruit* nodding during development, erect at maturity; rostrum 18–24mm, pubescent; mericarps 3.5–4.5mm long, pubescent, with basal tubercle bearing long white hairs. *Seeds* (2.5–)3–3.5mm long, finely reticulate.

SICHUAN. Hsi Chang Hsien, c.3000m, 10 viii 1932, *Yü* 1309, ?*pogonanthum* (GH).
YUNNAN. Adunzi, 3050m, 4 vii 1913, *Ward* 640, ?*pogonanthum* (E). Chengkang range, 3480m, 24 vii 1932, *Yü* 16948 (GH). Chungtien valley, 3500m, 1 viii 1939, *Feng* 1934 (GH). Fang Yang Tchang: Kan Ho above Mo So Yn, 3000m, 5 ix 1887, *Delavay* s.n. (P); Lan Kong, rec'd i 1889, *Delavay* s.n. (K). Lancang Jiang, Kaakerpo, Dokerla, Tsarung, c.3900m, v /vi 1932, *Rock* 23051 (BM, E, K). Lancang/Jinsha Jiang divide, Nakela mts E of Yuragan, 4115m, vi /vii 1932, *Rock* 23119 (K). Lan Ping Hsien, 2800m, 17 viii 1933, *Tsai* 53721, ?*pogonanthum* (GH). Lijiang, across river Beschui, 2950 - 3300m, 10 vii 1915, *Handel-Mazzetti*, ?*pogonanthum* 7013 (W). Lijiang distr.: Ngu Leh Kah, near, 3200, 25 vii 1914, *Schneider* 1998 (GH,

K); below gt. glacier of the Snow Range, 3600m, 2 ix 1914, *Schneider* 3354 (GH, K); E side, v/x 1922, *Rock* 4924 (E, K); E side, 27°30'N, 3350m, vii 1910, *Forrest* 6058 (E, K); E side, Sa Ba main gulch, 3350m, v/x 1922, *Rock* 5649 (E). Near Lijiang, W slopes, 3000m, x 1914, *Schneider* 3291 (GH, K). Longchuan Jiang, W side, Longchuan/Nu Jiang, 25°20'N, 2750m, viii 1912, *Forrest* 9070 (BM, E, K). Wei Si Hsien, Yeh Chih, 3600m, viii 1935, *Wang* 68376, ?*pogonanthum* (GH).

General distribution. N Burma and W Central Burma.

G. pogonanthum is a fourth species with nodding flowers and reflexed petals, but in this case the petals, at least sometimes, are evenly recurved rather than abruptly bent back near the base. Typically this species has clear pink petals without a basal zone of different colour and this, together with the greater quantity of hair in the flower, especially on the filaments, and the facts that the filaments are divergent and scarcely exceed the sepals, distinguishes it from *G. delavayi*. In some instances it has been difficult to decide which of these two species a specimen belongs to. *G. pogonanthum* is also apparently very closely related to *G. yunnanense*; the two are differentiated under the latter species. Doubtfully included here is *Handel-Mazzetti* 7013, which the collector assigned to *G. limprichtii*. A stock of *G. pogonanthum*, collected in W Central Burma, is in cultivation in Europe (Yeo, 1983, 1985); it was formerly thought to be *G. yunnanense*. In fact, *G. pogonanthum* has been largely unrecognized since it was described. Two accessions from Yunnan (*Brickell & Leslie*, 12102 and 12115, 1988) have also flowered at Cambridge; they have small flat flowers 20–24mm in diameter and stamens only 6mm long, accounting for the parenthetic lower limit in the above description.

G. meiguense Z. M. Tan has been placed in synonymy here, though it does show some departures from my description; these are the large sepals (12–16mm) and the strong reflexing of the petals shown in the illustration. The reflexing of the stipules, when fused in pairs, is observable in *G. pogonanthum* (?coll.21269, KUN).

23. Geranium yunnanense Franchet, Pl. Delav. 114 (1889); Knuth, Geran., Pflanzenr. IV.129: 178 (1912); Hand.-Mazz., Symb. Sin. 7(3): 620 (1933). Type: [Yunnan], sommet du Tsong chan au dessus de lac (or des lacs), 4000m, 19 viii 1887, *Delavay* 2647 (holo. P, iso. BM, E, K).

Syn.: *G. candicans* Knuth, Geran., Pflanzenr. IV.129: 581 (1912). Type: W Yunnan, eastern flank of the Tali Range, lat. 25°40' N, 10–11000ft, open grassy situations in pine forests, vi 1906, Forrest 1879 (holo. E, iso. K, P).

Icones: Garden 109: 37 (1983, '1984'); Yeo, Hardy Geraniums 100 (fol.) (1985).

*Rootstock stout, to c.1.5cm thick, moderately abbreviated or somewhat elongated, more or less vertical, partly above ground, rooting at the base, usually by one or a few stout tap-root-like members; apex loosely clothed with long brown stipules. *Stems* erect, probably trailing in age, pale in colour, retrorsely appressed-setulose, increasingly so upwards, more or less villous in the grooves; base sometimes nearly glabrous or shortly pubescent; internodes, except sometimes the first, long. *Basal leaves* few at flowering time, with the lamina up to 6(–10)cm wide, thick, divided as far as 4/5–6/7 (rarely almost

as far as base) into 5; outline angularly reniform (on account of the shortness of the median division) and irregular in profile (on account of the inequality of the teeth) with sinuses between divisions open (but the lamina often rolled into a funnel-shape so that outline is not displayed in dried specimens); divisions more or less rhombic, rather shortly tapered at apex, palmato-pinnately lobed in the distal half; lobes 1–2(–2½) times as long as wide, unequally 1–3-toothed; teeth usually symmetrically ovate or sometimes curving outwards, acute or sometimes subacute (not curving outwards so much, nor being so obtuse, as in *G. refractum*); upper surface light green, lightly marbled, strigillose, usually sparsely so; lower surface pale green, strigose on the veins, sometimes with scattered glandular hairs; petioles several times as long as the lamina, retrorsely setose, more densely so distally; stipules usually up to c.12mm long, brown, pubescent, attenuate. *Cauline leaves* similar, decreasing in size gradually upwards and increasing in density of indumentum, petioled; stipules 12(–15)mm long, free and oblong-lanceolate or ovate-lanceolate, occasionally the middle ones fused in pairs and ovate, with awned apices. *Inflorescence* little-branched, few-flowered (flowers often 10 or fewer); peduncles mostly 4–12cm long; pedicels mostly 1–3cm long (rarely more than twice as long as sepals), bent under the flower at anthesis and afterwards, the proximal part at these stages divaricate or declined, more or less erect from the base at maturity; peduncles and pedicels eglandular, unilaterally villous and more or less densely setulose, the hairs recurved or retrorsely appressed; bracteoles 7–12mm long, linear. *Flowers* 2.5–4.5cm in diameter, nodding at anthesis, declined or inverted during ripening of fruit. *Sepals* 11–14mm long, including mucro 1–1.5mm long, widely divergent or patent, green, sometimes flushed with purple, sometimes with a small purple zone at base, finely appressed-pubescent, with long hairs on the margins and bristly hairs on the veins, rarely also with long spreading glandular hairs (pigmented only in the gland). *Petals* 15–20mm long, not more than 1⅓ times as long as broad, rounded at apex, divergent, forming a saucer-shaped corolla; colour pink to purple, occasionally white or nearly so; base with dense marginal tufts of mainly straight hairs and, between the tufts, with dense to sparse loose hairs adaxially and appressed hairs abaxially. *Filaments* (8–)11–15mm long, as long as or slightly longer than the sepals, diverging distally when functional, evenly tapered from a rather narrow base, purplish red distally and paler towards base or entirely whitish, with long, stiff subpatent to lightly recurved white hairs on basal ⅓–⅔, denser towards the base and there copious to very dense; nectaries separate, pilose at the top. *Anthers* 2.5mm long or slightly more, blue-black, with yellow pollen. *Style* (5–)10–14mm long, glabrous or setulose at the base if long, setulose or setose throughout if short, the hairs sometimes extending on to the stigmas. *Stigmas* 2.5–4.5 mm long, usually long in short-styled plants, purplish red. *Fruit* nodding during development, erect when ripe; rostrum 15mm in short-styled plants, 20–23mm in long-styled, pubescent; mericarps 3–4mm long, long-pilose, with basal tubercle bearing long white hairs. *Seeds* 3mm long, faintly reticulate.

YUNNAN. Che Tse Lo, Pi Lo Shan, summit, 4000m, 21 viii 1931, *Tsai* 58085 (GH), and 15 ix 1934, *Tsai* 58637 (GH). Chungtien, S of, Bödö to Alo, 4100m, 7 viii 1914, *Handel-Mazzetti* 4523 (W). Jingo Shan pass, 3650m, 30 vii 1922, *Gregory & Gregory* s.n. (BM). Jinsha Jiang to Chungtien, 3200m, viii 1914, *Schneider* 2362 (GH, K). Kiang Pu, Wei Si Hsien, 3000m,

vii 1934, *Tsai* 64623 (GH). Lancang/Jinsha Jiang divide, N of Pien Tien Go, 27°30'N, 3350m, vi 1924, *Forrest* 25519 (BM, E, K, P). Lancang/Nu Jiang divide: Sila, 4000m, 18 viii 1938, *Yü* 22393 (E, GH); Nakela mts, E of Yurgan, 3800m, vi /vii 1932, *Rock* 23119 (E, GH). Lijiang Range: Tali, Pe Yun Mt summit, rec'd iii 1933, *McLaren (B.)* 186 (BM, K, E); NW, mt Shwemenkan, c.3900m, vii 1923, *Rock* 9733 (BM, E, GH, K); NW, Tamichung, 24 viii 1949, Ching 21446 (GH). Longchuan/Nu Jiang divide, 25°21'N, 2450m, viii 1912, *Forrest* 9090 (BM, E, K). Tali Range, E flank, 25°40N, c.3200m, vi 1906, *Forrest* 1879 (E, K, P) and c.3000m, vii 1906, *Forrest* 4218 (BM, E, K). Tsarung border: Yundshi mt, c.3900m, x/xi 1932, *Rock* 23464 (BM, E, GH, K) and 23466 (BM); W Mekong (Lancang Jiang), Kaakerpo, Dokerla, Tsarung, c.3900m, v /vi 1923, *Rock* 23052 (BM, E, GH, K). Tsong Chan: 4000m, 19 viii 1887, *Delavay* s.n. (P); near the summit, 4000m, 19 viii 1887, *Delavay* s.n. (K, P). Wei Si Hsien, Yeh Chi, 3600m, viii 1935, *Wang* 68451 (GH). Yangpi drainage basin, mountains, viii 1922, *Rock* 6263 (E, W).

General distribution. N Burma.

G. yunnanense differs from all four species with nodding flowers dealt with so far in not having its petals reflexed; being also wider they form in fact a saucer-shaped flower. It differs from all these except *G. pogonanthum* also in its divergent stamens with blue-black anthers. Its possession of these characters in common with *G. pogonanthum*, together with similar petal-colour and distribution of hairs on the petals and filaments, makes it appear most closely related to that species. It has less hairy leaves than that species, and also usually more abruptly tapered leaf-divisions and less acute leaf-teeth, and fewer, larger flowers.

The variation seen in material that I have assigned to *G. yunnanense* is greater than is normal for species that occupy a compact geographical area. Thus *Forrest* 4281 and 9090 have all parts of the flower rather small and the styles relatively short; the same applies to *Forrest* 1879 except for its larger petals. As I cannot find any other special characters correlated with these I do not wish to recognize the plants as constituting a separate taxon. The type of *G. yunnanense* is in any case approximately intermediate between these smaller-flowered plants and the many large-flowered specimens collected by Forrest, Rock, McLaren, Wang and Yü. Examples with white or near-white petals are *Forrest* 25519 ('pure white or faintly flushed rose' according to collector's label) and *Forrest* 1897 (the type of *G. candicans* Knuth).

Although *G. yunnanense* has been much collected, it appears that it was first cultivated in Europe only in 1981, when it was brought to Edinburgh by the Sino-British Expedition to Cangshang (not 'Scottish Botanical Expedition to China', as stated by Yeo, 1985). Confusion in British gardens between *G. yunnanense* and *G. pogonanthum*, and between *G. candicans* and the Himalayan *G. lambertii* Sweet, has been discussed by Yeo (1983).

24. Geranium farreri Stapf in Curtis's Bot. Mag. 151: t. 9092 (1926). Type: cult. Hort. Kew., 1924, *Farrer* 170F. p.p. [but see discussion] (specimen figured in Curtis's Bot. Mag.), (lecto. K); [cult.] Hort. Kew., 170F., 120.17/Farrer, two sheets, one mixed with *G. pylzowianum*, isolecto. K).

Icones: Garden 85: 369 (1921); Gard. Chron., ser. 3, 75: 333 (as G. Farrer's pink) (1924) & 87: 241 (as *G. napuligerum*) (1930); Curt. Bot. Mag. 151: t. 9092 (1926); Graf, Exotica 4, ed. 11, 1177 (as *G. napuligerum*) (1982); Yeo, Hardy Geraniums 101 (fol.) (1985).

*Rootstock very small, usually with a stout taproot and some slender lateral roots; lateral crowns of the rootstock may separate from the parent one spontaneously. *Stems* rather stout for the size of the plant (which is up to c.12cm tall), with a short or obsolescent first internode and up to 3 other internodes, opposite-leaved and with paired or solitary branches, red, subglabrous to retrorsely pubescent. *Basal leaves* with lamina up to 3cm wide, thick, with recurved margins, divided as far as ¾ or more into 7; outline oblate, scarcely angled, with the basal sinus usually narrow; divisions scarcely overlapping, truncate or subtruncate, palmately lobed in the distal ¼–⅓; lobes obtuse, cuspidate, some of them with 1 or 2 ovate or obsolescent, more or less acute, teeth; upper surface dull green, faintly marbled, bordered with red, rather sparsely and finely strigose, with impressed veins; lower surface much paler, sometimes flushed with purple, with scattered fine antrorsely curved hairs mainly on the veins; petioles red, with retrorsely divergent pubescence or pilosity; stipules up to c.4mm long, ovate, acute or obtusish, glabrous except for minute hairs on the margins. *Cauline leaves* very similar, often noticeably anisophyllous, decreasing in size upwards, the upper usually with 5 divisions, all distinctly petioled; stipules up to 5mm long, free, puberulent, often denticulate distally, tinged with red. *Inflorescence* of 1–6 cymules, the first arising at the 1st–3rd node; peduncles 1.5–4cm long; pedicels 1–3cm long; peduncles and pedicels becoming reddish, retrorsely pubescent; bracteoles like the cauline stipules but lanceolate, entire; fructescent pedicels reflexed and geniculate under the flower or sometimes not geniculate, so that the developing fruit lies on the ground. *Flowers* nodding in bud, at anthesis flat and with axis horizontal. *Sepals* 7.5–10mm long including mucro 0.5–1mm long, widely divergent, green, with wide scarious margin slightly tinged with pink, more generally red in age, more or less pubescent with a few slightly stronger hairs on the veins. *Petals* 14–15mm x 10–15mm, suborbicular to oblate and clearly contracted into a short, broad claw, the margins of which are recurved in life; margins elsewhere undulate; colour pale pink with translucent veins; claw ciliate and with a dense tuft of pubescence at the extreme base, its adaxial surface with a small median tuft (difficult to see) and the abaxial with a very few hairs. *Filaments* 9–11mm long, white, tinged with pink distally, abruptly dilated and with fine divergent hairs at the base, mainly on the margins and extending for about ⅕ of their length (a very few sometimes scattered as far as ½ their length), porrect or slightly declined when functional; nectaries with a scanty tuft of hairs at the top. *Anthers* c.2.3mm long, dull purple to blackish violet. *Style* 10–13mm, declined, pink, glabrous. *Stigmas* 1.5mm long, pinkish. *Fruit* with rostrum 23mm, puberulent, with scattered fine longer hairs; mericarps 3.5–4mm long, densely hirsute with short and long spreading hairs. *Seeds* 2.8–3mm long, smooth.

GANSU. SW Gansu, [Da Tung chain, Min Shan], [Red Ridge above Ardjeri], viii 1914, [*Farrer* 201, see discussion] (E). T'ao River Basin, N of Chabaku Pass, 4200m, viii 1925, *Rock* 13184 (K).
SHAANXI. Shaanxi/Sichuan boundary, Ta-pa-shan, 4000m (teste *Icon. Cormophyt. Sinic.* 2: 526 [1972]).

General distribution. Endemic.

G. farreri is similar in habit and foliage to *G. stapfianum* but different in its flowers with horizontal axis, very pale pink concolorous and rounded petals and long style. There is also a rather subtle difference in the form of the leaf-divisions: they have relatively broadly ovate and unequal lobes and teeth so that the division is usually subtruncate rather than truncate. *G. farreri* differs from the other dwarf species, *G. napuligerum* and *G. canopurpureum*, by the same set of characters (except the rounded petals), while *G. napuligerum* is further characterized by the glandular hairs on the sepals. These four species are also all quite distinct from each other in their underground parts.

The dark anthers contribute noticeably to the appearance of the flower in the male stage. In the organization of its flower *G. farreri* is similar to *G. pratense*, both having the axis horizontal, the stamens loosely porrect and the style and stamens long, these organs together serving as the alighting place for large bees.

Farrer twice described his discovery of this species (Farrer, 1916: 76, 1917: 172–3), either calling it *G. pylzowianum* or using the provisional name *G. pylzowianum* var. *alpinum*. The location was the Red Ridge of the Min Shan, the summit of which was made of shingle and scree supporting no plants other than *G. farreri*. Farrer had to make a return visit for seeds and obtained only two (no. F.201). He probably used the above names under pressure from the botanical authorities (Bowles, 1921), but he was quite clear as to the distinctness of this plant from *G. pylzowianum* and he emphasized that the two occurred in different areas (Farrer, 1917). Stapf (1926) said he did not know whether these seeds gave rise to plants that were distributed, and he described *G. farreri* from material cultivated at Kew as number F.170 (170F. in K), which had been collected and distributed as *G. pylzowianum*. Stapf stated that at Kew the seeds had given rise to both species and there are in K two sheets of 170F. (accession no. 120.17/Farrer, pressed 20 v 1923) one bearing pieces of *G. farreri*, the other of *G. pylzowianum* apart from one piece of *G. farreri*. In fact, plants of F.201 were raised in England (at Ingleborough, Farrer's home) and progeny had been distributed (Bowles, 1921). In view of the lapse of time between Kew's accession of F.170 in 1917 and the making of the specimen in 1923, and in view of the distribution of F.201 (perhaps under the name *G. pylzowianum*) from at least 1920, it seems easily possible that the two species became mixed either in distribution from Farrer's garden or after receipt at Kew. Therefore it is most probable that the type material is after all F.201, originating from the place where Farrer said he found his new plant.

G. farreri has become widespread in cultivation, and my description is based on stocks from Hillier's Nursery and the Uppsala Botanic Garden, amended by reference to *Rock* 13184 (K). Both the above-mentioned Farrer numbers derive from collecting in Gansu and Tibet in 1914. The Farrer specimen in E that I cite came to my notice only in October 1986. Its original label was apparently lost and it had been labelled as either from Farrer's expedition to Burma in 1919 or that to Kansu/Tibet in 1914-15; it had quite legitimately but unfortunately been filed in 'India'. There can be little doubt that it corresponds to the seed-gathering numbered F. 201. Rock's locality is in the same mountain range.

When this species was given an award by the Royal Horticultural Society in 1924 it was tentatively identified as *G. napuligerum* and this name has stuck to it in gardens and horticultural literature with remarkable tenacity, even to this day, despite the fact that in 1926 Stapf rejected the notion that it was that species.

25. Geranium christensenianum Hand.-Mazz., Symb. Sin. 7(3): 621 et Taf. 9, Abb. 2 (1933). Type: Yun nan, ex silvis Pei Tsao Lin, 25 ix 1919, Siméon Tén 1392 (holo. C). Icones. Handel-Mazzetti, Symb. Sin. 7(3): t. 9 (1933).

Stems possibly decumbent, probably scrambling, pubescent, with additional glandular hairs throughout or only above. *Leaves* up to c.5.5cm wide, divided scarcely as far as ¾ into 3; divisions ovate, sometimes with wide sinuses between them; lobes short, few; lobes and teeth ovate, acute, conspicuously mucronate; upper surface pubescent; lower surface densely pubescent, sometimes with glandular hairs near the petiole; petioles pubescent, with or without additional glandular hairs, the lowest available c.1½ times as long as lamina, upper decreasing gradually; stipules up to c.11mm long, free, lanceolate. *Inflorescence* diffuse, with cymules in axils of foliage leaves; peduncles 1.5–6cm long; pedicels at anthesis about as long as the sepals and perhaps bent, afterwards 1.5–2 times as long as sepals and apparently erect; peduncles and pedicels with long, patent, colourless glandular hairs with pigmented heads. *Sepals* 11–12mm long including mucro 1.5–2mm long, probably green, with glandular hairs as on the pedicels. *Petals* c.14 x 10mm, broadly obovate, hairy at base on margins and adaxial surface (indumentum of abaxial surface unknown), white (collector's note) with dark violet veins. *Filaments* about the same length as the sepals, black except at the scarcely dilated base, curved outwards at first, with short and not very dense spreading hairs on basal ⅔. *Anthers* black. *Style* setulose except at apex. *Stigmas* 5mm long, black. *Fruit* erect, with rostrum (apparently nearly ripe) 18mm, densely clothed with long-glandular hairs.

YUNNAN. Beyendjing (see protologue), Pe Tsao Lin, 15 ix 1917, *Tén* 1392 (C) and 25 ix 1919, *Tén* 1392 (C).

This species is known only from the type and one other specimen, both being rather incomplete. It is quite distinct from other SW Chinese species in its tripartite leaves and black stamens and stigmas combined with white petals. The species which it appears to resemble most is the Himalayan *G. lambertii* Sweet, with which it has in common the habit, soft pubescence, type of glandular hair, short pedicels, flower colours, sepal size and stigma length; it differs from it in having only 3 leaf-divisions, in its smaller petals, less hairy stamens and apparently erect fructescent pedicels.

26. Geranium platyanthum Duthie in Gard. Chron., ser. 3, 39: 52 (1906); anon. in Kew Bull. 1907, app. 3: 68 (1907). Type: Geranium platyanthum, Duthie, n. sp. in Gard. Chron., China, *E. H. Wilson* 995 [deleted; really 1948, see discussion], received from J. Veitch & Sons, 25 v 04 [apparently cultivated] (lecto., K, chosen here).

Syn.: *G. eriostemon* Fisch. ex DC., Prodr. 1: 641 (1824); Knuth in Engler, Pflanzenr. IV.129: 121 (1912); Lingelsheim et al. in Feddes

Repert. Beih. 12: 430 (1922); Hand.-Mazz., Symb. Sin. 7(3): 618 (1933); non *G. eriostemum* Poiret, Encycl. suppl. 2(2): 759 (1811). Type: In betuletis apud Bouretas in Daouria, 17/28 Julio (holo. G(DC), seen in microfiche).

Icones : Sweet, Geran. 2: t. 197 (1824); Schischkin, Fl. URSS 14: 49 (fol.) (1949); Iconogr. Cormophyt. Sinic. 2: 520 (1972); Fl. Hebei. 2: 9 (1988); Yeo, Hardy Geraniums 89 (fol.) (1985) (all as *G. eriostemon*); James Veitch & Sons Ltd, Novelties, 1906, 3 (1906).

*Rootstock c.1.5cm thick, main lateral roots moderately thick (c.2–4mm). *Stems* erect, with very long lower internodes, alternate-leaved below, branched, with coarse spreading eglandular hairs and, at the base or more usually on later internodes, purple-tipped glandular hairs. *Basal and lower cauline leaves* with the lamina mostly 10–16cm wide, usually wider than long, divided as far as ½–⅗ into 5 or 7; divisions broadly ovate or oblong-ovate, the middle one sometimes smaller than its neighbours, shallowly lobed; lobes much shorter than broad and unevenly serrate; teeth and tips of lobes obtuse or acutish, upper surface rugose, strigose or loosely hirsute; lower surface rather densely hirsute; petioles 1½–3½ times as long as the lamina, with spreading eglandular and sometimes, additionally, glandular hairs; basal stipules up to c.2cm long. *Upper leaves* opposite, with very short petioles and 3–5 broadly ovate divisions with unevenly serrate rather than lobed margins; margins often red; stipules of paired leaves free, narrowly deltoid. *Inflorescence* dense, the later cymules without peduncles and forming umbels; lowest peduncles 5–8cm long, longer than the subtending leaves, upper often shorter than the pedicels, all erect; pedicels 1–2cm long, arcuate at anthesis, erect afterwards; bracteoles 2–4mm long; peduncles and pedicels densely clothed with red-tipped glandular hairs of mixed lengths. *Flowers* more or less inverted at anthesis, the short-peduncled ones (the majority) overtopped by developing fruits of earlier flowers, erect during development of fruit. *Sepals* 7.5–10.5 mm long, including mucro 0.5–1mm long, green, sometimes flushed with red, patent, clothed with long hairs, mostly tipped with purplish-red glands. *Petals* 11.5–13.5mm long and about as wide, patent or, where sepals permit, reflexed, forming a very flat corolla apart from marginal undulations, rounded at apex, broadly cuneate at base; colour medium violet-blue, fading to white at base; margins near the base ciliate with pointed hairs and in addition with dense tufts of glossy-surfaced hairs which may be distally thickened and obtuse, also with setae between the tufts abaxially but none adaxially. *Filaments* 10–11mm long, evenly dilated at the extreme base, straight, connivent, blackish purple distally, fading to white at base, clothed in the basal half with long patent-recurved hairs; nectaries glabrous, prominent, drying to a dark colour. *Anthers* c.2.3mm long, dull blue with yellowish pollen. *Style* 8.5–10.5mm long, green, largely glabrous. *Stigmas* c.1.5mm long, greenish to brownish or dull red. *Fruit* erect, with rostrum 22–28mm, pubescent and sparsely to densely clothed with long red-tipped glandular hairs; mericarps 3.5–4mm long, dark brown or blackish, puberulent and loosely hirsute with glandular and eglandular hairs, with bristly tubercle at base. *Seeds* c.2.2mm long, blackish brown, finely reticulate.

GANSU. Lichen, Toul Ping, 2150–2950m, viii 1923, *Ching* 412 (P). SW Gansu, T'ao River basin, T'ao River, Choni, 2600m, vi 1925, *Rock* 12225 (P). W Gansu, near Sin Long Chan, and near Ma Ho Chan, 9 vii 1918, *Licent* 4085 (P).
HUBEI. Patung: v 1901, *Wilson* 1948 (GH, K); Paokang, vi 1901, *Wilson* 1948a (K).
MONGOLIA E. Gihol, or Gihoe, viii 1864, *David* 2194 (P). Ipehoachan, vii 1863, *David* 2244 (P).
SICHUAN. Dajian Lu: c.3350m, rec'd 1890, Pratt s.n. (K); Ta Hsiang Ling [in GH], vii 1904, *Wilson* 3298 (GH, K). Pao Hsing Hsien, 25 vi 1936, *Chu* 2937 (BM, W). Mountains around Sungpan, vi-viii 1914, *Weigold* s.n. (W). Sungpan Hsien, 10 viii 1928, *Fang* 4130 (E). [Mupin & Dajian Lu distr.], vii 1908, *Wilson* 2439 (BM, GH, K).
TIBET E. Dawo (Ressenyi), Lumpuer valley, Djulussni, 3800m, 15 vii 1914, *Limpricht* 2005 (WRSL).

General distribution. N China, Manchuria, Siberia.

G. platyanthum has nodding flowers with connivent stamens as do *G. retectum*, *G. refractum*, *G. delavayi* and *G. sinense* but the petals are broad and approximately patent, not narrow and reflexed; it is also very distinct from the last three in its inflorescence, in which the later flowers form umbel-like clusters, while the developing fruits are kept out of the way of the nodding flowers by being held above them on erect pedicels. *G. erianthum* DC., which does not extend south into our area, is apparently a distinct species, though the differences are not marked. It differs in that the eglandular hairs of the lower stem are not spreading, the leaves are more deeply divided and more acutely and profusely lobed and toothed, and the flowers tend to have a horizontal rather than a declined axis.

My description of *G. platyanthum* is drawn partly from cultivated material. The plants generally cultivated in Britain are most likely derived from type material, though they have been named *G. chinense*, which in this context is presumably a made-up gardeners' name. I also grow a stock from Vladivostok Botanic Garden; this flowers earlier than the so-called *chinense*, the flowers are less nodding and the leaves slightly more prominently angled. The Japanese *G. eriostemon* var. *reinii* (Franchet & Sav.) Maxim. differs considerably in being less hairy and in having a leaf-shape which shows a much closer approach to that of *G. erianthum*. The Kew Herbarium (K) includes a Japanese specimen which appears to be *G. platyanthum* var. *platyanthum*, which is not reported for Japan by Ohwi (1965) (who used the name *G. eriostemon* Fischer ex DC., the earlier homonym of which, *G. eriostemum* Poiret, is not in Index Kewensis).

The label of the specimen in K marked as the type of *G. platyanthum* bears no printing and no signature, but most of the writing, partly in ink and partly in pencil, is apparently in Duthie's rather variable hand (L. L. Forman, pers. comm.). The collecting number, written in ink as *Wilson* 995, has been crossed out in pencil. I have not encountered the number 995 among *Geranium* specimens collected by Wilson. Duthie (1906, Jan. 27) said the new species was raised 'last year' by Veitch from seed of the two numbers *Wilson* 1948, W. Hupeh, and 3298, Tachien lu. The circumstantial evidence is that the 'type' specimen was cultivated, probably at Veitch's nursery, rather than at Kew. *Wilson* 3298 was collected in July 1904, so presumably flowered in its first year from seed in 1905. The 'type' specimen was prepared in 1904 and if, as supposed, it was cultivated, it cannot be no. 3298 and must be no. 1948, collected in June 1901. The original

collections of nos. 1948 and 3298 must be regarded as syntypes, along with the cultivated specimen, and the latter is now selected as a lectotype in accordance with Duthie's indication.

27. Geranium retectum Yeo, **spec. nov.** Type: Western Szechuan, vii 1908, *Wilson* 2442 (holo. GH, iso. BM, K) [Wilson was in area: Mupin - Dajian Lu at this time (Howard, 1980)]. Fig. 9.

Herba perennis; caulorhiza crassa. Caules usque ad 85cm, robusti, pallides, internodio primo 30cm excedente, rami solitarii vel binati instructa, breviter retrorse appresso-pilosi et supra pilis glandulosis incoloratis longissimis ferentes. Laminae foliorum usque ad 15cm latae, tenuia, supra laete virides, parce strigosae, infra paulo pallidiores, in venis setulis curvatis setisque instructae. Laminae foliorum caulinorum inferiorum ambitu pentagona, usque ad ¾ partem quinquefidae, sinubus lateralibus clausis, centralibus apertis. Divisiones laminum late rhomboidei, vix lobati sed argute biserrati in dimidio superiore, dentibus ovatis vel deltoideis, porrectis vel paulo incurvatis, subacutis vel acutis instructi. Petioli lamina usque ad duplo longiores. Folia media et superiora quinquefida vel trifida, divisionibus ovatis vel ovato-lanceolatis, quam inferiora magis acuminati, sinubus centralibus magis apertis, sursum divisio mediano aucto, petiolis reductis. Stipula foliorum medianorum usque ad 15mm longa, pluridentata. Inflorescentia initio cymulas bifloras paucas, postea collocationes subumbellatos 3- vel 4-flores evolvens. Pedunculi pedicellique longe glanduloso-pilosis, priores 2.5–3cm longi, posteriores 1.5–2cm longi, sub anthesi prope florem inflexi, postea erecti. Flores sub anthesi nutantes, postea erecti. Sepala sub anthesi c.7mm longa, mucrone c.1mm longo incluso, reflexa, post anthesin usque ad 9mm accrescentes, virides, pilis longis glandulosis instructa. Petala 9 x 4mm, anguste obovata, valde reflexa, basem leviter constricta, colore ut videtur alba, basem in marginibus pilorum penicillis densis et in superficie pilis sparsis suffulta. Filamenta staminum c.14mm longa, conniventia, sensim angustata, pilis longissimis subpatentibus vel recurvatis sparsim ornata, colore verosimiliter basin alba, apice rubra. Antherae c.2.5mm longae. Stylus 9mm longitudinis attingens. Stigmata c.2mm longa. Fructus erectus, flores sub anthesi excedens; rostrum 16–20mm metiens, pubescens et longe glanduloso-pilosum. Mericarpia c.3mm longa, pallide brunnea, glanduloso-hirta, basi tuberculo setoso instructa.

Rootstock short, rather thick. *Stem* to 85cm tall, stout, pale in colour, with the first internode attaining more than 30cm and with solitary or paired branches, shortly retrorsely appressed-hairy and, in the upper parts, with very long patent, colourless glandular hairs. *Leaves* with lamina up to 15cm wide, thin; upper surface light green, sparsely strigose; lower surface slightly paler, with curved setulae and setae on the veins. *Lower cauline* and probably the *basal leaves* divided as far as ¾ into 5; outline pentagonal; lateral sinuses open, central ones closed; divisions broadly rhombic, scarcely lobed, rather coarsely doubly serrate, with the serrations beginning at or above the middle, or lower on the basal margin of the leaf; teeth ovate or deltoid, porrect or slightly incurved, subacute or acute; petioles up to c. twice as long as laminae; lowest stipules c.18mm long. *Middle and upper leaves* divided as far as ⅘ into 3 or 5, their divisions becoming ovate or ovate-lanceolate, acuminate and with the central sinuses more open and, in the upper leaves, the middle lobe the largest, the petioles almost none and the margins red; stipules of middle leaves up to 15mm long, united, pluridentate. *Inflorescence* with the first one or few cymule(s) 2-flowered, other flowers in subumbellate clusters of 3 or 4; peduncles 2.5–3.5cm long; pedicels 1.5–2.5cm long; pedicels recurved in bud, bent under the flower at anthesis, erect afterwards, with long glandular hairs. *Flowers* nodding below the horizontal at anthesis, erect afterwards. *Sepals* c.7mm long

FIG. 9. *Geranium retectum*, isotype, *Wilson* 2442 (K). Approximately life-size.

at anthesis including mucro c.1mm long, becoming 9mm long in fruit, strongly reflexed at anthesis, green, with long patent colourless glandular hairs. *Petals* c.9 x 4.5mm, narrowly obovate, slightly contracted at base, strongly reflexed; colour apparently white; margins with a dense tuft of white hairs mainly distal to the contracted part; adaxial surface with a few hairs between the marginal tufts. *Filaments* c.14mm long (twice as long as sepals), connivent, evenly tapered from base for c.2/5 of their length, bearing rather scattered, very long subpatent to recurved hairs; colour probably red distally, white proximally; nectaries pilose. *Anthers* c.2.5mm long, narrow, possibly bluish. *Style* 9mm long (but noticeably shorter at first), sparsely setose. *Stigmas* c.2mm long, green. *Fruit* erect, overtopping the flowers that are open; rostrum 16–20mm, shortly pubescent and with long glandular hairs; mericarps c.3mm long, pale brown, with scattered glandular hairs and with a basal tubercle bearing long hairs.

SICHUAN. Known only from the type collection.

General distribution. Endemic.

G. retectum is a lax, large-leaved plant in the style of *G. henryi*, but quite different in its taxonomic characters. It shows relationship to *G. platyanthum* in its tendency to produce umbellate flower-clusters subtended by pairs of subsessile leaves, and in having nodding flowers overtopped by the developing fruits, long, connivent filaments, similar hairs on the filaments and reflexed petals (the epithet of the name refers to the exposure of the reproductive organs by the sharp reflexing of the petals). It is easily separable from *G. platyanthum* in its slender stems, thin leaves, sparse indumentum, deeper leaf-divisions with deeper and more regular serrations, more strongly reflexed, narrower and non-overlapping small white(?) petals and the greater length of the stamens relative to the sepals. It is known to me only from the type collection. The species has the marks of a strongly shade-tolerant plant.

28. Geranium pratense L., Sp. Pl. 681 (1753); Knuth, Geran., Pflanzenr. IV.129: 127 (1912); Lingelsheim et al. in Feddes Repert. Beih. 12: 430 (1922). Type: I am not aware that this species has been typified; it was described from North Europe.
Icones: Ross-Craig, Drawings Brit. Pl. 6: t. 32 (1952); Iconogr. Cormophyt. Sinic. 2: 522 (1972); Fl. Hebei. 2: 10 (1988).

*Rootstock c.1.5cm thick, compact, vertical. *Stems* stout, with long internodes and paired leaves, reflexed-pubescent and with long glandular hairs above or throughout. *Basal leaves* up to 11cm wide (few available), divided nearly to the base into 5, pentagonal in outline; divisions rhombic, deeply pinnately lobed; lobes divergent, c.2–4 times as long as broad, though with a much narrower body, the width being made up by 2–7 divergent lanceolate or ovate teeth; tips of lobes and teeth acute; upper surface closely pubescent or puberulent; veins beneath similarly clothed; petioles c.2–4 times as long as the lamina, retrorsely pubescent and with long glandular hairs; stipules largely adnate, c.2.5cm long, lanceolate. *Cauline leaves* numbering 3 or 4 pairs, similar to the basal, decreasing in size and relative petiole-length upwards until the uppermost are sessile; stipules c.5–10mm, triangular-lanceolate, light brown, pilose, free or united.

Inflorescence dense, with the buds crowded, or occasionally lax; peduncles mostly 1.5–5cm long but the first one sometimes much longer; pedicels 2–7(–25)mm long; peduncles and pedicels more or less densely short-pubescent and densely clothed with long glandular hairs; peduncles erect (though whole inflorescence branches may be recurved in bud); pedicels at anthesis erect but bent under the flower; fructescent pedicels entirely reflexed; bracteoles 7–8mm long, lanceolate. *Flowers* saucer-shaped, with axis horizontal at anthesis and reflexed during development of fruit. *Sepals* 9–13mm long including mucro c.1.2–2.5mm long, divergent, green with a brownish violet zone at the base, tomentulose, the outer ones also with copious long glandular hairs; veins rather prominent. *Petals* 16–18 x 10–11mm, obovate; apex rounded; colour blue, the veins sometimes purplish; base with small dense tufts of white hairs on the margins. *Filaments* c.9–11mm long, longer than the sepals, abruptly dilated at the base, purplish, with a few small hairs at the base, erect when functional, curving outwards later; a small dense tuft of hairs stands over each nectary. *Anthers* c.2.4–2.8mm long, dull blue. *Style* 7–9.5mm long, puberulent at the base. *Stigmas* c.2.5mm long. *Fruit* finally erect; rostrum 25–32mm, shortly pubescent and densely glandular-hairy; mericarps 4.5mm long, finely pilose and with a few glandular hairs at the tip, with a bristly tubercle at the base, light brown. *Seeds* nearly 3mm long, finely reticulate.

SICHUAN. Baurong to Dajian Lu, via Hadjaha, 2750–4700m, v/vi 1929, *Stevens* 333 (GH, W). NW Sichuan, 2440–3660m, ix 1904, *Wilson* 3301 (BM, GH, K). Sungpan Hsien, 17 viii 1928, *Fang* 4281 (E, GH, K). Sungpan Hsien, 28 vii 1928, *Fang* 4371 (E, GH).

General distribution. Europe, Caucasus, N and C Asia, W Himalaya.

This description of the enormously wide-ranging *G. pratense* has been drawn up from Chinese specimens, though not all are from our area. The species has little affinity with the great majority of Chinese species and is distinctive in many characters, among which may be mentioned the deeply and complexly cut leaves, dense inflorescence, the short pedicels, flowers with horizontal axis and porrect but not connivent stamens, the relatively long sepal mucro, short stigmas, long style and the reflexing of the pedicel and flower during fruit-development.

29. Geranium nepalense Sweet, Geraniaceae 1: t. 12 (1820); Franchet in Bull. Soc. Bot. France 33: 444 (1886); Franchet, Pl. Delav. 116 (1889); Knuth Geran., Pflanzenr. IV.129: 192 (1912), pro parte; Hand.-Mazz., Symb. Sin. 7(3): 621 (1933). Type: Sweet, Geraniaceae 1: t. 12

Syn.: *G. lavergneanum* Léveillé in Bull. Soc. Agric. Sci. Arts Sarthe 39: 319 (1904) (repr. as *Bouquet de fleurs de Chine*). Type: [Yunnan] Kweichow ('Kouy-Tchéou'), Hin-y-hien, C. C. au bord des routes, des fossés, 10 iv 1897, *Bodinier* 1534 (holo. E [teste Lauener, 1967], iso. P).

G. fangii Knuth in Feddes Repert. 40: 218 (1936), p.p. (see also *G. sibiricum*). Type: Szechuan, Nanchuan-hsien, 8000–9000ft, 20 v 1928, *Fang* 834 (syn. E, GH, P); Szechuan, Nanchuan-hsien, 8000–9000ft, 25 v 1928, *Fang* 906 (syn. E, GH); Szechuan,

Nanchuan-hsien, 7500–8500ft, 3 vi 1928, *Fang* 1393 (syn. E, K, GH).

?*G. oliganthum* Huang in Acta Phytotax. Sin. 1: 61 cum ic. (1951). Type: Hebei, . . . *K. M. Liou* 331 (PE?).

Icones: Sweet, Geran. 1: t. 12 (1820); Iconogr. Cormophyt. Sinic. 2: 529 (1972); Yeo, Hardy Geraniums 118 (fol.) (1985).

*Rootstock up to c.1cm thick, condensed, often branched, usually tap-rooted. *Stems* ascending or decumbent, rarely rooting at the nodes, more or less densely pubescent or villous with fine, subpatent, recurved, hairs, or with the hairs reflexed and appressed, opposite-leaved, much-branched, the branches usually paired but nodes sometimes monopodial; internodes very variable in length. *Basal leaves* up to 5cm wide, divided as far as ¾–⅚ into 5 or 7, more or less angled in outline with the basal sinus rather narrow; divisions broadly rhomboidal or broadly obovate, lobed in the distal half, their margins in the proximal half slightly concave; lobes about as long as broad, with one or several ovate teeth; tips of lobes and teeth obtuse to acute; upper surface strigose, sometimes lightly marbled with pale green; lower surface strigose or with hairs mainly on the veins which are then strigose or subhispidly setose; petioles much longer than the lamina, clothed as the stems; stipules 8–12mm long, narrowly deltoid, usually with excurrent midrib, light brown, pubescent. *Cauline leaves* similar to the basal but the divisions 5 or 3 in number and variable in their proportions and the degree to which the apex is tapered; lobes and teeth usually few and coarse when there are only 3 divisions of the leaf; lower surface sometimes purplish; petioles becoming shorter upwards; stipules linear-lanceolate. *Inflorescence* diffuse, leafy; cymules (1–)2(–3)-flowered; lower peduncles 6–10(–18)cm long and the upper c.2–4cm long, all erect; pedicels 1.2–2cm long, erect or ascending; peduncles and pedicels reflexed-strigose or shortly recurved-pubescent and long-setose; fructescent pedicels reflexed and geniculate under the flower. *Flowers* erect or inclined upwards, saucer-shaped. *Sepals* 4–7.5mm long excluding mucro 0.25–0.75mm long, divergent, green, tomentose or puberulent, with long bristles on the veins. *Petals* c.6mm long, c.1½ times as long as broad, rounded or retuse at apex, narrow and slightly contracted at base, sparsely ciliate towards the base and with a few hairs on both surfaces; colour pale pink to white, rarely purple, with simple deeper pink veins. *Filaments* 3–4mm long, strongly and abruptly dilated in the lower half, the dilated part ciliate and with a few hairs on the back. *Anthers* c.0.3–0.5mm long, usually bluish. *Style* about half the length of the sepal body. *Stigmas* 0.5–1mm long, red, appressed-hairy on the outer surface. *Fruit* erect during development; rostrum 10–13mm, shortly pubescent, sometimes with scattered, long fine hairs in addition; mericarps 3–3.5mm long, densely setose, pale brown, with a densely setose tubercle at the base. *Seeds* c.2mm long, finely reticulate.

HUBEI. Nanchuan, Ta Pin, xi 1907, *Silvestri* 1201 (P). Patung distr., rec'd iii 1889, *Henry* 5431 (K). Yichang, 1886, *Henry* 2777 (K, P).

SICHUAN – SELECTED SPECIMENS. Dajian Lu: as Kangtin Hsien, c.2650m, 22 ix 1928, *Fang* 3509 (E, GH, K); as Kangting, 3350m, 23 vii 1963, *Kuang & Wang* 286 (K); plain, 15 vi 1898, *Mussot* 70 (P). Emei Shan: 1887, *Faber* s.n. (P) and 1050m, rec'd xii 1887, *Faber* 486 (K) and 900m, rec'd xii 1887, *Faber* 488 (K); Chi Shih Chiu Tao Kuai, c.1500m, 16 xi

1939, *Sun & Chang* 1351 (GH); Chiu Lar Tung, 1800m, 11 viii 1940, *Tai* 197 (GH); Chutien, 1760m, 21 v 1939, *Chow* 9858 (GH); Kuan Hsiu Po, 1200m, 17 vii 1939, *Sun & Chang* 879 (GH); Ling Ai Ssu, 30 vi 1939, *Sun & Chang* 574 (GH). Guan Xian, 17 ix 1877, *de Poli* s.n. (P). Huei Li Hsien, 2850m, 16 ix 1932, *Yü* 1521 (GH). Kuan Hsien, c.1000m, 4 vii 1928, *Fang* 1994 (E, GH, K). SW Sichuan, Yungning, near Hai Mendschou road, Yunnansen lake, 2800m, 16 vi 1914, *Handel-Mazzetti* 3089 (W). Oua Pao Shan massif, Gan Tchang, S valley, 16 vi 1908, *Legendre* 472 (K). Pei Pah, 4 iv 1946, *Law* 402 (K) and 10 iv 1946, *Law* 450 (K). Tien Chuan Hsien, 1500m, 14 iv 1936, *Chu* 2332 (BM, E, W) and 2350m, 4 vi 1936, *Chu* 2695 (BM, E, W). Tungpan to Woutshwan, Min Tal, viii 1914, *Weigold* s.n. (W). Ya Long valley, Gul Se Y(?), 2000m, 30 iv 1911, *Legendre* 816 (P). S of Yatschow, Wa Schan, iv/v 1915, *Weigold* s.n. (W).

YUNNAN – SELECTED SPECIMENS. Adunzi: 2700m, ix 1935, *Wang* 70280 (GH); Huann Fu Ping, 3400m, viii 1935, *Wang* 69150 (GH). Beyendjing, Tn 38 (W). Che Tse Lo, 3200m, 11 ix 1933, *Tsai* 58494 (GH). Chen Kiang, 1790m, iii/v 1939, *Tsiang & Wang* 16065 (GH). Chen Shong Hsien, 1200m, 15 vi 1933, *Tsai* 52197 (GH). Chungtien valley, 3300m, 10 viii 1939, *Feng* 1963 (GH). Dali distr., 25°40'N, 2050m, iv/v 1906, *Forrest* 4280 (BM, E); 2400m, viii 1914, *Schneider* 3107 (GH, K). Dali range, E flank, 25°40'N, c.2300m, vi/vii 1906, *Forrest* 4279 (BM, E). Dongchuan plain: 2500m, viii 1913, *Maire* s.n. (E); 2500m, viii rec'd 1921, *Maire* s.n. (E, P) and iv 1910, *Maire* 177 (BM, E, W). Fo Hai, 1900m, vii 1936, *Wang* 77333 (GH). Kunming, 2090m, iv 1935, *Wang* 62795 (GH). Kunming & distr.: Kwei Chow, Pin Fa, iii 1902–03, *Cavalerie* 914 (K); 31 iii 1897, *Ducloux & Bodinier* 171 (P); 1900m, 9 v 1916, Schoch 91 (K); 16 ii 1914, *Handel-Mazzetti* 57 (W); rec'd 1906, *Maire* 2576 (E). La Shih Pa, 18 vi 1922, *Gregory & Gregory* s.n. (BM). Lan Ping Hsien, 2600m, 3 ix 1933, *Tsai* 56017 (GH). Lijiang & distr.: near Ngu Leh Keh, 2900m, 31 vii 1914, *Schneider* 2088 (GH, K); Lijiang Hsien, 2500m, vii 1935, *Wang* 65102 and 71216 (GH); E slope Lijiang range, 2750m, vi 1922, *Rock* 4389 (E, GH, P); NW, between Tamichung and Tuchi, 20 x 1939, *Ching* 21914 (GH); W, Laschiba, 14 v 1939, *Ching* 20307 (GH). Meng Huas, Paitupo, 1800m, 11 v 1938, *Yü* 15819 (E, GH). Mengzi: c.1980m, 12 iv 1895, *Hancock* 176 (K); SW mountains, 1830m, [1896], *Henry* 9270 (K). Mo So Yn, 28 v 1887, *Delavay* s.n. (P). Mo Tsou, 800m, v rec'd 1913, *Maire* s.n. (E). Momyen(?), 18 v 1868, *Anderson* s.n. (K). Ping Pien Hsien, 1300m, 5 vii 1934, *Tsai* 60630 (GH). Shang Pa, 2000m, 30 x 1934, *Tsai* 59116 (GH). Shang Pa Hsien, 1800m, 8 xi 1933, *Tsai* 54819 (GH). Shun Ning Hsien, 2800m, ii 1936, *Wang* 71888 (GH). Shung Kiang Hsien, 2200m, iv 1936, *Wang* 73069 (GH). Ta Kouan, Tchen Fong Chou, v 1887, *Delavay* 3 (P). Near Ta Pin Tze: Che Tong, 13 v 1886, *Delavay* 2557 (P); Ta Long Tan, 13 ix 1887, *Delavay* 2821 (K, P). Tengyueh valley/distr.: 25°00'N, c.1760m, iii 1906, *Forrest* 4988 (BM, E); 25°00'N, c.1980m, vii 1912, *Forrest* 8598 (E). Wei Se (Si) Hsien: 3650m, 3 x 1934, *Tsai* 59658 (GH, KUN); 2300m, 5 xi 1934, *Tsai* 63028 (GH); Kang Pu, 2300m, vii 1935, *Wang* 64184 (GH); Li Ti Pin pass, c.3400m, 23 vi 1922, *Gregory & Gregory* s.n. (BM); Yeh Chih, 2500m, vii 1935, *Wang* 67883 (GH); Yeh Chih Wa Rung, 3400m, viii 1935, *Wang* 68276 (GH). Wen Shan Hsien, 1600m, 11 ii 1933, *Tsai* 51749 (GH). Yung Jen Hsien, 2500m, 13 v 1933, *Tsai* 52836 (GH).

General distribution. Himalaya; C & E China (teste *Inconogr. Cormoph. Sinic.* 2 [1972]).

G. nepalense is one of a group of closely related species with small white or very pale pink (occasionally deep purplish red) flowers. Five of them are treated here, none being endemic to our area. It is rather variable; two rather different forms from the Himalayan region are in cultivation in Cambridge. One (from Nepal) is slender and trailing, with shallower, shorter and broader leaf-divisions, and the other (from Kashmir) is erect, with the leaves larger as well as having deeper and narrower divisions. Similar variation is found in China. Narrower leaf-divisions give a resemblance to *G. sibiricum*, which has one-flowered cymules (usually two-flowered in *G. nepalense*) and slightly smaller floral and fruit parts (except for the rostrum) but longer sepal mucros. The coarser form also

shows an approach to *G. thunbergii* which, however, is a still coarser-looking and usually hairier plant with slightly larger flowers and sometimes glandular hairs on the upper parts; in habit it is also probably a more bushy plant. Both *G. nepalense* and *G. thunbergii* retain their leaves in winter. The remaining two species of the group are *G. wilfordii* and *G. yuexiense*.

G. nepalense is common in our area and the description here is based on Chinese material, apart from the exceptional flower colour, purple, which occurs in the type.

30. Geranium thunbergii Siebold ex Lindley & Paxton, Paxton's Flower Garden 1: 186 (1851) et in T. Baines, Paxton's Flower Garden, revised edn, 1: 191 (1882). Type: *G. thunbergii* Siebold [cult. Garden of the Horticultural Society of London] ('H. H. S.'), Herb. J. Lindley, purchased 1866 (lecto. CGE, chosen here)

Syn.: *G. nepalense* Sweet var. *thunbergii* (Siebold ex Lindley & Paxton) Kudo, Medic. Pl. Hokkaido t. 55 (1922).

Icones: Paxt. Flow. Gdn 1: 186 (1851) & revised edn 1: 191 (1882); Makino, Ill. Fl. Japan, revised edn, 396 (as *G. nepalense*) (1961); Yeo, Hardy Geraniums 117 (fol.) (1985).

*Rootstock up to c.1cm thick, branching. *Stem* decumbent or ascending, with many nodes, sparsely to densely clothed with moderately long recurved hairs and also unilaterally pubescent with shorter recurved hairs, sometimes also with long glandular hairs above; leaves paired; branches in unequal pairs or solitary. *Basal leaves* absent at flowering time, those of plants in cultivation to c.7cm wide, reniform or transversely subrectangular in outline, divided as far as (½)–⅘–⅚ into 5 or 7; divisions shortly oblong to (more usually) flabellate or shortly tapered from well beyond the middle, 3-lobed at the apex; lobes broader than long, usually with one or two teeth; teeth shorter than or as long as broad, ovate to semicircular in outline; upper surface strigose, sometimes with additional finer pubescence, often with bold purplish red blotches in the sinuses above in winter; lower surface sometimes sparsely strigose and with the veins strigose or pubescent, often flushed with purple beneath in young plants or during winter. *Cauline leaves* up to 6.5(–11.5)cm wide, divided as far as ¾–⅚ into 3 or 5; outline trilobate or pentagonal; divisions obovate, ovate or sometimes rhomboidal, weakly and shallowly lobed; lobes ovate, sometimes with a few obsolescent teeth; lobes and teeth together producing the effect of an unevenly toothed margin; tips of divisions, teeth and lobes acute or obtusish; surfaces clothed as the basal leaves; petioles up to c.1½ times as long as the laminae, clothed as the stems; stipules mostly 5–7mm long, ovate-acuminate to linear-lanceolate, pubescent. *Inflorescence* diffuse, leafy; peduncles 2.5–4cm long; pedicels 1–2cm long; peduncles and pedicels clothed as the stems, usually rather densely; fructescent pedicels reflexed or divaricate, fruiting pedicels erect, gradually swollen under the calyx; bracteoles c.2mm long, linear. *Flowers* saucer-shaped, apparently erect. *Sepals* 5.5–8mm long including mucro 0.5–1mm long, more or less tomentulose and with loose glandular and, usually, eglandular hairs. *Petals* (only available in one specimen which is probably Japanese) 8.5 x 6mm; *petals of cultivated specimens* c.7–10.5 x 4–6mm, rounded or retuse at apex and cuneate at base; colour

white or pale to deep purplish pink and then the veins darker; base ciliate and with a few hairs on the adaxial surface. *Filaments (of cultivated plants)* 4–5mm long, tapered evenly from a broad base or contracted about the middle, pilose, the marginal hairs extending beyond the middle; colour white, tinged with pink distally. *Anthers* usually bluish. *Style* 3–3.5mm long, densely setulose. *Stigmas* 1mm long, pink, strigose on the non-receptive surface for most of their length. *Fruit* with rostrum 15–19mm, shortly and thickly pubescent and with more scattered long red-tipped glandular hairs, these sometimes only a few and at the base; mericarps 2.5–3.5mm long, blackish brown, pubescent and with long glandular and eglandular hairs towards the top. *Seeds* 2–2.4mm long, very finely reticulate.

General distribution. NE China, Japan.

Though *G. thunbergii* occurs in China it is not recorded from our area. Nevertheless, it seems desirable to include it for comparison with *G. nepalense*, of which it has been treated as a variety or subspecies. Differences are given under the latter species. Several stocks have been observed in cultivation at Cambridge, some of unknown origin from horticultural sources, and two from known localities in Japan. The species is evergreen, and in one of the Japanese stocks some of the plants developed the usual red marks in the leaf-sinuses in winter but others did not. The species is also rather variable in indumentum and flower-colour. It seems never to have one-flowered cymules and so is easily distinguished from *G. sibiricum*, which also shows differences in its leaves and has smaller flowers. The distinctions from *G. wilfordii* are given under that species.

When the name *G. thunbergii* was first published by Siebold & Zuccarini in *Abh. Akad. Wiss. München* (a work republished as *Florae Japonicae* . . . [1846]) the protologue read '*G. palustre* Thunb. Fl. Jap. p. 268.' Thunberg, in the place stated, repeated word for word the Linnaean diagnosis of *G. palustre*, though with the statements in altered sequence, and referred to 'Sp. Pl. 954' (i. e. the second edition; *G. palustre* was described in Cent. Pl. 2, 25 [1756]); he also gave Japanese names of the plant, its distribution (iuxta Nagasaki, in Kofido, alibi) and flowering time (September, October). From this it is clear that *G. thunbergii* Siebold & Zuccarini is a nomen nudum; these authors were attempting to separate the material known to Thunberg from *G. palustre* L. but they failed to describe it. Lindley & Paxton validated the name by providing a short description and a line-drawing of a shoot newly in flower from a plant cultivated in England; they stated that their plant was probably the *G. palustre* of Thunberg, which presumably means they had seen no specimens of the latter. Their plant had deep purple petals. The specimen in CGE here cited as the lectotype is the one that was used for the drawing. Some of its petals have retained their purple colour. Either the specimen or the illustration could serve as the type and I have therefore carried out a lectotypification.

31. Geranium yuexiense Z. M. Tan in Bull. Bot. Res. 6: 55 (1986). Type: Sichuan: Yuexi, Laji Commune, alt. 3600m, 11 vii 1979, *Yuexi Exped.* 704 (holo. ICD, non vidi). Icones: Bull. Bot. Res. 6: 64 (1986).

Rootstock a horizontal rhizome, to 6cm long and 1.5cm thick with many thick roots distinctly swollen for several cm from just beyond their origins. *Stems* to 40cm, several, ascending, c.2mm thick, retrorsely pubescent and sparsely set with spreading colourless glandular hairs below, sparsely and retrorsely appressed-pubescent above, opposite-leaved. *Basal and lower cauline leaves* with lamina up to 6.5cm wide, broadly cordate or reniform with subtruncate base; divided as far as 6/7–7/8 of the radius into 3 or 5; divisions cuneate-subrhombic, entire in basal 1/3 or more, long-acuminate, those of the lowest leaves entire, otherwise pinnately lobed; lobes oblong, 1–2 times as long as broad, entire or rarely irregularly dentate; tips of lobes and teeth acute, black-mucronate; upper surface dark green, sparsely pubescent; lower surface pale green, with appressed pubescence, especially on the veins; petiole 5–12cm long, retrorsely appressed-pubescent and with spreading colourless glandular hairs basally, pilose distally, more densely below the lamina; stipules 10–15 x 2–4mm, triangular-lanceolate to ovate-oblong, brown, appressed-pubescent. *Upper leaves* with petioles 5–10mm long. *Inflorescence* diffuse, cymules axillary or forming a terminal cyme; peduncles 2–13cm long, 2-flowered, retrorsely appressed-pubescent; pedicels 0.8–1.5cm long, retrorsely appressed-pilose or recurved-pilose; bracts 6–12 x 1–2mm. *Flowers* erect. *Sepals* 5–6mm long; appressed-pubescent, long-ciliate on the margin; mucro c.1mm. *Petals* 5–8 x c.3mm, obovate-oblong, with rounded apex and abruptly narrowed, sometimes shortly stipitate, base; base villous. *Filaments* a little longer than the sepals, dilated and villous below, glabrous above. *Anthers* black. *Stigmas* apparently c.1.5mm long.

SICHUAN. Yuexi, Laji Commune, 3600m, 11 vii 1979, Yuexi Exped. 704 (ICD, non vidi).

General distribution. Endemic.

The above description is a paraphrase of the original, amplified from the illustration. This species is known only from the type; I have placed it here mainly on account of the small flowers. Its author compares it with *G. fangii*, which I have synonymized with *G. nepalense* and *G. sibiricum* of the same alliance. Its most important differences from *G. thunbergii* are the stout rootstock with swollen roots, more finely and deeply cut leaves, villous petal-bases and erect fructescent pedicels.

32. Geranium wilfordii Maxim. in Bull. Acad. Imp. Sci. Pétersb. 26: 453 (1880); Knuth, Geran., Pflanzenr. IV.129: 191 (1912); Rostanski & Tokarski in Fragm. Florist. Geobot. 19: 385 (1973). Type: Coast of Manchuria, lat. 44–45°N, 1859, *Wilford* (syn. W); the protologue includes several other localities without indication of collectors.

Syn.: *G. hastatum* Nakai in Bot. Mag. Tokyo 23: 100 (1909). Type: several specimens cited; should be at TI.

G. wilfordii var. *glandulosum* Z. M. Tan in Bull. Bot. Research, N. E. Forestry Inst. (China) 6: 56 et 65 (1986). Type: Sichuan: Baoxing, Dengchigou, Huangshuijing, alt. 2200m, 27 ix 1936, *K. L. Chu* 3935 (holo. SZ, non vidi).

Icones: Makino, Ill. Fl. Japan, revised edn, 396 (as *G. krameri*) (1961); Iconogr. Cormophyt. Sinic. 2: 529 (1972); Fragm. Florist. et Geobot. 19: 386 (1973); Bull. Bot. Research, NE Forestry Inst., 6: 65 (1986); Fl. Hebei. 2: 8 (1988).

*Rootstock apparently short and small, bearing fibrous and some moderately thickened roots. *Stems* erect, perhaps becoming decumbent, subglabrous below or the lowest internodes villous, otherwise finely and sparsely reflexed-strigose, increasingly recurved-crisped-pubescent upwards and sometimes also with long spreading colourless glandular hairs; opposite-leaved, the lower nodes monopodial or with two very unequal branches; internodes long, commonly 6–12cm. *Basal leaves* (of cultivated plants) and *lower cauline leaves* with lamina up to 11cm wide, flushed with purple when old, especially above, divided as far as 3/5–3/4 into 5; divisions broadly obovate-elliptic to broadly ovate, very shallowly 3-lobed; lobes broader than long, the median and more rarely the lateral with 1 or 2 shallow broadly ovate teeth (so that the division appears unevenly crenate); upper surface sparsely strigose, lower with the veins strigose; petiole about twice as long as lamina, retrorsely strigose, especially towards the apex; free part of stipules c.4mm long, pilose. *Cauline leaves* (except the lowest) 4–10cm wide, divided as far as c.4/5–6/7 into 3; divisions ovate or trullate (rarely broadly ovate), the laterals patent and the median becoming elongate and much the largest at higher nodes, all sharply acuminate, unevenly incised-crenate-serrate, incised-serrate or incised-crenate-biserrate (rather than lobed and toothed); teeth obtusish or with a sharp mucro; indumentum as the lower cauline leaves; lower petioles longer than lamina, upper shorter, clothed as the lower cauline; stipules up to c.5(–10)mm long, linear-lanceolate, entire, free, weakly pilose. *Inflorescence* diffuse, leafy; peduncles mostly 1.5–6cm long, normally 2-flowered, erect; pedicels mostly 1–3cm long, erect at anthesis and in ripe fruit, sometimes erect in the meanwhile, sometimes sharply reflexed with hooked tips; peduncles and pedicels reflexed-strigose or recurved-crisped-pubescent or sometimes with dense long glandular or eglandular patent hairs. *Flowers* erect or upwardly inclined at anthesis. *Sepals* (5–)6.5–8.5mm long at anthesis, including mucro 0.8–1.5mm long, and up to 9.5mm long in fruit, divergent or patent, with inconspicuous veins, apparently entirely green, puberulent between the veins, strigillose or strigose on the veins, sometimes also with a general clothing, especially towards the base, of long glandular or eglandular subpatent hairs. *Petals* c.7mm long, broadly obovate, not much longer than broad, rounded or retuse at apex, slightly contracted at base; colour pale pink or white with magenta veins; base with a few hairs on margins and both surfaces. *Filaments* 4–5mm long, strongly dilated at the base for up to half their length, some or all with the top of the dilation on one or both sides ending in a blunt or sharp tooth, sparsely or freely divergently setose or setulose in the lower part and sometimes with a few hairs on the back. *Anthers* c.0.8mm long, violet-blue, with blue pollen. *Style* about half the length of the sepal-body. *Stigmas* c.1.5–2mm long, very pale pink to crimson, setulose on the outer side. *Fruit* erect during development; rostrum (12–)13–18mm, shortly pubescent, sometimes also with long glandular hairs; mericarps 2.8–3.4 mm long, loosely setose, light brown, with a bristly tubercle at the base; awns minutely pilose on inner surface. *Seeds* c.2.2–2.5mm long, very finely reticulate.

HUBEI. Yichang and distr., *Henry* 1687 (K), *Henry* 2232 (K), *Henry* 2777 (K) and a. 1887, *Henry* 4197 (K, P). Patung distr.: *Henry* 7343 (K); Nan T'o and mts to northward, *Henry* 2645 (K); vii 1900, *Wilson* 1479 (W).
SICHUAN. Kuan Hsien, 1000m, 4 vii 1928, *Fang* 1994 (E, GH, K). Pao Hsing Hsien, 2200m, 27 ix 1936, *Chu* 3959 (BM, W). Tchen Kéou Tin, Iao Kouang Su, 1400m, viii, *Farges* 110 (P).

General distribution. N China, Far East USSR, Japan.

G. wilfordii is distinguished from its nearest ally, *G. thunbergii*, by its erect habit, long internodes, sparse indumentum, and the form of the middle and upper cauline leaves, which have only three divisions of which the middle one greatly predominates and is elongate and acuminate. My description from herbarium material has been amplified from one cultivated stock originating from the Soviet Far East and acquired in 1985. Even when grown in a cool greenhouse this goes dormant in winter, a point in which it differs from the two preceding species and resembles *G. sibiricum*. Like *G. thunbergii* it may or may not have glandular hairs on the upper parts.

G. wilfordii is a mainly northern species, infrequent in our area. *W. P. Fang* 1994, from Sichuan, has smaller than usual sepals and rostrum (it is mixed with *G. nepalense*). Unusually short and broad leaf-divisions (which still show evidence of the characteristic shape) are found in Fan & Li 462 (Hunan Prov., 1935), *Farges* 110 (E Sichuan) and some examples from Hubei. My description was drawn up before the publication of *G. wilfordii* var. *glandulosum* Z. M. Tan; I had not considered it necessary to give taxonomic recognition to the glandular-haired state, but Tan shows the inflorescence as becoming terminally cymose; however, this may represent a late stage in the plant's development.

33. Geranium sibiricum L., Sp. Pl. 683 (1753); Knuth, Geran., Pflanzenr. IV.129: 195 (1912); Lingelsheim et al. in Feddes Repert. Beih. 12: 431 (1922). Type: Geranium sibiricum, HU, catal. no. 858.87 (holo. LINN).

Syn.: *G. lavergneanum* Léveillé var. *cinerascens* Léveillé in Bull. Soc. Agric. Sci. Arts Sarthe 39: 319 (1904) (repr. as *Bouquet de fleurs de Chine*). Type: [Yunnan] ('Kouy Tchéou'), champs, jardins, bord des routes, 4 xii 1897, *Bodinier & Laborde* 2018 (holo. E [teste Lauener (1967)], iso. P [two]).

G. fangii Knuth in Feddes Repert. 40: 218 (1936), p.p. (see also *G. nepalense*), quoad *Fang* 5507, Szechuan, Mow Hsien, Mowchow, 20 ix 1928 (syntypes, E, K, GH, P).

Icones: Hegi, Ill. Fl. Mitteleur. 4(3): 1695 (1924); Iconogr. Cormophyt. Sinic. 2: 530 (1972); Yeo, Hardy Geraniums 118 (fol.) (1985); Fl. Hebei. 2: 8 (1988).

*Rootstock compact, up to 1cm thick, sometimes shortly branched, with roots up to 4mm in diameter at their origin (cultivated plants). *Stems* erect or decumbent, retrorsely strigose or recurved-villous, sometimes with subpatent hairs above, opposite-leaved, the lower nodes sometimes monopodial, the branches otherwise in unequal pairs; internodes long, commonly 6–12cm. *Basal leaves* few, not present at flowering time, those of cultivated plants up to 7.5(–9.5)cm wide, divided as far as ¾–6/7 into (5 or) 7; outline

suborbicular, with narrow basal sinus, to transversely heptagonal, with wide basal sinus; divisions narrowly rhombic or narrowly obtrullate, palmately 3-lobed in the distal 1/3–2/5, the entire basal part with straight or slightly concave margins; lobes about 1 1/3–2 times as long as broad, the median much exceeding the laterals, each with 2 or 3 unequal teeth; teeth slightly broader than long to c.1 1/2 times as long as broad, ovate and either acute or obtusish and mucronate; upper surface rather dark green, sometimes lightly marbled with pale green, freely setose with curved hairs; lower surface slightly paler than upper and slightly shining, with sparse hairs like those of the upper, densely beset on the veins with larger curved hairs; petioles 2–2 1/2 times as long as the lamina, patently setose, sometimes also with a band of pubescence; stipules up to 11(–15)mm long, narrowly triangular to linear-lanceolate, finely pointed, subtomentose. *Cauline leaves* up to 7cm wide, divided as far as 7/8–9/10 into 5 or, in the upper leaves, 3; outline of the lower unevenly pentagonal, with a wide basal sinus; divisions rhombic or narrowly rhombic or, in upper leaves, lanceolate and with the middle lobe predominating, pinnately lobed, the entire basal part with the margin concave, at least in the median lobe; lobes oblong-lanceolate to ovate-lanceolate, up to 2 or 3 times as long as broad, divergent at a narrow angle but not or scarcely curved outwards, rather symmetric, with 1–5 distinct and ovate or obsolescent teeth, or with few or no teeth in the upper leaves; tips of lobes and teeth acute; upper surface usually light green (cultivated plants), strigose or with curved setulae; lower surface with curved setulae and with larger curved hairs on the veins; (the hairs varying from sparse to dense on both surfaces); petioles up to 3 1/2 times as long as the lamina, decreasing gradually in length upwards, the uppermost obsolescent, loosely retrorsely hirsute; stipules mostly 3–9mm long, free, linear-lanceolate with a subulate tip, sometimes bifurcate, hairy. *Inflorescence* diffuse, leafy; cymules 1-flowered; peduncles suppressed or up to 2.5cm long; pedicels 1.3–2.5cm long; peduncles and pedicels clothed as the stems, hairs particularly dense and sometimes more spreading just under the calyx; pedicels thickened under the flowers, more or less erect at anthesis, afterwards divaricate or reflexed and sharply geniculate under the flower. *Flowers* approximately erect, cup-shaped. *Sepals* 4.5–5.5mm long at anthesis including mucro 0.6–0.8(–1.5)mm long, up to 7mm long in fruit, divergent, green, usually puberulent, sometimes with slightly longer incurved hairs on the the veins and with long appressed or loose hairs mainly on the veins and margins and especially towards the base. *Petals* 5–5.5mm long, about equalling the sepals, obovate with rounded or retuse apex, with a few hairs on the margins towards the base, pink with simple darker purplish red veins (ground colour usually white in cultivation). *Filaments* 3.5–4mm long, strongly and rather abruptly dilated in the basal half, setose along the margins towards the base with divergent or nearly appressed shortly tapered hairs. *Anthers* short and broad, with blue sutures (cultivated material). *Style* about half the length of the sepal body, setulose, not usually obsolescent. *Stigmas* c.1.3mm long, crimson, setulose on the outside. *Fruit* erect during development; rostrum 10.5–12mm, pubescent; mericarps 2.8–3.2(–3.8)mm long, loosely setose, light brown, with bristly tubercle at base, the awns shortly pubescent on inner surface. *Seeds* c.2.5mm long, minutely reticulate.

QINGHAI. Xining, Qinghai Hu (Koko Nor), 2900m, 3 viii 1930, *Hopkingson* 832 (P).
HUBEI. *Wilson* s.n. (K, ex hb. Hong Kong).
SHANXI. Hoa Yum Miao distr., 29 vii 1916, *Licent* 2371, ?*G. sibiricum* (P). Hoang Ts'ao Keou, NW mts, 30 vii 1914, *Licent* 616 (P). Kiao Shan, Shan Hai Kwan, 5/8 ix 1915, *Licent* 1577, ?*G. sibiricum* (P). Ma Kia Pou: 20 vii 1914, *Licent* 244 (P); Ts'ai Yang Shan, 21 vii 1914, *Licent* 292 (P); (Hoang Ho & Pai Ho), Young Mong Shan, 29 vii 1914, *Licent* 524 (P).
SICHUAN. Tongolo distr., ix 1891, *Soulié* 57 (P).
YUNNAN. Kunming distr.: 1913, *Maire* 1418, ?*G. sibiricum* (E); 1913, *Maire* 2572, ?*G. sibiricum* (E); ('Kouy Tchéou'), Pu Fa, vi 1913, *Esquirol* 4379 (P). Lan Ping Hsien, 3000m, 17 viii 1933, *Tsai* 53768 (GH). Tong Tch'ouan, 2600m, rec'd vii 1913, *Maire* s.n.

General distribution. N China, Manchuria, Mongolia, Japan, Far East USSR westwards to E Central Europe, Himalaya (a weedy species, introduced elsewhere and possibly not native throughout the range stated here).

G. sibiricum is characterized by its one-flowered cymules and the narrow leaf-divisions which, in the stem-leaves, are deeply pinnately lobed, though the lobes diverge at a narrow angle; in the basal leaves, where the lobed part is rather shorter, I have described the divisions as palmate because the lobes radiate from the base, but the arrangement does not differ much from that in the cauline leaves. There may sometimes be some difficulty in distinguishing *G. sibiricum* from *G. nepalense* when that has one-flowered cymules, but *G. sibiricum* also differs in its smaller flowers and longer sepal mucro.

I have assigned one of the syntypes of *G. fangii* (*Fang* 5507) to *G. sibiricum*. There are, however, some specimens that I have named as *G. sibiricum* with a query.

I have had several stocks of *G. sibiricum* under observation in the Cambridge Botanic Garden, two of them from China, including one from our area (Sichuan). Those that have been overwintered in a cool greenhouse go dormant, like *G. wilfordii*.

34. Geranium carolinianum L., Sp. Pl. 682 (1753); Knuth, Geran., Pflanzenr. IV.129: 54 (1912). Type: ?
Icones: Iconogr. Cormophyt. Sinic. 2: 519 (1972).

*Plant annual. *Stem* erect, with a very long first internode (15–25cm), pubescent, with or without a few solitary leaves at lowest nodes, opposite-leaved above and with branches arising from the axils of the paired leaves. *First basal leaves* about 5cm wide, divided ½-way into 7, more or less reniform in outline; divisions truncate, entire or very shallowly 3-lobed; lobes entire. *Later basal leaves* and *main cauline leaves* divided as far as ¾–6/7 into 5 or 7; divisions nearly rhombic but broadest above the middle, deeply 3-lobed; lobes about twice as long as broad, with several more or less deep teeth; lobes and teeth more or less parallel-sided and widely divergent, obtuse or acute at the tips; petioles of cauline leaves decreasing in length upwards rapidly; stipules 5–9mm long, linear-lanceolate, membranous. *Inflorescence* either diffuse and regular (var. *carolinianum*) or condensed, with most of the peduncles reduced or suppressed and the flowers densely clustered (var. *confertiflorum* Fernald); pedicels in fruit c.½–1½ times as long as calyx, with long glandular hairs. *Flowers* permanently erect. *Sepals* 5mm long at anthesis and 7mm long or more in fruit, including mucro c.1.2mm long, sometimes very broad, only weakly divergent, with glandular and eglandular hairs. *Petals* 5–7mm long,

at least twice as long as broad; colour white or pale pink; base with a few hairs on the margins. *Filaments* slightly more than half the length of the sepal body, proximal half dilated but nearly parallel-sided. *Stigmas* c.1mm long. *Fruit* erect; rostrum c.13mm long; mericarps 3–3.5mm long, black, with glandular hairs and at the base a bristly tubercle, the whole often separating completely from the rostrum after discharge. *Seeds* c.1.8mm long, distinctly reticulate.

SICHUAN. Yen Yüan (teste *Iconogr. Cormophyt. Sinic.* 2: 519 [1972]).
YUNNAN. Lijiang (teste *Iconogr. Cormophyt. Sinic.* 2: 519 [1972]).

General distribution. E North America.

G. carolinianum is an introduction to China (teste *Iconogr. Cormophyt. Sinic.* 2: 519 [1972]). Its annual life-cycle, rather finely divided upper leaves, small funnel-shaped whitish flowers, relatively long sepal mucros, glandular hairs in the inflorescence and black mericarps with a bristly tubercle at the base will together distinguish it from native species.

Subgenus **Robertium** (Picard) Rouy & Fouc., Flore de France 4: 94 (1897); Yeo in Bot. J. Linn. Soc. 89: 9 (1984).

Syn.: *Robertium* Picard in Mém. Soc. Agric. Boulogne-sur-Mer 2: 134 (1837).

Section *Polyantha* Reiche, Die Pflanzenfamilien 3(4): 8 (1890); Yeo in Bot. J. Linn. Soc. 89: 13 (1984).

35. Geranium polyanthes Edgew. & Hook. f. in J. D. Hook., Fl. Brit. Ind. 1: 431 (1874); Knuth, Geran., Pflanzenr. IV.129: 136 (1912); Hand.-Mazz., Symb. Sin. 7(3): 620 (1933). Type: *Geranium polyanthes* Wallich H[erbarium] I[ndicum] 8564, 1847, Kamoon, *Blinkworth* (Herbarium Benthamianum 1854) (lecto. K, chosen here; iso. K etc.); Herb. Ind. Or., Hook. f. & Thomson, Sikkim, Regio temp., alt. 9–12000ft, *J. D. Hooker*, as *G. donianum* (several iso. K, etc.).
Icones: Polunin & Stainton, Flow. Himal. t. 20, fig. 237 (1984); Yeo, Hardy Geraniums 147 (fol.) & t. 30 (1985).

*Rootstock up to c.1.5cm thick, almost tuberous, knotty, little-branched, with more or less thickened as well as fibrous roots. *Stems* erect, with few long internodes, alternate-leaved, unilaterally pubescent and additionally pilose with long, fine, slightly recurved unicellular hairs; lower branches sometimes appearing axillary, sometimes leaf-opposed, upper axillary, paired. *Basal leaves* mostly 2.5–4.5cm wide, present at flowering time, divided as far as ½–¾ into 7; outline flabellate, usually with a narrow basal sinus; divisions cuneate, their lateral margins straight or concave with rather narrow sinuses between them, truncate and mostly 3-lobed at apex; lobes much broader than long, obtuse or truncate, mucronate, each with one or two shallow, mucronate teeth; upper surface deep green, smooth, covered with coarse, 2–4-celled, subacute hairs which appear flattened and shiny in the dried state, the veins and margins clothed with fine

setulae; lower surface pale, glabrous apart from widely scattered long, fine spreading hairs; petioles several times longer than the lamina, hirsute with long hairs like those of the stem; stipules up to c.5mm long, glabrous, brown, very obtuse. *Lower cauline leaves* (below the inflorescence) numbering only one or two, alternate, similar to the basal but with (progressively) shorter petioles, sometimes with only 5 divisions, between which the sinuses are wider; stipules acute, purple, hirsute. *Upper cauline leaves* opposite, much smaller than lower, with the divisions less truncate and their middle lobes prominent; petioles very short; lower surface with some of the hairs gland-tipped. *Inflorescence* dense, composed of groupings of a pair of leaves between which are a sessile (epedunculate) two-flowered cymule and two branches that terminate either in a further such cymule and branches or a bracteolate, umbel-like cluster of flowers, all axes terminating finally in such clusters; pedicels about as long as sepals, permanently erect, unilaterally pubescent with short recurved hairs and also more or less densely pilose with very long patent unicellular hairs, sometimes with some long glandular hairs distally. *Flowers* erect, funnel-shaped. *Sepals* 6–7mm long, including mucro c.0.5(–0.75)mm long, suberect, obtuse, green, flushed with purplish red at edges, densely covered with large glandular hairs with 2–3-celled stalks and easily seen yellowish gland-heads that sometimes become brown or rarely purplish red, and with some eglandular hairs like those of the stem and pedicels, these being longer than the glandular hairs. *Petals* 10–15mm long, c.1½ times as long as wide, greatly overlapping, attenuate at base and rounded-truncate at apex, forming an *Oxalis*-like flower, bright magenta-pink, glistening in texture, with fine and slightly feathered dark veins nearly reaching the apex but pale at base; base with the surfaces glabrous and the margins lightly villous with fine hairs. *Filaments* c.4.5mm long, gradually dilated downwards from near the apex, finely pilose in the lower half, white. *Anthers* c.0.7mm long, broad, yellow. *Style* c.3mm long, white-tomentose except at apex. *Stigmas* 1.5mm long, yellowish, tipped with pink. *Fruit* erect; rostrum 12–13.5mm, almost or quite without a stylar portion, shortly pubescent, inner surface of awns almost glabrous; mericarps 4–5mm long, acute at apex, very slightly laterally compressed, their surface puberulent, with pubescent raised midrib and lateral reticula. *Seeds* c.3.2mm, yellowish brown, smooth, remaining within the mericarp.

YUNNAN. Chi Na Tung, Tsa Wa Rung, 2800m, viii 1935, *Wang* 65221 (GH). Kiukiang upper valley, Clulung, Chialahmuto, c.3500m, 7 viii 1938, *Yü* 19713 (E, GH, KUN). Lancang/Jinsha Jiang divide, Awa, E of, 27°25'N, 99°18'E, 3350m, vii 1924, *Forrest* 25537 (E, K, W). Lancang/Nu Jiang divide, Sewalongba, 3400m, 27 viii 1938, *Yü* 22528 (E, GH). Nu ('Lu')/Di-jion Jiang [Irrawady] divide, Tangblanglong, W slope, 3300m, 10 vii 1916, *Handel-Mazzetti* 9525 (W). Tsekou, rec'd vi 1905, *Monbieg ('Manberg')* s.n. (K).

General distribution. E Himalaya.

G. polyanthes is distinct from all other species of this section except *G. umbelliforme* in its clustered flowers. Differences from *G. umbelliforme* are given under that species. Other striking characters are the smooth-textured leaves, the very small stamens and small yellow anthers and the absence of any stylar component in the mature rostrum.

Introductions of this species from the Himalayan part of its range into cultivation in Britain have been made many times, and some of the finer points of the above description have been obtained from plants in cultivation. It has recently been demonstrated to me by Mr H. D. Harrison of Scunthorpe, Lincolnshire, that in some plants from Sikkim that he is growing the flowers of the first cymules are chasmogamous but (in his conditions) do not set fruit, while those in the clusters are cleistogamous, all setting fruit without having opened. In this the plants resemble those of sect. *Trilopha*, which also have in common with sect. *Polyantha* the acute apex of the mericarp.

36. Geranium umbelliforme Franchet in Bull. Soc. Bot. France 33: 443 (1886); Franchet, Pl. Delav. 115 (1889); Knuth, Geran., Pflanzenr. IV.129: 137 (1912). Type: Yunnan, au Col de Koua la po (Ho Kin), 3000m, 4 viii 1885, *Delavay* 1944 (holo. P). Icones: Franchet, Pl. Delav. t. 25 (1889).

Rootstock up to c.1.5cm thick, erect or horizontal, knotty, the swellings sometimes separated by lengths of thinner rhizome (c.4mm thick). *Stems* erect, with the first internode 2–9cm long, alternate-leaved below, with branches in the axils, opposite-leaved above, pubescent in bands, generally clothed with long, tapered, few-celled glandular hairs with small red heads, the heads distinctly wider than the tips of the hairs and easily visible under the lens (c.x12), sometimes also with still longer unicellular eglandular (sharp-pointed) hairs. *Basal leaves* usually few at flowering time, with the lamina 5.5–7.5cm wide, divided as far as ½–⅘ into 5(–7), outline orbicular or pentagonal-suborbicular; sinuses between the divisions nearly closed to moderately open; basal sinus rather narrow; divisions broadly cuneate, truncate or subtruncate at apex and palmately 3- to 5-lobed in the distal ⅕–¼; lobes slightly wider than long, with 1–3 teeth; tips of lobes and teeth obtuse, mucronate; upper surface edged with red, beset with thick, blunt, 2-celled eglandular hairs and with fine antrorse pubescence on veins and margins; lower surface not much paler, with scattered glandular hairs similar to those of the stem; petioles up to 3 times as long as the lamina, clothed as the leaves; stipules c.7mm long, obtuse, glabrous or weakly ciliate. *Cauline leaves* similar to basal, their size and relative length of petiole decreasing upwards gradually; divisions 5 or, in the upper leaves 3, sometimes rounded or shortly tapered at the apex; tips of lobes and teeth sometimes acutish; stipules 5–7(–10)mm long, ovate to ligulate or lanceolate, obtuse to acute. *Inflorescence* not lax but with rather few flowers, mainly composed of 3- and 4-flowered umbellate groups but sometimes also including pedunculate and epedunculate 2-flowered cymules; pedicels 1–5.5cm long; peduncles and pedicels clothed as the stems but more densely, the pedicels sometimes recurved in bud, otherwise permanently erect; bracteoles 3–5mm long, filiform. *Flowers* erect, funnel-shaped. *Sepals* 6.5–8.5mm long including mucro 0.5–1mm long, heavily flushed with purple; margins with short fine eglandular hairs; surface with glandular hairs, and sometimes long eglandular hairs, like those of the stem. *Petals* 13–16 x 6–7mm, cuneate or spathulate, not clawed or with indistinct claw about as long as lamina, rounded or retuse at apex; colour bright purplish red with fine dark purplish red veins; profusely hairy on the adaxial surface and margins over about the basal third, and with a few hairs on the back at the base. *Filaments*

5.5mm long, divergently hairy for more than half their length, not dilated at base, or alternately with a small abrupt dilation at the base, or abruptly but unequally dilated, alternate stamens having the larger half of the dilation angular and tooth-like; colour unknown; without a basal hair-tuft or alternate filaments with one. *Anthers* c.0.8mm long. *Style* c.4.5mm long, setose below or throughout. *Stigmas* c.1.2–1.5mm long, probably dark red. *Fruit* with rostrum 19mm long (only one available), with a stylar portion 2mm long, pubescent, eglandular or nearly so; mericarps puberulent, their size and sculpture unknown.

SICHUAN. Muli: 3050m, 22 vii 1921, *Ward* 4543 (E); Kulu mts, 3380m, vii 1929, *Rock* 18042 (E, GH).
YUNNAN. Lijiang range, 27°30'N, c.3500m, vii 1910, *Forrest* 6195 (BM, E, K, P).

General distribution. Endemic.

G. umbelliforme is similar to *G. polyanthes* but differs in its less deeply divided leaves that have more numerous teeth and more hairs on the lower surface, these being glandular, the red tips of its glandular hairs, the hairy adaxial face of the petal-base and the presence of a small stylar portion in the mature rostrum. Some examples are also distinct in the angled dilation at the base of some or all of the stamen filaments.

37. Geranium moupinense Franchet in Nouv. Arch. Mus. Paris, sér. 2, 8: 208 (1886) (=Plantae Davidianae 2); Knuth, Geran., Pflanzenr. IV.129: 137 (1912). Type: Moupine, vi 1869, *David* (P, non vidi) [I have seen two sheets in P collected at Mupin by David in 1870].

Rootstock elongate, slender, covered with old stipules. *Stems* 12–25cm tall, erect or flexuous, alternate-leaved, unbranched at the lower nodes, probably opposite-leaved above, unilaterally pubescent and with scattered long tapered apparently glandular hairs with colourless 2- to 3-celled stalks and minute, usually coloured heads, the heads not or little wider than the top of the stalk and with or without a basal constriction (heads not clearly visible with a x12 lens, needing twice this magnification for clarity), such hairs usually denser at the nodes. *Basal leaves* up to 6cm wide, divided as far as ⅔ into 7; outline reniform with a rounded basal sinus; sinuses between the divisions narrow and acute or obsolete; divisions cuneate-flabellate, truncate at apex, 3-lobed in the distal ⅕–¼; lobes truncate, mucronate, sometimes with 1 or 2 obtuse lateral teeth, the lateral as broad as long, the median broader; upper surface green, with scattered long glandular hairs like those of the stem, and small fine curled hairs or puberulence; lower surface discolorous, brown in the dried state, with the veins deep purple at the base, the hairs like those of the upper surface but confined to veins and margins; petioles up to about 3 times as long as lamina, with the same indumentum as the stem; stipules c.3mm long, broadly ovate, membranous. *Cauline leaves* up to 4.5cm wide, similar to the basal, but divided as far as ¾ into 5 or 7 broadly rhombic divisions with obtuse lobes; petioles decreasing in length upwards but laminae not subsessile; stipules up to 8mm long, linear. *Inflorescence* diffuse, with first peduncle usually at the second node, 5–8cm long; pedicels c.1.5–3cm long; peduncles and pedicels with recurved short pubescence and scattered glandular hairs like those of the stem; bracteoles linear or linear-lanceolate,

6–9mm long, membranous (no fructescent pedicels available). *Flowers* apparently erect and funnel-shaped; posture in bud uncertain. *Sepals* 7.5–8.5(–10)mm long excluding mucro 1.5–2.5mm long, slightly divergent, reddish, densely to sparsely clothed, principally at the base, with long glandular hairs like those of the stem; apex emarginate in some. *Petals* c.15–17(–20)mm long, more or less narrowed into a claw, c. twice as long as broad; colour pink; claw c.⅓ as long as whole petal, very hairy on margins and both surfaces at the base, with sparser hairs over most of the length of the claw. *Filaments* 8–8.5mm long, scarcely dilated towards the base, densely long-hairy for nearly half their length. *Anthers* c.1.3mm long. *Style* 6mm long, shortly pubescent. *Stigmas* c.1.3–1.8mm long. *Fruit* (according to protologue) with rostrum 20–25mm long, lightly pubescent and with mericarps lightly and loosely transversely veined. *Seeds* unknown.

SICHUAN. Mupin, 1870, *David* (P, two sheets, evidently representing different gatherings).

General distribution. Endemic.

This description of *G. moupinense* was drawn up from two herbarium sheets and amplified from the protologue at various points. The species differs from *G. polyanthes* and *G. umbelliforme* in its loose inflorescence with 2-flowered cymules. It resembles *G. umbelliforme* in its hairy petals but further differs from it in its longer sepals, longer stamens with scarcely dilated filaments and in the very small-headed glandular hairs (similar hairs, differing in the greater number of cells in the stalks, are found in *G. hispidissimum*).

38. Geranium ascendens Z. M. Tan in Bull. Bot. Res. 10: 23 (1990). Type: Sichuan, Yaan, *Chengdu Coll. Trad. Medicine Exped.* 102 (holo. CTMC, non vidi).
Icones: Bull. Bot. Research 10: 24 (1990).

Rootstock to 13cm long, 3–5mm thick, horizontal or oblique. *Stems* 40–50cm long, 1.5–2.5mm thick, ascending, with internodes to 27cm long, glabrous or puberulous below, retrorsely puberulous above. *Leaves* alternate below, opposite above. *Basal leaves* with petioles 13–27cm long, puberulous, at least above and especially near the lamina. *Cauline leaves* with lamina 3–4.5 x 6–8cm, reniform, divided as far as ½–¾ into 5 or 7; divisions cuneate, rounded subtruncate at apex, 3 lobed at the apex for c.¼ their length; lobes sub-oblong, with 2–3 rounded, rarely acute, mucronate teeth; upper surface dark green, very sparsely appressed-pubescent, retrorsely puberulous on the veins; lower surface pale green, the veins sparsely appressed-puberulous or rarely sparsely spreading-hirsute; lower petioles 6–9cm, upper 1–2cm long; stipules 5–8mm long, triangular-lanceolate, acuminate, ciliate. *Inflorescence* lax; peduncles 3.5–9.5cm long, retrorsely puberulous; pedicels apparently 1–3cm long. *Sepals* 8–10mm long including mucro c.2mm long, green, sparsely hairy on the ribs. *Petals* 16–20 x 10–12mm, rounded at apex, narrowed below, villous on the base and with the margins ciliate at the base, purple. *Stamens* 5–8mm long; filaments almost uniformly tapered, villous below; anthers yellow. *Style* apparently c.5mm long; stigmas apparently not more than 1.5mm. *Immature and mature fruits* and their pedicels erect. *Fruit* c.2.5cm long; carpels puberulous. *Seeds* c.2.5mm long, finely reticulate.

SICHUAN. Yaan, n. d. Chengdu Coll. of Trad. Chinese Medicine Exped. 102 (CTMC, non vidi).

General distribution. Endemic.

This species is said to be related to *G. moupinense*; the description of the indumentum and the illustration of the leaves tend to confirm this. The only character given for the fruit that suggests that the plant does indeed belong in sect. *Polyantha* is 'valvulae albo-puberulae'; the carpels should also be reticulate. However, the balance of probability is that it is a member of this section. It therefore appears to be very closely related to *G. wardii* Yeo from West Central Burma, which it resembles in its lax habit and in leaf-shape. It differs from *G. wardii* in the absence of glandular hairs, the alternate lower leaves, the small hairs of the leaf-lamina, the longer sepal-mucro (0.5–1mm in *G. wardii*), larger petals and stamens (respectively 10–13mm and 4–5mm long in *G. wardii*), the evident style and the erect fructescent pedicels.

39. Geranium strictipes Knuth, Geran., Pflanzenr. IV.129: 581 (1912). Type: NW Yunnan, eastern flank of Lichiang Range, lat. 27°12' N, 9000–10000ft, vi 1906, *Forrest* 2369 (holo. E) [sheets of *Forrest* 2369 in BM, K, P, have lat. as 27°20' N and alt. as 10–11000ft].

Syn.: *G. strigosum* Franchet in Bull. Soc. Bot. France 33: 42 (1886); Franchet, Pl. Delav. 113 (1889); Hand.-Mazz., Symb. Sin. 7(3): 621 (1933) non Burm. f. Type: Yun-nan, in dumetis Pe-ngay-tze, supra Houang-kia-pin, 4 ix, *Delavay* s.n. (holo. P, non vidi [I have, however, seen a specimen without a manuscript label in P from this locality '1883–1885' as '*Delavay* Ger. no. 2']).

G. strigosum var. *gracile* Franchet, Pl. Delav. 113 (1889) (rite var. *strigosum*).

G. strigosum var. *grandiflorum* Franchet, Pl. Delav. 113 (1889). Type: Yunnan, col de Koua-la-po (Hokin), 3000m, 13 vii 1886, *Delavay* 2165 (syn. P, K [s.n.]).

Rootstock 1–2.5cm thick, strongly abbreviated, branched, probably mostly below ground level, its tips with a few brown stipules, sometimes with a thick root and some thin lateral roots. *Stems* erect or ascending, more or less red, the first internode c.2–12cm long, internodes often decreasing rather abruptly after the second; leaves and branches at the first node numbering 2 or 3, branches above paired or solitary from paired leaves; indumentum composed of unilateral pubescence and additional pilosity of long fine straight, patent, eglandular (sharp-pointed) unicellular hairs, or of very long, coarse glandular hairs with 1–6-celled stalks and heads distinctly wider than apex of stalk and distinctly visible, though small, under the lens (c.x12), or of a mixture of these hair types, denser at nodes. *Basal leaves* rarely present at flowering time, c.2–7cm wide, divided as far as 3/5–7/8 into 7; petioles several times longer than lamina, with the same indumentum as the stems, increasingly dense near apex. *Cauline leaves* up to c.6cm wide, lamina divided as far as 3/4 or nearly to the base into 5 broadly rhombic divisions; breadth of divisions very variable, so that sinuses, if open, are lanceolate to triangular;

outline usually pentagonal; divisions palmately or, more usually, palmato-pinnately lobed in the distal ¼–½; lobes 1–2 times as long as broad, with usually 1 or 2 rather short teeth, some of these occasionally obsolescent; lobes and teeth usually curving outwards, their tips rather broad, shortly acuminate (rather than cuspidate); upper surface edged with red, strigose with coarse, obtuse, 1–2-celled hairs and also with smaller, acute, 1-celled hairs towards margin; lower surface pale, its hairs of the latter type, mostly on the veins; stipules c.8–10mm long, lanceolate, herbaceous, with eglandular and sometimes glandular hairs. *Inflorescence* diffuse; lowest peduncles 5–15cm long and upper c.4–6cm long; pedicels mostly 10–25mm long; peduncles and pedicels clothed as the stem or sometimes with eglandular hairs longer than the glandular; pedicels recurved in bud, more or less erect from anthesis onwards; bracteoles 3–8mm long, linear or linear-lanceolate, herbaceous. *Flowers* erect, bowl-shaped or funnel-shaped. *Sepals* (6.5–)8–11.5mm long including mucro 1.5–2.5(–3.5)mm long (=c.⅕ length of whole sepal), divergent, green, densely clothed with long glandular hairs with the stalks colourless, of 1–6 cells, the heads small, but wider than the tip of the stalk, with yellowish or purplish contents, also with short or long 1-celled eglandular hairs. *Petals* 11–15mm long, 1½(–2) times as long as wide, cuneate or attenuate at base, usually truncate or retuse (then sometimes apiculate), otherwise rounded at apex; colour pink to purplish red, more or less strongly marked with darker veins; margins and adaxial surface finely pilose at the base and abaxial surface so at extreme base. *Filaments* 6–7mm long, gradually tapered from the base, curving outwards distally, with a weak tuft of hairs on the back at the base; nectaries more or less glabrous. *Anthers* 2mm long, not broad, probably red; pollen yellow. *Style* 4mm long, white-tomentose at the base. *Stigmas* 1.75mm long, perhaps pinkish, becoming revolute. *Fruit* erect, with rostrum (18–)20–24(–38)mm long, finely and sparsely pubescent; mericarps 4.5–5(–6)mm long, acute at apex, slightly compressed laterally, sparsely pilose or pubescent, reticulate, dark brown. *Seeds* very minutely reticulate.

SICHUAN. Kientchang, Mienming, 2000m, 2 xi 1911, *Legendre* 1425 (P). Yen Yuan Hsien to Yung Ning, near Hunko, 2800m, 12 vi 1914, *Schneider* 1171 (E, GH). Yeng Yuen town to Yalung R, 27°22'N, 3000–3600m, 30 ix 1914, *Handel-Mazzetti* 5470 (W).
YUNNAN – SELECTED SPECIMENS. Haba range, W flank, 23 vi 1939, Feng 1367 (GH). Col de Hee Chan Men, 3000m, 13 vii 1887, *Delavay* s.n. (K, P). Lijiang distr./range: Ngu Leh Keh, 2900m, 18 vii 1914, *Schneider* 1864 (GH); Yulung Shan, vi/ix 1914/6, *Handel-Mazzetti* 3798 (W); Lijiang Hsien, 2300m, vi 1935, *Wang* 70555 (GH); Lijiang Valley, E side, 27°25'N, 3050m, vii 1910, *Forrest* 6113 (BM, E, K, P); 27°25'N, c.3200m, rec'd 1910, *Forrest* 10370 (BM, E, GH); E slope, 3000m, 18 vii 1914, *Schneider* 1869 (GH, K); E slope, Ma Huang Paddok, Nguluke, 3350m, 12 vi 1922, Rock 4352 (E); W slope, Ganhaitze, near, c.3200m, 6 vi 1922, *Rock* 4159 (E). Muli, 2750m, 10 vi 1921, *Ward* 4040 (E). Pe Ngay Tze mt, 1883–1885, *Delavay* (Ger. no.) 2 (P). Col de Yen Tze Hay, rec'd ix 1890, *Delavay* s.n. (K, P).

General distribution. Endemic.

G. strictipes is usually more hairy than the members of the section so far described, though less so than *G. hispidissimum*. It may be dwarf and little-branched or taller and bushy, and it has a very stout rootstock. The amount of variation in fruit-size is unusual; the largest fruits were found on a sparsely fruiting plant and the smallest on one with

more numerous fruits. It has larger flowers and fruits than *G. hispidissimum* and also differs from it constantly in the type of glandular hair. In the leaves, the main difference is a pinnate tendency in the lobing of the divisions, but the lobes are also deeper, with larger teeth in relation to the leaf-size, and both lobes and teeth are sharper.

40. Geranium hispidissimum (Franchet.) Knuth, Geran., Pflanzenr. IV.129: 183 (1912); Hand.-Mazz., Symb. Sin. 7(3): 621 (1933).

Syn.: *G. strigosum* var. *hispidissimum* Franchet, Pl. Delav. 113 (1889). Type: Yunnan, les coteaux calcaires près du col de Hee-chan-men, 15 vii 1887, *Delavay* s. n. (holo. P, iso. K).

G. strigosum var. *platylobum* Franchet, Pl. Delav. 113 (1889). Type: Yunnan, sur le Che tcho tze au dessus de Ta pintze, 2000m, 6 viii 1887, *Delavay* 2756 (holo. P).

G. platylobum (Franch.) Knuth, Geran., Pflanzenr. IV.129: 183 (1912).

Rootstock 1–2cm thick, strongly abbreviated, probably mostly below ground level, largely without roots in the upper part (the few roots present in dried specimens are very stout with a few small laterals); tip clothed with brown stipules. *Stem* erect or ascending, flushed with purple; first internode often short, branches paired at lower nodes, solitary from paired leaves above, shortly and sometimes unilaterally pubescent with recurved hairs, also sparsely to densely clothed with very long tapered apparently glandular hairs (more or less crumpled in dried specimens) with colourless 3–10-celled stalks and minute, usually coloured heads, the heads not or little wider than the top of the stalk and with or without a basal constriction (heads not clearly visible with a x12 lens, needing twice this magnification for clarity), such hairs usually denser at the nodes. *Basal leaves* with the lamina 3–7(–10)cm wide, divided as far as ½–⅘ into 5 or 7, reniform to suborbicular in outline; divisions cuneate-flabellate or obovate with apex rounded or subtruncate, not tapered, palmately lobed in the distal ¼–⅓; lobes about as broad as long, with usually 1 or 2 shallow teeth, some of the teeth obsolescent; lobes and teeth sometimes curving outwards, their tips more or less broadly rounded and cuspidate; sinuses between divisions narrowly to broadly triangular; upper surface green or flushed with red, densely to sparsely clothed with glandular hairs like those of the stem; lower surface pale, sometimes flushed with purple, the hairs like those of the upper surface but denser; petioles c.2½ times as long as lamina, clothed as the stem; stipules not more than 5mm long, deltoid, ciliate, sometimes pubescent. *Cauline leaves* similar, decreasing in size upwards gradually, divided as far as ⅔–¾ into 5, lobed or toothed in the distal ⅓–½; divisions in dried specimens often curled up through partial drying before pressing; tips of lobes and teeth becoming more acute; middle stipules mostly 8–12mm long, ovate-lanceolate, eglandular- and glandular-hairy, herbaceous in texture. *Inflorescence* rather diffuse; lowest peduncles 7–14cm long, upper 3–5cm long; pedicels mostly 8–15mm long; peduncles and pedicels clothed as the stem; bracteoles linear, c.4–8mm long, herbaceous in texture; pedicels, except when nodding in bud, permanently more or less erect. *Flowers* more or less erect, shallowly bowl-shaped or funnel-shaped.

Sepals 6.5–7.5mm long, including mucro 1.5–2mm long, divergent, green, with indumentum similar to that of the stem, but glandular hairs finer, the glands sometimes colourless; mucro sometimes foliaceous. *Petals* 9–12mm long, 1½ times as long as broad or less, cuneate at base, rounded at apex, divergent; colour white, pink or purplish red, the veins darker; margins and adaxial surface rather densely hairy at extreme base and with marginal ciliation extending for c.¼ the length of the petal. *Filaments* c.4.5mm long, dilated at the base, curving outwards distally, pilose on the back near the base, the hairs here or on the nectary forming a dense tuft. *Anthers* c.1.5mm long, broad. *Style* 3mm long, white-tomentose. *Stigmas* 1–1.5mm long, crimson. *Fruit* erect, with rostrum 16–21mm , densely and finely pubescent to sparsely puberulous; mericarps 4–4.5mm long, reticulately veined and with a midrib, acute at apex, somewhat laterally compressed, puberulous. *Seeds* finely reticulate with elongate areoles (at least in the subapical zone).

SICHUAN. Huei Li Hsien, 2900m, 17 ix 1932, *Yü* 1541 (GH).
YUNNAN. Che Tcho Tze, *Delavay* s.n. (K). Chien Chuan to Sung Kwei, pass, c.2900m, ix [1902], *Forrest* 132 (E). Dongchuan mountains, 2600m, vii rec'd 1913, *Maire* s.n. (BM, E, P). Ad collum Hee Chan Men, 15 vii 1887, *Delavay* s.n. (P, K). Kong-tze to Kunming, viii 1897, *Bélard* s. n. (P). Kunming distr.: ix 1897, *Bélard* 15 (P); rec'd 1901, *Ducloux* 224 (K); rec'd 1906, *Maire* 2575 and 2577 (E); mountains, vii rec'd 1906, *Maire* 884 (BM, P). Kunming to Suifu road, behind Kung Shan, 2700m, 4 ix 1911, *Mell.* s.n. (W). Lijiang Hsien, 2700m, vii 1935, *Wang* 70873 and 3000m, *Wang* 71296 (GH). Lijiang (range): Ahsi on Jinsha Jiang, 20 vi 1939, *Ching* 20787 (GH); E, above Duinaoko, c.3000m, 4 vii 1914, *Handel-Mazzetti* 3461 (W); S, Bai Wan Chang, 2700m, 1985, *Lancaster* 1664A (K); Nguluko, 2008m, 18 vii 1937, *Yü* 15323 (GH). Lou Pou mountains, 3000m, vi rec'd 1914, *Maire* s.n. (E, P). Ta Kai high plateau, 3200m, vii rec'd 1913, *Maire* s.n. (E). Below Ta Pin Tze, Che Tcho Tze, 2000m, 6 viii 1887, *Delavay* 2756 and 23 vii 1888, *Delavay* 4827 (P). Near Yungbei, between Dschao Ping & Boloti, 2600–3000m, 30 v 1914, *Handel-Mazzetti* 3358 (W). S of Yungning, near Ta Ts'ang Kai, 2600m, 26 v 1921, *Ward* 3971 (E).

General distribution. Endemic.

G. hispidissimum shares with *G. moupinense* the special kind of hair that appears to be glandular because the terminal cell, although it is scarcely wider than the others, is pigmented and sometimes has a basal constriction. In the very few specimens of *G. moupinense* that have been seen the number of stalk cells is fewer. *G. moupinense* also differs from *G. hispidissimum* in being much less hairy and in having alternate lower stem leaves. *G. strictipes* is apparently the closest relative of *G. hispidissimum*, sharing with it the opposite lower leaves, relatively dense indumentum and relatively long sepal mucro; the differences are listed under *G. strictipes*. *G. platylobum* seems to be merely an extreme state with unusually rounded leaf-divisions with more than usually obtuse lobes and teeth.

Section *Trilopha* P. F. Yeo in Bot. J. Linn. Soc. 89: 13 (1984).

41. Geranium ocellatum Cambess. in Jacquem., Voy. Inde 4 (Bot.): 33 (1841?); Franchet in Bull. Soc. Bot. France 33: 444 (1886); Franchet, Pl. Delav. 116 (1889); Hand.-Mazz., Symb. Sin. 7(3): 618 (1933). Type: ? Fig. 10.

Syn.: *G. ocellatum* var. *himalaicum* Knuth, Geran., Pflanzenr. IV.129: 62 (1912) (rite var. *ocellatum*).

G. ocellatum var. *yunnanense* Knuth, Geran., Pflanzenr. IV.129: 62 (1912). Type: 'Yunnan, Tapin-tze, *Delavay* a. 1883–1885, n. 2491' (holo. B†?, iso. P, two sheets [printed labels dated as in protologue but presumably incorrectly as autograph labels say respectively 13 ii 1887, though apparently changed from 13 ii 1886, and 26 ii 1887; specimens of 2491 in BM and E, dated 26 ii 1886, should thus also be treated as iso.])

G. tapintzense Huang in Notes RBG Edinb. 42: 326 (1985), based on *G. ocellatum* var. *yunnanense* Knuth but designating as holotype *Delavay* 8 iii 1883 (P), which is *Delavay* 1.

G. kweichowense Huang in Notes RBG Edinb. 42: 325 (1985). Types: Kweichow province [apparently Yunnan, see Introduction], Lo-fou, iii 1909, fleur rouge, *J. Cavalerie* 3615 (holo. E).

Icones: Yeo, Hardy Geraniums 148 (fol.) (1985).

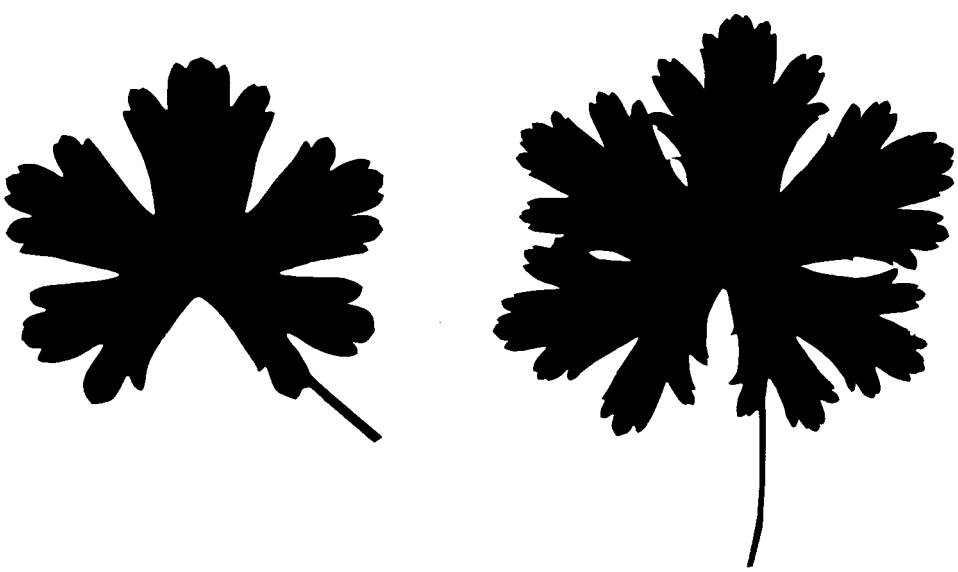

FIG.10. *Geranium ocellatum*. Leaf silhouettes of cultivated plants grown from seed collected in Jammu. Left, grown in cool conditions; right in tropical conditions.

*Rootstock annual, with a taproot. *Stems* erect(?) or ascending, opposite-leaved, with most of the branches paired, recurved-villous and with scattered extremely long fine unicellular eglandular hairs and, especially upwards, shorter pluricellular glandular hairs with yellowish heads. *Basal leaves* up to 4cm wide, often very numerous at first, divided as far as ⅔ to nearly ¾ into 7; outline suborbicular and weakly pentagonal with a usually narrow basal sinus; central sinuses acute; divisions shortly and broadly

spathulate, 3–5-lobed in the distal ¼–⅓; lobes about as long as broad, with 2–5 small broadly ovate, acute, teeth, the lateral strongly divergent; some of the teeth symmetrical, some reduced on the side towards the edge of the lobe and turned outwards (making the inward margin more curved than the outward); upper surface green, edged with red, pubescent with antrorse hairs; lower surface paler, hairs more numerous, those on the veins longer, villous towards the petiole; petiole much longer than lamina, villous with recurved hairs; stipules c.3mm long, lanceolate, reddish, hirsute. *Cauline leaves* similar to the basal but smaller and decreasing in size upwards, the basal divisions at the same time becoming reduced to lobes of the lateral divisions, the divisions cuneate-obovate, their lateral lobes less divergent and the teeth becoming fewer; lamina of the uppermost leaves densely glandular-hairy; petioles shorter than those of basal leaves but evident, with the same 3 types of hairs as the upper stem; stipules up to c.5mm long, free, linear, pubescent. *Inflorescence* diffuse, leafy, the first cymules often arising near ground level; lower peduncles up to 10cm long, upper usually 3–4cm long; pedicels mostly 1.2–3cm long; phases of production of cleistogamous flowers with much abbreviated peduncles and pedicels occur, giving rise to subumbellate flower-clusters; peduncles and pedicels very slender, villous (usually unilaterally) and densely glandular-hairy (heads of glands yellowish), erect at all stages. *Flowers* erect or inclined upwards, saucer-shaped. *Sepals* at anthesis 4mm long excluding mucro c.0.25–0.5mm long, divergent, green, with wide scarious margins, bearing short curved eglandular hairs and abundant larger glandular hairs, mostly on the veins and near the margins but nearly absent from the inner sepals; outer sepals inflexed along the lateral veins; fructescent sepals up to 5mm long, closely connivent, with the folds opened out, transversely wrinkled in the lower half. *Petals* 8mm long, divergent, nearly obcordate with broad retuse apex, or obovate, shortly attenuate at base; colour bright rose pink with a blackish purple base extending for about ⅓ the length of the petal; base with fine hairs on the margins. *Filaments* 3–3.5mm long, moderately dilated at the base, glabrous or with few scattered hairs near the base, pale at the base, blackish purple and divergent distally. *Anthers* c.1mm long, blackish purple. *Style* 2.5mm long, setulose. *Stigmas* c.1mm long, blackish purple, glabrous. *Fruit* erect, with rostrum 7.5–10mm, pubescent distally, its awns caducous on dehiscence; mericarps c.2mm long, discharged with the seed inside, acuminate, carinate and closely transversely rugose with 9–12 ribs arising from either side of the midrib, a few being weak and fading out quickly, glabrous apart from a scattering of small white spherical trichomes. *Seeds* about the same length as the mericarps, finely reticulate.

SICHUAN. Pai Kuo Wan to Mo So Ying, 1 iv 1914, *Schneider* 652 (K, P).
YUNNAN. Beyendjing: 26 iii 1916, *Tén* 43 (C); 1 iii 1916, *Tén* 380 (P, W). Keng Ma, 1620m, iv 1936, *Wang* 72927 (GH). Kiao Kia, Kao Chan Se, 28 ii 1909, *Ducloux (Tén)* 1098 (E). N of Kunming: below Hsinlung, 25 34S, 1700m, 9 iii 1914, *Handel-Mazzetti* 480 (W); near Schinling, 9 iii 1914, *Schneider* 278 (K). Mengzi distr. ?, Chu Yuan, 1896, *Henry* 10606 (K). Mo Tsou: mt, 850m, *Maire* s.n. (E); (de)mi-mt, 700m, rec'd 1914, *Maire* s.n. (BM, E). Szemao, W mts, 1525m, 1897/9, *Henry* 12882 (K). Ta Pin Tze, Ten Tchouan, 8 iii 1883, *Delavay* 1 (K, P). Yan Shan, Pan Lung Chuan, 1200m, 23 x 1936, *Wang* 84595 (KUN). Yunnan distr.: Gau Chouen, rec'd 1922, *Cavalerie* 7164 (K); Kwei Chow, Lofou, iii 1909, *Cavalerie* 3615 (K, P).

General distribution. Himalaya, Arabian Peninsula, mts of E Africa, Cameroon and SW Angola.

G. ocellatum in flower is entirely distinct from all other Chinese species on account of the almost black centre of the flower; apart from *G. polyanthes* it is the only species in our area known to produce cleistogamous flowers, which it does abundantly on shortened pedicels and shortened or suppressed peduncles. Other important characters of the species are the annual habit, shallowly divided leaves with often profusely lobed and toothed divisions and the transversely ribbed mericarps which are discharged with the seeds inside them. Cultivation has shown me that the basal leaves are not necessarily numerous, being few in those plants that precociously produce cleistogamous flowers.

Knuth considered Chinese material to be varietally distinct (var. *yunnanense* Knuth) from Himalayan (var. *himalaicum* Knuth, which today would be properly called var. *ocellatum*); he said it had the basal petioles very hirsute with completely spreading hairs, compared with more or less spreading hairs (by implication less dense) in the otherwise very similar Himalayan variety. I find the Himalayan plants indeed very similar to the Chinese and have not so far found any need to distinguish them by name. I have now been growing plants from Jammu, India, together with a stock from Arabia and one from SW Angola, for some years; the two latter are somewhat different from one another but are erect-growing, in contrast to the decumbent Himalayan one, and they have fewer ribs on the mericarps. I suspect that the normal habit of both Chinese and Himalayan plants is decumbent or ascending (herbarium specimens may sometimes seem to be erect). I think that a taxonomic division is more likely to be needed between the Chinese and Himalayan plants on the one hand, and the Arabian and African on the other.

Huang has raised *G. ocellatum* var. *yunnanense* to specific rank as *G. tapintzense* without providing any justification. At the same time he has described a related species *G. kweichowense* which has the basal leaves only 1–2cm wide and the petals only 5–6mm long. He states that the two taxa differ morphologically, ecologically and geographically. I saw the holotype and paratype of *G. kweichowense* at Edinburgh in May 1985 and compared them with other good specimens of Chinese origin and compared all with Himalayan material. My conclusion was that all were the same. I had borrowed the type of *G. ocellatum* var. *yunnanense* some years earlier and have a photograph of it. It is typical of Chinese material. I venture to suggest that the character of *G. kweichowense* could be due to response to different climates in different areas, perhaps related to altitude. Fig. 10 represents two plants from the same sample of seed from Jammu grown in widely different conditions, one of them with leaves of about the size described for *G. kweichowense*. (The specimen of *G. kweichowense* cited by Huang as *Cavalerie* 3619 is actually numbered 3615; the '5' looks very like a '9' but is quite different from the '9' in the date on the sheet.)

Section *Ruberta* Dumort., Florula Belg. 112 (1827); P. F. Yeo in Bot. J. Linn. Soc. 89: 16 (1984).

42. Geranium robertianum L., Sp. Pl. 681 (1753); Knuth, Geran., Pflanzenr. IV.129: 64 (1912); Hand.-Mazz., Symb. Sin. 7(3): 618 (1933). Type: I am not aware that this species has been typified; it was described from North Europe.

Syn.: *G. eriophorum* Léveillé in Bull. Soc. Agric. Sci. Arts Sarthe 59: 319 (1904). Type: [Yunnan] Kweichow ('Kouy-Tchéou'), murs de la Ville de Gan-pin, 28 iv 1897, *Bodinier* 1575 (holo. E [teste Lauener, 1967], iso. P).

G. robertianum L. var. *eriophorum* (Léveillé) Léveillé, Fl. Kouy-Tchéou 175 (1914).

Icones: Makino, Ill. Fl. Japan, revised edn, 399 (1961); Iconogr. Cormophyt. Sinic. 2: 520 (1972).

*Rootstock annual, stout, condensed, with a taproot, producing very many rosette leaves which wither during flowering. *Stems* usually reddish, several from the rosette, divergent, forking more or less unequally at the nodes, or solitary and then usually erect with 2 or 3 subequal branches at the first node, usually monopodial above, shortly and more or less unilaterally crisped-pubescent and with longer but unequal, pluricellular, red-headed glandular hairs. *Basal leaves* up to c.6cm wide (not well represented in herbarium specimens), divided to the base into 5; outline pentagonal; divisions rhombic, the median long-petiolulate (petiolule more than ⅓ as long as lamina) and the lateral and basal sharing a short common petiolule, all pinnatifid (but usually cut to the rachis above the first pair of lobes) into more or less ovate, deeply toothed lobes; tips of teeth and lobes more or less acute; both surfaces beset, especially on the veins, with pluricellular gland-hairs tapering strongly from a stout base to a small yellow head and (in the dried state) flattened; veins of upper surface also with fine antrorse pubescence; petiole 2 or 3 times as long as the lamina, with long but unequal red-tipped glandular hairs; stipules 4–6mm long, ovate or lanceolate. *Cauline leaves* up to 7cm wide, similar to the basal, decreasing in size, relative petiole length and complexity of lobing gradually upwards; stipules only 3–4mm long, narrowly triangular. *Inflorescence* diffuse, leafy; cymules 2-flowered or occasionally 3-flowered, the first often at the first node; bracteoles c.1mm long, peduncles 1–5cm long, erect; pedicels 3–15mm long, erect; peduncles and pedicels clothed as the stems. *Flowers* approximately erect, hypocrateriform. *Sepals* 4.5–6(–8 in cultivation)mm long including mucro c.0.8–1.2mm long, erect, flushed with red, eglandular-pubescent on the margins (only in the distal part of the inner sepals) and beset with long but unequal, pluricellular red-headed gland-hairs. *Petals* 8–9 x 2–3mm (limb 5.5 x 3.5–4mm in cultivation), abruptly contracted at the middle into a narrow claw with 2 keels on the adaxial side, rounded at apex, glabrous; colour pink with pale stripes. *Filaments* c.5mm long, evenly tapered, glabrous. *Style* c.5mm long, antrorsely hispidulous. *Stigmas* c.0.6mm long, pink. *Fruit* erect with rostrum 12–15mm, glabrous except for the stylar part; inner surface of awns glabrous; mericarps 2.5–3mm long, discharged with the seed inside, after discharge with a strand of long fibres attached near the apex on either side, brown, glabrous, obtuse at apex where there are 2–3(–5) collar-like keels, the surface elsewhere with a raised reticulum covering the upper half and more or less

undulate longitudinal ribs, well separated from the midrib, over the lower half. *Seeds* not examined.

HUBEI. Yichang to Patung (Wushan), near Patung (Wu Shan), spring 1888, *Henry* 5714 (BM, K).
SICHUAN. Dajian Lu distr.: 2450m, rec'd xii 1890, *Pratt* 281 (BM, K); 2450m, rec'd xii 1890, *Pratt* 295 (BM, K). Nanchuan Hsien, 1670m, v , *Fang* 821 (E).
YUNNAN - SELECTED SPECIMENS. Adunzi, Y. Tehching, Kaakerpo, 2800m, 4 vi 1937, Yü 8462 (KUN). Bei Ma Shan, 28°18'N, 99°01'E, 3050m, vi 1921, *Forrest* 19532 (E, K). Kiao Kia region, Tchao Kia Pin Tze, v 1909, *Ducloux* (Tén) 6064 (P). Kunming & distr.: Hiu Lin Ngay, above pagoda, 25 x 1899, *Ducloux* 700 (P); (as Kouy Tchéou = Kai Tchéou or Kwei Chow), vi 1908, *Cavalerie* 3074 (K, P) and Gan Chouen, v 1910, *Cavalerie* 3074 (P); Tsui Lehen, 8 v 1904, *Cavalerie* 3074 (K). Lancang Jiang, upper, Tsékou, 1895, *Biet* (?) 1553 (P). Lancang/Nu Jiang divide, Kari Pass, 27°40'N, 3200m, viii 1914, *Forrest* 12904 (E). Lo Shweli mt., i.e. Longchuan Jiang, summit, x 1937, *McLaren (V)* 52 (E). Tong Tchouan, Lou Pou, x 1909, *Ducloux (Tén)* 1439 (E) and 6424 (E). Above Yo Lin Chan, ix 1895, *Delavay* s.n. (P).

General distribution. Europe, Himalaya.

G. robertianum is entirely distinct from other Chinese species in its dissected leaves and hypocrateriform flowers with erect sepals and clawed petals. It was described from Europe, where it is widespread; it has separate distribution areas in the Himalayas and China. Since my description was first prepared I have cultivated *G. robertianum* from Sichuan (*Leslie* 33/81) and the above text has been amplified as a result. However, I have interpreted evidence of anthocyanin pigmentation in the vegetative parts as implying reddish colour in life, but the stock in cultivation has this pigment relatively weak, resulting in olive-green to orange-brown, depending of the intensity of the green colouring associated with it. It remains to be seen whether this is a constant difference from the European plant. The smaller flower-size, compared with that of most European plants, observed in the Chinese herbarium material is confirmed in the living plants, even though they give larger measurements. In European plants the sepals are 5–9.5mm long and the petals are 10–14mm long, with the limb measuring (4–)5.5–8 x (2.25–)3.5–5.5mm (Yeo, 1973; the minima reflect coverage of some unusually small-flowered populations). The leaf-lobing also seems to be less prolific, especially in the basal leaves. I have not yet seen living material of *G. robertianum* from the Himalayas.

Species incertae sedis

Geranium terminale Z. M. Tan in Bull. Bot. Res. 6: 53 et 63 (1986). Type: Sichuan: Xide, Tuanjie Commune, Wajiliangzi, alt.2800m. 13 vii 1979, *Xide Exped.* 586 (holo. ICD, non vidi).

This is a lax, broad-leaved plant, likened by its author to *G. hupehanum* (*G. henryi* var. *henryi*). It is known only from the type, and too many details are missing from the description to enable me to place it.

ACKNOWLEDGEMENTS

I am grateful to the authorities of the various herbaria, who have given me access to their collections and lent specimens, and to their staff members who have answered my questions about specimens and literature. Similarly I thank many private individuals and the staffs of many botanic gardens for helping me to build a collection of Chinese *Geranium* in Cambridge. I am especially grateful to Sarah Youngberg for careful transcription of most of the herbarium label data. I thank Mr D. H. Kent for drawing my attention to the existence of the name *Geranium eriostemum* Poiret, and an anyonymous reviewer for pointing out that a collection made by *Bock & Rosthorn* is kept in Oslo. The late William Gardener of East Mersea, near Colchester, kindly supplied translations of distribution data from *Iconographia Cormophytarum Sinicarum*. Frances Hibberd drew the diagram for Fig. 1.

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INDEX OF DETERMINATIONS

Bélard: 15 hispidissimum

Biet (?): 1553 robertianum

Bodinier: 1534 nepalense; 1575 robertianum

Bodinier (Laborde): 2018 sibiricum

Cavalerie: 914 nepalense; 2952 franchetii; 3074 robertianum; 3074 robertianum; 3074 robertianum; 3615 ocellatum; 7164 ocellatum

Chiao & Fan: 102 nepalense

Ching: 412 platyanthum; 20307 nepalense; 20787 hispidissimum; 20890 delavayi; 21209 stapfianum; 21446 yunnanense; 21914 nepalense; 30460 stapfianum

Chow: 9858 nepalense

Chu: 2332 nepalense; 2695 nepalense; 2937 platyanthum; 3959 wilfordii

Cunningham: 7 dahuricum; 85 orientalitibeticum; 104 orientalitibeticum; 118 nepalense?; 179 orientalitibeticum; 197 dahuricum; 362 refractum; 369 pylzowianum; 401 nepalense; 474 orientalitibeticum; 475 nepalense

David: 2194 platyanthum; 2244 platyanthum

Delavay: 1 ocellatum; (Geranium no.) 2 strictipes; 3 nepalense; 1944 umbelliforme; 1945 delavayi; 2165 strictipes; 2328 napuligerum; 2328 napuligerum; 2491 ocellatum; 2491 ocellatum; 2491 ocellatum; 2557 nepalense; 2647 yunnanense; 2756 hispidissimum; 2821 nepalense; 2821 sibiricum; 2969 napuligerum; 4827 hispidissimum; 6681 delavayi/sinense

Ducloux: 224 hispidissimum; 481 delavayi/sinense; 687 robertianum; 700 robertianum

Ducloux & Bodinier: 171 nepalense

Ducloux (Ngneou): 329 delavayi/sinense

Ducloux (Tén): 330 sinense; 1098 ocellatum; 1439 robertianum; 1440 duclouxii; 1441 sinense; 6064 robertianum; 6424 robertianum; 6425 duclouxii; 6426 sinense

Ducloux (Ty): 7093 robertianum; 7158 delavayi/sinense

Esquirol: 4379 sibiricum

Faber: 486 nepalense; 488 nepalense

Fang: 821 robertianum; 834 nepalense; 906 nepalense; 1393 nepalense; 1994 nepalense; 1994 wilfordii; 3509 nepalense; 3659 orientalitibeticum; 4024 pylzowianum; 4130 platyanthum; 4278 nepalense?; 4281 pratense; 4349 pylzowianum; 4349 stapfianum--cf; 4371 pratense; 5507 sibiricum

Farges: 110 wilfordii; 112 fusiforme; 112 henryi var. henryi

Farrer: 201 farreri

Feng: 1367 strictipes; 1402 delavayi; 1489 refractum; 1934 pogonanthum; 1963 nepalense

Forrest: 66 sinense; 132 hispidissimum; 797 delavayi; 1879 yunnanense; 2369 strictipes; 2369 strictipes; 2562 delavayi; 2637 stapfianum; 4218 yunnanense; 4279 nepalense; 4279 nepalense; 4280 nepalense; 4282 delavayi; 4283 sinense; 4956 nepalense; 4988 nepalense; 6058 delavayi; 6058 pogonanthum; 6113 strictipes; 6195 umbelliforme; 6198 stapfianum; 6302 delavayi; 6420 stapfianum; 6829 sinense; 8598 nepalense; 9070 pogonanthum; 9090 yunnanense; 10370 strictipes; 12904 robertianum; 14675 stapfianum; 16793 delavayi; 19037 stapfianum; 19532 robertianum; 19889 pylzowianum; 21989 napuligerum; 23172 stapfianum; 23172 stapfianum; 25519 yunnanense; 25537 polyanthes; 27844 stapfianum; 28195 sinense; 28521 refractum; 28567 stapfianum; 28828 yunnanense; 29201 pogonanthum; 29864 yunnanense; 30056 stapfianum; 30872 napuligerum; 30931 stapfianum

Hancock: ('Kew') 90 franchetii; 166 franchetii; 176 nepalense; 530 nepalense

Handel-Mazzetti: 57 nepalense; 480 ocellatum; 3089 nepalense; 3353 delavayi/sinense; 3358 hispidissimum; 3461 hispidissimum; 3796 stapfianum; 3798 strictipes; 4523 delavayi (cf.); 4523 yunnanense; 4533 refractum; 5152 sinense; 5470 strictipes; 7013 pogonanthum?; 7063 delavayi; 7271 stapfianum; 7289 delavayi (cf.); 9525 polyanthes; 10143 franchetii

Henry: 61 franchetii; 1687 wilfordii; 2232 wilfordii; 2645 wilfordii; 2777 wilfordii; 4197 wilfordii; 5341 nepalense; 5714 robertianum; 6154 franchetii; 6752 henryi var. henryi; 7343 wilfordii; 9270 nepalense; 10228 delavayi; 10228 delavayi; 10558 franchetii; 10606 ocellatum; 12882 ocellatum

Hopkingson: 832 sibiricum

Howell: 170 nepalense

Kang & Wen: 622 pylzowianum; 855 pylzowianum

Kuan & Wang: 28 orientalitibeticum; 581 refractum; 713 refractum; 1211 orientalitibeticum; 2377 nepalense; 2941 dahuricum

Kuang & Wang: 286 nepalense

Lancaster: 1664 hispidissimum

Law: 402 nepalense; 450 nepalense

Legendre: 472 nepalense; 816 nepalense; 1425 strictipes; 1518 franchetii

Licent: 244 sibiricum; 292 sibiricum; 524 sibiricum; 616 sibiricum; 1577 sibiricum?; 2371 sibiricum?; 4085 platyanthum; 4196 pylzowianum

Limpricht: 948 sinense; 984 delavayi; 1081 delavayi; 1606 orientalitibeticum; 1892 pylzowianum; 1895 refractum; 2005 platyanthum; 2184 refractum; 2209 refractum?

Liu: 1126 nepalense

Maire: 93 nepalense?; 145 robertianum; 177 nepalense; 752 nepalense; 836 nepalense; 884 hispidissimum; 884 hispidissimum; 1418 sibiricum?; 2572 sibiricum?; 2574 robertianum; 2575 hispidissimum; 2576 nepalense; 2577 hispidissimum

McLaren (AC.): 64 pylzowianum; 123 refractum

McLaren (B.): 172 delavayi; 186 yunnanense

McLaren (L.): 95 delavayi; 98 sinense; 98 delavayi/sinense
McLaren (N.): 146 stapfianum
McLaren (V.): 31 franchetii; 52 robertianum; 84 delavayi/sinense
Monbieg: 50 refractum
Mussot: 70 nepalense; 71 donianum; 72 dahuricum; 73 orientalitibeticum; 73 dahuricum
Peng: 12 nepalense
Pratt: 33 pylzowianum; 126 nepalense; 281 robertianum; 295 robertianum; 511 refractum
Rock: 4159 strictipes; 4352 strictipes; 4389 nepalense; 4443 strictipes; 4749 delavayi; 4789 nepalense; 4924 pogonanthum; 5018 stapfianum; 5288 sinense; 5399 stapfianum; 5649 pogonanthum; 5725 stapfianum; 6108 stapfianum; 6263 yunnanense; 9453 delavayi; 9733 yunnanense; 9850 stapfianum; 9902 stapfianum; 10001 stapfianum; 12225 platyanthum; 13184 farreri; 16316 refractum?; 16626 stapfianum; 16747 delavayi; 16749 refractum; 17542 pylzowianum; 17949 stapfianum; 18014 refractum; 18042 umbelliforme; 22142 refractum; 22165 stapfianum; 23051 pogonanthum; 23052 yunnanense; 23119 pogonanthum; 23119 yunnanense; 23418 refractum; 23464 yunnanense; 23466 yunnanense; 23673 stapfianum; 23766 refractum; 24104 delavayi; 24106 pogonanthum; 24486 pogonanthum; 24486 refractum
Schneider: 278 ocellatum; 652 ocellatum; 652 ocellatum; 1171 strictipes; 1171 delavayi; 1864 strictipes; 1869 strictipes; 1938 stapfianum; 1998 pogonanthum; 2088 nepalense; 2362 yunnanense; 2878 sinense; 3107 nepalense; 3291 pogonanthum; 3354 pogonanthum
Schoch: 90 franchetii; 91 nepalense
Silvestri: 1201 nepalense
Sino-Brit. Exped. Cangshang: K 028 nepalense
Soulié: 57 sibiricum; 58 pylzowianum; 386 pylzowianum; 553 orientalitibeticum; 616 orientalitibeticum
Stevens: 146 orientalitibeticum; 333 pratense
Sun & Chang: 574 nepalense; 879 nepalense; 1351 nepalense
Tai: 197 nepalense
Tén: 38 nepalense; 43 ocellatum; 89 sinense; 380 ocellatum; 1237 sinense; 1368 sinense; 1392 christensenianum
Tsai: 51749 nepalense; 52023 sinense; 52197 nepalense; 52836 nepalense; 53721 pogonanthum?; 53768 sibiricum; 54819 nepalense; 56017 nepalense; 56022 nepalense; 56032 nepalense; 57156 nepalense; 57604 nepalense; 58085 yunnanense; 58494 nepalense; 58637 yunnanense; 59116 nepalense; 59658 nepalense; 60630 nepalense; 60793 nepalense; 62035 nepalense; 62424 nepalense; 63028 nepalense; 63115 nepalense; 64623 yunnanense
Tsiang: 11817 nepalense
Tsiang & Wang: 16065 nepalense
Tsiang & Wang (A): 16477 franchetii
Tsiang & Wang (B): 16477 franchetii

Wang: 8102 nepalense; 20371 nepalense; 62795 nepalense; 63655 nepalense; 64184 nepalense; 65102 nepalense; 65221 polyanthes; 65528 stapfianum; 67621 nepalense; 67815 delavayi; 67883 nepalense; 68062 nepalense; 68127 nepalense; 68276 nepalense; 68376 pogonanthum?; 68451 yunnanense; 68642 refractum; 68810 refractum; 69150 nepalense; 70280 nepalense; 70555 strictipes; 70873 hispidissimum; 70934 strictipes; 71216 nepalense; 71296 hispidissimum; 71659 nepalense; 71888 nepalense; 71933 nepalense; 72927 ocellatum; 73069 nepalense; 77333 nepalense; 84595 ocellatum

Ward: 640 pogonanthum?; 745 refractum and delavayi; 922 stapfianum; 961 stapfianum; 3971 hispidissimum; 4040 strictipes; 4220 stapfianum; 4543 umbelliforme; 4778 delavayi; 4827 delavayi

Wilson: 666 franchetii; 1479 wilfordii; 1948 platyanthum; 1948a platyanthum; 1948 platyanthum; 1967 franchetii; 2201 henryi var. henryi; 2281 bockii; 2287 henryi var. henryi; 2348 bockii and fargesii; 2405 henryi var. wilsonii; 2439 platyanthum; 2440 bockii; 2441 refractum; 2442 retectum; 2443 refractum; 2545 krameri; 3298 platyanthum; 3299 refractum; 3300 orientalitibeticum; 3301 pratense; sibiricum

Yü: 301 nepalense; 303 nepalense; 1309 pogonanthum?; 1521 nepalense; 1537 sinense; 1541 hispidissimum; 6462 stapfianum; 6570 stapfianum; 6670 strictipes; 6805 stapfianum; 6872 pogonanthum?; 6905 refractum; 7096 refractum; 7118 pylzowianum; 7369 delavayi; 7621 delavayi; 7743 canopurpureum; 8462 robertianum; 8983 refractum; 9056 refractum; 9072 refractum; 9299 stapfianum; 11846 yunnanense; 12034 yunnanense; 12576 nepalense; 12647 delavayi; 15323 hispidissimum; 15410 stapfianum; 15426 pogonanthum; 15819 nepalense; 16948 pogonanthum; 19713 polyanthes; 19716 stapfianum; 19848 napuligerum; 19883 refractum; 20635 delavayi; 20804 refractum; 22166 refractum; 22393 yunnanense; 22423 refractum; 22498 delavayi; 22527 refractum; 22528 polyanthes

INDEX OF PLANT NAMES

The numbers refer to species-numbers in the text.

G. fusiforme Yeo = 14
G. hastatum Nakai = 32
G. henryi Knuth – 6
var. henryi
var. wilsonii (Knuth) Yeo
G. hispidissimum Franchet – 40
G. kariense Knuth = 20
G. krameri Franchet & Sav. – 2
G. kweichowense Huang = 41
G. lavergneanum Lévl. = 29
G. lavergneanum var. cinerascens Lévl. = 33
G. limprichtii Lingelsheim & Borza = 20
G. mairei Lévl. = 21
G. meiguense Z. M. Tan = 22
G. melanandrum Franch. = 19
G. moupinense Franch. – 37
G. multifidum D. Don non Andr. = 18
G. napuligerum misapplied = 24
G. napuligerum Franch. – 15
G. nepalense Sweet – 29
G. nepalense var. thunbergii (Lindley & Paxton) Kudo = 30
G. ocellatum Camb. – 41
G. ocellatum var. himalaicum Knuth = 41
G. ocellatum var. yunnanense Knuth = 41
G. oliganthum Huang = 29
G. orientali-tibeticum Knuth – 4
G. orientali-tibeticum misapplied = 3
G. palustre L. – see 30
G. palustre var. stipulaceum Franchet = 22
G. pinetorum Hand.-Mazz. – see 20
G. platyanthum Duthie – 26
G. platylobum (Franchet) Knuth = 40
G. platypetalum Franchet non Fischer & Meyer = 21
G. platyrenifolium Z. M. Tan – 12
G. pogonanthum Franchet – 22
G. polyanthes Edgeworth & J. D. Hooker – 35
G. pratense L. – 28
G. pseudofarreri Z. M. Tan – 8
G. pylzowianum Maxim. – 3
G. pylzowianum misapplied = 4, 17
G. refractoides Pax & Hoffm. = 19
G. refractum Edgew. & Hook.f – 19
G. retectum Yeo – 27
G. robertianum L. – 42
G. robertianum var. eriophorum (Lévl.) Lévl. = 42
G. rosthornii Knuth – 14
G. sibiricum L. – 33
G. sieboldii Maxim. = 2
G. sinense Knuth – 21
G. stapfianum Hand.-Mazz. – 17
G. stapfianum misapplied = 3
G. stenorrhizum Stapf = 18
G. strictipes Knuth – 39
G. strictipes misapplied = 17
G. strigellum Knuth = 9
G. strigosum Franchet non Burm. f. = 39
G. strigosum var. gracile Franchet = 39
G. strigosum var. grandiflorum Franchet = 39
G. strigosum var. hispidissimum Franchet = 40
G. strigosum var. platylobum Franchet = 40
G. strigosum var. strigosum = 39
G. tapintzense Huang = 41
G. terminale Z. M. Tan – see 6, post 42
G. thunbergii Siebold ex Lindley & Paxton – 30
G. umbelliforme Franchet – 36
G. wilfordii Maxim. – 32, and see 2
G. wilfordii var. glandulosum Z. M. Tan = 32
G. yesoense Franchet & Savatier – see 1
G. yuexiense Z. M. Tan – 31
G. yunnanense Franchet – 23
G. yunnanense misapplied = 22