

## 28. GALIUM Linnaeus, Sp. Pl. 1: 105. 1753.

拉拉藤属 *la la teng shu*

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Subshrubs to perennial or annual herbs. Stems often weak and clambering, often notably prickly or “sticky” (i.e., retrorsely aculeolate, “velcro-like”). Raphides present. Leaves opposite, mostly with leaflike stipules in whorls of 4, 6, or more, usually sessile or occasionally petiolate, without domatia, abaxial epidermis sometimes punctate- to striate-glandular, mostly with 1 main nerve, occasionally triplinerved or palmately veined; stipules interpetiolar and usually leaflike, sometimes reduced. Inflorescences mostly terminal and axillary (sometimes only axillary), thyrsoid to paniculiform or subcapitate, cymes several to many flowered or infrequently reduced to 1 flower, pedunculate to sessile, bracteate or bracts reduced especially on higher order axes [or bracts sometimes leaflike and involucre], bracteoles at pedicels lacking. Flowers mostly bisexual and monomorphic, hermaphroditic, sometimes unisexual, andromonoecious, occasionally polygamo-dioecious or dioecious, pedicellate to sessile, usually quite small. Calyx with limb nearly always reduced to absent; hypanthium portion fused with ovary. Corolla white, yellow, yellow-green, green, more rarely pink, red, dark red, or purple, rotate to occasionally campanulate or broadly funnelform; tube sometimes so reduced as to give appearance of free petals, glabrous inside; lobes (3 or)4(or occasionally 5), valvate in bud. Stamens (3 or)4(or occasionally 5), inserted on corolla tube near base, exerted; filaments developed to  $\pm$  reduced; anthers dorsifixed. Inferior ovary 2-celled,  $\pm$  didymous, ovoid, ellipsoid, or globose, smooth, papillose, tuberculate, or with hooked or rarely straight trichomes, 1 erect and axile ovule in each cell; stigmas 2-lobed, exerted. Fruit on pedicels sometimes elongating during development, green, gray, or infrequently white (to red, orange, or black), mostly dry to leathery schizocarps, infrequently spongy, rarely  $\pm$  fleshy and berrylike, ellipsoid to subglobose; schizocarps separating into 2 indehiscent mericarps, each with 1 seed, subglobose, ellipsoid-oblong, or reniform, smooth and glabrous to tuberculate and/or covered with trichomes often hooked and clinging; seeds small, grooved ventrally (i.e., adaxially); testa membranous; endosperm corneous; embryo curved; cotyledons leaflike; radicle terete, inferior.

More than 600 species: worldwide, mostly in meridional to temperate but also in alpine and arctic regions or in subtropical and tropical zones at higher elevations; 63 species (23 endemic, four of unconfirmed occurrence) in China.

*Galium* is by far the largest and most widespread genus within the tribe Rubieae (subfamily Rubioideae). According to the most recent contributions (Natali et al., *Opera Bot. Belg.* 7: 193–203. 1996; Ehrendorfer et al., *Fl. Iranica* 176: 1–287. 2005; Bremer & Eriksson, *Int. J. Pl. Sci.* 170: 766–793. 2009; Soza & Olmstead, *Taxon* 59: 755–771. 2010), this tribe is closest to Theligoneae, Putorieae, and Paederieae, and includes the following genera treated (or mentioned) in the present flora: *Asperula*, *Cruciata* Miller, *Galium*, *Kelloggia*, *Leptunis*, *Microphysa*, *Phuopsis*, *Rubia*, and *Sherardia* Linnaeus.

So far, the genera *Cruciata* and *Sherardia* have not been found in China yet but may be expected there because of their partly weedy character and widely adventive occurrence. They are included in the key below for future reference but not among the full generic presentations. *Sherardia arvensis* Linnaeus is widely distributed in warm temperate and high-elevation tropical regions and can be separated from *Asperula*, *Phuopsis*, *Leptunis*, or *Galium* by its terminal capitate inflorescences enclosed by leaflike bracts, its clearly developed calyx with 6 acute lobes, and its pink or violet corollas with well-developed funnelform tubes and 4 lobes.

Among the few *Cruciata* species, the W Eurasiatic *C. pedemontana* (Bellardi) Ehrendorfer appears occasionally as an adventive in warm temperate regions. It is common, e.g., in SE North America, and could be found in China too. *Cruciata* can be separated from *Galium* by its flowering stems with vegetative apices and the inflorescences consisting only of lateral axillary cymes on middle and lower stem nodes. These cymes are equal to or shorter than the subtending leaves when fully developed. In contrast, the inflorescences are mostly terminal and axillary and longer than the leaves in *Galium*.

The characters relevant for the taxonomy of *Galium* and other Rubieae deserve some comments. Life and growth forms are important, particularly with respect to the differentiation into half-shrubs, herbaceous perennials, and annuals. Stem and leaf posture, consistency, shape, and indumentum (e.g., pubescent or retrorsely aculeolate with recurved microhairs) are often quite diverse and may vary within species or even populations. The true leaves are always opposite and 2, but interpetiolar stipules may vary from inconspicuous and divided or simple to enlarged and leaflike, forming whorls of 4 or up to 6 and more. During seedling and shoot development all these taxa pass through the 2- and 4-whorl stage, but some taxa remain at this stage, while others continue to develop more numerous whorl elements toward the middle of their stems. This is a most informative differential character within Rubieae. Other relevant features relate to leaf shape, venation, texture, and particularly indumentum. Here, the presence of longer or shorter microhairs (use a lens) on surfaces and particularly margins as well as their forward or backward direction is of taxonomic importance.

Other morphological characters decisive for Rubieae taxonomy concern the inflorescences (e.g., the position and structure of the cymes). Flower shape is essential for the traditional separation of the genera *Asperula* (with salverform, funnelform, or cup-shaped corollas) and *Galium* (with  $\pm$  rotate corollas). It is now clear that there are transitions between these character states and that even closely related taxa may differ in this respect. So far, it has been possible to provisionally maintain *Asperula* and *Galium* by the transfer of obviously misplaced taxa and by using the presence or absence of bracts and bracteoles as a differential character for the two genera (see Ehrendorfer et al., loc. cit. 2005).

The indumentum of ovaries and fruit as well as fruit consistency also vary strongly within Rubieae. Informative are, for example,  $\pm$  fleshy berries (as in *Relbunium* Benthham & J. D. Hooker, *Rubia*, and certain *Galium* taxa) vs. dry schizocarps or the presence vs. absence of hairiness and whether the trichomes are hooked (i.e., the fruit disperse as “stick-tights” on animals) vs. straight. However, the distinction between all these structures is arbitrary, and there are even transitions between trichomes and tuberculate protuberances of various shapes as well as between hairy and glabrous.

All this is well illustrated by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: f. 1. 1998). Furthermore, ovary and fruit indumentum and surface structures may change during development and sometimes vary genetically within species or even within populations, as in several *Galium* species. In general, authors in other regions have documented infraspecific variation from glabrous to densely hairy or tuberculate fruit but traditionally have only separated plants with hooked trichomes into different species. However, intrepid Chinese authors have easily combined these latter morphotypes, e.g., in *G. dahuricum* sensu W. C. Chen (in FRPS 71(2): 255. 1999), whereas Fl. Japan (3a: 238–239. 1993) distinguished *G. manshuricum* on the basis of this character. Only careful studies and field observations can clarify such cases, as in *G. spurium*, where the infraspecific variation of fruit, either smooth, tuberculate, or covered with hooked hairs, has been proven.

Further differential characters for the taxonomy of Rubieae come from the fields of palynology (e.g., number of colpi), karyology (e.g., deviations from the normal chromosome base number  $x = 11$  in *Asperula* sect. *Cynanchicae* (Candolle) Boissier with  $x = 10$  or in *Galium* sect. *Aparinoides* (Jordan) Grenier with  $x = 12$ ; common occurrence of polyploidy), and reproductive biology. Most of the perennial Rubieae taxa have conspicuous hermaphroditic or andromonoecious flowers and inflorescences and are insect-pollinated and self-incompatible outbreeders (e.g., *Phuopsis* or *G. boreale* and *G. verum*). Nevertheless, for several annuals with small and inconspicuous flower aggregates selfing and autogamy have been documented (e.g., *G. aparine*, *G. spurium*, and *Sherardia arvensis*). Furthermore, polygamodioecy and dioecy occur in some groups (e.g., *G. elegans*). Up to now, only few and insufficient data from all these fields are available for Asian Rubieae species and have not been mentioned in FRPS. Nevertheless, such data are significant and will have to be addressed in more detailed future systematic Rubieae studies from this region.

The  $\alpha$ -taxonomy of Rubieae in E Asia is still in a problematic state. A general survey of the collections at the herbaria KUN, MO, PE, W, and WU has revealed the existence of many very polymorphic, complex, and insufficiently understood species groups. Therefore, the present treatment has to be regarded as provisional.

A particularly critical case concerns several *Galium* species described by H. Léveillé from 1904–1917 (see Lauener & Ferguson, Notes Roy. Bot. Gard. Edinburgh 32: 103–115. 1973). These descriptions are most fragmentary and the relevant types are not yet studied sufficiently (but see Mill, Edinburgh J. Bot. 53: 193–213. 1996). Relevant taxa in alphabetical order are *G. blinii* (see under that name), *G. bodinieri* (see under *G. blinii* and *G. rebae*), *G. cavaleriei* (see under *G. asperifolium*), *G. comarii* (see under *G. dahuricum*), *G. esquirolii* (see under *G. asperifolium*), *G. hongnoense* (see under *G. spurium*), *G. mairei* (see under *G. elegans*), *G. martini* (see under *G. bungei*), *G. quinatum* (see under *G. blinii*), *G. remotiflorum* (see under *G. bungei*), and *G. venosum* (see under *G. bungei*).

The treatment of *Galium* for the *Flora of Taiwan* by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998; Fl. Taiwan, ed. 2, 4: 254–259. 1998) is not satisfactory in several aspects: keys and descriptions are rather idealized and lack carefully observed ranges of morphological variation for the taxa; species are circumscribed more narrowly and based on different characters than used by other authors in the region (e.g., presence vs. absence of leaf indumentum is considered variable within species by most other authors); the treatment is not well reconciled with continental *Galium* taxonomy (e.g., there are no references to the Russian floras, and names synonymized by others are used without explanation); and at least two names based on types from Taiwan are missing.

With respect to a more “natural” and general taxonomic classification of the Rubieae and *Galium*, a number of recent morphological, karyological, palynological, and particularly DNA-analytical studies (e.g., Natali et al., loc. cit.; Robbrecht & Manen, Syst. & Geogr. Pl. 76: 85–146. 2006; Bremer & Eriksson, loc. cit.; Soza & Olmstead, loc. cit.) are available. They show that *Theligonum* should be placed into a separate tribe (Theligoneae), that the tribe Rubieae is monophyletic, and that *Kelloggia* (as subtribe Kelloggiinae, still with normal Rubiaceae stipules, calyx teeth, and 3-colpate pollen, but already with hooked trichomes on the dry mericarps) occupies a basal position in Rubieae. The Central American genus *Didymaea* J. D. Hooker (still with normal stipules but with the calyx already lacking, 5-colpate pollen, and seeds separating from the fleshy pericarp) represents a link to the genus *Rubia* in the true Rubiinae. Their stipules are nearly always leaflike, the pollen is polycolpate, and the seeds never separate from the pericarp. *Rubia*, a well-circumscribed and certainly monophyletic genus, is always perennial, has 5-lobed corollas, and berrylike fruit.

The remaining Rubiinae are also monophyletic as a whole, but their traditional genera *Asperula*, *Bataprine* Nieuwland, *Callipeltis* Steven, *Crucianella* Linnaeus, *Cruciata*, *Galium*, *Leptunis*, *Mericarphaea* Boissier, *Microphysa*, *Phuopsis*, *Relbunium*, *Sherardia*, *Valantia* Linnaeus, and *Warburgina* Eig are all essentially interdigitated. They are difficult to separate and can hardly be brought into concordance with available phylogenetic data. These advanced Rubiinae tend to develop more and more apomorphic character profiles, i.e., change from perennial to annual, increase in numbers of leaflike stipules from 4 to numerous, loss of bracts and prophylls in the inflorescences, reduction from 5-lobed to (3 or)4-lobed corollas, specialization of mericarps, etc. As shown by the most comprehensive phylogram available so far (Natali et al., loc. cit.: f. 2; Soza & Olmstead, loc. cit.: f. 1, 2) and new findings (unpubl.), these more apomorphic Rubiinae form a polytomy or a grade with seven parallel clades. The most basal clade (1) consists of the monotypic *Galium* sect. *Cymogalia* Pobedimova only. The following *Sherardia* clade (2) includes *Crucianella*, *Phuopsis*, *Sherardia*, and several sections of *Asperula* together with *Leptunis*. Separate clades are formed by *G.* sect. *Depauperata* Pobedimova (3), *A.* sect. *Glabella* Grisebach, including *G.* sect. *Aparinoides* (4), and *A.* sect. *Asperula* (5). The *Cruciata* clade (6) consists not only of the genera *Cruciata* and *Valantia* but also of all sections of *Galium* (including the traditional genera *Bataprine*, *Microphysa*, and *Relbunium*) that form whorls of 2 leaves and normally not more than 2 even-sized leaflike stipules. Finally, the *G.* sect. *Galium* clade (7) comprises this and various other sections of *Galium*, which regularly develop whorls of leaves and leaflike stipules with 5 to more elements.

From the above data and the fact that a number of major groups of Rubiinae have not been DNA-analyzed yet, it is obvious that it is still difficult and partly impossible to harmonize DNA-supported clades with the traditional genera and sections. Thus, extensive changes are expected for generic and sectional circumscriptions within Rubiinae in the future. Therefore, we refrain from taxonomic changes for the present flora, list taxa in alphabetical order, and only supplement phylogenetic comments. Thus, the present treatment in principle follows FRPS (71(2): 216–286. 1999), mainly based on Pobedimova et al. (Fl. URSS 23: 287–381. 1958), but also considers Ehrendorfer et al. (loc. cit. 2005). In order to make comparison with available phylogenetic data and present infrageneric classification easier, relevant information is inserted as a “Taxonomic Conspectus” before the individual species descriptions. It was not until this volume was ready for the press that the need for the nomen novum, *Galium glabriusculum*, was discovered; therefore, this species alone is outside of the alphabetical order.

Here the key to species of *Galium* is extensively revised from that of FRPS. It includes all of the Chinese *Galium* species with full ranges of differential character variation. Furthermore, it keys out all other Rubieae genera which are easily confused with *Galium* and are documented or can be expected in China. Details on the genera *Asperula*, *Leptunis*, *Microphysa*, *Phuopsis* and *Rubia* can be found where they are listed in alphabetical order, references to *Cruciata* and *Sherardia* appear in the comments above.

Several species are keyed out more than once in the present key because they are circumscribed by combinations of characters rather than by unique features. Furthermore, many *Galium* species are markedly variable because of genetic differentiation (e.g., *G. bungei*, *G. elegans*) but also because of phenetic plasticity due to different environmental conditions. References to the number of leaves and leaflike stipules in whorls as well as leaf measurements refer to middle stem regions. Measurements of organs with hairy surfaces (e.g., leaves, fruit, and mericarps) here apply to the solid surface of the structure and do not include the trichomes. The terms “leaf whorl,” “ovary,” and “uncinate trichome” follow common usage in *Galium*. Intraspecific taxa are adopted from FRPS in order to facilitate future and more detailed work on this group and comparison with other floras. They are not included in the following main key but are subordinated under the relevant species in alphabetical order and keyed out there.

### Taxonomic conspectus of the Rubieae (excluding *Kelloggia* and *Rubia*)

In FRPS (71(2): 216–286. 1999) the taxa of *Galium* were placed in the following sections (designated here by capital letters): *G.* sect. *Depauperata* (A), *G.* sect. *Aparine* (B), *G.* sect. *Pseudaparine* Lange (C), *G.* sect. *Cymogalia* (D), *G.* sect. *Trachygalium* (E), *G.* sect. *Leptogalium* Lange (F), *G.* sect. *Platygalium* (G), *G.* sect. *Galium* (H), *G.* sect. *Leiogalium* (I), *G.* sect. *Trichocarpa* (Pobedimova) Pobedimova (J), *G.* sect. *Asperuloides* Pobedimova (K), and *G.* sect. *Brachyantha* (Boissier) Pobedimova (L). Some species of uncertain position were classified as dubious (M). Species accepted in the present treatment but lacking in FRPS are designated as (Z). For comparison, a current (e.g., Jelenevsky et al., *Novosti Sist. Vyssh. Rast.* 35: 174–187. 2003; Ehrendorfer et al., *Fl. Iranica* 176: 1–287. 2005), DNA-analytically supported (e.g., Natali et al., *Opera Bot. Belg.* 7: 193–203. 1996; Soza & Olmstead, *Taxon* 59: 755–771. 2010; Ehrendorfer, unpubl.) but still provisional taxonomic conspectus is presented below. It lists all species here accepted under their clades and sections. For the clades 1–6 one should compare the comments above, for the sections compare Ehrendorfer et al. (loc. cit.). The placement of *Galium* species into sections (or lack of placement) by FRPS is indicated by showing the relevant letters used above in parentheses after the species names.

#### Clade 1

*Galium* sect. *Cymogalia* Pobedimova s.s.

39. *Galium paradoxum* (D)

#### Clade 2

- Phuopsis stylosa*  
*Sherardia arvensis*  
*Leptunis trichodes*  
*Asperula oppositifolia*

#### Clade 3

*Galium* sect. *Depauperata* Pobedimova

16. *Galium exile* (A; incl. *G. songaricum* sensu FRPS)

#### Clade 4

*Galium* sect. *Aparinoides* (Jordan) Grenier

27. *Galium karakulense* (E)  
25. *Galium innocuum* (as *G. trifidum*: E; incl. “*G. palustre*”)

#### Clade 5

*Asperula* sect. *Asperula*

- Asperula orientalis*

#### Clade 6

*Galium* sect. *Platygalium* W. D. J. Koch s.l.

9. *Galium bungei* (E; incl. *G. martini*: M)  
45. *Galium sabwinense* (E)  
12. *Galium crassifolium* (A)  
31. *Galium linearifolium* (E)  
21. *Galium hirtiflorum* (Z)  
20. *Galium glandulosum* (A)  
18. *Galium forrestii* (D)  
44. *Galium rupifragum* (Z)  
35. *Galium morii* (D)  
54. *Galium tarokoense* (A)  
34. *Galium minutissimum* (M)

36. *Galium nankotaizanum* (M; incl. *G. maborasense*)

47. *Galium serpylloides* (A)

29. *Galium kinuta* (G)

24. *Galium hupehense* (M)

30. *Galium kunningense* (Z)

17. *Galium formosense* (as *G. kwanzanense*: M)

15. *Galium elegans* (D)

63. *Galium yunnanense* (M)

26. *Galium kamschaticum* (D)

10. *Galium chekiangense* (as *G. nakaii*: G)

*Microphysa elongata*

40. *Galium platygalium* (K)

32. *Galium maximoviczii* (K)

7. *Galium boreale* s.l. (G)

60. *Galium turkestanicum* (M)

#### Clade 7

[*Galium* s.s.]

*Galium* sect. *Hylaea* (Grisebach) Ehrendorfer s.l.

37. *Galium odoratum* (J)

4. *Galium asperuloides* (A)

22. *Galium hoffmeisteri* (as subsp. of *G. asperuloides*: A)

14. *Galium echinocarpum* (A)

53. *Galium takasagomontanum* (M)

59. *Galium triflorum* (A)

58. *Galium trifloriforme* (Z)

*Galium* sect. *Trachygalium* K. Schumann s.l.

48. *Galium sichuanense* (Z)

13. *Galium dahuricum* (as “*G. davuricum*”: F; incl. *G. comarii*, *G. nietherthii*, *G. pseudoasprellum*)

56. *Galium tokyoense* (as var. of “*G. davuricum*”: F)

41. *Galium prattii* (M)

52. *Galium taiwanense* (M)

3. *Galium asperifolium* (I)

6. *Galium blinii* (as syn. of *G. asperifolium* var.: I; incl. *G. quinatum*: M)

51. *Galium sungpanense* (A)

42. *Galium pusillosetosum* (A)

1. *Galium acutum* (M)

43. *Galium rebae* (Z)

33. *Galium megacyttarion* (Z)

5. *Galium baldensiforme* (A)

49. *Galium glabriusculum* (A)

28. *Galium karataviense* (as *G. rivale* s.l.: K)

61. *Galium uliginosum* (F)

*Galium* sect. *Leiogalium* Ledebour

38. *Galium paniculatum* (M; incl. *G. xinjiangense*: J)

*Galium* sect. *Orientalium* Ehrendorfer

8. *Galium bullatum* (I)

*Galium* sect. *Galium*

23. *Galium humifusum* (L)

62. *Galium verum* (H)

11. *Galium consanguineum* (as *G. majmechense*: H)

46. *Galium saurense* (M)

*Galium* sect. *Aparine* W. D. J. Koch s.s.

50. *Galium spurium* (as *G. aparine* var. *tenerum*: B)

2. *Galium aparine* (B)

*Galium* sect. *Kolgyda* Dumortier s.s.

57. *Galium tricorntum* (as *G. tricornis*: B)

*Galium* sect. *Microgalium* Grisebach

19. *Galium ghilanicum* (Z)

55. *Galium tenuissimum* (C)

**Key to species of *Galium* and to related genera of the Rubiaceae**

- 1a. Interpetiolar stipules inconspicuous, multifid or fimbriate, not leaflike and not forming whorls with true leaves; corolla funnelform, (4 or)5-lobed; ovary and dry mericarps with hooked trichomes ..... *Kelloggia* (see p. 183)
- 1b. Interpetiolar stipules mostly leaflike and in whorls with true leaves, rarely reduced.
  - 2a. Corolla lobes regularly 5; fruit fleshy, mericarps berrylike, 2(or 1, by non-development), often dispersed together ..... *Rubia* (see p. 305)
  - 2b. Corolla lobes usually 4 (rarely 3); fruit dry or leathery, mericarps mostly 2, nearly always separating for dispersal.
    - 3a. Leaves in middle stem region opposite, with stipules reduced or  $\pm$  leaflike and in whorls of 4 but then always clearly smaller than true leaves.
      - 4a. Corolla pink, funnelform, with well-developed tube longer than lobes; fruit smooth ..... *Asperula oppositifolia* (see p. 78)
      - 4b. Corolla white, rotate, with tube shorter than lobes; fruit with uncinatate trichomes.
        - 5a. Perennial herbs; leaves 5–30  $\times$  5–23 mm, obtuse to truncate at base, on petioles 1.5–10 mm; flowers 3–11 in cymes; corolla with 4 lobes ..... 39. *G. paradoxum*
        - 5b. Annual herbs; leaves 2–12  $\times$  1–4 mm, acute to cuneate at base, subsessile or on short petioles; flowers solitary at each node; corolla mostly with 3 lobes ..... 16. *G. exile*
    - 3b. Leaves in middle stem region opposite and with very similar leaflike stipules in whorls of 4–16.
      - 6a. Leaf apex rounded, obtuse, or  $\pm$  blunt, never acute or with a hyaline mucro; leaves in whorls of 4–6, linear to broadly oblong, 1-nerved, dried blackening; ripe mericarps globose, didymous and only with a short zone of contact, glabrous; corolla cup-shaped to slightly campanulate, 3- or 4-merous.
        - 7a. Inflorescences with many-flowered cymes; corolla 4-lobed, 2.5–4 mm in diam.; leaves mostly 15–20  $\times$  5–8 mm ..... 27. *G. karakulense*
        - 7b. Inflorescences with 1–3(or 4)-flowered cymes; corolla mostly 3-lobed, 1–1.8 mm in diam.; leaves mostly 3–8  $\times$  1–2 mm ..... 25. *G. innocuum*
      - 6b. Leaf apex mostly  $\pm$  acute, often with a hyaline mucro; leaves in whorls of 4–16, sometimes broader and with 3–5 palmate nerves; ripe mericarps ovoid to subglobose, with a longer zone of contact and with diverse surface structures; corolla diverse, but often rotate and always 4-merous.
        - 8a. Leaves and leaflike stipules in middle stem region never in whorls of more than 4 (if rarely in whorls of up to 6 then leaves with 3–5 palmate principal veins), from linear to broadly ovate.
          - 9a. Stem apex vegetative, with few- to several-flowered lateral cymes only in leaf axils and shorter than or  $\pm$  equal to subtending leaves, nodding in fruit ..... *Cruciata* (see comments above)
          - 9b. Stem apex usually floriferous, with terminal and axillary cymes, often longer than subtending leaves and mostly not nodding in fruit.
            - 10a. Condensed plants of rocks or high elevations; stems usually less than 10 cm tall, glabrous or with spreading (but never retrorse) hairs; leaves mostly  $\pm$  ovate, (1–)3–8(–20)  $\times$  (0.8–)2–4(–10) mm, with 1–3 main veins; corolla rotate, often only 1.5–2 mm in diam.; mericarps with spreading (rarely appressed) hooked or  $\pm$  straight trichomes.
              - 11a. Mericarps with  $\pm$  straight hairs, 2–2.5 mm in diam.; stems mostly pilose or hirtellous.
                - 12a. Fruiting pedicels straight; Xizang ..... 47. *G. serpylloides*
                - 12b. Fruiting pedicels nodding; Taiwan ..... 36. *G. nankotaizanum*
              - 11b. Mericarps with weakly to strongly curved and uncinatate trichomes; stems partly glabrous.
                - 13a. Corolla ca. 3 mm in diam.; stems glabrous ..... 53. *G. takasagomontanum*
                - 13b. Corolla 1.2–2 mm in diam.; stems  $\pm$  hairy or glabrous.
                  - 14a. Stems  $\pm$  hairy.
                    - 15a. Leaves ovate to broadly lanceolate, acute, up to 3.5 mm wide; Yunnan ..... 44. *G. rupifragum*
                    - 15b. Leaves broadly elliptic to obovate, obtuse and mucronate, up to 10 mm wide; Taiwan ..... 17. *G. formosense*
                  - 14b. Stems glabrous; Taiwan.
                    - 16a. Leaves very small, only 0.8–1 mm wide, with 1 main vein only; fruit hairs spreading ..... 34. *G. minutissimum*
                    - 16b. Leaves wider, with 1 or 3 main veins; fruit hairs appressed.
                      - 17a. Leaves with 3 main veins; corolla only ca. 1.2 mm in diam. .... 35. *G. morii*
                      - 17b. Leaves with 1 main vein; corolla ca. 2 mm in diam. .... 54. *G. tarokoense*
        - 10b. Taller plants, usually of lower elevations with larger leaves (if plants  $\pm$  condensed then stem hairs retrorsely curved or fruit hairs appressed but not hooked).

- 18a. Leaves with 1 principal vein or 2 lateral veins only weakly visible and not extending past middle of blade.
- 19a. Open corollas funnelform, 2.5–3 mm, tube somewhat shorter than lobes; fruit with pericarp smooth to granular, becoming slightly inflated, enclosing both mericarps at dispersal ..... *Microphysa elongata* (see p. 216)
- 19b. Open corollas rotate, fused basal part much shorter than lobes; mericarps clearly separated.
- 20a. Stems ± strigose-hirsute, with hairs ± retrorse (but not retrorsely aculeolate); leaves ovate or elliptic to linear-lanceolate, broadest ± in middle, at lower side usually with glandlike spots; flowers unisexual, usually yellowish, ± greenish, or reddish; fruit normally with uncinata trichomes.
- 21a. Plants usually less than 15 cm tall, strongly branched from base; leaves often less than 8 mm, mostly glabrescent or glabrous, subleathery; inflorescences with few-flowered, bracteate cymes ..... 20. *G. glandulosum*
- 21b. Plants usually more than 15 cm tall, little branched; leaves usually longer than 8 mm, hairy on both sides; inflorescences paniculate to corymbiform, little bracteate.
- 22a. Leaves linear-elliptic to narrowly lanceolate, mostly 8–17 × 1–2.5 mm, dried rather papery; inflorescence paniculate ..... 21. *G. hirtiflorum*
- 22b. Leaves ovate-elliptic, mostly 8–12 × 3–5 mm, dried rather subleathery; inflorescence corymbiform ..... 18. *G. Forrestii*
- 20b. Stems glabrous or with indumentum, but not with retrorse hairs; leaves often broadest above middle and thinner, without glandlike spots; flowers usually bisexual.
- 23a. Leaves ± linear, often longer than 20 mm, in addition to 1 principal, with 2 weaker lateral veins; corolla 4–5 mm in diam.
- 24a. Leaves linear-spatulate, 1–4 mm wide; inflorescences loose, broadly paniculiform; ovaries and fruit glabrous and smooth ..... 31. *G. linearifolium*
- 24b. Leaves linear-lanceolate, 3–9 mm wide; inflorescences dense, elongate-paniculate; ovaries and fruit with sparse hooked trichomes or glabrous ..... 60. *G. turkestanicum*
- 23b. Leaves not linear, mostly shorter than 20 mm; corolla smaller.
- 25a. Leaves ovate, length/breadth index 2 or less, in addition to 1 principal, with 2 weaker lateral veins; corolla larger; fruit with spreading hooked or straight hairs; Taiwan.
- 26a. Mericarps with straight trichomes; corolla 2–2.5 mm in diam.; stems pilose or glabrescent ..... 36. *G. nankotaizanum*
- 26b. Mericarps with hooked trichomes; corolla ca. 3 mm in diam.; stems glabrous ..... 53. *G. takasagomontanum*
- 25b. Leaves ovate-oblong to lanceolate, length/breadth index 2 or more, with only 1 principal vein; corolla 1.5–2 mm in diam.; ovaries and fruit glabrous or with various indumentum.
- 27a. Leaves dried subleathery; fruit with appressed, ± curved (but not uncinata) hairs; Shanxi ..... 12. *G. crassifolium*
- 27b. Leaves dried papery; fruit with various indumentum.
- 28a. Plants ascending, weak, sparsely hairy or glabrous; inflorescence few flowered, peduncles and pedicels very thin and elongated, latter mostly 4–8 mm; fruit with spreading uncinata trichomes ..... 45. *G. salwinense*
- 28b. Plant erect, more robust, indumentum diverse; inflorescences ± many flowered, peduncles and pedicels thicker and shorter, latter mostly 2–4 mm; fruit tuberculate, with appressed or spreading hooked trichomes, or more rarely smooth ..... 9. *G. bungei*
- 18b. Leaves with 3–5 palmate principal veins, lateral veins well marked and extending for more than half of blade length.
- 29a. Corolla funnelform or cup-shaped, 2–5 mm in diam., with fused lower part ± as long as lobes; ovaries and fruit glabrous.
- 30a. Corolla cup-shaped or campanulate, 2–2.7 mm in diam.; cauline leaves broadly lanceolate, always in whorls of 4 ..... 30. *G. kunmingense*
- 30b. Corolla funnelform or campanulate, 2.5–5 mm in diam.; middle stem leaves ovate to elliptic, in whorls of 4–6.
- 31a. Open corollas 3.5–5 mm in diam.; cauline leaves usually in whorls of 4, 12–28 mm ..... 40. *G. platygalium*

- 31b. Open corollas 2.5–3.5 mm in diam.; cauline leaves in whorls of 4–6(–8),  
23–53 mm ..... 32. *G. maximoviczii*
- 29b. Corolla rotate, (1–)2–5 mm in diam., with fused base much shorter than lobes.
- 32a. Leaves linear to linear-lanceolate, 27–40 × 3–9 mm, in addition to 1 principal, with  
2 weaker lateral veins; corolla 4–5 mm in diam.; ovaries and fruit with sparse  
uncinate trichomes or glabrous ..... 60. *G. turkestanicum*
- 32b. Leaves lanceolate to ovate, shorter, 3 principal veins mostly readily visible.
- 33a. Fruit glabrous, smooth to granular-papillose, or with appressed and ± hooked or with  
spreading and straight (but never with spreading and hooked) trichomes.
- 34a. Open corollas 3–4 mm in diam.; stems (except nodes) mostly glabrous and smooth.
- 35a. Leaves ovate-lanceolate to ovate, papillose, length/breadth index mostly 2.5 or  
less; cymes rather few flowered; ovaries and fruit with ± appressed, apically  
somewhat bent trichomes ..... 10. *G. chekiangense*
- 35b. Leaves mostly rather narrowly lanceolate, smooth or ± hairy, length/breadth  
index mostly 3 or more; cymes many flowered; ovaries and fruit glabrous or  
with various indumentum ..... 7. *G. boreale*
- 34b. Open corollas (1–)2–2.5 mm in diam.; stems glabrous or ± hairy.
- 36a. Cauline leaves broadly to narrowly lanceolate, length/breadth index often  
3.5 or more.
- 37a. Stems hairy throughout; leaves lanceolate; fruit with straight hairs or rarely  
glabrous ..... 24. *G. hupehense*
- 37b. Stems (except nodes) glabrous; leaves ovate-lanceolate (sometimes also broader),  
apex subacute to acuminate, striate-punctate glandular below; fruit glabrous  
and smooth ..... 29. *G. kinuta*
- 36b. Cauline leaves narrowly to broadly ovate-lanceolate, length/breadth index usually  
3 or less.
- 38a. Leaves 6–30 × 3–20 mm; fruiting pedicels straight; fruit glabrous or scaberulous;  
mainland ..... 15. *G. elegans*
- 38b. Leaves 4–10 × 2–5 mm; fruiting pedicels nodding; fruit with ± straight  
trichomes; Taiwan ..... 36. *G. nankotaizanum*
- 33b. Fruit with ± spreading and uncinat trichomes.
- 39a. Open corollas 3 mm or more in diam.; stems (except nodes) often glabrous and smooth.
- 40a. Leaves lanceolate to ovate-lanceolate or elliptic, length/breadth index 3.5 or more,  
apex acute to acuminate ..... 7. *G. boreale*
- 40b. Leaves ovate, length/breadth index less than 3.
- 41a. Leaf apex obtuse to rounded, usually mucronate; mainland ..... 26. *G. kamschaticum*
- 41b. Leaf apex acuminate; Taiwan ..... 53. *G. takasagomontanum*
- 39b. Open corollas 2.5 mm or less in diam.; stems often ± hairy.
- 42a. Leaves ovate-lanceolate to narrowly elliptic, with acute apex, length/breadth  
index normally more than 2.5 ..... 63. *G. yunnanense*
- 42b. Leaves ovate to broadly elliptic, with obtuse to rounded apex, entire or shortly  
mucronate, length/breadth index normally less than 2.5.
- 43a. Leaves up to 20 mm wide; plants slender to usually rather robust; mainland ..... 15. *G. elegans*
- 43b. Leaves up to 10 mm wide; slender low plants; Taiwan ..... 17. *G. formosense*
- 8b. Leaves and leaflike stipules in middle stem region regularly in whorls of more than 4, i.e., in  
whorls of 5–16, with only 1 principal vein, linear to broadly lanceolate or elliptic, but never  
ovate or with a length/breadth index of less than 2.5.
- 44a. Inflorescences capitate and enclosed by leaflike bracts; corolla funnellform or salverform,  
4–15 mm, with 4 or 5 lobes.
- 45a. Plants perennial, 20–70 cm tall; calyx limb obsolete; corolla 5-lobed, 12–14 mm ..... *Phuopsis stylosa* (see p. 291)
- 45b. Plants annual; corolla 4-lobed, shorter.
- 46a. Calyx teeth well developed; corolla pink, tube 4–5 mm ..... *Sherardia arvensis* (see comments above)
- 46b. Calyx lacking; corolla bluish, tube 7–13(–15) mm ..... *Asperula orientalis* (see p. 78)
- 44b. Inflorescences branched, not enclosed by bracts; corolla rotate, campanulate,  
or funnellform, 0.5–13 mm, mostly with 4 (rarely 3) lobes.
- 47a. Medium stem leaves marginally (and often on upper side) with microhairs directed forward  
(use 20× lens), thus antrorsely ciliolate or aculeolate; stems mostly not retrorsely aculeolate.
- 48a. Ovaries and fruit densely covered with uncinat trichomes; plants perennial with smooth stems.

- 49a. Corolla funnelform, with tube  $\pm$  as long as lobes ..... 37. *G. odoratum*
- 49b. Corolla rotate, with tube markedly shorter than lobes.
- 50a. Robust, procumbent to ascending plants often longer than 50 cm; inflorescences terminal and lateral with cymes in upper 2–4 nodes ..... 59. *G. triflorum*
- 50b. Slender erect plants, less than 50 cm tall; inflorescences predominantly terminal.
- 51a. Leaves 6–25  $\times$  2–7 mm; open corollas ca. 2 mm in diam.; Taiwan (cf. also *G. takasagomontanum*) ..... 14. *G. echinocarpum*
- 51b. Leaves often larger; open corollas 1.5–3.5 mm in diam.; mainland.
- 52a. Leaves mostly in whorls of 7 or 8, (ob)lanceolate, length/breadth index mostly 3.5–4.5, subpetiolate; fruit with uncinata trichomes 0.6–0.8 mm; expected in Xizang ..... 4. *G. asperuloides*
- 52b. Leaves mostly in whorls of 6, narrowly obovate to broadly oblanceolate, length/breadth index mostly 2.5–3.5, clearly petiolate; fruit with uncinata trichomes 0.8–1.2 mm or longer; widespread ..... 22. *G. hoffmeisteri*
- 48b. Ovaries and fruit glabrous or hairy, but never with uncinata trichomes; plants perennial or annual.
- 53a. Plants annual, slender; flowers on pedicels and peduncles often longer than 5 mm and in lax, diffuse inflorescences.
- 54a. Leaves filiform, 20–30 mm, ascending; corolla funnelform, pink to red; ovary and mericarps with dense, short and curved hairs ..... *Leptunis trichodes* (see p. 213)
- 54b. Leaves linear to oblanceolate, 4–20 mm, spreading to reflexed; corolla  $\pm$  rotate, whitish, yellowish, or greenish; ovary and fruit glabrous or slightly tuberculate.
- 55a. Inflorescences broadly ovate, diffuse and intricate, with fruiting pedicels elongated to 20 mm ..... 55. *G. tenuissimum*
- 55b. Inflorescences rather narrowly thyrsoid, not diffuse and intricate, with fruiting pedicels only up to 4 mm ..... 19. *G. ghilanicum*
- 53b. Plants perennial, slender to robust; flowers on pedicels and peduncles 0.5–5 mm, in lax to  $\pm$  congested inflorescences.
- 56a. Corolla funnelform, lobed for 1/2–2/3, white.
- 57a. Inflorescences lax,  $\pm$  ebracteate; stems erect, smooth; main stem leaves 15–65  $\times$  3–12 mm ..... 38. *G. paniculatum*
- 57b. Inflorescences congested, strongly bracteate; stems procumbent, mostly  $\pm$  hairy; main stem leaves 5–23  $\times$  1–2(–5) mm ..... 23. *G. humifusum*
- 56b. Corolla rotate, lobed for 3/4 or more, often yellowish; plants erect to ascending.
- 58a. Leaves in middle stem region in whorls of not more than 6; plants of (sub)alpine region, not taller than 30 cm ..... 46. *G. saurense*
- 58b. Leaves in middle stem region in whorls of more than 6 and up to 12.
- 59a. Open corollas 3.5–5 mm in diam., white; fruit somewhat spongy or fleshy, 3–3.5 mm, with a dry pericarp separating from rest of fruit ..... 8. *G. bullatum*
- 59b. Open corollas ca. 3 mm in diam., yellow to whitish; fruit with dry mericarps, 1.5–2 mm, with pericarp dark and firmly attached to rest of fruit.
- 60a. Leaves mostly 2.5–5 mm wide, glabrous abaxially; fruit ca. 1.5 mm ..... 11. *G. consanguineum*
- 60b. Leaves 1–2.5 mm wide, glabrous to densely pubescent abaxially; fruit 1.5–2 mm ..... 62. *G. verum*
- 47b. Medium stem leaves marginally (not on leaf surface) with microhairs directed backward (use 20 $\times$  lens), thus retrorsely aculeolate or completely glabrous and smooth; stems often retrorsely aculeolate.
- 61a. Annuals, often in  $\pm$  disturbed, weedy habitats; stems and leaf margins retrorsely aculeolate; fully developed mericarps subspherical, 2–6 mm; open corollas 1–2 mm in diam.
- 62a. Fruit becoming pendulous on arching peduncles and pedicels, verrucose to spinulose; leaves glabrescent above ..... 57. *G. tricornutum*
- 62b. Fruit on divaricate straight peduncles and pedicels (only latter sometimes bent just beneath fruit), mostly with uncinata trichomes; leaves  $\pm$  hairy above.
- 63a. Open corollas 1.5–2 mm in diam.; individual mature mericarps 2.5–5 mm in diam., with trichomes arising from tuberculate bases ..... 2. *G. aparine*
- 63b. Open corollas 1–1.5 mm in diam.; individual mature mericarps 1–3 mm in diam., with trichomes straight from base ..... 50. *G. spurium*
- 61b. Perennials, in  $\pm$  natural habitats; fully developed mericarps ellipsoid, 1.5–3 mm; open corollas 1–4 mm in diam.

- 64a. Middle stem leaves narrowly obovate to oblanceolate, mostly 18–28 × 5–10 mm; stems slightly retrorsely aculeolate; inflorescences of medium size, with terminal and lateral, few- to several-flowered, rather loose cymes with small bracts, in fruit stiffly divaricate; corolla rotate, 1.5–2 mm in diam.; fruit with hooked trichomes ..... 58. *G. trifloriforme*
- 64b. Middle stem leaves mostly smaller; inflorescences different, usually more bracteate; fruit smooth, verrucose, or with hooked trichomes.
- 65a. Corolla funnellform to subcampanulate, with tube ± as long as or slightly shorter than lobes, whitish; ovaries and fruit glabrous, smooth or verrucose; leaves papery to subleathery and glossy; stems rough, retrorsely aculeolate, procumbent to clambering.
- 66a. Corolla funnellform; plants robust, 0.6–1.2 m, often forming mats; main stem leaves 8–50 × 2–8 mm ..... 28. *G. karataviense*
- 66b. Corolla subcampanulate; plants slender and ± erect, 10–60 cm tall; main stem leaves 3–16 × 1–3 mm ..... 61. *G. uliginosum*
- 65b. Corolla rotate, fused basal part much shorter than lobes; ovaries and fruit with hooked trichomes, tuberculate, or glabrous; stems glabrous, rough, or hairy.
- 67a. Middle stem leaves larger, (5–)10–35(–50) × (1–)2.5–10 mm, mostly ± hairy, at least margins retrorsely aculeolate; cymes lateral and terminal, many flowered; ovaries and fruit glabrous or with diverse indumentum; plants from lower elevations, relatively robust, erect or clambering, stems up to 0.7 m tall.
- 68a. Stems branched from base; cymes leafy, with bracts to last branches; stems and leaves (nodes and margins excepted) glabrous and smooth; mericarps with spreading uncinat trichomes ..... 48. *G. sichuanense*
- 68b. Stems normally branched from middle; cymes usually less leafy; stems and leaves mostly with more indumentum; fruit glabrous, papillose, tuberculate, or with uncinat trichomes.
- 69a. Peduncles and pedicels slender, filiform and often ± flexuose, with inconspicuous bracts; pedicels up to 5 mm, in fruit elongated to 10 mm or more; flowers never reddish; plants usually clambering; ovary and fruit surfaces diverse.
- 70a. Fruit often with uncinat trichomes; mainland ..... 13. *G. dahuricum*
- 70b. Fruit glabrous; Taiwan ..... 52. *G. taiwanense*
- 69b. Peduncles and pedicels rather stiff and often divaricate and ± bracteate; pedicels shorter than 5 mm and hardly elongated in fruit; ovary and fruit surfaces diverse, but often glabrous.
- 71a. Corolla red to purple (very rarely maroon or white), 1.5–2.5 mm in diam. .... 6. *G. blinii*
- 71b. Corolla whitish, yellowish, or greenish.
- 72a. Corolla small, 1.5–2 mm in diam., yellow to greenish white, lobes aristate; inflorescences divaricate and regularly bracteate with bracts similar to but smaller than leaves, giving a diffuse miniature aspect; ovary and fruit surface variable; plants often clambering ..... 3. *G. asperifolium*
- 72b. Corolla larger, mostly more than 2 mm in diam.; inflorescences ebracteate or with bracts ± reduced and irregularly distributed; ovary and fruit surface smooth to tuberculate; plants erect, hardly clambering.
- 73a. Leaves lanceolate, gradually narrowed into acute apex ..... 41. *G. prattii*
- 73b. Leaves subspatulate to obovate, apex rounded and abruptly narrowed into a mucro ..... 56. *G. tokyoense*
- 67b. Middle stem leaves uniformly small, 2–12(–15) × 0.3–3.5 mm, glabrous and smooth to ± hairy; cymes lateral and terminal, few flowered; ovaries and fruit with uncinat (very rarely ± straight) trichomes or glabrous; plants from high elevations, usually reduced and weak, caespitose to procumbent, stems only up to 0.3 m.
- 74a. Ovaries and fruit with uncinat (very rarely ± straight) trichomes.
- 75a. Leaves and stems ± densely hispid and often retrorsely aculeolate; stems with 4 conspicuous whitish angles ..... 42. *G. pusillosetosum*
- 75b. Leaves completely glabrous and smooth or only slightly hairy and/or retrorsely aculeolate; stems with 4 inconspicuous angles.
- 76a. Leaves dried blackening, papery and thin, oblanceolate to narrowly obovate, with flat margins, hardly longer than 7 mm ..... 5. *G. baldensiforme*
- 76b. Leaves dried greenish-brownish, with ± revolute margins, often longer than 7 mm.
- 77a. Plants nearly always smooth; leaves ± subleathery; ovary in flower ca. 1 mm ..... 49. *G. glabriusculum*

- 77b. Plants retrorsely aculeolate at least on margins and lower side of papery leaves; ovary in flower 0.5–0.8 mm ..... 51. *G. sunpanense*
- 74b. Ovaries and fruit glabrous, smooth, papillose, or verrucose; Himalaya.
- 78a. Plants weak to procumbent but not mat-forming; cells of adaxial leaf surface relatively large, readily visible individually with 20× lens; corolla mostly whitish ..... 33. *G. megacyttarion*
- 78b. Plants procumbent and often mat-forming; cells of adaxial leaf surface small, not or hardly visible individually with 20× lens.
- 79a. Stems ± densely hairy and/or retrorsely aculeolate, with 4 conspicuous whitish angles ..... 42. *G. pusillosetosum*
- 79b. Stems glabrous or only slightly retrorsely aculeolate, with inconspicuous angles.
- 80a. Leaves on main stems 2–8.5 mm; inflorescence cymes 1- to few flowered, fascicled; corolla white, pale green, or pale yellow, with upper surface of lobes papillose ..... 1. *G. acutum*
- 80b. Leaves on main stems 5–10.5 mm; inflorescence cymes 1–6-flowered; corolla nearly always red or purple, with upper surface of lobes glabrous and smooth except ± puberulent on margins and central vein ..... 43. *G. rebae*

**1. *Galium acutum*** Edgeworth, Trans. Linn. Soc. London 20: 61. 1846.

尖瓣拉拉藤 jian ban la la teng

Herbs, perennial, procumbent, much branched, mat-forming. Stems up to 30 cm, 4(or 6)-angled, glabrous, smooth or sometimes with scattered (very rarely more dense) short and straight hairs. Leaves in whorls of up to 6, sessile; blade drying papery and blackish, linear-oblongate to narrowly elliptic-oblongate, 2–8.5 × 0.3–1.5 mm, glabrous and smooth, occasionally with straight hairs, base cuneate, margins flat to thinly revolute, very rarely antorsely aculeolate, apex acute, ± contracted and mucronate; vein 1. Inflorescences with terminal and axillary cymes, 1- to few flowered; peduncles (1.5–)3–8(–10) mm; pedicels (0.1–)0.5–2(–3) mm, glabrous, smooth. Ovary ellipsoid-obovoid, ca. 0.5 mm, didymous, glabrous. Corolla white, pale greenish, or yellowish, rotate, 1.2–3.5 mm in diam., glabrous to puberulent, lobed for 2/3 or more; lobes 4, lanceolate-spatulate, inside (i.e., adaxially) papillose, shortly acuminate. Mericarps ellipsoid, ca. 1 × 0.4–0.6 mm, glabrous, smooth or granular-verruculose, often on elongating pedicels. Fl. and fr. Jul–Oct.

Mountain rocks and slopes; 2000–4100 m. ?Sichuan, Xizang, ?Yunnan [India, Nepal, Pakistan].

*Galium acutum* is a (sub)alpine Himalayan member of the *G. asperifolium* group (see under that species). This group of taxa can be divided into subgroups: (1) from lower elevations and (2) from higher elevations. The latter subgroup is represented in the W Himalaya of Pakistan by *G. acutum* alone (Nazimuddin & Ehrendorfer, Pl. Syst. Evol. 155: 71–75. 1987). Mill (Edinburgh J. Bot. 53: 193–213. 1996; Fl. Bhutan 2(2): 825–834. 1999) has analyzed both subgroups in detail with emphasis on their E Himalayan members. Among subgroup (2) he recognized three species: *G. acutum* and the newly described *G. rebae* and *G. megacyttarion*. The only material from China incorporated in Mill's study are specimens of *G. rebae* from Xizang deposited at E and BM. Additional species from subgroup (2) from the C and E Himalaya and adjacent China treated here are *G. baldensiforme*, *G. pusillosetosum*, *G. glabriusculum*, and *G. sunpanense*. They appear well separable from *G. acutum*.

*Galium acutum* and *G. rebae* are very closely related taxa. Mill (loc. cit. 1996: 199) presented a differential table which has been incor-

porated into the present descriptions. Nevertheless, from the material available now, it appears that only flower color (white or greenish white in *G. acutum* and reddish crimson in *G. rebae*) is really decisive for their separation. Furthermore, at lower elevations, *G. acutum* appears linked to *G. asperifolium* var. *sikkimense*. Cufodontis (Oesterr. Bot. Z. 89: 239. 1940) has described such transitional forms with longer and ± retrorsely aculeolate stems and hairy corolla lobes from the Indian Himalaya as *G. acutum* var. *trichanthum* Cufodontis.

Mill (loc. cit. 1996: 194–198) considered *Galium acutum* to be restricted to the NW Himalaya except for one provisionally identified specimen from Sikkim. In contrast, specimens studied by us from the herbaria PE, KUN, and WU clearly show that *G. acutum* extends much further to the east, reaching Yunnan and Sichuan.

*Galium himalayense* was regarded as a synonym of *G. acutum* by Cufodontis (loc. cit.: 239–243). Mill (loc. cit. 1996: 195; loc. cit. 1999: 831–832) agreed but maintained the taxon as *G. acutum* var. *himalayense* and described its sympatric occurrence with *G. acutum* var. *acutum* throughout the NW Himalaya. As Mill did not consider the possible occurrence of flower dimorphism in *G. acutum*, it remains uncertain whether the flower and stigma size differences listed are possibly correlated with male and female plants or simply correspond to hermaphroditic variants within the morphological amplitude of the species. In order to stimulate such studies and to clarify the distribution of the two taxa in China, a key and descriptions (according to Mill, loc. cit. 1996) follow:

- 1a. Open corollas 2.3–3.5 mm in diam.; stigmas united to near middle, in total length subequal to stamens ..... 1a. var. *acutum*
- 1b. Open corollas 1.2–2.3 mm in diam.; stigmas united only shortly at base, in total length shorter than stamens ..... 1b. var. *himalayense*

**1a. *Galium acutum* var. *acutum***

尖瓣拉拉藤(原变种) jian ban la la teng (yuan bian zhong)

*Galium asperifolium* Wallich var. *setosum* Cufodontis.

Leaves of main stems with blades mucronate at apex, mucro 0.2–0.45 mm. Corolla 2.3–3.5 mm in diam.; lobes 1.9–4 × as long as wide, mucronate with mucro 0.15–0.3 mm. Stigmas united to near middle, in total length subequal to stamens. Fl. and fr. Jul–Oct.

Mountain rocks and slopes; 2000–4100 m. ?Sichuan, Xizang, ?Yunnan [India, Nepal, Pakistan].

**1b. *Galium acutum* var. *himalayense*** (Klotzsch & Garcke) R. R. Mill, Edinburgh J. Bot. 53: 195. 1996.

喜马拉雅尖瓣拉拉藤 xi ma la ya jian ban la la teng

*Galium himalayense* Klotzsch & Garcke, Bot. Ergebn. Reise Waldemar, 88. 1862.

Leaves of main stems with blade submucronate at apex, mucro 0.15–0.2 mm. Corolla 1.2–2.3 mm in diam.; lobes 1.4–2.75 × as long as wide, acute or submucronate with mucro to 0.1 mm. Stigmas united only shortly at base, in total length shorter than stamens. Fl. and fr. Jul–Oct.

Mountain rocks and slopes; 2000–4100 m. ?Sichuan, Xizang, ?Yunnan [India, Nepal].

**2. *Galium aparine*** Linnaeus, Sp. Pl. 1: 108. 1753, s.s.

原拉拉藤 yuan la la teng

Herbs, annual, procumbent or clambering. Stems 30–90 cm high, 4-angled, 1–4 mm in diam., branched from base, retrorsely aculeate along angles, glabrescent to pilose at nodes. Leaves at middle stem region in whorls of 6–10, subsessile; blade drying papery, narrowly oblanceolate to narrowly oblong-oblanceolate, 10–60 × 3–10 mm, usually somewhat pilosulous or hispidulous adaxially, retrorsely aculeolate along midrib abaxially, base acute, margins flat to thinly revolute, retrorsely aculeolate, apex acute and shortly mucronate; vein 1. Inflorescences terminal and axillary, cymes 2- to several flowered; axes glabrous to aculeolate; bracts ± leaflike or none, 1–5 mm; peduncles 1–5 cm; pedicels 1–30 mm, finally elongating and sometimes curved directly under fruit. Ovary subglobose, 0.3–0.5 mm, with uncinata trichomes. Flowers hermaphroditic. Corolla yellowish green or white, rotate, 1.5–2 mm in diam.; lobes 4, triangular to ovate, acute. Mericarps subglobose to kidney-shaped, 2.5–5 mm, with a dense cover of uncinata trichomes 0.4–1.2 mm from swollen base. Fl. Mar–Jul, fr. Apr–Nov.

Forest margins, riversides, meadows, open fields, farmlands; near sea level to 2500 m. Evidently rare in China and possibly only introduced [originally in W Eurasia and the Mediterranean, but today nearly worldwide as an adventive].

The *Galium aparine* group (*G.* sect. *Aparine*, formally part of *G.* sect. *Kolgyda* s.l.) forms an annual, extremely polymorphic, and predominantly autogamous polyploid complex, also called *G. aparine* s.l. or *G. aparine* agg. One has to consider as possible perennial ancestors the morphologically very close E Asiatic taxa (e.g., *G. sungpanense*: see there) and other annuals, such as the Aegean endemic *G. monachinii* Boissier & Heldreich (2x, 2n = 22) and the Eurasian and African *G. spurium* (2x and 4x, 2n = 20, 40). By allopolyploidy they apparently have contributed in the Mediterranean and W Eurasia to *G. aparine* s.s. (4x, 6x, and 8x with ± euploid and slightly oscillating aneuploid chromosome numbers), which today has become a nearly worldwide weed (Ehrendorfer et al., Fl. Iranica 176: 239. 2005).

Many authorities, including Cufodontis (Oesterr. Bot. Z. 89: 245–247. 1940) and W. C. Chen (in FRPS 71(2): 234–237. 1999), have treated all these plants under *Galium aparine* s.l. and recognized four varieties: var. *aparine*, var. *echinospermum*, var. *leiospermum*, and var. *tenerum*. Whereas the first refers to *G. aparine* s.s. described above, the

latter three should be assigned to *G. spurium* (see there). Here, we follow the narrow circumscription of *G. aparine* s.s. and the specific separation of *G. spurium* outlined above, in spite of occasional difficulties in separating the two taxa on the basis of flower and mericarp size. A relevant survey of extensive Chinese material at the herbaria PE and KUN has clearly shown the common and wide occurrence of *G. spurium* in comparison with the rare and only occasional documentation of *G. aparine* s.s. Only future karyosystematic studies on the group in E Asia will clarify their distribution and ecological position. With respect to the common confusion of members of the *G. aparine* group with other annual and perennial taxa of *Galium* see *G. spurium*.

**3. *Galium asperifolium*** Wallich in Roxburgh, Fl. Ind. 1: 381. 1820.

楔叶律 xie ye lü

?*Galium cavaleriei* H. Léveillé; ?*G. esquirolii* H. Léveillé.

Herbs, perennial, weak to climbing or trailing, usually much branched. Stems 20–70 cm, 4-angled to 4-winged, villosulous to hirtellous and/or sparsely aculeolate to smooth. Leaves on main stems in whorls of up to 6(–8), sessile or with very short (ca. 1 mm) petiole; blade drying papery to leathery, adaxially dark green and shiny, abaxially paler, oblanceolate-oblong, oblanceolate, or obovate, (5–)10–20(–25) × (1–)1.5–4(–6) mm, adaxially scaberulous, hirtellous to glabrous, abaxially densely villosulous, hirsute, pilose to glabrous, base acute to cuneate, margins retrorsely aculeolate and ± hairy, flat to thinly revolute, apex obtuse, rounded, truncate, or emarginate and shortly mucronate; vein 1. Inflorescences ± paniculate, up to 18 cm, expanding through growing season, with terminal and axillary, several- to many-flowered cymes; peduncles glabrous to rarely villosulous, regularly spreading to divaricate, with a dichasial branching pattern, at most nodes with leaflike bracts (1–4 mm); pedicels 0.2–2.5 mm. Ovary obovoid, 0.2–0.3 mm, mostly glabrous or smooth, but sometimes also verrucose, hirtellous, or with undeveloped uncinata trichomes. Corolla greenish white or yellow, rotate, 1.5–2 mm in diam., glabrous, lobed for 2/3 or more; lobes 4, triangular-ovate, filamentous-aristate (rarely only acute). Mericarps ellipsoid, 1–2 mm, glabrous and smooth or rarely granular-tuberculate, hirtellous, or with appressed to spreading hooked trichomes, on pedicels often slightly elongating to 4 mm. Fl. and fr. (May–)Jun–Sep(–Oct).

Mountain slopes, farmland sides, riversides and beaches, grasslands, forests, thickets, ditch sides, open fields, meadows; 400–3500 m. Guangxi, Guizhou, Hubei, Hunan, Sichuan, Xizang, Yunnan [Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka, Thailand].

*Galium asperifolium* is an exceedingly variable and widespread species and was the first described from a larger assembly of taxa, here called *G. asperifolium* group and provisionally placed into *G.* sect. *Trachygalium* (but certainly not into *G.* sect. *Leptogalium* as in Yamazaki, Fl. Japan 3a: 238–239. 1993, or into *G.* sect. *Leiogalium* as in W. C. Chen, FRPS 71(2): 271. 1999). According to Cufodontis (Oesterr. Bot. Z. 211–251. 1940), Nazimuddin and Ehrendorfer (Pl. Syst. Evol. 155: 71–75. 1987), Mill (Edinburgh J. Bot. 53: 193–213. 1996; Fl. Bhutan 2(2): 825–834. 1999), Ehrendorfer et al. (Fl. Iranica 176: 194. 2005), and the present treatment, the center of diversity of the *G. asperifolium* group lies in the E Himalaya and SW China. Within this area, two subgroups of taxa can be recognized, one with larger plants, longer than 10 mm middle stem leaves, and many-flowered cymes from lower eleva-

tions (1), the other with more condensed growth, shorter middle stem leaves, and 1- to few-flowered cymes from higher elevations (2). Both subgroups include taxa with whitish, yellowish to greenish, and others with reddish, purplish, or brownish flower color. The (sub)alpine subgroup (2) is briefly surveyed under *G. acutum*. Subgroup (1), discussed here, is represented by taxa with ± whitish flowers: *G. subfalcatum* Nazimuddin & Ehrendorfer and *G. campylotrichum* Nazimuddin & Ehrendorfer in the W Himalaya of Pakistan and the widespread *G. asperifolium* with its var. *sikkimense* (= *G. sikkimense*) in the C and E Himalaya (including Bhutan). In addition, subgroup (1) includes taxa with a more easterly distribution, extending from China into the remaining parts of E Asia (including Japan): *G. dahuricum* (including *G. comarii*, *G. manshuricum*, *G. niewerthii*, and *G. pseudoasprellum*), *G. prattii*, *G. taiwanense*, and *G. tokyoense*. Subgroup (1) taxa with reddish flowers are *G. blinii* in SW China and the newly described Bhutan endemic *G. craticulatum* R. R. Mill (see also Mill, loc. cit. 1996; loc. cit. 1999).

Because of its great variability with respect to habit and the indumentum of stems, leaves, and fruit, *Galium asperifolium* is often not easily separable from its closest relatives, and transitional forms occur. Its best differential characters are the many-flowered, divaricate, distally dichasial branching, and strongly bracteate cymes and the small yellowish-greenish flowers with aristate corolla lobes. *Galium blinii* mainly deviates by larger, reddish flowers and non-aristate corolla lobes. The filiform and flexuose peduncles and pedicels separate *G. dahuricum*, and the less bracteate inflorescences and larger flowers separate *G. prattii*, *G. taiwanense*, and *G. tokyoense*. To the taxa of the (sub)alpine subgroup (2, e.g., *G. acutum*) *G. asperifolium* is linked particularly through its var. *sikkimense*.

In addition to its natural complexity, the taxonomy of the *Galium asperifolium* group is rendered difficult by a number of badly described and insufficiently documented species created by H. Léveillé. On the basis of the studies by Cufodontis (loc. cit.), Lauener and Ferguson (Notes Roy. Bot. Gard. Edinburgh 32: 103–115. 1973), Mill (loc. cit. 1996), and our own judgment, we suggest to dispose of them in the following way: *Galium blinii* is maintained as a separate species (possibly with *G. bodinieri* and *G. quinatum* as synonyms), whereas *G. cavaleriei* and *G. esquirolii* (and “*G. cuneatum* H. Léveillé,” though a nomen nudum) are provisionally assigned as synonyms to *G. asperifolium* s.l. (including var. *sikkimense*); *G. comarii* and *G. niewerthii* are treated as synonyms of *G. dahuricum*.

The following schematic key to the varieties of *Galium asperifolium* corresponds to W. C. Chen (loc. cit.: 271–274) who mainly followed Cufodontis (loc. cit.: 239–240). Only *G. asperifolium* var. *setosum* has been eliminated because it clearly is a synonym of *G. acutum*. Individuals with uncinete trichomes on ovaries and fruit, but otherwise identical to typical *G. asperifolium*, are reported here for the first time. They still lack a varietal name and are provisionally accommodated under var. *asperifolium*. In contrast to Mill (loc. cit. 1996; loc. cit. 1999), *G. sikkimense* is here again reduced to varietal status under *G. asperifolium*, following Cufodontis (loc. cit.: 241). Forms of this species with ± glabrescent stems dominate to the east of its wide distribution area, but intraspecific and local variation of stem indumentum is so extensive and continuous as to make this character useless as a basis for specific separation. Mill (loc. cit. 1996: 201–212) assumed *G. asperifolium* var. *asperifolium* to be most common in C and W Nepal and to be replaced by var. *sikkimense* toward the east. This statement is in conflict with the data on distribution in China from Chen (loc. cit.) and our own observations presented below. In view of the taxonomical complexity of the *G. asperifolium* group and the common misinterpretation of its members, further careful studies are obligatory.

1a. Plants stout, often clambering; stems usually villosulous to hirtellous and ± densely

retrorsely aculeolate; leaf blade relatively large, often oblanceolate-oblong, ± hairy and marginally retrorsely aculeolate; inflorescence large, many flowered; corolla lobes aristate.

2a. Ovary and fruit glabrous, smooth, granular-tuberculate, or with uncinete trichomes ..... 3a. var. *asperifolium*

2b. Ovary and fruit hirtellous ..... 3b. var. *lasiocarpum*

1b. Plants often ± smaller; stems with ± reduced indumentum; leaf blade smaller, often more lanceolate, more weakly retrorsely aculeolate to smooth along margins; inflorescence with fewer flowers; corolla lobes apiculate to acute.

3a. Mericarps smooth ..... 3c. var. *sikkimense*

3b. Mericarps granular-tuberculate ..... 3d. var. *verrucifractum*

### 3a. *Galium asperifolium* var. *asperifolium*

楔叶律(原变种) xie ye lü (yuan bian zhong)

*Galium pseudohirtiflorum* H. Li.

Plants stout, often clambering. Stems 20–70 cm, much branched, villosulous or hirtellous, ± retrorsely aculeolate. Leaf blade often larger, oblanceolate-oblong, mostly ± hirsute and with margins retrorsely aculeolate. Inflorescences large, with many-flowered cymes. Corolla lobes filamentous-aristate. Ovary and fruit glabrous and smooth, verrucose, or rarely with uncinete trichomes. Fl. and fr. Jun–Sep.

Mountain slopes; 1200–3000 m. Guizhou, Sichuan, Xizang, Yunnan [Afghanistan, Bangladesh, India, Nepal, Pakistan, Sri Lanka, Thailand].

3b. *Galium asperifolium* var. *lasiocarpum* W. C. Chen, Acta Phytotax. Sin. 28: 303. 1990.

毛果楔叶律 mao guo xie ye lü

Ovary and fruit hirtellous. Fl. and fr. May–Oct.

• Mountain slopes, farmland sides, riversides, forests; 1400–3200 m. Guangxi, Guizhou, Yunnan.

Mill (loc. cit. 1996) commented on the extensive indument variation on all organs of *Galium asperifolium* throughout most of its range but did not mention any occurrence of straight hairs on fruit in this species group, nor has anyone else besides W. C. Chen. Therefore, this variety is only provisionally included here. Its densely hirsute ovary and fruit suggests that it may belong to another species, possibly *G. pusillosetosum*.

3c. *Galium asperifolium* var. *sikkimense* (Gandoger) Cufodontis, Oesterr. Bot. Z. 89: 241. 1940.

小叶律 xiao ye lü

*Galium sikkimense* Gandoger, Bull. Soc. Bot. France 66: 307. 1920.

Herbs, perennial, weak to clambering or trailing. Stems 20–60 cm, usually much branched, sparsely hairy and retrorsely aculeolate to smooth. Leaves often smaller and narrower, less

hairy and retrorsely aculeate to ± glabrous and smooth. Inflorescences large to medium sized with many- to several-flowered cymes. Corolla lobes apiculate to acute. Ovary and fruit glabrous and smooth. Fl. Jun–Sep, fr. Jul–Oct.

Mountain slopes, river beaches, ditch sides, open fields, grasslands, meadows, thickets, forests; 400–3200 m. Guangxi, Guizhou, Hubei, Hunan, Sichuan, Xizang, Yunnan [Bhutan, India, Nepal].

**3d. *Galium asperifolium* var. *verrucifractum*** Cufodontis, Oesterr. Bot. Z. 89: 241. 1940.

滇小叶律 dian xiao ye lü

Similar to *Galium asperifolium* var. *sikkimense* but with granular-tuberculate fruit. Fl. and fr. Aug–Oct.

• Mountain slopes, grasslands, thickets; 2300–3500 m. Sichuan, Xizang, NW Yunnan.

The type material of this variety from Yunnan (particularly *Handel-Mazzetti 9697*, WU) consists of transitional forms toward *Galium acutum*.

**4. *Galium asperuloides*** Edgeworth, Trans. Linn. Soc. London 20: 61. 1846.

车叶律 che ye lü

Herbs, perennial, emerging from filiform reddish rhizomes. Stems weak but generally erect, 10–45 cm tall, 4-angled, glabrous and smooth, except hispidulous at nodes. Middle stem leaves and leaflike stipules in whorls of (6 or)7 or 8, subsessile to very shortly petiolate; blade drying papery or membranous, remaining green, elliptic to narrowly oblong-ob lanceolate or lanceolate, (10–)20–50(–60) × 3–13 mm, length/breadth index mostly 3.5–4.5, glabrescent, base acute or cuneate, midrib smooth or rarely retrorsely aculeolate, margins and upper leaf side with antrorse microhairs, apex obtuse or rounded and abruptly apiculate; vein 1. Inflorescences terminal and sometimes in axils of upper leaves with few- to several-flowered cymes; axes glabrous, smooth; bracts none or few, 1–2 mm; pedicels 0.5–5 mm. Ovary ovoid, 0.5–0.8 mm, with uncinete trichomes. Corolla white or light greenish, rotate, 2.5–3.8 mm in diam., lobed for 3/4 or more; lobes 4, ovate, acute. Mericarps ellipsoid, 1.8–2.5 mm, with dense uncinete trichomes 0.6–0.8 mm, on fruiting pedicels elongating to 10 mm. Fl. Apr–Aug, fr. May–Sep.

Forests on mountain slopes, thickets, ditch sides, along rivers, meadows; 1500–2800 m. Expected in Xizang [Afghanistan, India, Kashmir, Pakistan].

*Galium asperuloides* was previously circumscribed more broadly to include as subspecies plants treated here as *G. hoffmeisteri*. The specific status of the latter is well justified (Ehrendorfer et al., Fl. Iranica 176: 193–194. 2005; see comments and differential characters under that species). When the two taxa are classified as one species, the “typical” plants have to be called *G. asperuloides* subsp. *asperuloides*. Vegetative plants are very similar to *G. odoratum*. Together with *G. echinocarpum* from Taiwan and others they constitute *G. sect. Hylaea*.

**5. *Galium baldensiforme*** Handel-Mazzetti, Symb. Sin. 7: 1029. 1936.

玉龙拉拉藤 yu long la la teng

Herbs, perennial, tender, caespitose. Stems ascending, 3–12(–25) cm tall, 4-angled, glabrous and smooth or rarely slightly retrorsely aculeolate. Leaves in whorls of up to 5 or 6, sessile; blade drying papery and blackish, oblanceolate to narrowly obovate, 2–7 × 1–3 mm, mostly glabrous and smooth, but occasionally with straight hairs abaxially or marginally slightly retrorsely aculeolate, base cuneate, margin flat, apex acute and often shortly mucronate; vein 1. Inflorescences with cymes terminal and in axils of upper leaves, 1- or usually 2- or 3-flowered; peduncles up to 18 mm and pedicels 2–5 mm, glabrous and smooth, elongating during fruit development. Ovary subglobose, ca. 0.7 mm, densely covered by undeveloped trichomes. Corolla pale green, rotate, ca. 2 mm in diam., glabrous; lobes 4, triangular, acute. Mericarps ellipsoid, ca. 2 mm, with dense brownish yellow uncinete trichomes ca. 0.7 mm. Fl. Aug, fr. Aug–Oct.

• Rocky slopes, meadows, frost heave sites, river floodplains in mountains; 2800–4300 m. Qinghai, Sichuan, Xizang, Yunnan (Lijiang).

*Galium baldensiforme* belongs to the alpine subgroup (2) of the *G. asperifolium* complex within *G. sect. Trachygalium* s.l. (see under *G. acutum* and *G. asperifolium*). It has been widely misidentified with related taxa, e.g., with *G. glabriusculum* from which it differs in its more oblanceolate, thinner leaves, blackening when dried, and a slight tendency toward more indumentum.

Two collections from Xizang (*H. Li 1978-07-22* and *Y. T. Chang & Lang, Nie-La-Mu, 1966-06-25*, both from PE) differ from typical *Galium baldensiforme* by purple flowers (reminiscent of *G. rebae*), ± straight whitish hairs on its (still young) ovaries, and scattered straight hairs on the upper and lower leaf sides (mainly midvein, but glabrous along leaf margins). After closer inspection and field studies, these populations may very well deserve species rank.

A specimen from Sichuan (Dege Co., anonymous collector 7029, PE) with stronger indumentum, subleathery, broadly lanceolate leaves with retrorsely aculeolate margins, and aristate corolla lobes apparently links *Galium baldensiforme* with *G. asperifolium* var. *sikkimense*.

**6. *Galium blinii*** H. Léveillé, Bull. Acad. Int. Géogr. Bot. 25: 48. 1915.

五叶拉拉藤 wu ye la la teng

?*Galium bodinieri* H. Léveillé; ?*G. quinatum* H. Léveillé & Vaniot.

Herbs, perennial, weak to climbing, trailing, or matted. Stems usually much branched, 20–70 cm, 4-angled, retrorsely aculeolate to glabrescent. Middle stem leaves in whorls of 6–8, subsessile; blade drying papery or leathery, often blackening, linear-oblong to broadly (ob)lanceolate, (5–)10–22(–30) × (1–)2–4.5(–5.5) mm, adaxially and particularly abaxially ± rough, base acute to cuneate, margin flat to thinly revolute, densely retrorsely aculeolate, ± gradually narrowed into acute apex; vein 1. Inflorescences with terminal and axillary, several-flowered cymes 2–5 cm; axes ± glabrous, often slightly divaricate, with small bracts on lower branches only; pedicels (0.2–)1–3(–5) mm. Ovary obovoid, 0.2–0.3 mm, glabrous or with undeveloped trichomes. Corolla red to purple or violet (only very rarely white), rotate, 1.5–2.5(–3) mm in diam., glabrous; lobes 4, triangular-ovate, acute. Mericarps ovoid, 1–2 mm, glabrous, smooth to verrucose, or sometimes with appressed or spreading uncinete trichomes. Fl. Jun–Sep, fr. Jul–Oct.

• Mountain slopes, river beaches, ditch sides, open fields, grasslands, meadows, thickets, forests; 800–3000 m. Guizhou, Hubei, Shaanxi, Sichuan, Xizang, Yunnan.

*Galium blinii* is a critical taxon that belongs to the lower elevation subgroup (1) of the *G. asperifolium* group (see there). It was considered a synonym of *G. asperifolium* var. *sikkimense* by Cufodontis (Oesterr. Bot. Z. 89: 241. 1940), Lauener and Ferguson (Notes Roy. Bot. Gard. Edinburgh 32: 106. 1973), and W. C. Chen (in FRPS 71(2): 273. 1999). Only Mill (Edinburgh J. Bot. 53: 204. 1996) commented on its reddish purple flowers and other differential characters, regarded it as a distinct species, and proposed to use its old but so far neglected name. Up to now, specimens of this rather widespread taxon were named as *G. asperifolium* var. *sikkimense*, *G. pseudoasprellum* var. *densiflorum*, etc. Analyses of a considerable number of relevant specimens from PE, KUN, and WU support Mill's interpretation and led to the above, more elaborate description. It shows that *G. blinii* is quite variable with respect to leaf shape and ovary/fruit indumentum but relatively well characterized not only by its reddish purple flowers but also by height, leaf size, retrorsely aculeolate stems and leaf margins, and the usually medium-sized and only small-bracteate cymes, relatively short and firm post-floral peduncles and pedicels, and larger flowers with acute (but not aristate) lobes. This allows separation from its closest relatives, *G. prattii* and *G. asperifolium* (where transitional forms occur), but also from *G. dahuricum* and *G. tokyoense*.

Further studies will have to show to what extent the following, also reddish purplish flowering taxa from SW China can be separated from *Galium blinii*: *G. craticulatum* was described as an endemic from the high mountains of Bhutan (Mill, loc. cit.: 202) and said to differ from *G. blinii* in its present circumscription by completely glabrous stems with conspicuous, vein-marked wings, less retrorsely aculeolate leaves, larger flowers, and longer filaments; *G. bodinieri*, also with reddish flowers, according to Mill (loc. cit.: 204–205) is reminiscent of *G. craticulatum* (particularly in its broadly winged stems) and may represent a link between *G. blinii* and the alpine, more condensed and shorter leaved *G. rebae*; the purple-flowered *G. quinatum* (not mentioned by Mill) was very poorly described and is listed above as a possible synonym of *G. blinii*, but types have neither been seen by Lauener and Ferguson (loc. cit.: 107) nor by us.

**7. *Galium boreale* Linnaeus, Sp. Pl. 1: 108. 1753, s.l.**

北方拉拉藤 bei fang la la teng

Herbs, perennial, erect, 20–65 cm tall. Stems 4-angled, usually glabrous, rarely shortly hairy, hispidulous at nodes, angles thickened. Leaves in whorls of 4, sessile or subsessile; blade drying papery or thinly leathery, linear-lanceolate or lanceolate to ovate, (10–)15–40(–80) × (1–)3–15 mm, glabrous or sparsely puberulent to hispidulous and/or pilose, abaxially never with striate to punctate glandular idioblasts, base cuneate to sub-rounded, margins usually revolute and antrorsely scaberulous to hispidulous, apex acute or usually narrowly tapered then obtuse to rounded at very tip; principal veins palmate, 3. Inflorescences terminal, elongate or broadly paniculiform, 2–15 cm, with several- to many-flowered cymes in axils of uppermost leaves and terminal; peduncles glabrous or puberulent at nodes, smooth or scaberulous; bracts ligulate, lanceolate, or elliptic, 1–4 mm; pedicels 0.5–2 mm elongating in fruit to 3.5 mm. Ovary subglobose, 0.8–1 mm, glabrous or sparsely to densely strigillose to pilosulous. Corolla white or pale yellow, rotate, 3–4 mm in diam., glabrescent, lobed for 3/4 or more; lobes 4, ovate-lanceolate, acute. Mericarps subglobose, 1–2 mm, pericarp firmly attached but sometimes ± inflated, glabrous or ± densely hairy

with ± appressed, ascending, or spreading, straight or curved, but hardly truly uncinuate trichomes 0.3–0.5 mm. Fl. May–Aug(–Sep), fr. (May–)Jun–Oct.

Open forests and thickets, mountain slopes, grasslands, meadows, open fields, ditch sides, river valleys and beaches, swamps, farmland sides, wastelands; 200–4600 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, India, Japan, Kashmir, Korea, Mongolia, Pakistan, Russia; SW Asia (Armenia, Iran), Europe, North America].

The name *Galium boreale*, as used here in a wide sense, corresponds to a widespread and polymorphic, still insufficiently studied N Hemisphere polyploid complex (Ehrendorfer et al., Fl. Iranica 176: 179–181. 2005) within *G. sect. Platygaliun* s.l. In China, another species of this section with much smaller flowers, *G. kinuta*, can be separated from this *G. boreale* aggregate only with difficulties, because the two are linked by intermediate (and possibly hybrid) populations (see under *G. kinuta*).

Within the *Galium boreale* aggregate and the flora of China, W. C. Chen (in FRPS 71(2): 260–263, 285. 1999) recognized only *G. boreale* Linnaeus s.l. with numerous infraspecific taxa and *G. turkestanicum*, whereas 11 species in three series were listed for the flora of the former Soviet Union by Pobedimova et al. (Fl. URSS 23: 345–354. 1958). From these only *G. turkestanicum* is fully accepted here (*G. ussuriense* and *G. rubioides* are cited as synonyms under *G. boreale* var. *lanceolatum* and *G. boreale* var. *rubioides*). Furthermore, and according to Pobedimova et al. (loc. cit.), *G. amblyophyllum* Schrenk, *G. amurense* Pobedimova, and *G. septentrionale* Roemer & Schultes can be expected to occur in China. With the exception of the briefly mentioned *G. septentrionale*, they were not considered by W. C. Chen in FRPS and are only mentioned here. As a competent treatment of the *G. boreale* aggregate is not yet possible, we follow the schematic taxonomic differentiation proposed by Cufodontis (Oesterr. Bot. Z. 89: 225–228. 1940) and accepted by W. C. Chen (loc. cit.). This scheme defines numerous varieties according to leaf shape and the density, type, and distribution of indumentum on leaves, ovaries, and fruit. These varieties form a morphologically ± continuous series, linking the extremes: *G. boreale* var. *rubioides* with large ovate leaves and a broadly paniculate inflorescence and *G. boreale* var. *intermedium* with much smaller lanceolate leaves and an elongated narrow inflorescence. The following key and short descriptions are presented here for reference, to facilitate comparison, and to stimulate future studies.

- 1a. Ovary and fruit glabrous.
  - 2a. Leaf blade pilose or scabrous abaxially at least along veins.
    - 3a. Leaf blade linear-lanceolate or narrowly lanceolate ..... 7h. var. *lancilimbus*
    - 3b. Leaf blade ovate-lanceolate or ovate ..... 7k. var. *rubioides*
  - 2b. Leaf blade glabrous abaxially.
    - 4a. Leaf blade linear-lanceolate or narrowly lanceolate .... 7d. var. *hyssopifolium*
    - 4b. Leaf blade broadly lanceolate or ovate-lanceolate ..... 7g. var. *lanceolatum*
- 1b. Ovary and fruit ± hairy.
  - 5a. Ovary and fruit sparsely hirtellous or scabrous.
    - 6a. Leaf blade linear-lanceolate or narrowly lanceolate ..... 7e. var. *intermedium*
    - 6b. Leaf blade broadly lanceolate or ovate-lanceolate ..... 7j. var. *pseudorubioides*

- 5b. Ovary and fruit densely hirsute or tomentose.
  - 7a. Leaf blade sparsely pubescent or scabrous at least along veins abaxially.
    - 8a. Leaf blade linear-lanceolate or narrowly lanceolate ..... 7c. var. *ciliatum*
    - 8b. Leaf blade broadly lanceolate or ovate-lanceolate ..... 7f. var. *kamtschaticum*
  - 7b. Leaf blade glabrous abaxially.
    - 9a. Leaf blade less than 4 mm wide ..... 7b. var. *boreale*
    - 9b. Leaf blade 4–15 mm wide.
      - 10a. Leaf blade 4–6 mm wide ..... 7a. var. *angustifolium*
      - 10b. Leaf blade wider than 6 mm ..... 7i. var. *latifolium*

**7a. *Galium boreale* var. *angustifolium*** (Freyn) Cufodontis, Oesterr. Bot. Z. 89: 226. 1940.

狭叶砧草 xia ye zhen cao

*Galium rubioides* Linnaeus var. *angustifolium* Freyn, Oesterr. Bot. Z. 45: 341. 1895.

Leaf blade narrowly lanceolate, 4–6 mm wide, abaxially glabrous. Ovary and mericarps densely hirsute or tomentose. Fl. Jun–Aug, fr. Jul–Sep.

Mountain slopes, river valleys, swamps, grasslands, meadows; 500–3900 m. Hebei, Heilongjiang, Nei Mongol, Sichuan, Xinjiang, Xizang [Japan, Kashmir, Russia; NE Europe].

**7b. *Galium boreale* var. *boreale***

北方拉拉藤(原变种) bei fang la la teng (yuan bian zhong)

*Galium boreale* var. *vulgare* Turczaninow.

Leaf blade narrowly lanceolate or linear-lanceolate, 1–3.9 mm wide, glabrous. Ovary and mericarps densely hirsute or tomentose with slightly curved, white trichomes. Fl. May–Aug, fr. Jun–Oct.

Forests, thickets, or tussocks on mountain slopes, ditch sides, grasslands, meadows; 700–3900 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shandong, Shanxi, Sichuan, Xinjiang, Xizang [India, Korea, Pakistan, Russia; Europe, North America].

**7c. *Galium boreale* var. *ciliatum*** Nakai, J. Jap. Bot. 15: 340. 1939.

硬毛拉拉藤 ying mao la la teng

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, abaxially sparsely hairy or scabrous at least along veins. Ovary and mericarps densely hirsute or tomentose. Fl. Jun–Sep, fr. Jul–Oct.

Mountain slopes, river beaches, ditch sides, open fields, meadows; 200–4600 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Japan, Russia; Europe (Finland, Romania), North America].

**7d. *Galium boreale* var. *hyssopifolium*** (Hoffmann) Candolle, Prodr. 4: 600. 1830.

斐梭浦砧草 fei suo pu zhen cao

*Galium hyssopifolium* Hoffmann, Deuschl. Fl., Dritter Jahrgang, 71. 1800; *G. boreale* f. *hyssopifolium* (Hoffmann) B. Boivin; *G. boreale* subsp. *hyssopifolium* (Hoffmann) Schübler & G. Martens; *G. rubioides* var. *hyssopifolium* (Hoffmann) Persoon.

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, glabrous abaxially. Ovary and mericarps glabrous. Fl. and fr. Jun–Aug.

Mountain slopes, grasslands; 1800–2300 m. Sichuan, Xinjiang [Europe].

This variety probably has a wider geographic range.

**7e. *Galium boreale* var. *intermedium*** Candolle, Prodr. 4: 601. 1830.

新砧草 xin zhen cao

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, sparsely pubescent to glabrescent. Ovary and mericarps sparsely hirtellous or scabrous. Fl. Jun–Jul, fr. Jul–Oct.

Mountain slopes, wastelands, forests, grasslands, meadows; 1500–1800 m. Gansu, Heilongjiang, Xinjiang [Russia; Europe].

**7f. *Galium boreale* var. *kamtschaticum*** (Maximowicz) Nakai, Bot. Mag. (Tokyo) 23: 103. 1909.

堪察加拉拉藤 kan cha jia la la teng

*Galium boreale* f. *kamtschaticum* Maximowicz, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 9 [Prim. Fl. Amur.]: 141. 1859; *G. boreale* var. *koreanum* Nakai.

Leaf blade broadly lanceolate or ovate-lanceolate, 6–10 mm wide, abaxially sparsely hairy or scabrous at least along veins. Ovary and mericarps densely hirsute or tomentose. Fl. and fr. Jun–Sep.

Mountain slopes, farmland sides, riversides, river valleys, grasslands, meadows; 800–2400 m. Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shaanxi, Shanxi, Sichuan, Xinjiang [Kashmir, Korea, Mongolia, Russia; C Asia (“Turkestan”), NE Europe].

Nakai (Bot. Mag. (Tokyo) 23: 103. 1909) commented on Japanese plants and presented a key to *Galium*, including “*Galium boreale* var. *kamtschaticum* Maximowicz” with no further information. Some authors have considered this a validly published combination (e.g., in Go vaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 16 Nov 2007), whereas others have not (e.g., W. C. Chen, loc. cit.: 263) and have instead cited J. Coll. Sci. Imp. Univ. Tokyo 31: 498. 1911 (sometimes called Fl. Koreana 2) as the place of publication. Nakai’s new combination was indeed validly published in 1909 because, before 1953, merely citing an author’s name could constitute indication of a basionym (*Vienna Code*, Art. 33.2). Pobedimova et al. (loc. cit.: 419) erroneously attributed this varietal name to Maximowicz, 1859; it was published as a “forma” there.

**7g. *Galium boreale* var. *lancoletatum*** Nakai, J. Jap. Bot. 15: 341. 1939.

光果砧草 guang guo zhen cao

*Galium boreale* var. *leiocarpum* Nakai; *G. ussuriense* Pobedimova.

Leaf blade broadly lanceolate or ovate-lanceolate, 6–12 mm wide, glabrous abaxially. Ovary and mericarps glabrous. Fl. and fr. May–Sep.

Mountain slopes, open fields, grasslands; 900–1900 m. Heilongjiang, Jilin, Xinjiang [Korea, Russia; C Asia (“Turkestan”)].

Nakai’s two varieties were published simultaneously; the choice of epithet was apparently made by Cufodontis (Oesterr. Bot. Z. 89: 227. 1940).

**7h. *Galium boreale* var. *lancilimum*** W. C. Chen, Acta Phytotax. Sin. 28: 302. 1990.

披针叶砧草 pi zhen ye zhen cao

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, abaxially pilosulous or scabrous at least along veins. Ovary and mericarps glabrous. Fl. and fr. summer and autumn.

• Mountain slopes, grasslands, meadows, ditch sides, wastelands; 1800–3000 m. Gansu, Heilongjiang, Sichuan, Xinjiang.

**7i. *Galium boreale* var. *latifolium*** Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 18: 315. 1845.

宽叶拉拉藤 kuan ye la la teng

Leaf blade ovate-lanceolate, 6–15 mm wide, glabrous abaxially. Ovary and mericarps densely hirsute or tomentose. Fl. and fr. Jun–Sep.

Mountain slopes, grasslands, meadows, farmland sides, river beaches; 700–2700 m. Gansu, Heilongjiang, Jilin, Liaoning, Nei Mongol, Ningxia, Shanxi, Xinjiang [Kashmir, Korea, Russia; C Asia (“Turkestan”)].

**7j. *Galium boreale* var. *pseudorubioides*** Schur, Enum. Pl. Transsilv. 280. 1866.

假茜砧草 jia qian zhen cao

*Galium boreale* subsp. *pseudorubioides* (Schur) Soó.

Leaf blade broadly lanceolate or ovate-lanceolate, 5–12 mm wide, sparsely pubescent to glabrescent abaxially. Ovary and mericarps sparsely hirtellous or scabrous. Fl. and fr. Jun–Jul.

Mountain slopes, meadows; ca. 1400 m. Heilongjiang, Jilin, Xinjiang [Russia; C Asia (“Turkestan”), Europe].

**7k. *Galium boreale* var. *rubioides*** (Linnaeus) Čelakovsky, Prodr. Fl. Böhmen 2: 281. 1872.

茜砧草 qian zhen cao

*Galium rubioides* Linnaeus, Sp. Pl. 1: 105. 1753.

Leaf blade ovate-lanceolate or ovate, 4–6 mm wide, abaxially pilosulous or scabrous at least along veins. Ovary and mericarps glabrous. Fl. and fr. Jun–Sep.

Mountain slopes, grasslands; 1100–1400 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, Xinjiang [Russia; Europe].

This broad- and large-leaved taxon is quite distinct from *Galium boreale* s.s. in Europe and is usually treated there as a separate species. Contrary to the above distribution data given by W. C. Chen (loc. cit.: 261) and according to Pobedimova et al. (loc. cit.: 420) it does not extend into Asia.

**8. *Galium bullatum*** Lipsky, Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 300. 1894.

泡果拉拉藤 pao guo la la teng

Subshrubs, perennial, erect or ascending, sometimes caespitose, 5–40 cm tall. Rootstock stout, woody. Stems 4-angled, very shortly pilose at base, glabrous and smooth above. Leaves in whorls of 5–8, drying blackish, linear to linear-oblong, 12–27 × 1–2 mm, glabrous or sparsely ciliolate toward acute apex; vein 1. Inflorescences terminal on main and short lateral branches, cymose to corymbiform, lax, few to several flowered; axes glabrous and smooth; bracts reduced or none; pedicels 1–4 mm. Ovary ovoid, ca. 1.5 mm, glabrous. Corolla white, cup-shaped to subrotate, 3.5–5 mm in diam., glabrous; lobes 4, lanceolate-oblong, slightly mucronulate. Fruit usually from 1 mericarp only, subglobose, 3–3.5 mm in diam., glabrous, smooth, white, with pericarp inflated, spongy to ± fleshy. Fl. Jun–Jul, fr. Jul–Aug.

Grasslands, meadows; ca. 500 m. ?Xinjiang [SW Asia (Armenia, ?Iran, Nakhichevan)].

*Galium bullatum* is a member of *G. sect. Orientaligium* centered in SW Asia and characterized by slightly cup-shaped corollas, never retrorsely aculeolate stems, etc. The above diagnosis is taken from the original description and a collection by Szovits in W (“in Persia borealis”). We have not seen a specimen from China. The description by W. C. Chen (in FRPS 71(2): 274. 1999), evidently based on plants from Xinjiang, deviates from the authentic material in W by describing the stems as retrorsely hispidulous along angles and the corolla as rotate. Species of *G. sect. Orientaligium* usually are rather locally distributed (Ehrendorfer et al., Fl. Iranica 176: 205–231. 2005), and the distance between Nakhichevan and Xinjiang is enormous. All this makes it quite unlikely that *G. bullatum* (or even other related members of *G. sect. Orientaligium*) really occurs in China. A definite decision has to wait until voucher specimens become available for comparison.

**9. *Galium bungei*** Steudel, Nomencl. Bot., ed. 2, 1: 657. 1840.

四叶律 si ye lu

Herbs, perennial, 5–50 cm tall, erect from tender reddish rootstock or filiform rhizome. Stems often caespitose, 4-angled, unbranched or little branched, smooth, glabrous and smooth or pilosulous to pilose, rarely retrorsely aculeolate, at nodes ± hispidulous. Leaves in whorls of 4, subsessile; blade drying papery, ovate-oblong, ovate-lanceolate, lanceolate-oblong, elliptic-oblong, or narrowly oblanceolate, (6–)8–20(–34) × (2–)3–7(–10) mm, length/breadth index usually 3–5, glabrous and sometimes antrorsely aculeolate on midrib and near margins, to pilosulous or pilose throughout, lower side sometimes glandular-punctate or striate, base cuneate, apex acute or slightly obtuse; 1 principal vein, 2 lateral veins usually inconspicuous. Inflorescences terminal and/or axillary, cymose to paniculate, congested to lax, cymes few to several flowered, 1–5 cm; peduncles glabrous, smooth; bracts none or few, spatulate to narrowly elliptic, 1–5 mm; pedicels (1–)2–4(–7) mm. Ovary subglobose to ellipsoid, laterally somewhat flattened, 0.4–0.8 mm, glabrous to strigillose, smooth to tuberculate. Corolla yellowish green or white, rotate, 1.5–2.5 mm in diam., glabrescent; lobes 4, ovate or oblong, acute to acuminate. Mericarps ellipsoid, 1–2 mm, tuberculate, aculeolate or with appressed and curved to spreading and uncinat trichomes ca. 0.3 mm, rarely glabrous and smooth. Fl. Apr–Sep, fr. May–Jan.

Forests, thickets, or meadows on mountains, hills, open fields, farmlands, ditch sides, riversides and beaches, streamsides; near sea level to 3600 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

*Galium bungei* designates a group of tender perennial herbs from *G. sect. Platygaleum*, widespread and common at low to middle elevations throughout China. *Galium bungei* is also used medicinally there. The group is very variable with respect to habit and inflorescence, as well as stem, leaf, and fruit indumentum (the latter from tuberculate to spreading hooked trichomes). The small and inconspicuous flowers suggest autogamous reproduction. All this has caused the recognition of several “species.” In view of the gradual nature of this variation and the partly simple genetic basis of the underlying differences, we give them less taxonomic weight, follow Cufodontis (Oesterr. Bot. Z. 89: 219–223. 1940) and the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010), and include them all as synonyms under *G. bungei* s.l. Only the closely related *G. salvinense*, endemic in Sichuan and Yunnan, is maintained on the basis of its elongated and slender pedicels and the constant hooked fruit trichomes.

Forms of *Galium bungei* with broader leaves in Sichuan (e.g., var. *punduanoides*) develop, in addition to the principal vein, stronger side veins somewhat approaching the larger *G. yunnanense*, typically with 3-veined leaves, which occurs in the same area.

To bring some schematic order into the extreme variation of a broadly circumscribed *Galium bungei* s.l., Cufodontis (loc. cit.: 221–222) created six varieties, without giving much weight to differences in fruit surface. These varieties were taken up by W. C. Chen in FRPS (71(2): 247–250. 1999) and are also presented here. In contrast to this approach, Yamazaki (J. Jap. Bot. 61: 51. 1991; Fl. Japan 3a: 236–237. 1993) recognized several of these varieties as species for the *Flora of Japan*: *G. pogonanthum* (corresponding to *G. bungei* var. *setuliflorum*), separated by having appressed upcurved short hairs on its fruit rather than spreading hooked trichomes as *G. bungei* s.s.; *G. gracilens* (corresponding to *G. bungei* var. *bungei*), characterized by short appressed punctate fruit hairs and slender inflorescences; and *G. trachyspermum* (corresponding to *G. bungei* var. *trachyspermum*), with short appressed hooked fruit hairs and more condensed inflorescences. For each of these segregate species Yamazaki (loc. cit. 1991; loc. cit. 1993) also created several new additional varieties not considered here. For their treatment of Taiwanese members of *G. bungei* s.l. Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 105–106. 1998; Fl. Taiwan, ed. 2, 4: 255–256. 1998) accepted two species: *G. gracilens* with tuberculate fruit and *G. fukuyamae* with appressed uncinat fruit hairs. Below, we present the schematic infraspecific classification of W. C. Chen in FRPS. Descriptions are sketchy due to the limited material available. Nevertheless, this may help as a reference and basis for urgently needed future studies on this polymorphic and phylogenetically important group.

- 1a. Stems pubescent.
  - 2a. Pubescence with trichomes shorter than diam. of stems ..... 9c. var. *hispidum*
  - 2b. Pubescence with trichomes longer than diam. of stems ..... 9d. var. *punduanoides*
- 1b. Stems glabrous, hairy only at nodes.
  - 3a. Corolla lobes sparsely pubescent at least in bud ..... 9e. var. *setuliflorum*
  - 3b. Corolla lobes glabrous.
    - 4a. Leaf blade broadly elliptic, obovate, or broadly lanceolate;

inflorescences crowded, congested to subcapitate ..... 9f. var. *trachyspermum*

- 4b. Leaf blade narrowly lanceolate, linear-lanceolate, or ovate-lanceolate; inflorescences lax.
  - 5a. All leaves narrowly lanceolate or linear-lanceolate, to 3 cm ..... 9a. var. *angustifolium*
  - 5b. Lower stem leaves ovate-lanceolate, upper stem leaves narrower, often less than 2 cm ..... 9b. var. *bungei*

**9a. *Galium bungei* var. *angustifolium*** (Loesener) Cufodontis, Oesterr. Bot. Z. 89: 221. 1940.

狭叶四叶律 xia ye si ye lü

*Galium gracile* f. *angustifolium* Loesener, Beih. Bot. Centralbl., Abt. 2, 37: 182. 1920.

Leaf blade narrowly lanceolate or linear-lanceolate, to 3 cm. Fl. Jun–Jul, fr. Aug–Oct.

• Anhui, Fujian, Gansu, Hebei, Henan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanxi, Zhejiang.

**9b. *Galium bungei* var. *bungei***

四叶律(原变种) si ye lü (yuan bian zhong)

*Galium fukuyamae* Masamune; *G. gracile* Bunge (1833), not Wallroth (1822); *G. gracile* var. *miltorrhizum* (Hance) Loesener; *G. gracilens* (A. Gray) Makino; *G. lutchuense* Nakai; *G. miltorrhizum* Hance; *G. remotiflorum* H. Léveillé & Vaniot; *G. trachyspermum* A. Gray var. *gracilens* A. Gray.

Stems glabrous. Leaf blade ovate-lanceolate at lower part, attenuate at upper part. Inflorescence paniculate and lax. Corolla glabrous. Fl. Apr–Sep, fr. May–Jan.

Forests or meadows on hills or mountains, open fields, farmlands, ditch sides; below 100–2600 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

**9c. *Galium bungei* var. *hispidum*** (Matsuda) Cufodontis, Oesterr. Bot. Z. 89: 222. 1940.

硬毛四叶律 ying mao si ye lü

*Galium gracile* f. *hispidum* Matsuda, Bot. Mag. (Tokyo) 26: 130. 1912; ?*G. martini* H. Léveillé & Vaniot; *G. trachyspermum* var. *hispidum* (Matsuda) Kitagawa.

Stems soft pubescent, trichomes shorter than diam. of stem. Fl. Apr–Jun, fr. May–Sep.

• Forests or meadows on mountain slopes, river beaches, open fields; 100–3400 m. Anhui, Fujian, Gansu, Henan, Hubei, Jiangsu, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang.

In the protologue Cufodontis correctly cited the basionym of his variety but incorrectly gave his varietal name as “var. *hispidum* (Kitag.) Cufodontis” when the basionym author was actually Matsuda.

*Galium martini* was accepted as a dubious species by W. C. Chen in FRPS (loc. cit.: 282). The protologue (Bull. Soc. Bot. France 55: 58. 1908) is quite incomplete but probably refers to a strongly hairy plant of *G. bungei* s.l. from Guizhou. Therefore, the name is provisionally placed here as a possible synonym of var. *hispidum* or var. *punduanoides* until a detailed study of the type (E) will clarify the matter.

**9d. *Galium bungei* var. *punduanoides*** Cufodontis, Oesterr. Bot. Z. 89: 222. 1940.

毛四叶律 mao si ye lu

?*Galium martini* H. Léveillé & Vaniot.

Stem soft to stiffly pubescent, trichomes longer than diam. of stems. Inflorescence often more congested and terminal. Fl. Jun–Jul, fr. Jul–Aug.

• Forests, thickets, or meadows on mountains, open fields, riversides; 900–3600 m. Gansu, Jiangsu, Sichuan, Yunnan.

**9e. *Galium bungei* var. *setuliflorum*** (A. Gray) Cufodontis, Oesterr. Bot. Z. 89: 221. 1940.

毛冠四叶律 mao guan si ye lu

*Galium trachyspermum* var. *setuliflorum* A. Gray, Mem. Amer. Acad. Arts, n.s., 6: 393. 1859; *G. pogonanthum* Franchet & Savatier; *G. pogonanthum* var. *setuliflorum* (A. Gray) H. Hara; *G. setuliflorum* (A. Gray) Makino.

Corolla lobes sparsely pubescent at least in bud.

Jiangsu, Shanxi [Japan, Korea].

**9f. *Galium bungei* var. *trachyspermum*** (A. Gray) Cufodontis, Oesterr. Bot. Z. 89: 221. 1940.

阔叶四叶律 kuo ye si ye lu

*Galium trachyspermum* A. Gray in Perry, Narr. Exped. China Japan 2: 313. 1856; *G. venosum* H. Léveillé.

Leaf blade broadly elliptic, obovate, or broadly lanceolate. Inflorescences congested to subcapitate. Fl. Apr–May, fr. Apr–Jul.

Forests or meadows on hills, open fields, streamsides; near sea level to 800 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Sichuan, Zhejiang [Japan, Korea].

**10. *Galium chekiangense*** Ehrendorfer, Novon 20: 270. 2010.

浙江拉拉藤 zhe jiang la la teng

Herbs, perennial, with thin rhizomes. Stems 2–4 from a common base, erect, usually unbranched, 20–30(–40) cm tall, with only 4 or 5 internodes from base to first inflorescence node, with 4 prominent, rounded, and whitish angles, glabrous and smooth except for short and stiff hairs at nodes. Leaves and leaflike stipules in whorls of 4, subsessile; blade drying somewhat leathery and light brownish green, broadly elliptic to ovate, (15–)23–30(–50) × (8–)11–15(–25) mm, length/breadth index 2.5 or less, gradually narrowed into base, broadest near middle, gradually narrowed into apex, mostly

shortly apiculate but without a hyaline point, glabrous except for antrorse microhairs (0.1–0.2 mm) along 3 main veins, mostly on lower but also on upper side and along slightly revolute margins, papillose on upper side under a strong lens (20×), lower side clearly marked by numerous darker and linear idioblasts. Inflorescences loosely thyrsoid and elongate, from uppermost 2 or 3 nodes, clearly longer than subtending leaves, cymes lateral and terminal, somewhat divaricate, 1–4 cm, with few and inconspicuous linear bracts and rather few flowered; peduncles 1–2 cm and pedicels 0.1–1 cm. Ovary obovoid, 0.8–1 mm. Corolla greenish white, rotate, ca. 3 mm in diam., glabrous; lobes 4, acuminate. Ripe mericarps ovoid, 1.5–2(–3) mm, densely covered by stiff and appressed to slightly divergent microhairs, 0.15–0.25 mm and with an acute and ± bent apex. Fl. Jul, fr. Aug.

• Lower montane forests; ca. 1400 m. Fujian, Zhejiang.

Specimens of *Galium chekiangense* from the province of Fujian were included and described in FRPS (71(2): 265. 1999) under the name of *G. nakaii* Kudô ex H. Hara (J. Jap. Bot. 9: 517. 1933). These Fujian vouchers were not available, but two fruiting specimens from the adjacent province of Zhejiang (formerly Chekiang: Xi ming shan) in the herbarium PE could be studied. They were determined as “*G. kamschaticum*” and closely correspond to the description of *G. nakaii* in FRPS. These PE specimens deviate clearly from authentic Japanese specimens of *G. nakaii* as well as from *G. kamschaticum* and *G. oreganum* Britton. This has justified the description of *G. chekiangense* as a new and endemic Chinese species and makes *G. nakaii* an endemic of Japan.

*Galium chekiangense* clearly belongs to *G.* sect. *Platygalium* s.l. (Ehrendorfer et al., Fl. Iranica 176: 175. 2005) and apparently is a member of the *G. kamschaticum* species group, which includes the amph-Beringian *G. kamschaticum* (in China limited to elevations of 1500–2300 m in the NE provinces of Heilongjiang and Jilin), the Japanese *G. nakaii* from Hokkaido and N Honshu, and the W North American *G. oreganum*. These three latter species differ from *G. chekiangense* by their leaf blades drying dark brownish (not light brownish green), thin, membranous and smooth, neither papillose above nor with glandular-striate idioblasts below, and by their ripe mericarps with much longer uncinuate trichomes (0.8–1 mm, not 0.15–0.25 mm). In addition, *G. nakaii* has inflorescence cymes mostly shorter (not clearly longer) than the subtending leaves.

For further and more detailed studies of the *Galium kamschaticum* group, one should refer to the wide circumscription of *G. kamschaticum* (with three varieties) and the confused, partly contradictory description of the fruit indumentum of *G. nakaii* in Yamazaki (Fl. Japan 3a: 234–235. 1999).

**11. *Galium consanguineum*** Boissier, Diagn. Pl. Orient., ser. 1, 6: 69. 1846.

卷边拉拉藤 juan bian la la teng

*Galium consanguineum* subsp. *majmechense* (Bordzilowski) A. D. Mikheev; *G. majmechense* Bordzilowski; *G. verum* Linnaeus var. *consanguineum* (Boissier) Boissier.

Herbs, perennial, often caespitose from a stout and woody rootstock with rhizomes. Stems erect, to 1 m tall, 4-angled, glabrous to puberulent at least at nodes, smooth. Leaves in whorls of 6–12, sessile; blade drying papery, linear-oblongate to linear, 20–28 × 1–3 mm, glabrous, more rarely ± hairy,

base acute to straight, margin shortly to strongly revolute and usually antrorsely aculeolate, apex acute and mucronate; vein 1. Inflorescences narrowly paniculate with main stems and short lateral and terminal, few- to several- or many-flowered, rather congested cymes; peduncles glabrous, smooth; pedicels 0.5–3 mm, subtended by leaflike bracts. Ovary subglobose to obovoid, 0.5–0.8 mm, smooth, glabrous or ± hispidulous with straight hairs. Corolla yellow, rotate, ca. 3 mm in diam., glabrous, lobed for 3/4 or more; lobes 4(or 5), lanceolate-oblong, acute to acuminate. Mericarps ellipsoid to obovoid, ca. 1.5 × 1 mm, glabrous or ± hispidulous with straight trichomes. Fl. Jul–Aug, fr. Aug–Sep.

Thickets; [1300–]1700[–2800] m. Xinjiang [SW Asia (Armenia, Azerbaijan, Iran, Iraq, Lebanon, E Turkey)].

*Galium consanguineum* was treated as *G. majmechense* (a younger synonym) by W. C. Chen (FRPS 71(2): 269. 1999). It belongs to the polymorphic *G. verum* group or complex (see additional comments under that species) and apparently links it (as a hybrid taxon?) to more broadly leaved and glabrous members of *G.* sect. *Orientigalium* (Ehrendorfer et al., Fl. Iranica 176: 205–207. 2005). *Galium consanguineum* can be separated from *G. verum* by its broader (more than 2.5 mm), ± glabrous leaves, but intermediates occur.

**12. *Galium crassifolium*** W. C. Chen, Acta Phytotax. Sin. 28: 299. 1990.

厚叶拉拉藤 hou ye la la teng

Herbs, perhaps perennial, ascending, ca. 10 cm tall. Stems 4-angled, caespitose, glabrous and smooth or sparsely puberulent. Leaves in whorls of 4, sessile or subsessile; blade drying leathery, elliptic or ovate, 3–8 × 2–4 mm, scabrous with microhairs, base cuneate or subobtusate, margins antrorsely ciliate, apex obtuse and mucronate; vein 1. Inflorescences terminal and/or axillary, cymose, few flowered, up to 1 cm; axes glabrous and smooth, somewhat bracteate; pedicels ca. 1 mm. Flowers unknown. Mericarps ovoid, 0.5–1 mm, with appressed, slightly curved microhairs, ca. 0.3 mm. Fl. Aug–Sep, fr. Oct.

- Valleys, open habitat; ca. 800 m. Shanxi (Zhenba).

We have seen no authentic material of *Galium crassifolium*, but the original description is accompanied by a good drawing. In the protologue similarities with the Taiwanese *G. tarokoense* are suggested. Both species are distantly related, but apparently *G. crassifolium* falls within the morphological amplitude of the polymorphic *G. bungei*. Its distinctness with respect to reduced plants from dry habitats should be checked in the future.

**13. *Galium dahuricum*** Turczaninow ex Ledebour, Fl. Ross. 2: 409. 1844.

大叶猪殃殃 da ye zhu yang yang

Herbs, perennial, from a slender reddish rootstock. Stems erect to ascending, weak to procumbent and often climbing, sometimes up to 2.5 m, 4-angled, sparsely to densely retrorsely aculeolate along angles and at nodes, rarely ± glabrescent. Leaves on main stems in whorls of 5 or 6, subsessile; blade drying papery, of very variable shape, from obovate and elliptic-oblong to narrowly oblanceolate, (11–)15–40(–55) × (2–)3–10(–14), sparsely to densely retrorsely aculeolate adaxially along midrib, abaxially, and along flat to thinly reflexed mar-

gins, base acute to cuneate, apex acute to obtuse and mucronate; vein 1. Inflorescences paniculate, with axillary and terminal, several- to many-flowered, usually very lax and up to 7 cm long cymes; axes filiform and often flexuous, sparsely aculeolate to glabrous; bracts few, lanceolate; pedicels slender, in flower 2–5 mm. Ovary obovoid, ca. 0.8 mm, with dense spreading or appressed undeveloped trichomes, or glabrous. Corolla white or pale green, rotate, of quite different sizes, (1–)1.5–3(–4) mm in diam., glabrous; lobes 4, triangular, obtuse to acute or minutely apiculate. Mericarps ellipsoid, ca. 2 mm, with appressed or spreading and uncinat trichomes (0.3–0.5 mm), tuberculate to completely glabrous and smooth, on pedicels elongating to 10 mm or more. Fl. Jun–Sep, fr. Jul–Nov.

Humid forests, thickets, ditch sides, grasslands, meadows; 200–3400 m. Fujian, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan, Zhejiang [Japan, Korea, Russia].

Within *Galium* sect. *Trachygalium* and the extremely polymorphic species group of *G. asperifolium* (see there) Cufodontis (Oesterr. Bot. Z. 89: 239–243. 1940), Yamazaki (Fl. Japan 3a: 206–240. 1993), and W. C. Chen (in FRPS 71(2): 255–258. 1999) differentiated the closely related taxa *G. dahuricum* (in FRPS as “*G. davuricum*,” the spelling used in the protologue by Ledebour), *G. tokyoense*, *G. pseudoasprellum*, and *G. manshuricum* mainly according to the lack (in the two former) and the presence (in the two latter) of appressed or spreading uncinat trichomes on the mericarps. As this character apparently often varies within populations of these taxa, the present treatment relies on the much more stable feature of slender, filiform, and ± flexuose vs. more stiff and divaricate peduncles and pedicels. The former state characterizes *G. dahuricum* (including *G. manshuricum* and *G. pseudoasprellum*), the latter *G. tokyoense*. This species assembly has its distribution center in E Asia but extends with *G. asprellum* Michaux s.s. into E North America.

*Galium pseudoasprellum* was accepted as a species by Cufodontis (loc. cit.: 237–238), W. C. Chen (loc. cit.: 254–255), and Yamazaki (loc. cit.: 238), and the latter two also maintained *G. niewerthii*. In our opinion and because of their similar inflorescences, both taxa should be regarded as synonyms of *G. dahuricum*, the former under var. *lasiocarpum*, the latter under var. *dahuricum*. Even if we have not seen authentic specimens of *G. niewerthii*, all of its characters listed fall within the limits of *G. dahuricum*; thus, we regard it as a glabrous-fruited form of that variable species. So far, *G. comarii* has been a badly understood taxon (see Cufodontis, loc. cit.: 241; Lauener, Notes Roy. Bot. Gard. Edinburgh 32: 107. 1972; Mill, Edinburgh J. Bot. 53: 193–213. 1996). Because of its slender inflorescence, extremely long pedicels, and rugose fruit mentioned in the protologue, it can now be safely assigned as another synonym of *G. dahuricum* var. *dahuricum*.

The following infraspecific taxa of *Galium dahuricum* (and *G. pseudoasprellum*), accepted by Cufodontis (loc. cit.: 237–238, 243–244) and W. C. Chen (loc. cit.), are keyed and listed here for comparison.

- 1a. Ovary and mericarps glabrous or tuberculate ..... 13a. var. *dahuricum*
- 1b. Ovary and mericarps with spreading or appressed uncinat trichomes.
  - 2a. Inflorescences with loosely branched cymes, with filiform and ± flexuose pedicels of up to 5 mm, in fruit up to 10 mm ..... 13b. var. *lasiocarpum*

- 2b. Inflorescences more congested,  
pedicels shorter than 5 mm ..... 13c. var. *densiflorum*

**13a. *Galium dahuricum* var. *dahuricum***

大叶猪殃殃(原变种) da ye zhu yang yang (yuan bian zhong)

*Galium asprellum* Michaux var. *dahuricum* (Turczaninow ex Ledebour) Maximowicz; *G. comarii* H. Léveillé & Vaniot; *G. dahuricum* var. *leiocarpum* Nakai; *G. niewerthii* Franchet & Savatier.

Stems and nodes often ± glabrescent. Leaf blade with margins ± retrorsely aculeolate. Inflorescences lax; peduncles and pedicels strongly elongated. Ovary and mericarps glabrous or tuberculate. Fl. Jun–Jul, fr. Aug–Oct.

Forests, grasslands; 700–1000 m. Fujian, Guizhou, Hebei, Heilongjiang, Hubei, Hunan, Jilin, Liaoning, Nei Mongol, Sichuan, Xinjiang, Yunnan [Korea, Russia].

This variety was listed as *Galium niewerthii* for the *Flora of Japan* (Yamazaki, loc. cit.: 238). Forms with many-flowered inflorescences, somewhat shorter pedicels, and glabrous ovaries and fruit have been seen from Yunnan; they apparently tend toward *G. asperifolium* and/or *G. pratii*. *Galium taiwanense* (see there) is very close to *G. dahuricum* var. *dahuricum* and evidently replaces it on Taiwan.

**13b. *Galium dahuricum* var. *lasiocarpum*** (Makino) Nakai, J. Coll. Sci. Imp. Univ. Tokyo 31: 498. 1911.

东北猪殃殃 dong bei zhu yang yang

*Galium asprellum* var. *lasiocarpum* Makino, Bot. Mag. (Tokyo) 17: 76. 1903; *G. dahuricum* var. *manshuricum* (Kitagawa) H. Hara; *G. manshuricum* Kitagawa; *G. pseudoasprellum* Makino.

Stem nodes and leaf blade retrorsely aculeolate. Inflorescences lax; peduncles and pedicels elongated. Ovary and mericarps with dense appressed or spreading uncinete trichomes. Fl. Jun–Jul, fr. Aug–Oct.

Forests, meadows, ditch sides; 300–1100 m. Gansu, Hebei, Heilongjiang, Henan, Jiangsu, Jilin, Liaoning, Qinghai, Shaanxi, Shanxi, Sichuan, Yunnan [Japan, Korea].

**13c. *Galium dahuricum* var. *densiflorum*** (Cufodontis) Ehren-dorfer, Novon 20: 277. 2010.

密花拉拉藤 mi hua la la teng

*Galium pseudoasprellum* var. *densiflorum* Cufodontis, Oesterr. Bot. Z. 89: 237. 1940.

Stems often lower and leaf blade smaller. Inflorescences shorter and more congested; pedicels rarely longer than 5 mm; bracts larger, similar to leaves. Ovary and mericarps with dense spreading uncinete trichomes. Fl. Jul–Aug, fr. Aug–Nov.

• Forests, thickets, meadows on mountains; 700–3400 m. Gansu, Guizhou, Hebei, Henan, Jiangxi, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xizang, Yunnan.

The above geographic indications for this variety are uncertain because of confusion with *Galium tokyoense*, etc. At least in part, *G. dahuricum* var. *densiflorum* may refer to transitional (?hybrid) forms of *G. dahuricum* var. *lasiocarpum* with *G. asperifolium*, *G. blinii*, *G. pratii*, and/or *G. sungpanense*.

**14. *Galium echinocarpum*** Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30(1): 147. 1911.

刺果猪殃殃 ci guo zhu yang yang

Herbs, perennial, emerging from reddish, filiform rhizomes. Stems ascending to erect, 10–40 cm tall, 4-angled, glabrous and smooth. Leaves in whorls of (4 or)5 or 6, subsessile; blade drying papery, oblanceolate, obovate, narrowly elliptic, or narrowly oblanceolate, 6–25 × 2–7 mm, glabrous or sometimes sparsely hispid to strigillose, base acute, margins flat, smooth or antorsely aculeolate, apex acute to obtuse or rounded and abruptly mucronate; vein 1. Inflorescences terminal and in axils of upper leaves, with lax, few- to several-flowered cymes; axes glabrous, smooth; bracts none or leaflike, 2–6 mm; pedicels 0.5–2 mm. Ovary subglobose, 0.5–0.7 mm, densely strigillose with undeveloped trichomes. Corolla white, rotate, ca. 2 mm in diam., glabrous, lobed for 3/4 or more; lobes 4, triangular, apex obtuse. Mericarps subglobose to ellipsoid, ca. 2 mm, with dense uncinete trichomes ca. 1 mm, on pedicels elongating to 10 mm. Fl. May, fr. May–Dec.

• Montane forest regions, grassy fields, along drainage ditches; 900–3500 m. Taiwan.

*Galium echinocarpum* is very similar to *G. hoffmeisteri* and replaces it on Taiwan. *Galium takasagomontanum* may belong here as a synonym (see there).

**15. *Galium elegans*** Wallich in Roxburgh, Fl. Ind. 1: 382. 1820.

小红参 xiao hong shen

Herbs, perennial, climbing or procumbent to usually erect, 0.1–1 m tall, from a slender rootstock with purplish rhizomes. Stems somewhat stout, 4-angled, smooth, sparsely to densely puberulent at nodes, angles thickened. Leaves in whorls of 4, subsessile or petiole to 1.5 mm; blade drying papery to leathery, green to gray, or dark brown, ovate to broadly elliptic, 6–30 × 3–20 mm, length/breadth index mostly 2 or less, sparsely to densely hirtellous, villosulous, or hispidulous to scaberulous at least on principal veins, abaxially often glandular-punctate and/or -striate, base rounded to acute, margins antorsely ciliate to ciliate and flat to thinly revolute, apex rounded to obtuse; principal veins palmate, 3(or)5. Inflorescences thyrsoid to paniculiform, with several- to many-flowered, 2–10 cm long cymes in uppermost leaf axils and terminal; peduncles glabrescent to sparsely scaberulous, hirtellous, puberulent, or villosulous; bracts narrowly spatulate to narrowly elliptic, 1–3 mm; pedicels 0.5–2.5 mm. Flowers dioecious, polygamo-dioecious, or sometimes ?hermaphroditic. Ovary obovoid, in staminate flowers ca. 0.5 mm and glabrous to scaberulous or sparsely strigillose, in pistillate and bisexual flowers 0.8–1 mm and usually moderately to densely strigillose, particularly on their lateral side. Corolla white or pale yellow, rotate, 2–2.5 mm in diam., glabrous; lobes 4, ovate-triangular, acute to rounded. Mericarps ellipsoid, 1–1.5 mm, with sparse to dense and spreading uncinete trichomes 0.5–0.8 mm, rarely scaberulous or glabrous. Fl. Apr–Aug(–Oct), fr. May–Dec.

Forests, thickets, meadows on mountain slopes, streamsides, open fields, on rocks; 200–3500 m. Anhui, Fujian, Gansu, Guangxi, Guizhou,

Hunan, Qinghai, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Kashmir, Myanmar, Nepal, Pakistan, Thailand].

*Galium elegans* is a widely ranging, polymorphic species that may not be completely distinct from several other related taxa. It is here circumscribed more narrowly than by Cufodontis (Oesterr. Bot. Z. 89: 228–232. 1940) and W. C. Chen (in FRPS 71(2): 242–245. 1999), which reduces its variation a bit. These aspects are discussed below.

Plants with narrower leaves are separated here as *Galium yunnanense*. This species comprises two of the varieties included by Cufodontis in *G. elegans*, i.e., *G. elegans* var. *angustifolium* and *G. elegans* var. *nemorosum*. Separation of the two taxa is not always easy, as transitional specimens occasionally occur.

Plants of *Galium elegans* with shortened pedicels and more congested cymes (e.g., from Sichuan, Shimian Xian) may approach the Himalayan *G. confertum* Royle ex J. D. Hooker.

*Galium nephrostigmaticum* was described as a species by Diels, an opinion still maintained by some authors. Here, it is treated as a variety of *G. elegans*, following W. C. Chen (Acta Phytotax. Sin. 28: 301. 1990) who referred to its glabrous to scaberulous ovaries and fruit, as noted in Diels's protologue. In contrast to this, Cufodontis (loc. cit.) synonymized *G. nephrostigmaticum* with *G. elegans* var. *elegans*. In an extensive discussion he demonstrated that *G. elegans* is dioecious and that *G. nephrostigmaticum* was based on a male plant with staminate flowers and reduced glabrous to smooth ovaries and sessile stigmas. In contrast, pistillate flowers of *G. elegans* have hairy ovaries and fruit, well-developed styles, and reduced stamens. Thus, according to Cufodontis, *G. nephrostigmaticum* does not merit taxonomic recognition. Ehrendorfer et al. (Fl. Iranica 176: 177. 2005) did not contradict the conclusions of Cufodontis but noted that some plants of *G. elegans* are monoecious or have bisexual flowers. This shows that the reproductive biology of this species apparently is more complex than thought before. Provisionally, *G. nephrostigmaticum* is treated here as a variety, pending more detailed studies of this critical group.

The still uncertain relationships between *Galium elegans* on the Chinese mainland and *G. formosense* on Taiwan are discussed under the latter taxon. In the present treatment their separation is maintained provisionally.

The traditional varieties of *Galium elegans* are separated schematically by the density, type, and distribution of the indumentum on the vegetative organs and have doubtful taxonomic value. W. C. Chen in FRPS (loc. cit.) also used leaf size and apex shape as characters to differentiate these varieties. For reference and to facilitate comparison with other works, we present a key to these infraspecific taxa below.

- 1a. Ovary (and fruit?) glabrous to scaberulous ..... 15c. var. *nephrostigmaticum*
- 1b. Ovary and fruit with ± uncinat trichomes.
  - 2a. Leaf blades in middle stem region ovate-lanceolate, length/breadth index 2–2.5, apex acute or obtuse and shortly acuminate, with a dense and fine indumentum ..... 15d. var. *velutinum*
  - 2b. Leaf blade ovate to ovate-lanceolate or broadly elliptic, length/breadth index usually less than 2, apex usually obtuse or slightly acuminate.
    - 3a. Stems sparsely or densely hirsute; leaf blade small and

thickly textured, not black when dry ..... 15a. var. *elegans*

- 3b. Stems pilose or glabrescent at least on upper parts; leaf blade often large and thinly textured, blackish brown when dry ..... 15b. var. *glabriusculum*

**15a. *Galium elegans* var. *elegans***

小红参(原变种) xiao hong shen (yuan bian zhong)

*Galium petiolatum* Geddes.

Stems sparsely or densely hirsute. Leaf blade drying thickly textured, not black, ovate to ovate-lanceolate or broadly elliptic, length/breadth index usually less than 2, apex obtuse or slightly acuminate. Mericarps with spreading uncinat trichomes. Fl. Apr–Aug, fr. May–Dec.

Forests, thickets, meadows on mountain slopes, streamsides, open fields, on rocks; 600–3500 m. Anhui, Gansu, Guizhou, Hunan, Qinghai, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Kashmir, Myanmar, Nepal, Pakistan, Thailand].

**15b. *Galium elegans* var. *glabriusculum* Requier ex Candolle, Prodr. 4: 600. 1830.**

广西拉拉藤 guang xi la la teng

*Galium elegans* f. *glabriusculum* (Requier ex Candolle) H. Hara ex H. Ohba.

Stems pilose or glabrescent at least on upper parts. Leaf blade drying ± blackish brown, often thinly textured, ovate, ovate-lanceolate, or elliptic, 10–33 × 5–18 mm, length/breadth index usually 2 or less, apex mostly obtuse. Mericarps with spreading uncinat trichomes. Fl. Jul–Aug, fr. Jul–Oct.

Forests or meadows on mountains and at streamsides; 1100–2900 m. Guangxi, Guizhou, Sichuan, Xizang, Yunnan [India, Nepal].

We have not seen authentic material of this taxon.

**15c. *Galium elegans* var. *nephrostigmaticum* (Diels) W. C. Chen, Acta Phytotax. Sin. 28: 301. 1990.**

肾柱拉拉藤 shen zhu la la teng

*Galium nephrostigmaticum* Diels, Notes Roy. Bot. Gard. Edinburgh 5: 279. 1912.

Similar to *Galium elegans* var. *elegans*, but ovary (and fruit?) glabrous to scaberulous. Fl. Apr–Oct, fr. Aug–Dec.

• Forests, meadows; 200–3000 m. Gansu, Guizhou, Sichuan, Yunnan.

This taxon apparently refers to male plants only (see above).

**15d. *Galium elegans* var. *velutinum* Cufodontis, Oesterr. Bot. Z. 89: 230. 1940.**

毛拉拉藤 mao la la teng

*Galium mairei* H. Léveillé.

Plants densely and finely pubescent, trichomes slender, spreading. Leaf blade lanceolate or ovate-lanceolate, 7–15 × ca.

3 mm, length/breadth index 2–2.5, apex acute or obtuse and shortly acuminate. Mericarps with spreading uncinat trichomes. Fl. and fr. Jul.

• Meadows or on rocks on mountain slopes; 2100–2300 m. Sichuan, Yunnan.

**16. *Galium exile*** J. D. Hooker, Fl. Brit. India 3: 207. 1881.

单花拉拉藤 dan hua la la teng

*Galium handelii* Cufodontis (1940), non Nábělek (1923).

Herbs, annual, slender, procumbent to weak, 4–20 cm tall. Roots slender, reddish when dry. Stems slender, 4-angled, somewhat branched, sparsely retrorsely aculeolate to glabrous. Middle stem leaves opposite with clearly smaller, leaflike stipules in whorls of 4; blades drying papery, obovate or oblanceolate to linear-elliptic, (2–)3.5–10(–12) × 1–3.5(–5) mm, adaxially with sparse appressed hairs or glabrous, margins mostly antrorsely ciliate, otherwise glabrous, base acute, cuneate, or shortly petiolate, apex obtuse to acute but not mucronate; principal vein 1, with inconspicuous pinnate-reticulate lateral veins. Flowers mostly solitary; pedicels 1–3 mm, glabrous. Ovary subglobose, ca. 1 mm, densely covered with undeveloped trichomes. Corolla white, rotate, 1–1.5 mm in diam.; lobes 3(or 4), ovate, obtuse. Mericarps ovoid to elongated, 2–2.5 mm, with dense, white to yellowish brown, uncinat trichomes 0.2–0.5 mm, on pedicels elongating to 10 mm and curved near apex. Fl. Jun–Jul, fr. Aug–Sep.

Rock crevices on mountain slopes, sand and gravel drifts on grassy plains; 1200–4800 m. Gansu, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [India, Nepal].

In his description of *Galium handelii* Cufodontis (Oesterr. Bot. Z. 89: 234–235. 1940) referred to the close *G. songaricum* Schrenk (in Fischer & C. A. Meyer, Enum. Pl. Nov. 1: 57. 1841) but overlooked the older homonym by Nábělek and the Himalayan *G. exile*. This latter annual has a much wider distribution than thought before and is quite variable in China with respect to leaf shape and hairiness, length of pedicels, shape of mericarps, etc. In view of its remarkably small flowers and high fruit set, it very likely is autogamous.

Within the morphologically and DNA-analytically very isolated *Galium* sect. *Depauperata* (Ehrendorfer et al., Fl. Iranica 176: 231–232. 2005) *G. exile* is morphologically very close to the W North American *G. bifolium* S. Watson and particularly to *G. songaricum*, described from the C Asiatic mountain system of Alatau. This latter species, treated in FRPS as “*G. soongoricum*,” is assumed to differ by its 1- or 2(or 3)-flowered cymes, the 4-lobed flowers, and the strongly elongating fruiting pedicels. In FRPS (71(2): 224–227. 1999) both taxa are accepted and indicated for very much the same area in China. Nevertheless, a first analysis of all Chinese specimens in PE, KUN, MO, and WU has not revealed reliable differential characters. Even the inflorescence character and the corolla lobe number varies in some specimens. All these findings do not exclude the possibility that further and more detailed studies will allow to separate the populations from the mountains of C and N Asia as typical *G. songaricum*. But for the Chinese flora and the present treatment we recognize only one species, *G. exile*. In case that the two taxa cannot be separated as species in the future *G. songaricum* will have to replace *G. exile* for priority reasons.

As noted already by Cufodontis (loc. cit.), both *Galium exile* and *G. songaricum* have sometimes been misidentified as *G. pauciflorum*, a synonym of *G. spurium* from the *G. aparine* group. In contrast to *G.*

*exile*, the latter always has more than 4 leaf whorl elements, retrorsely aculeolate leaf margins, and more than 1-flowered cymes.

**17. *Galium formosense*** Ohwi, Repert. Spec. Nov. Regni Veg. 36: 55. 1934.

关山猪殃殃 guan shan zhu yang yang

*Galium kwanzanense* Ohwi.

Herbs, perennial, procumbent to erect, (5–)8–20(–30) cm tall. Stems 4-angled, sparsely to rather densely pilose, angles thickened. Leaves in whorls of 4, sessile; blade drying submembranous, blackish green, broadly elliptic to obovate, 4–20 × 3–10 mm, length/breadth index 2 or less, both surfaces sparsely to densely pilose at least along veins, base cuneate to obtuse, apex obtuse to rounded and mucronate; principal veins 3, palmate. Inflorescences with terminal and axillary, few- to many-flowered, 1–3 cm long cymes; peduncles sparsely pilose to glabrous and smooth; bracts spatulate to ovate, 1.5–3 mm; pedicels 1–4 mm. Flowers ?hermaphroditic. Ovary obovoid, ca. 0.5 mm, densely pubescent with uncinat trichomes. Corolla yellowish white, rotate, 1–2 mm in diam., glabrous; lobes 4, ovate, 0.4–0.8 mm, acute. Mericarps ovoid, ca. 1 mm, with dense white to yellowish uncinat trichomes 0.4–0.5 mm. Fl. Jun–Sep, fr. Jun–Nov.

• Mountains, along trails and roads, fields, open ditches; 600–3000 m. Taiwan (Gaoxiang).

Ohwi described the relatively tall (“20–30 cm”) *Galium formosense* from lower elevations and the condensed *G. kwanzanense* (“5–10 cm”) from an exposed higher peak of Taiwan. The technical differences indicated mainly relate to flower diameter (1 mm in the former, 2 mm in the latter). In their study of Taiwanese *Galium* Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998; Fl. Taiwan, ed. 2, 4: 254–259. 1998) formally synonymized the taxa and demonstrate a considerable ecological amplitude of *G. formosense* s.l. Furthermore, the specific separation of *G. formosense* from two other Taiwan mountain endemics, with glabrous stems, *G. morii* and *G. tarokoense*, needs better documentation.

In FRPS (71(2): 243. 1999), W. C. Chen treated *Galium formosense* as a synonym of *G. elegans*. He referred to Cufodontis (Oesterr. Bot. Z. 89: 228. 1940) who supported the occurrence of *G. elegans* in Taiwan based on Hayata’s report of *G. rotundifolium* Linnaeus (in J. Coll. Sci. Tokyo 30(1): 148. 1911) and to J. M. Chao (in Fl. Taiwan 4: 261. 1978) who considered *G. elegans* to be the same as *G. formosense*. In their study of Taiwanese *Galium* Yang and Li (loc. cit. 1998; loc. cit. 1999) did not mention *G. elegans* nor compare *G. formosense* to it. This rather suggests that they were unaware of Cufodontis’s work than that they concluded the two species to be distinct. Similarly, Cufodontis (loc. cit.: 211–251), studying only mainland material, did not mention *G. formosense*, already described in 1934. The Taiwanese specimens at MO (studied by C. M. Taylor) appear to represent a distinct species but fall within *G. elegans* as more broadly circumscribed by Cufodontis (loc. cit.: 228–232). Thus, *G. formosense* is here provisionally separated and regarded as replacing *G. elegans* on Taiwan. In future studies, it will be of particular importance to clarify whether the dioecy or polygamodioecy found in *G. elegans* (see there) also occurs in *G. formosense*.

**18. *Galium forrestii*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 279. 1912.

丽江拉拉藤 li jiang la la teng

Herbs, perennial, 15–25 cm tall. Stems little branched, 4-

angled, ± retrorsely strigose hairy. Leaves in whorls of 4, sessile or shortly petiolate; blade rather subleathery, pale abaxially, ovate-elliptic, 8–12 × 3–5 mm, strigose to hirsute, abaxially yellowish brown glandular-punctate or striate, base cuneate, apex acute or apiculate; principal vein 1, 2 lateral veins weak. Inflorescences terminal, corymbiform, with terminal and axillary several-flowered and somewhat bracteate cymes; pedicels ca. 1.5 mm. Ovary obovoid, hispidulous. Flowers ca. 2.8 mm in diam., probably sexually differentiated (dioecious or polygamo-dioecious?). Corolla yellowish green, dark brown when dry, rotate, lobed for 3/4 or more; lobes 4, subovate, apiculate at apex. Fruit unknown, but probably with uncinete trichomes. Fl. Jun–Aug.

• Meadows on mountain slopes; 3000–3200 m. Sichuan (Yajiang), Yunnan (Lijiang).

Because of its uncertain fruit indumentum, *Galium forrestii* is in need of further studies. We have not seen authentic material but agree with Cufodontis (Oesterr. Bot. Z. 89: 232. 1940) that it is obviously close (or even identical?) with *G. glandulosum* and/or *G. hirtiflorum*. Their characteristic stem indumentum and other similarities link these taxa as members of the *G. hirtiflorum* group within *G. sect. Platygaliium* s.l. (see under *G. hirtiflorum*).

**19. *Galium ghilanicum*** Stapf, Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 50: 53. 1886.

姬兰拉拉藤 ji lan la la teng

*Galium parisiense* Linnaeus var. *brachypodum* Boissier; *G. transcaucasicum* Stapf.

Herbs, annual, ascending, branching from base. Stems (4–)8–30(–40) cm tall, tender, 4-angled, with retrorsely aculeolate angles and numerous, rather short internodes. Leaves at middle stem region in whorls of (5 or)6–8(or 9), ± sessile; blade drying papery, linear-elliptic to narrowly oblanceolate, mostly glabrous but margins and sometimes abaxial vein sparsely to densely antrorsely aculeolate, base acute, apex acute-acuminate. Inflorescences narrowly thyrsoid, with axillary and terminal cymes mostly 2–6-flowered; peduncles as long or 2–4 × as long as subtending leaves, slightly divaricate, with 1 or 2 bracts, ± smooth; pedicels thin, 0.5–4 mm, reflexed and hardly elongated in fruit. Flowers hermaphroditic. Ovary obovoid to ellipsoid, ca. 0.8 mm, glabrous. Corolla white or greenish white, slightly cup-shaped, 0.8–1.2 mm in diam.; lobes ovate, acute to shortly apiculate. Mericarps subglobose to kidney-shaped, 0.8–1.5 mm, colliculate, glabrous.

Open habitats; ca. 700 m. Xinjiang (Yining) [Afghanistan, Nepal, N Pakistan, Tajikistan; SW Asia].

*Galium ghilanicum* belongs to the annual *G. sect. Microgaliium* and is a taxon widespread in SW Asia. It is here recorded for the first time for China. In FRPS (71(2): 237. 1999) it was misidentified as *G. aparine* var. *leiospermum* (= *G. aparine* f. *leiocarpum*, *G. spurium*), from which it is clearly separable by its antrorsely (and not retrorsely) aculeolate leaf margins. The other Chinese representative of *G. sect. Microgaliium*, *G. tenuissimum*, differs from *G. ghilanicum* mainly by its strongly elongated peduncles and pedicels.

**20. *Galium glandulosum*** Handel-Mazzetti, Symb. Sin. 7: 1028. 1936.

腺叶拉拉藤 xian ye la la teng

Herbs, perennial, caespitose, procumbent or erect, 5–15 cm tall. Stems numerous from reddish rhizomes and roots, usually strongly branched, 4-angled, densely retrorsely strigose hairy, hispidulous at nodes. Leaves in whorls of 4, sessile or subsessile; blade drying subleathery, quite variable in shape, ovate to oblong or lanceolate, (2.5–)4–10(–14) × (0.6–)1–3(–4.5) mm, sometimes with scattered hairs adaxially, on margins and on midrib abaxially, or mostly glabrescent, adaxially slightly shiny and papillose, abaxially matte and usually minutely glandular-punctate or -striate, base cuneate, margins revolute, apex acute or subobtusate; principal vein 1, lateral veins 2, weak. Inflorescences terminal and in axils of upper leaves, with few- to several-flowered and up to 2 cm long cymes; peduncles ± hairy, bracteate, ± divaricate in fruit; pedicels 1–2(–5) mm. Flowers usually sexually differentiated (dioecious or polygamo-dioecious?). Ovary obovoid, ca. 0.8 mm, with ± curved trichomes. Corolla yellowish, greenish, or ± brownish-reddish, rotate, 1.8–2.7 mm in diam.; lobes 4, ovate, obtuse or slightly acute. Mericarps reniform, 1.5–2 mm, mostly with ± uncinete trichomes of ca. 0.3 mm (very rarely also glabrous?), on straight or ± curved, up to 4 mm long pedicels. Fl. Jun–Aug, fr. Aug–Sep.

• Mountain slopes, river beaches, open shrublands and forests, grasslands, on rocks; 2300–3900 m. Sichuan, Xizang, Yunnan.

*Galium glandulosum* is mainly characterized by condensed habit, short and predominantly retrorse stem hairs, subleathery leaves, often with glandlike idioblasts on abaxial leaf sides, strongly bracteate cymes, sexual differentiation of flowers, and hooked trichomes on fruit. Glabrous-fruited specimens included by W. C. Chen in FRPS (71(2): 228. 1999) may belong to other species. *Galium glandulosum* and *G. forrestii* are members of the *G. hirtiflorum* group (see there) within *G. sect. Platygaliium* s.l.

**21. *Galium hirtiflorum*** Requier ex Candolle, Prodr. 4: 600. 1830.

毛花拉拉藤 mao hua la la teng

Herbs, perennial, weak, procumbent or suberect, 10–60 cm tall. Rhizome and roots red, filiform. Stems numerous, 4-angled, with retrorse and/or spreading hairs to glabrescent. Leaves and leaflike stipules in whorls of 4; blade drying papery or membranous, linear-elliptic to narrowly lanceolate, (3–)8–17(–25) × (0.5–)1–2.5(–3.5) mm, both surfaces hirsute or only midrib and margins with straight or slightly curved hairs, base gradually and shortly attenuate, apex obtuse to subacute or shortly acuminate; vein 1. Inflorescences terminal and axillary, with several- to many-flowered cymes on peduncles longer than leaves; pedicels 1–6 mm. Flowers evidently sexually differentiated (dioecious or polygamo-dioecious?). Ovary obovoid, ca. 0.5 mm, hairy. Corolla light greenish, marked with reddish, rotate, 2–2.5 mm in diam.; lobes 4, ovate, cuspidate, sparsely hirsute toward apex. Mericarps ellipsoid, 1–1.5 mm, with dense uncinete trichomes 0.5–0.7 mm. Fl. Jul–Aug, fr. Sep–Oct.

Among shrubs and stones; 1700–3000 m or higher. Expected in Xizang [Bhutan, India, Nepal].

*Galium hirtiflorum* was not included in the Chinese flora by W. C. Chen but is likely to occur in Xizang. According to Ehrendorfer et al.

(Fl. Iranica 176: 179. 2005) the group of *G. hirtiflorum* s.l. includes a series of vicarious Himalayan taxa: *G. subtrinervium* Ehrendorfer & Schönbeck-Temesy in Pakistan (Swat) and Kashmir, *G. hirtiflorum* s.s. extending eastward to Bhutan and possibly adjacent China, and finally *G. glandulosum* and *G. Forrestii* reaching Yunnan and Sichuan. Their common group characters are short and retrorse stem hairs, subleathery leaves with glandlike idioblasts abaxially, strongly bracteate cymes, sexual differentiation of flowers, and fruit with uncinata trichomes.

**22. *Galium hoffmeisteri*** (Klotzsch) Ehrendorfer & Schönbeck-Temesy ex R. R. Mill, *Edinburgh J. Bot.* 53: 95. 1996.

六叶律 liu ye lu

*Asperula hoffmeisteri* Klotzsch, *Bot. Ergebn. Reise Waldemar*, 87. 1862; *Galium asperuloides* Edgeworth subsp. *hoffmeisteri* (Klotzsch) H. Hara; *G. asperuloides* var. *hoffmeisteri* (Klotzsch) Handel-Mazzetti; *G. asperulopsis* H. J. P. Winkler; *G. japonicum* Makino (1895), not (Maximowicz) Makino & Nakai (1908); *G. triflorum* Michaux var. *hoffmeisteri* (Klotzsch) J. D. Hooker.

Herbs, perennial, from filiform reddish rhizomes. Stems generally erect, (10–)15–30(–40) cm tall, 4-angled, glabrous and smooth, sometimes hispidulous at nodes. Middle stem leaves and leaflike stipules in whorls of up to 6 (in weak plants rarely only up to 4), with petioles up to 3 mm; blade drying papery or membranous, narrowly elliptic-oblong to broadly oblanceolate, (10–)15–30(–40) × (4–)5–10(–12) mm, length/breadth index mostly 2.5–3.5, glabrescent, smooth or rarely retrorsely aculeolate on abaxial midrib, base acute to obtuse, margins antrorsely aculeolate, apex obtuse to rounded and abruptly apiculate; vein 1. Inflorescences terminal and sometimes in axils of upper leaves, with few- to several-flowered cymes; peduncles glabrous, smooth; bracts none or few, 1–2 mm; pedicels 0.3–3 mm. Ovary obovoid to subglobose, 0.5–0.8 mm, strigillose with undeveloped trichomes. Corolla white or light green, rotate, 2.5–3 mm in diam., glabrescent, lobed for 3/4 or more; lobes 4, ovate, acute. Mericarps ellipsoid, 1.2–2 mm, with dense uncinata trichomes 0.8–1.2 mm, on pedicels elongating and up to 10 mm. Fl. Apr–Aug, fr. May–Sep.

Forests on mountain slopes, thickets, along rivers, ditch sides, meadows; 400–4000 m. Anhui, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shanxi, Sichuan, Xizang, Yunnan, Zhejiang [Afghanistan, Bhutan, India, ?Japan, Kashmir, Korea, Myanmar, Nepal, Pakistan].

*Galium hoffmeisteri*, together with *G. bungei*, *G. spurium*, and *G. verum*, is one of the most commonly collected species of *Galium* in China. Previous authors usually have included it as a subspecies under *G. asperuloides*. Only recently, the two taxa were discussed and re-established on the species level by Ehrendorfer et al. (Fl. Iranica 176: 183–185. 2005) and by Mill (loc. cit.). All specimens seen so far from China belong to *G. hoffmeisteri*. Nevertheless, as *G. asperuloides* s.s. ranges in the W Himalaya from Afghanistan to N Pakistan and N India, it can also be expected in SW China (in particular, Xizang). Accordingly, it is included in the present treatment for reference.

In Japan *Galium hoffmeisteri* is replaced by *G. nipponicum* Makino (*G. trifloriforme* var. *nipponicum* (Makino) Nakai), but some of the Japanese specimens greatly approach *G. hoffmeisteri*. Another very similar vicariant is *G. echinocarpum* from Taiwan. Further relatives are the Eurasian disjunct *G. odoratum* and the circumboreal *G. triflorum*.

Together with *G. asperuloides*, all these taxa belong to *G.* sect. *Hylaea* as shown by Ehrendorfer et al. (loc. cit.: 181–185). *Galium triflorum* is rare in China and closely related to *G. trifloriforme* (see under these species). The latter may be a hybridogenous taxon linking *G.* sect. *Hylaea* and *G.* sect. *Trachygalium*. But to synonymize *G. trifloriforme* with *G. hoffmeisteri* (e.g., W. C. Chen in FRPS 71(2): 230. 1999; Govaerts et al., *World Checkl. Rubiaceae*; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) is certainly not correct.

Slender plants of *Galium hoffmeisteri* are distantly reminiscent of *G. kikumugura* Ohwi (= *G. brachypodum* Maximowicz (1874), not Jordan (1846)) from Japan (see also under *G. sichuanense*). Yamazaki (Fl. Japan 3a: 236. 1993) described *G. kikumugura* as having leaf whorls of 4. In reality, it always develops whorls of up to 5 or 6 in the middle stem region. These leaves are quite similar to those of *G. hoffmeisteri* and have margins slightly antrorsely aculeolate or smooth. Nevertheless, *G. kikumugura* strongly deviates from *G. hoffmeisteri* and other members of *G.* sect. *Hylaea* by its cymes nearly exclusively lateral in leaf axils, usually consisting only of a filiform peduncle, a single bract, and 2 small flowers (ca. 1.5 mm in diam.) or sometimes a single flower. Furthermore, its kidney-shaped (not ellipsoid) mericarps (1.8–2 × 0.9–1 mm) differ by having scattered short and hooked hairs only ca. 0.1 mm. These latter characters are reminiscent of *G.* sect. *Trachygalium* and particularly of *G. bungei* (in *G.* sect. *Platygalium* s.l., where leaf whorls have only 4 elements). Thus, *G. kikumugura* is an isolated and aberrant species of the genus, possibly better placed into a separate monotypic section.

**23. *Galium humifusum*** M. Bieberstein, *Fl. Taur.-Caucas.* 1: 104. 1808.

蔓生拉拉藤 man sheng la la teng

*Asperula humifusa* (M. Bieberstein) Besser.

Herbs, perennial, sometimes slightly woody at base, clampering to procumbent, from a thick rootstock with slender, trailing reddish rhizomes. Stems up to 1 m tall, 4-angled to subterete, often caespitose, glabrescent to white pilosulous, hirtellous, and/or pilose often with mixed trichome types, smooth or sparsely scaberulous. Leaves in whorls of 6–10, sessile, frequently reflexed; blade drying papery, from linear and narrowly oblong-oblanceolate to oblong-elliptic or ligulate, (5–)10–28(–32) × (1–)1.5–3(–6) mm, adaxially glabrous and scaberulous, abaxially glabrous to densely white pilosulous or -pilose, base straight to cuneate, margin antrorsely aculeolate and usually markedly revolute, apex obtuse to acute and mucronate with tip to 2 mm; vein 1. Inflorescences with numerous terminal and axillary, congested to fasciculate, leaflike and many-flowered cymes; peduncles glabrous to hirtellous and/or pilosulous, with reduced leaves and leaflike bracts, 1.5–3 mm; pedicels 1–4 mm. Ovary ellipsoid, 0.8–1 mm, glabrous to hispidulous with straight trichomes. Corolla yellowish white to white, funnel-form, 1.5–2.5 × 2.5–3 mm, glabrous to sometimes hairy on outside; lobes 4, ca. 1/2 as long as tube, triangular-ovate, acute to apiculate. Mericarps ellipsoid to reniform, 1–1.5 × 1.5–2 mm, glabrous and smooth, granulate or hispidulous, becoming separated in middle as fruit expand but remaining attached at top and bottom. Fl. and fr. May–Oct.

Riversides and beaches, forests, grasslands, farmland sides, wastelands, meadows, mountain slopes; 400–2200 m. Xinjiang [Afghanistan, Kazakhstan, Mongolia, Pakistan, Russia, Turkistan; SW Asia (Armenia, Azerbaijan, Georgia, Iran, Iraq), E Europe (Balkan Peninsula, Ukraine)].

This species has often been included in *Asperula* (e.g., Pobedimova et al., Fl. URSS 23: 276. 1958) because of its funnelliform, relatively large, white corollas, but its affinities are clearly with members of *Galium*, particularly *G. verum*, though the flowers are distinct. Rarely the two species form a hybrid, which has been called *G. ×himmelbauerianum* (Ronniger) Soó, and both should be placed into *G.* sect. *Galium*.

*Galium humifusum* is “a widespread diploid species, very variable due to modificational plasticity and genetic diversity” (Ehrendorfer et al., Fl. Iranica 176: 197. 2005), but at present it does not appear possible to recognize infraspecific taxa.

**24. *Galium hupehense*** Pampanini, Nuovo Giorn. Bot. Ital. 17: 719. 1910.

湖北拉拉藤 hu bei la la teng

*Galium boreale* Linnaeus var. *molle* Hemsley; *G. hemsleyanum* Beauverd; *G. hupehense* var. *molle* (Hemsley) Cufodontis.

Herbs, perennial, erect, with slender rhizome. Stems 4-angled, pilosulous. Leaves in whorls of 4, subsessile; blade lanceolate, 30–50 × 6–12 mm, length/breadth index above 4, adaxially hispidulous to scaberulous, abaxially pilose at least on principal veins, apex acuminate to subacute; principal veins 3, palmate. Inflorescence terminal, paniculiform, 15–20 × 4–8 cm, with many-flowered cymes; peduncles and pedicels hairy to glabrescent. Ovary ovoid, densely hairy. Corolla yellowish white, rotate, ca. 2 mm in diam., glabrous or pilose; lobes 4, ovate, hairy outside, acute. Mericarps with straight trichomes (and/or ?glabrous). Fl. Jul, fr. Aug–Sep.

- Mountains; ca. 2000 m. Hubei (Yichang), Jiangsu (Kunshan).

*Galium hupehense*, possibly endemic to EC China, is evidently related to the also small-flowered *G. kinuta* (Cufodontis, Oesterr. Bot. Z. 89: 223–224. 1940) but has hairy stems, whereas *G. chekiangense* and *G. boreale* differ i.a. by their larger flowers (3–4 mm in diam.). As we have seen no authentic material of *G. hupehense*, the above description is based on available literature sources only. Its original description gives no information on ovary and fruit indumentum, whereas straight (and ?multicellular) hairs are indicated for the certainly synonymous *G. hemsleyanum*. Possibly by mistake, W. C. Chen (in FRPS 71(2): 281–282. 1999) reported plants with glabrous (var. *hupehense*) and with densely hairy ovaries (var. *molle*). Both are recorded from Yichang, only the latter from more condensed plants in Kunshan. These uncertainties and the status of *G. hupehense* with its varieties need to be clarified in the future.

**25. *Galium innocuum*** Miquel, Fl. Ned. Ind. 2: 341. 1857.

小猪殃殃 xiao zhu yang yang

*Galium modestum* Diels; *G. trifidum* Linnaeus var. *modestum* (Diels) Cufodontis.

Herbs, perennial, weak to procumbent, from slender rhizomes. Stems (7–)10–40(–60) cm, 4-angled, caespitose, glabrous and smooth to sparsely retrorsely aculeolate on angles. Leaves in whorls of 4(–6), subsessile; blade drying papery, blackish or green, linear-lanceolate to oblanceolate, 3–8(–10) × 1–2 mm, glabrous and smooth to sparsely retrorsely aculeolate on margins and midrib, base acute to attenuate, apex rounded or obtuse; vein 1. Inflorescences terminal and axillary, cymes 1–

3.5 cm, with 1–3(or 4) flowers; peduncles glabrous and smooth; bracts oblanceolate to narrowly elliptic; fruiting pedicels (3–)5–8(–10) mm, straight and ± divaricate. Ovary didymous, glabrous, smooth. Corolla white, cup-shaped to slightly campanulate, 1–1.8 mm in diam.; lobed to 1/2 or slightly more; lobes 3(or 4), ovate and rounded at tip. Fruit markedly didymous, mericarps (sub)globose, 2–2.8 mm, glabrous, smooth to slightly tuberculate. Fl. and fr. Mar–Aug.

Swampy or wet localities at lower to upper montane elevations. Fujian, Sichuan, Taiwan, Yunnan, and elsewhere [India, Indochina, Indonesia (Java, Sumatra), New Guinea].

In the available floras of China and Taiwan, W. C. Chen (in FRPS 71(2): 252–253. 1999) and Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998; Fl. Taiwan, ed. 2, 4: 254–259. 1998) have completely ignored *Galium innocuum*, classifying most of the relevant specimens under *G. trifidum*. In the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) *G. trifidum* var. *modestum* appears as a synonym under *G. innocuum*, with a range from India to China and through Taiwan to SE Asia and New Guinea. Originally, *G. innocuum* was described from Java. In the critical revision of *G.* sect. *Aparinoides* by Puff (Canad. J. Bot. 54: 1911–1925. 1976), not considered by the above authors, *G. innocuum* is accepted as a valid species and regarded as a southern member of the *G. trifidum* group. The above diagnosis and distribution data correspond to Puff’s revision. He differentiated the two species mainly by their fruiting pedicels: relatively short, straight, and ± divaricate in *G. innocuum* but slender, elongated, and conspicuously arcuate in *G. trifidum* s.s. According to Puff (loc. cit.: 1922–1923) only *G. innocuum* but none of the subspecies of *G. trifidum* occur in China. This is in strong conflict with W. C. Chen (loc. cit.: 253) who described the distribution of *G. trifidum* in China by listing the provinces Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, and Zhejiang. As we have seen only limited Chinese material of *G.* sect. *Aparinoides*, the question remains whether *G. innocuum* extends from S to N China or is replaced further north by populations of the *G. trifidum* group not mentioned by Puff. Furthermore, one has to consider that species from other sections of *Galium* have often been misidentified as members of *G.* sect. *Aparinoides*, e.g., *G. bungei*. In view of these uncertainties, we accept only *G. innocuum* but not *G. trifidum* for the present Chinese flora.

Another problematic taxon in *Galium* sect. *Aparinoides* for the *Flora of China* is *G. palustre* Linnaeus. In spite of the critical comments by Cufodontis (Oesterr. Bot. Z. 89: 232. 1940), this species has been included in FRPS by W. C. Chen (loc. cit.: 250). According to Puff (loc. cit.: 1923–1924) this species belongs to the *G. palustre* group of taxa, with leaves often in whorls of more than 4, many-flowered cymes (more than 3 or 4 flowers), and smooth pedicels. Its natural distribution is verified from temperate and boreal Europe to W Siberia, whereas occurrences in E North America (and elsewhere) are obviously adventive. Considering the common confusion of *G.* sect. *Aparinoides* taxa (in China particularly *G. innocuum* in the south and *G. karakulense* in the north) and the lack of authentic specimens seen by us, we exclude *G. palustre* from China in the present text.

**26. *Galium kamschaticum*** Steller ex Schultes & J. H. Schultes, Mant. 3: 186. 1827.

三脉猪殃殃 san mai zhu yang yang

Herbs, perennial, erect, 5–25 cm tall, emerging from filiform rhizomes. Stems mostly unbranched, 4-angled, glabrous to sparsely hispidulous. Leaves in whorls of 4, sessile or subses-

sile; blade drying blackish brown and papery, broadly elliptic, ovate, or suborbicular, 10–25 × 6–17 mm, glabrous to hispidulous at least on veins, otherwise adaxially smooth, abaxially not glandular-striate, base cuneate to obtuse, margins antrorsely ciliolate or hispidulous, apex ± rounded and usually mucronate; principal veins 3, palmate. Inflorescences small, thyrsoid, cymes terminal and in axils of uppermost leaves, 2–6 cm, few to several flowered, lax; peduncles glabrous, smooth; bracts leaflike or ligulate to narrowly elliptic, 0.5–4 mm; pedicels 1–5 mm. Ovary subglobose, ca. 1 mm, densely pubescent with spreading uncinat trichomes. Corolla white or greenish yellow, rotate, 2.5–3(–4) mm in diam., glabrous, lobed for 3/4 or more; lobes 4, elliptic-lanceolate or ovate-triangular, acute. Mericarps ovoid, 1.5–2 mm, with dense uncinat trichomes 0.8–1 mm, on pedicels usually elongating to 15 mm. Fl. and fr. Jul–Sep.

Forests on mountains, tussocks at ditch sides; 1500–2300 m [as low as ca. 100 m in N Japan]. Heilongjiang, Jilin [Japan, Korea, NE Russia; NW North America].

*Galium kamschaticum* is an amphi-Beringian member of *G. sect. Platygali* and forms a related species group with *G. chekiangense* in SE China, *G. nakaii* in Japan, and *G. oreganum* in W North America. In the *Flora of Japan* (Yamazaki, Fl. Japan 3a: 206–240. 1993) three varieties are recognized, one of them endemic to Japan, the second extending to Sakhalin and the Kuriles, and only var. *kamschaticum* more widespread and extending to the NE provinces of China. Specimens from SE China, Zhejiang, that were determined as *G. kamschaticum* and those from Fujian that were listed by W. C. Chen (in FRPS 71(2): 265. 1999) as *G. nakaii* differ from typical *G. kamschaticum* by their leaves drying somewhat leathery, greenish-brownish, papillose, glandular-striate abaxially, and by their fruit with short hairs 0.1–0.2 mm, with a bent but not hooked tip. In the present flora they are treated as a new species, *G. chekiangense* (see the comments under that species).

**27. *Galium karakulense*** Pobedimova in Schischkin, Fl. URSS 23: 712. 1958.

粗沼拉拉藤 cu zhao la la teng

Herbs, perennial, weak to procumbent, 40–70 cm tall. Rootstock slender, with prolonged rhizomes. Stems 4-angled, flaccid, much branched, retrorsely aculeolate, hispidulous or glabrescent at nodes. Leaves in whorls of 4(or 5), subpetiolate; blade drying papery, elliptic to oblanceolate, (12–)15–20(–30) × (2–)5–8(–12) mm, densely antrorsely aculeolate adaxially and along margins, retrorsely aculeolate on abaxial midrib, base attenuate to cuneate, margins thinly revolute, apex rounded to bluntly pointed; vein 1. Inflorescences paniculate, terminal and lateral cymes with several to many flowers (usually more than 4); peduncles scabrous and ± divaricate; bracts ovate to elliptic, 3–7 × 1–3 mm; pedicels 2–4.5 mm, rough, elongated in fruit. Ovary didymous, glabrous. Corolla white, cup-shaped, 3–4(–4.5) mm in diam., 4-lobed to ca. 1/2. Mericarps (sub)globose, 1.5–2.5(–3.5) mm, glabrous, slightly verrucose. Fl. Jul, fr. Aug–Sep.

Swamps and riversides at low to middle elevations. Xinjiang (Chabuhaer) [Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Uzbekistan].

*Galium karakulense* represents *G. sect. Aparinoides* in C Asia and is considered as a link between the *G. trifidum* group in the N Hemisphere and the predominantly Mediterranean-European *G. palustre*

group (Puff, Canad. J. Bot. 54: 1923–1924. 1976). It is also treated in Pobedimova et al. (loc. cit.) and Ehrendorfer et al. (Fl. Iranica 176: 174. 2005) and may be responsible for some of the erroneous indications of *G. palustre* for N China, as discussed under *G. innocuum*. The latter is the second verified species of the section in the more southerly part of the Chinese flora. In comparison with *G. karakulense*, *G. innocuum* is a much smaller and more slender plant with few-flowered cymes and smooth pedicels.

**28. *Galium karataviense*** (Pavlov) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 278. 1971.

喀喇套拉拉藤 ka la tao la la teng

*Asperula karataviensis* Pavlov, Vestn. Akad. Nauk Kazakhsk. S.S.R. 4: 95. 1951; *A. aparine* M. Bieberstein, s.l.; *A. rivalis* Sibthorp & Smith, s.l.; *Galium rivale* (Sibthorp & Smith) Grisebach, s.l.

Herbs, perennial, procumbent and often matted or lodged, from slender, reddish brown rhizomes. Stems 0.6–1.2 m, much branched, densely retrorsely aculeolate on 4 angles. Leaves in whorls of 6–10, sessile or subsessile; blade drying papery or somewhat leathery and ± glossy, narrowly (ob)lanceolate or narrowly elliptic, (6–)15–25(–50) × (2–)2.5–4(–8) mm, glabrescent, both surfaces sparsely to densely aculeolate on midrib, base acute to cuneate, margins flat to narrowly revolute, densely retrorsely aculeolate, apex acute and shortly mucronate; vein 1. Inflorescences terminal and axillary, to 12 × 9 cm, with several to many-flowered cymes; peduncles elongating as inflorescences develop, becoming much longer than subtending leaves; axes glabrescent, sparsely to densely retrorsely aculeolate; bracts elliptic or oblong-lanceolate, 1.5–3 × 0.5–1 mm; pedicels 1–3 mm. Ovary ellipsoid to obovoid, 0.5–0.8 mm, glabrous. Corolla bluish to violet (rarely white?), shortly funnellform, 1.5–2.5 mm, tube 1–1.5 × as long as lobes; lobes 4, triangular-spatulate. Mericarps subglobose to ellipsoid, 1.5–2 × 1.7–2 mm, glabrous, smooth or often tuberculate. Fl. and fr. Jun–Sep.

Humid forests, riversides, beaches, wet grasslands; 700–3300 m. Gansu, Hebei, Heilongjiang, Nei Mongol, Ningxia, Qinghai, Shanxi, Sichuan, Xinjiang [C Asia].

*Galium karataviense* was treated in FRPS (71(2): 280. 1999) as *G. rivale*. In a wider sense the latter name and its synonyms apply to a polymorphic polyploid complex (2x, 4x, 6x), ranging from NE, E, and SE Europe to SW and C Asia. Because of its funnellform corollas this group formerly was treated as part of the genus *Asperula*, either as *A. aparine* or as *A. rivalis* (e.g., in Pobedimova et al., Fl. URSS 23: 275. 1958). More recently, morphological analyses (see Ehrendorfer et al., Fl. Iranica 176: 188. 2005) and DNA-data have clearly shown that it is closely related to *G. uliginosum* in *G. sect. Trachygalium*. Similarities with the annual *G. sect. Euaparine* are homoplasies.

In former treatments (e.g., Fl. Europaea 4: 20. 1976) *Galium rivale* was circumscribed in a wide sense. On the basis of differences in floral (relative length of corolla tube and lobes, color), fruit (mericarp epidermis with rounded or acute cells), and other characters, several still insufficiently understood microspecies have been suggested (Pobedimova et al., loc. cit.: 327, under *Asperula*; Ehrendorfer & Schönbeck, Pl. Syst. Evol. 174: 200–202. 1991, under *G. anguineum*; Ehrendorfer et al., loc. cit., under *G. pseudorivale* Tzvelev). Accordingly, among the vicarious microspecies of *G. rivale* s.l., *G. anguineum* Ehrendorfer & Schönbeck-Temesy from Iraq and Iran, with white corollas and divaricate fruiting axes, is replaced toward the east in C Asia by *G. karatavi-*

*iense*, with bluish to violet corollas and more convergent fruiting axes. Further studies will have to demonstrate whether species status is really justified for all these taxa and how they correspond to the different cytotypes encountered in this polyploid complex.

**29. *Galium kinuta*** Nakai & H. Hara, J. Jap. Bot. 9: 518. 1933.

显脉拉拉藤 xian mai la la teng

*Galium boreale* Linnaeus var. *japonicum* Maximowicz; *G. japonicum* (Maximowicz) Makino & Nakai (1908), not Makino (1895).

Herbs, perennial, erect, 20–60 cm tall. Stems with 4 thickened angles, glabrous and smooth, hispidulous only at nodes. Leaves in whorls of 4, subsessile or petiole to 2 mm; blade drying mostly somewhat leathery, remaining ± green, oblanceolate to ovate-lanceolate, sometimes even narrowly elliptic or ovate, 20–80 × 4–20 mm, length/breadth index (2–)3–5(–6), strigillose or hispidulous at least along veins to glabrescent, sparsely to densely punctate- to striate-glandular abaxially, base acute to rounded, margins flat to thinly revolute, antrorsely ciliolate to hispidulous, apex subacute to acute, but hardly concave and long acuminate; principal veins 3, palmate. Inflorescences paniculiform, to 25 × 15 cm, cymes in uppermost leaf axils and terminal, many flowered, lax and often somewhat divaricate; peduncles smooth and glabrous or hispidulous at nodes; bracts oblanceolate to narrowly elliptic, 1.5–3 mm; pedicels 1.5–3 mm. Ovary subglobose to obovoid, ca. 0.8 mm, smooth, glabrous. Corolla white to ± purplish, rotate, 2–2.5 mm in diam., glabrous; lobes 4, ovate, acuminate. Mericarps subglobose to obovoid, ca. 2.5 mm, glabrous and smooth. Fl. May–Jul, fr. Aug–Sep.

Mesic, generally rich forests on mountain slopes, rocks at watersides, open grasslands, meadows; 500–2100 m. Gansu, Hebei, Henan, Hubei, Liaoning, Shaanxi, Shanxi, Sichuan, Xinjiang [Japan, Korea].

*Galium kinuta*, described from Japan, was first reported for China by Cufodontis (Oesterr. Bot. Z. 89: 223–224. 1940). Nevertheless, the more numerous samples now available suggest certain differences: in Chinese specimens the leaves are more leathery (not paperlike) when dry, abaxially more markedly punctate-striate-glandular (not inconspicuously so), and apically ± acute (but hardly concave and long attenuate). It is still uncertain whether these differences merit taxonomic separation of the Japanese and Chinese populations. Another critical aspect is the occurrence of specimens intermediate between Chinese *G. kinuta* and local *G. boreale* s.l., as observed, e.g., from Henan, Shaanxi, and Shanxi. Local studies will have to show whether this is due to hybridization and whether it is linked to the extreme variability of *G. kinuta* in leaf shape, ranging from narrowly lanceolate to ovate.

*Galium kinuta* may be related to the still badly understood *G. hupehense* (see there). Similarities also exist with *G. platygalium*, which differs by funnelliform corollas. *Galium hoffmeisteri* (= *G. japonicum* Makino (1895)) and *G. kinuta* (= *G. japonicum* (Maximowicz) Makino & Nakai (1908)) have been widely confused because of similar habit and name confusion.

**30. *Galium kunmingense*** Ehrendorfer, Novon 20: 270. 2010.

昆明拉拉藤 kun ming la la teng

Herbs, perennial, erect, (12–)15–20(–25) cm tall. Stems with 4 prominent and rounded angles, with scattered antrorsely (or sometimes also retrorsely) curved short hairs, more dense at

nodes; internodes 1.5–4 cm at middle stem regions, longer or somewhat shorter than leaves. Leaves in whorls of 4; blade drying leathery, broadly lanceolate, (10–)15–25(–35) × (4.5–)6–7.5(–9) mm, length/breadth index (2–)2.5–3.5(–4), glabrous, adaxially papillose, abaxially without glandular idioblasts, base cuneate, margins revolute, antrorsely aculeolate, apex acute but not acuminate; 3 prominent principal veins extending into apex region. Inflorescences pyramidal, with cymes from middle to upper stem nodes and terminal, several to many flowered; axes glabrous, somewhat divaricate; peduncles mostly 1.5–4 cm; pedicels (0.5–)1–5 mm; bracts lanceolate, small and inconspicuous. Flowers hermaphroditic. Ovary obovoid, ca. 0.5 mm, glabrous, smooth. Corolla white to greenish, cup-shaped or campanulate, (2–)2.3–2.5(–2.7) mm in diam., fused at base for ± length of 4 free lobes, 0.8–1 mm, lanceolate, acute but not apiculate. Mericarps ovoid, 1.5–3 mm, glabrous and ± smooth. Fl. Jun–Aug, fr. Jul–Sep.

- Open grasslands and rocky slopes; 1900–2500 m. C Yunnan.

The new *Galium kunmingense* clearly belongs to *G.* sect. *Platygalium*. Among species in the section with corollas basally fused to ca. 1/2 the length *Microphysa elongata* deviates by leaves with only one main vein, somewhat inflated fruit mericarp, and funnelliform corollas. *Galium platygalium* and *G. maximoviczii* have similar corollas but deviate by their broader and 3–5-veined leaves. Closer relationships can be assumed for some E Asiatic *Galium* species with rotate corollas: *G. kinuta* has glabrous fruit but narrower, adaxially punctate-striate glandular leaves, slender, more floriferous inflorescences, and larger flowers. Apparent relatives with rotate and smaller flowers are *G. hupehense* with spreading straight fruit hairs, *G. chekiangense* with appressed curved fruit hairs, and particularly *G. yunnanense*, with spreading uncininate fruit hairs. This latter is ± sympatric with *G. kunmingense* but differs not only by its rotate (not campanulate/cup-shaped) and smaller corollas and uncininate fruit hairs, but also by its more hairy and abaxially punctate-striate glandular leaves. It is remarkable that *G. kunmingense*, a quite conspicuous species that evidently was not too rare in the surroundings of the capital of Yunnan, has remained unnoticed up to now.

**31. *Galium linearifolium*** Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 7: 152. 1837.

线叶拉拉藤 xian ye la la teng

Herbs, perennial, erect, sometimes slightly woody at base. Stems up to 65 cm tall, 4-angled, hirtellous or puberulent to glabrescent or smooth and glabrous. Leaves in whorls of 4, sessile or subsessile; blade drying leathery, linear-spatulate, often slightly falcate, 10–60 × 1–4 mm, adaxially glabrous, weakly shiny, antrorsely aculeolate along midrib and/or near margins, abaxially glabrous or sparsely hirtellous along midrib, base cuneate or obtuse, margin antrorsely aculeolate or pubescent, revolute, apex obtuse to acute; vein 1. Inflorescences terminal, paniculiform, with few- to many-flowered, 1.5–5 cm long cymes; peduncles hirtellous to glabrous, smooth; bracts narrowly elliptic, 1–3 mm or often lacking; pedicels 1.5–6 mm. Ovary ellipsoid to obovoid, ca. 0.8 mm, glabrous, smooth. Corolla white, rotate, ca. 4 mm in diam.; lobes 4, lanceolate, acute. Mericarps ellipsoid to subglobose, 2.5–3 mm, glabrous and smooth. Fl. Jun–Aug, fr. Jul–Sep.

Grassy slopes, forests, thickets, mountain meadows; 400–1800 m. Hebei, Hubei, Liaoning [Korea].

*Galium linearifolium* seems to be a rare species and is easily confused with *G. boreale*. The latter has leaves usually somewhat lanceolate and with 3 main veins. Cufodontis (Oesterr. Bot. Z. 89: 219–223. 1940) mentioned a certain affinity of *G. linearifolium* with *G. bungei*. Although *G. linearifolium* is said in FRPS to have leaves in whorls of 4, the relevant figure (71(2): 251, t. 56, f. 3. 1999) shows them in whorls of 5, evidently a mistake.

**32. *Galium maximoviczii*** (Komarov) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 277. 1971 [*“maximowiczii”*].

异叶轮草 yi ye lun cao

*Asperula maximoviczii* Komarov, Trudy Glavn. Bot. Sada 39: 109. 1923, based on *A. platygalium* Maximowicz var. *pratensis* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 284. 1874.

Herbs, perennial, from thin creeping rhizomes. Stems erect, 0.3–1 m tall, 4-angled, smooth; nodes hispidulous or glabrous. Leaves in whorls of 4–6(–8), subsessile or with petiole up to 6 mm; blade drying papery, lanceolate-oblong, lanceolate-elliptic, or ovate to ovate-lanceolate, (23–)35–40(–53) × (7–)9–10(–18) mm, glabrous or sparsely to moderately hispidulous, at least on principal veins, margins antrorsely ciliolate or -aculeolate, base acute to cuneate, apex tapered and shortly obtuse to acute; veins 3–5, palmate. Inflorescences broadly paniculate, 4–20 × 2–15 cm, lax and many flowered, with cymes in axils of uppermost leaves and terminal; peduncles ± glabrous; bracts linear to narrowly elliptic, 1–5 mm; pedicels 2–4 mm. Ovary obovoid and laterally flattened, ca. 0.8 mm, glabrous, smooth. Corolla white, campanulate; tube ± as long as lobes, 2.5–3.5 mm in diam.; lobes 4, ovate-oblong, obtuse. Mericarps ellipsoid, 2–2.5 mm, glabrous, smooth to granular-papillose. Fl. Jun–Jul, fr. Jul–Oct.

Forests, thickets, or grasslands on mountains, open fields, ditch sides; 1600–3800 m. Anhui, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Zhejiang [Korea, Russia].

*Galium maximoviczii* differs from the quite close *G. platygalium* (see there) by somewhat smaller campanulate flowers and larger leaves in whorls of up to 6(–8). Within *G. sect. Platygalium* the two species form an isolated group limited to the temperate E Asiatic mainland, characterized by its whorls of leaves and leaflike stipules often with more than 4, up to 6, or rarely even 8 elements, with 3–5 palmate principal veins, and campanulate to funnellform corollas. In Pobedimova et al. (Fl. URSS 23: 273. 1958) the two taxa were placed in the artificial *Asperula* sect. *Galioidae* Pobedimova ser. *Paniculatae* Pobedimova.

**33. *Galium megacyttarion*** R. R. Mill, Edinburgh J. Bot. 53: 200. 1996.

大胞拉拉藤 da bao la la teng

Herbs, perennial, weak to procumbent. Stems 6–40 cm, sharply 4-angled, glabrous, smooth, rough or sparsely retrorsely aculeolate; internodes 6.5–33 mm; nodes ± hairy. Middle stem leaves in whorls of up to 6, sessile; blade drying papery, often blackening, linear-oblong to narrowly elliptic, 2–12.5 × 0.4–2 mm, glabrous, smooth or sparsely retrorsely aculeolate on midrib abaxially, adaxially with relatively large epidermal cells (use 20× lens), base acute, margins flat to thinly revolute, apex acute then contracted and mucronate; vein 1. Inflorescences axillary, with 1- or occasionally 3-flowered cymes; pedicels

0.2–1.5 mm, glabrous, smooth. Ovary ellipsoid-obovoid, ca. 0.5 mm, glabrous, smooth. Corolla white or pale green (perhaps sometimes drying pink), rotate, 1.5–2.7 mm in diam.; lobes 4, lanceolate-spatulate, glabrous beneath, puberulent above, with shortly acuminate apex, clearly longer than stamens. Mericarps ellipsoid, 0.7–1.1 × 1–1.5 mm, glabrous, granular-verruculose, with pedicels often elongating to 3.5 mm. Fl. and fr. Jul–Sep.

Open places, forests; 1800–3100 m. ?Sichuan, Xizang [Bhutan, India, Nepal].

*Galium megacyttarion* (type from Uttar Pradesh, *Raizada* 7326, E) belongs to the high elevation Himalayan subgroup (2) of the *G. asperifolium* group, which includes *G. acutum* (see additional comments under these species). The protologue of *G. megacyttarion* describes the flowers as having stamens shorter than the corolla; comparable information is not yet available for the majority of the Chinese *Galium* species. We have seen no material cited in the original description nor plants which undoubtedly belong here. Nevertheless, one very condensed provenance (*Duthie* 7492, from Bhutan, the Black Mountain Expedition 1888, WU) exhibits the large leaf epidermal cells described for *G. megacyttarion*; but it deviates by having antrorse microhairs on the adaxial leaf side and glabrous leaf margins, finely rough stems, many-flowered cymes, and glabrous petals. It was determined by Cufodontis (Oesterr. Bot. Z. 89: 241–243. 1940) erroneously as *G. asperifolium* var. *sikkimense*. Another plant with large epidermal cells has been seen from Sichuan (W. C. Chen, 23 Jun 1988, PE), but this corresponds in all other characters to *G. pusillosetosum*.

**34. *Galium minutissimum*** T. Shimizu, J. Fac. Textile Sci. Technol. Shinsu Univ., A, 36(12): 58. 1963.

微小拉拉藤 wei xiao la la teng

Herbs, perennial (not annual), ascending, caespitose, minute, 2–3 cm tall. Stems 4-angled, branched, glabrous or sometimes hispidulous at nodes. Leaves in whorls of 4; blade rhombic-oblong, 2–3 × 0.8–1 mm, glabrous or abaxially hispidulous along midrib, base attenuate, apex obtuse; vein 1. Inflorescence with terminal and partly axillary few-flowered cymes, glabrous axes, and ca. 2 mm long pedicels. Flowers unknown. Mericarps reniform, sparsely hispid with apically weakly curved trichomes.

- Mountains; 1800–2400 m. Taiwan (Hualian).

*Galium minutissimum* was accepted as a species by W. C. Chen (in FRPS 71(2): 283. 1999) but was not treated or mentioned by Yang and Li in their publication on *Galium* in Taiwan (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998) or in the subsequent second edition of Fl. Taiwan (4: 254–259. 1998). We have seen no authentic material, and the specific status of *G. minutissimum* remains uncertain. The taxon obviously belongs to *G. sect. Platygalium* and the closely related *G. morii* group (see there) from the high mountains of Taiwan.

**35. *Galium morii*** Hayata, Icon. Pl. Formosan. 7: 32. 1918.

森氏猪殃殃 sen shi zhu yang yang

*Galium sigeyosii* Masamune.

Herbs, perennial, erect, 5–10 cm tall. Stems slender, 4-angled, glabrous. Leaves in whorls of 4, sessile or subsessile; blade drying papery, obovate, elliptic, or elliptic-oblong, 1–6 × 1.5–10 mm, glabrous or sparsely hairy abaxially, base obtuse, margins smooth, apex obtuse or apiculate-acute; principal veins 3, palmate. Inflorescences terminal or sometimes axil-

lary, with few-flowered cymes of 0.5–1.5 cm; peduncles and bracts glabrous; pedicels 1–2 mm. Ovary densely strigillose with undeveloped trichomes. Corolla ?white, rotate, ca. 1.2 mm in diam., lobed for 3/4 or more; lobes 4, ovate. Mericarps subglobose, ca. 1 mm, with dense, ± appressed uncinat trichomes.

- Mountains; 2500–3400 m. Taiwan (Jiayi).

*Galium morii* was described as a very small plant from Yu Shan (Mt. Morrison) in Taiwan. We have seen no authentic material. The present description combines information from the protologue, FRPS (71(2): 241. 1999), and Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 106–107. 1998; Fl. Taiwan, ed. 2, 4: 256. 1998). But there are certain conflicts: whereas the leaves were characterized by FRPS as 1- or indistinctly 3-veined, the protologue and Yang and Li said they were 3-veined.

*Galium morii* was the first species to be described from an obviously closely related assembly of *G. sect. Platygalium* taxa growing in the high mountains of Taiwan, which is here called the *G. morii* group and also includes *G. formosense*, *G. minutissimum*, *G. nankotaizanum*, and *G. tarokoense*. On the mainland, the newly described *G. rupifragum* from Yunnan obviously also belongs here. This *G. morii* group is characterized by low and condensed growth, small ovate to elliptic or broadly lanceolate leaves, reduced inflorescences, and hairy fruit. Affinities obviously exist with the aggregates of *G. elegans* and *G. serpylloides*.

Characters used to differentiate the taxa of the *Galium morii* group are stem indumentum, number of leaf veins (1–3), uncinat to straight fruit hairs, etc., but many taxonomical problems remain. As an example: *G. morii* may not be clearly separable from *G. tarokoense* by its smaller and sparsely pubescent, 3-nerved leaves (vs. larger, completely glabrous, and rather 1-nerved leaves of *G. tarokoense*); the two taxa are geographically separated according to Yang and Li (loc. cit. 1998: 107, 110). Furthermore, relationships between the alpine core group (as *G. morii*) and other taxa with taller growth from lower elevations (as *G. formosense*) evidently need more attention in the future. Transitional states in the above characters make it necessary to place several species in two or three different positions in our key.

**36. *Galium nankotaizanum*** Ohwi, Repert. Spec. Nov. Regni Veg. 36: 56. 1934.

南湖大山猪殃殃 nan hu da shan zhu yang yang

*Galium maborasense* Masamune.

Herbs, perennial, erect, often reduced, 5–12(–20) cm tall. Stems 4-angled, sparsely to moderately pilose becoming glabrescent, angles thickened. Leaves in whorls of 4, sessile to subsessile; blade drying membranous, ovate, elliptic, or broadly lanceolate, 4–10 × 2–5 mm, length/breadth index 2–3, both surfaces sparsely hirsute at least along midrib, base cuneate to obtuse, apex acute to obtuse, sometimes apiculate; principal vein 1, 2 lateral veins weakly developed. Inflorescences terminal and in upper leaf axils, with cymes 2- to several flowered, 2–16 mm, shorter to somewhat longer than subtending leaves; peduncles glabrescent, bracteate; pedicels 0.8–4 mm. Flowers hermaphroditic. Ovary obovoid, ca. 0.5 mm, densely appressed hairy. Corolla white, rotate, 2–2.5 mm in diam., lobed for 1/2–2/3; lobes 4, ovate. Fruit on pedicels becoming deflexed to nodding; mericarps obloid to oblate, 0.8–1 mm, densely grayish yellow hairy with straight or slightly curved trichomes ca. 0.8 mm. Fl. Jul, fr. Aug–Sep.

- Under shrubs and in rock crevices; 3000–3500 m. Taiwan (Hualian, Nantou, Yilan).

*Galium nankotaizanum* is closely related to a group of species described from the high mountains of Taiwan (see under *G. morii*). *Galium maborasense*, treated as a separate but dubious species by W. C. Chen (in FRPS 71(2): 284. 1999), was explicitly synonymized by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 107. 1998) with *G. nankotaizanum*. This publication apparently was not available to Chen, but here we follow these Taiwanese authors.

*Galium nankotaizanum* is mainly characterized by its straight or slightly curved fruit trichomes. This links it to the high-alpine Himalayan group of *G. serpylloides* s.l. (see there). Otherwise, *G. nankotaizanum* also appears similar to taxa with hooked fruit trichomes, e.g., *G. tarokoense*, with glabrous stems and only 1 principal leaf vein, from which it apparently differs by larger flowers.

**37. *Galium odoratum*** (Linnaeus) Scopoli, Fl. Carniol., ed. 2, 1: 105. 1771.

车轴草 che zhou cao

*Asperula odorata* Linnaeus, Sp. Pl. 1: 103. 1753.

Herbs, perennial, from slender and elongated rhizomes. Stems erect, 10–50 cm tall, 4-angled, glabrous and smooth except hispidulous at nodes. Leaves in whorls of 6–10, sessile or petiole to 1 mm; blade drying papery, oblanceolate, oblong-lanceolate, or narrowly elliptic, (6–)15–50(–65) × (3–)4.5–15(–17) mm, length/breadth index ca. 4, glabrous except antrorsely aculeolate on margins and with antrorse microhairs on upper side and sometimes on abaxial midrib, base acute to cuneate, margins flat, apex acute or usually obtuse then abruptly mucronate; vein 1. Inflorescences terminal, with several- to many-flowered cymes; axes glabrous, smooth; bracts none or leaflike, 1–3 mm; pedicels 1–4 mm. Ovary ellipsoid to obovoid, ca. 0.8 mm, densely hispidulous. Corolla white or bluish white, ± broadly funnellform, 4.5–6.5 × 3–7 mm, glabrous, lobed for ca. 1/2; lobes 4, triangular-spatulate, acute. Mericarps subglobose, 2–2.5 mm, with dense uncinat trichomes 1–1.2 mm. Fl. and fr. Jun–Sep.

Mountain forests; 1500–2800 m. Gansu, Heilongjiang, Jilin, Liaoning, Ningxia, Qinghai, Shandong, Shanxi, Sichuan, Xinjiang [Japan, Korea, Russia; NW Africa, SW Asia, Europe; introduced in North America].

Dried plants of *Galium odoratum* have a sweet coumarine odor, which is still evident on herbarium specimens; its name refers to this. On account of its funnellform corollas (with the tube ± as long as the lobes), *G. odoratum* usually has been treated as a member of *Asperula*. As shown by Ehrendorfer et al. (Fl. Iranica 176: 183. 2005) and verified by DNA-analytical studies, it belongs to *G. sect. Hylaea* and is closely related to *G. asperuloides* and *G. hoffmeisteri*. Without flowers it is difficult to separate, particularly from the former with more narrow leaves, but generally *G. odoratum* is more robust. As a constant element of temperate deciduous forests (often with *Fagus*), it has an extensive but rather disjunct distribution area throughout Eurasia, with diploid cytotypes in E Asia, replaced by tetraploids in Europe.

**38. *Galium paniculatum*** (Bunge) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 277. 1971.

圆锥拉拉藤 yuan zhui la la teng

*Asperula paniculata* Bunge in Ledebour, Fl. Altaic. 1: 140. 1829; *Galium xinjiangense* W. C. Chen.

Herbs, perennial, often somewhat caespitose from elongated, much branched, and ca. 1 mm thick rhizomes. Stems erect, to 60 cm tall, 4-angled, little branched, glabrous and smooth, only sometimes puberulent at nodes. Leaves in whorls of up to 6, subsessile; blade drying papery, discolorous (more pale abaxially), lanceolate or narrowly lanceolate, (15–)25–60(–70) × (3–)5–10(–12) mm, glabrous, smooth or mostly somewhat antorsely ciliolate on margins and midrib, base acute to cuneate, apex acute to acuminate; vein 1. Inflorescences terminal, 8–16 × 8–16 cm, corymbiform to paniculate, lax, with several- to many-flowered cymes; axes glabrous, smooth with few lanceolate, 1–3 mm long bracts and 1.5–6 mm long pedicels. Ovary obovoid, ca. 1 mm, glabrous. Corolla white, drying often yellowish brown, campanulate to funnel-form, ca. 4 mm in diam., glabrous, lobed for ca. 1/2; lobes 4, triangular, acute. Fruit on elongating pedicels with ellipsoid, ca. 2 mm, glabrous and smooth mericarps. Fl. Jun–Jul, fr. Aug–Sep.

Montane river valleys, open forests, grasslands, rocky slopes and talus; 1300–1900 m. Xinjiang [Russia].

When W. C. Chen described *Galium xinjiangense*, he compared it only with the completely different *G. odoratum*, not being aware of the certainly conspecific *G. paniculatum*. Because of its corolla shape, this characteristic and relatively isolated taxon was originally described as *Asperula*. But there is no affinity to any group of *Asperula* as presently circumscribed. Instead, there are similarities with *G. ser. Nemoralia* M. Popova of *G. sect. Leiogalium* and with some members of *G. sect. Orientigalium*. Therefore, the transfer of *A. paniculata* to *Galium* by Pobedimova was fully justified.

Pobedimova et al. (Fl. URSS 23: 271. 1958) also discussed the disjunct distribution of this relict species, which extends from its center in the Altai to the middle Yenisei and to the Dzungarian Alatau in NW China (Xinjiang).

**39. *Galium paradoxum*** Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 281. 1874.

林猪殃殃 lin zhu yang yang

Herbs, perennial, ascending from filiform rhizomes. Stems erect, slender, 4–25 cm tall, 4-angled and narrowly winged, glabrous and smooth, only nodes slightly shortly hairy. Middle stem leaves opposite and with 2 leaflike but clearly smaller stipules in whorls of 4, at lower nodes stipules linear, 1.5–3 mm; petiole 1.5–10 mm; leaf blade membranous, suborbicular, broadly ovate to ovate-lanceolate, or elliptic-oblong, (5–)6–30(–40) × (3.5–)5–15(–23) mm, adaxially with scattered, ± appressed, short hairs, abaxially glabrescent, base attenuate, obtuse to truncate, margins antorsely hispidulous-ciliolate, apex acute to rounded; single principal vein with 2–4 pairs of pinnate lateral veins. Inflorescences terminal and in axils of upper leaves with 3–11-flowered cymes; axes trichotomous and ± divaricate; bracts narrowly elliptic or ligulate, 0.8–3 mm; pedicels 1–3 mm. Ovary ovoid, ca. 0.5 mm, with undeveloped uncinat hairs. Corolla white, rotate, 2.5–3 mm in diam., lobed for 1/2–2/3; lobes ovate, obtuse, subapiculate to acute or acuminate. Mericarps ovoid, 1–2 mm, densely covered with uncinat yellowish brown trichomes 0.8–1 mm, on pedicels thickening and elongating up to 11 mm. Fl. May–Aug, fr. Jun–Sep.

Forests, meadows, near water, on shady (sub)alpine rocks; 1200–

4000 m. Anhui, Gansu, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jilin, Liaoning, Qinghai, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Japan, Korea, Nepal, Russia].

*Galium paradoxum* is a rather unusual species of the genus because of its broad, petiolate, and pinnately nerved opposite leaves, forming whorls of 4 with 2 smaller leaflike stipules. Therefore, it can be confused with other genera, in particular *Kelloggia*, which differs by its calyx teeth and its never-leaflike stipules. Because of its isolated position, *G. paradoxum* was made the type species of *G. sect. Cymogalia* and placed into a monotypic series, *G. ser. Paradoxa* (see Pobedimova et al., Fl. URSS 23: 326. 1958). As shown by Ehrendorfer et al. (Fl. Iranica 176: 232. 2005) and unpublished DNA analyses, it is only distantly related to *G. kamschaticum*, *G. rotundifolium*, and *G. elegans* in *G. sect. Platygaleum* s.l. or to members of *G. sect. Hylaea*, as *G. hoffmeisteri*.

Schönbeck-Temesy and Ehrendorfer (in Tan et al., Davis & Hedge Festschrift, 111–114. 1989) commented on the morphological variation and biogeography of *Galium paradoxum* and recognized three subspecies, of which subsp. *paradoxum* and subsp. *duthiei* occur in China as keyed out and described below. The third, *G. paradoxum* subsp. *franchetianum* Ehrendorfer & Schönbeck-Temesy, is restricted to Japan and can be recognized by its relatively larger leaves with relatively short trichomes and often acute apices, and by its relatively large flowers. A survey of many new collections now available from the herbaria PE, KUN, MO, and WU shows that ranges of variation in all differential features used overlap and that many intermediates occur. With respect to the two Chinese taxa one can suspect not only an allopatric but also an altitudinal differentiation pattern.

- 1a. Leaves usually lanceolate-ovate, (10–)12–30(–40) × (5–)7–15(–23) mm; corolla lobes obtuse to subapiculate ..... 39a. subsp. *paradoxum*
- 1b. Leaves broadly ovate to suborbicular, (5–)6–10(–17) × (3.5–)4–7(–10) mm; corolla lobes acute to acuminate ..... 39b. subsp. *duthiei*

**39a. *Galium paradoxum* subsp. *paradoxum***

林猪殃殃(原亚种) lin zhu yang yang (yuan ya zhong)

Leaves ovate-lanceolate or sometimes ovate or elliptic-oblong, attenuate at base, (10–)12–30(–40) × (5–)7–15(–23) mm. Corolla lobes obtuse to subapiculate. Fl. May–Aug, fr. Jun–Sep.

Forests, meadows, near water; 1200–3000 m. Anhui, Gansu, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jilin, Liaoning, Qinghai, Shanxi, Sichuan, Yunnan, Zhejiang [Bhutan, Korea, Russia].

**39b. *Galium paradoxum* subsp. *duthiei*** Ehrendorfer & Schönbeck-Temesy in Tan et al., Davis & Hedge Festschrift, 113. 1989.

达氏林猪殃殃 da shi lin zhu yang yang

Leaves broadly ovate to suborbicular, (5–)6–10(–17) × (3.5–)4–7(–10) mm, truncate at base. Corolla lobes acute to acuminate. Fl. Jul–Aug, fr. Jul–Sep.

On shady (sub)alpine rocks; 2700–4000 m. Hubei, Sichuan, Xizang, Yunnan [Bhutan, India, Nepal].

In an otherwise quite typical specimen of this subspecies (e.g., Sichuan, Lutinghsien Mujaogou: *T. P. Wang 18-9-1938*, PE) the stipules at the mid-stem region are quite comparable to true leaves, only

slightly smaller. This results in a considerable similarity to small plants of *Galium hoffmeisteri* from *G.* sect. *Hylaea*, which differ by their leaves and leaflike stipules in whorls of up to 5 or 6.

**40. *Galium platygalium*** (Maximowicz) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 277. 1971.

卵叶轮草 luan ye lun cao

*Asperula platygalium* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 284. 1874.

Herbs, perennial, from thin creeping rhizomes. Stems erect, 20–35 cm tall, with 4 thickened angles, smooth, at nodes glabrous or hispidulous. Leaves in whorls of 4(–6), sessile, with petiole up to 2 mm; blade drying papery to leathery, elliptic or elliptic-oblong to ovate, (12–)20–25(–28) × (7–)10–11(–15) mm, glabrous or hirtellous to hispidulous along principal veins, ± abruptly narrowed into short petiole, margins antrorsely ciliate, apex obtuse to subacute; principal veins 3–5, palmate. Inflorescences umbel-like thyrsoid and many-flowered panicles with terminal and lateral cymes from uppermost leaf axils; peduncles smooth and glabrous; bracts narrowly oblanceolate or elliptic to ligulate, 1–3 × 0.5–1.5 mm; pedicels 0.5–1.5 mm. Ovary ellipsoid, ca. 0.8 mm, glabrous. Corolla white, funnellform, with tube ± as long as lobes, 4–5 mm in diam.; lobes 4, elliptic-oblong. Mericarps ovoid, 1.7–2.8 mm, glabrous and smooth. Fl. and fr. Jul–Sep.

Open forests on mountain slopes; ca. 1700 m. Heilongjiang, Jilin, Shanxi [Korea, Russia].

*Galium platygalium* is closely related to *G. maximoviczii* (see there) but has larger flowers and whorls of opposite leaves and leaflike stipules with 4 or more (rarely up to 6) elements. Because of their slightly elongated, fused corolla base, the two species in the older literature were placed into the genus *Asperula*, where they had no other close relatives. In spite of their increase in leaf whorl elements, the two species have been placed by Ehrendorfer et al. (Fl. Iranica 176: 175. 2005) into *G.* sect. *Platygalium* s.l. Though this section normally is characterized by leaf whorls with only up to 4 elements, this placement may be justified because the two species correspond otherwise quite well, as in habit, inflorescences, and leaves (with 3–5 palmate principal veins).

Furthermore, *Galium platygalium* and *G. maximoviczii* exhibit similarities with *Microphysa elongata* (see p. 216), also with a well-developed corolla tube but with leaves in whorls of only 4 and only 1 main vein. Thus, the monotypic “genus” *Microphysa*, maintained here, is another obvious member of *G.* sect. *Platygalium*.

**41. *Galium prattii*** Cufodontis, Oesterr. Bot. Z. 89: 244. 1940.

康定拉拉藤 kang ding la la teng

Herbs, perennial, erect to weak, up to 50 cm tall. Stems obtusely 4-angled, usually branched, ± retrorsely aculeolate on angles or glabrous. Leaves in whorls of 6, sessile; blade drying papery, lanceolate, 15–35 × 2.5–6 mm, glabrous, adaxially smooth or scaberulous along midrib and near margins, abaxially sparsely retrorsely aculeolate along midrib, base cuneate, margins sparsely to densely retrorsely aculeolate, flat to thinly revolute, gradually narrowed into acute to acuminate apex; vein 1. Inflorescences terminal and axillary, cymes many flowered; peduncles glabrous, smooth; bracts none or few, 1–2 mm; pedicels 1–4 mm. Ovary obovoid, 0.5–0.8 mm, glabrous. Corolla

white to greenish, rotate, 2.5–3 mm in diam., lobed for 2/3 or more, glabrous; lobes 4, triangular-spatulate, acute to shortly acuminate. Mericarps ovoid, ca. 1 mm, glabrous, smooth or minutely granulose. Fl. Jun, fr. Aug.

• Valleys, open habitats of the montane zone; 3100–3700 m. Sichuan (Kangding).

*Galium prattii* apparently is endemic in Sichuan. It is often so close to forms of the reddish-purplish flowering *G. blinii* that only the longer lanceolate leaves, the more flower-rich cymes, and the white to greenish flower color of *G. prattii* help to separate them. Otherwise, *G. prattii* seems to link *G. asperifolium* and *G. tokyoense*. From the first it differs by less-bracteate inflorescences and less-acuminate corolla lobes, from the second by its leaves, which are lanceolate and apically more gradually narrowed (vs. subspatulate and apically rounded, mucronate).

**42. *Galium pusillosetosum*** H. Hara, J. Jap. Bot. 51: 134. 1976.

细毛拉拉藤 xi mao la la teng

Herbs, perennial, procumbent and ascending, caespitose, (5–)10–20(–40) cm tall. Stems with 4 prominent whitish angles, variable from ± densely hispid with straight trichomes of ca. 0.8 mm to retrorsely (very rarely also antrorsely) aculeolate. Middle stem leaves in whorls of up to 5 or 6 (never only 4), sessile; blade drying blackish, narrowly oblanceolate to narrowly lanceolate, (3–)5–10(–17) × 0.8–2(–4.2) mm, hispid, retrorsely aculeolate on midrib and margins or glabrescent, base cuneate, apex acute and shortly mucronate; vein 1, whitish. Inflorescences with axillary and/or terminal cymes, few to several flowered; peduncles divaricate, with leaflike bracts, 1–3 mm; pedicels 0.5–3 mm. Ovary ovoid, ca. 0.6 mm, densely hispidulous, glabrescent or glabrous. Corolla purple, yellowish green, or white, rotate, 2.5–3 mm in diam., glabrous or scaberulous inside; lobes 4, ovate, acute. Fruit subglobose, ca. 2 mm in diam., with dense to sparse ± uncinat trichomes 0.5–0.7 mm or glabrous and smooth. Fl. and fr. May–Aug.

Mountain slopes, open ground and grasslands; 2100–3900 m. Gansu, Nei Mongol, Ningxia, Qinghai, Shanxi, Sichuan, Xinjiang, Xizang [Bhutan, Nepal].

*Galium pusillosetosum* is an obvious alpine member of the *G. asperifolium* group (*G.* sect. *Trachygalium* s.l.). Main differential characters are its relatively dense leaf and stem indumentum and its conspicuous whitish stem angles. These separate it from *G. acutum*, *G. baldensisforme*, *G. megacytarion*, *G. rebae*, *G. glabriusculum*, and *G. sungpanense*. Nevertheless, its variability with respect to leaf epidermal cell size, flower color, and ovary and fruit indumentum is remarkable.

**43. *Galium rebae*** R. R. Mill, Edinburgh J. Bot. 53: 195. 1996.

芮芭拉拉藤 rui ba la la teng

?*Galium bodinieri* H. Léveillé.

Herbs, perennial, procumbent and mat-forming. Stems (5–)14–30(–45) cm, 4-angled or -sulcate, branched, glabrous and smooth, but sometimes with scattered straight hairs. Leaves in whorls of up to 6, sessile; blade drying papery, blackish, linear-lanceolate to narrowly oblanceolate, 2.5–10.5 × 0.4–1.4 mm, with inconspicuous epidermal cells, glabrous and smooth, rarely with a few straight hairs on abaxial midvein, base cuneate, margins entire and smooth, flat to thinly revolute, apex acute, contracted and shortly mucronate; vein 1. Inflorescences

with predominantly axillary cymes, 1–6-flowered; axes glabrous, smooth; pedicels 0.1–3.2 mm. Ovary ellipsoid-obovoid, ca. 0.5 mm, glabrous, smooth. Corolla red, purple, or occasionally white, rotate, 1.7–3.6 mm in diam., glabrous to papillose; lobes 4, lanceolate-spatulate, adaxially glabrous except puberulent on margins and central vein, apex acute to shortly acuminate. Mericarps ellipsoid, ca.  $1.5 \times 0.7$  mm, glabrous and smooth or granular- verruculose, on pedicels often elongating to 5 mm. Fl. and fr. Jun–Nov.

Damp banks under evergreen forests, alpine meadows, on rocks; 2000–4000 m. Sichuan, Xizang, Yunnan [Bhutan, India (Sikkim), Nepal].

*Galium rebae* belongs to the Himalayan and SW Chinese complex of (sub)alpine taxa from the *G. asperifolium* group studied by Mill (Edinburgh J. Bot. 53: 193–213. 1996; Fl. Bhutan 2(2): 825–834. 1999). It is closely related to *G. acutum* and often only separable by its flower color (see comments under that species). At the same time, it appears linked to the likewise reddish flowering but larger *G. blinii* at lower elevations. Reddish flowers also occur in *G. pusillosetosum*, which differs by its dense stem, leaf, and fruit indumentum.

#### 44. *Galium rupifragum* Ehrendorfer, Novon 20: 273. 2010.

屏边拉拉藤 ping bian la la teng

Herbs, perennial, densely caespitose, emerging from a slender branching rootstock; all vegetative parts very fragile when dried and with a loose indumentum of soft hairs, 0.5–0.8 mm,  $\pm$  straight and spreading, on upper leaf surface slightly retrorse. Stems ascending or erect, 5–10 cm tall, 4-angled, hairy, with 12–18 internodes, increasing in length from 2–8(–15) mm upward, with some short vegetative lateral branches from middle region to inflorescence base. Leaves in whorls of 4; blade thinly papery and remaining  $\pm$  greenish when dried, ovate to broadly lanceolate,  $5\text{--}8 \times 2.5\text{--}3.5$  mm, loosely hairy on both sides and marginally, base attenuate, margins flat or slightly revolute, apex acute to apiculate; principal veins 3, palmate, lateral weak. Inflorescences terminal, often with 3 cymes, each with 3–5 flowers; bracts few and  $\pm$  reduced; peduncles 4–5 mm and pedicels 0.5–3 mm, glabrescent, somewhat elongated and divaricate in fruit. Flowers hermaphroditic. Ovary ovoid, ca.  $0.5 \times 0.3$  mm, with still undeveloped appressed hairs. Corolla greenish white, rotate, ca. 1.5 mm in diam., with 4 triangular and acute to slightly apiculate lobes. Mericarps 0.8–1 mm, with spreading uncinat trichomes ca. 0.25 mm. Fl. and fr. Jul–Sep.

- Mountain regions, on rocks; ca. 1800 m. Yunnan (Pingbian).

The above description of *Galium rupifragum* is based on two sheets collected by H. T. Tsai (*H. T. Tsai 60986*) on rocks at the type locality and deposited in PE. *Galium rupifragum* belongs to *G.* sect. *Platygalium* s.l. and exhibits affinities with the *G. bungei* group, in particular with *G. salwinense*. Both share slender growth and uncinat fruit hairs. But *G. salwinense* has fewer (only up to 10) and longer (up to 10–20 mm) stem internodes, smaller leaves, only 1 (and not 3) main leaf veins, and smaller flowers. Nevertheless, on Emei Shan (Sichuan) typical *G. salwinense* occurs at lower elevations, whereas at higher elevations reduced forms approach *G. rupifragum*. In addition, there are also obvious similarities between *G. rupifragum* and representatives of the *G. morii* group (see there), growing with five accepted species in the high mountains of Taiwan, particularly with *G. morii* itself and with the related *G. formosense*. Main differences from the latter are its lower growth and smaller leaves, from the former its hirsute stems and the more divaricate, often longer peduncles and pedicels.

#### 45. *Galium salwinense* Handel-Mazzetti, Symb. Sin. 7: 1028. 1936.

怒江拉拉藤 nu jiang la la teng

Herbs, perennial, weak, procumbent to ascending, from filiform rhizome, 8–50 cm tall. Stems 4-angled, glabrous or with sparse spreading hairs. Middle stem leaves in whorls of 4, sessile or subsessile; blade drying papery, dark green, narrowly ovate or elliptic to oblong-lanceolate,  $(3\text{--}5)\text{--}18\text{--}(23) \times (1.5\text{--})3\text{--}7\text{--}(11)$  mm, sparsely and at margins antrorsely hairy, base attenuate, apex slightly acute; vein 1. Inflorescences terminal and axillary, slender and slightly divaricate, cymes 1.5–6 cm, rather few flowered; axes glabrous, nearly ebracteate; pedicels  $(2\text{--})4\text{--}8\text{--}(12)$  mm. Ovary obovoid, ca. 1 mm, appressed hairy. Corolla yellowish,  $\pm$  rotate, 1–1.3 mm in diam.; lobes 4, triangular,  $\pm$  obtuse. Mericarps ovoid, 1–1.5 mm, densely with short uncinat trichomes ca. 0.1 mm. Fl. and fr. Jul–Oct.

- Shady habitats, rocks in forests; 1700–2800 m. Sichuan, Yunnan (Gongshan).

The regional *Galium salwinense* is apparently closely related to the widespread *G. bungei*. Nevertheless, its habit, elongated pedicels, and fruit surface, always with short and spreading hooked trichomes, offer reliable differential characters.

#### 46. *Galium saurense* Litvinov, Trudy Bot. Muz. Imp. Akad. Nauk 7: 75. 1910.

狭序拉拉藤 xia xu la la teng

*Galium densiflorum* Ledebour var. *saurense* (Litvinov) Tzvelev.

Herbs, perennial, caespitose, with stout rootstock and slender, woody rhizomes. Stems erect or ascending, 8–30 cm tall, 4-angled and  $\pm$  puberulent. Leaves in whorls of 4 in lower and of 6 in middle stem region, sessile; blade dark green adaxially, pale green abaxially, linear or linear-oblong,  $7\text{--}15 \times 0.5\text{--}2.5$  mm, smooth or usually sparsely to densely scaberulous adaxially, usually densely hairy abaxially, base acute to cuneate, margins  $\pm$  revolute, apex mucronate; vein 1. Inflorescences narrowly paniculate with axillary and terminal, 3–15-flowered cymes; peduncles bracteose,  $\pm$  densely pubescent (rarely glabrescent), with 1–3 mm long pedicels. Ovary ellipsoid,  $\pm$  puberulent. Corolla yellow, rotate, 3–4 mm in diam., lobed for 3/4 or more; lobes 4, ovate-oblong, acute. Mericarps ellipsoid, ca.  $2 \times 3$  mm,  $\pm$  densely puberulent (rarely glabrous or  $\pm$  tuberculate). Fl. and fr. Jul–Aug.

Alpine and subalpine habitats. Qinghai, Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Russia].

*Galium saurense*, a C Asiatic mountain taxon, belongs to *G.* sect. *Galium* and the extremely polymorphic Eurasian *G. verum* group. It refers to condensed alpine populations, in which the leaf whorls are reduced to 4–6 elements. The Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) treats it as a synonym of *G. verum* subsp. *verum*, whereas Ehrendorfer et al. (Fl. Iranica 176: 199, 204. 2005) suggest to maintain its specific rank as long as the whole group has not been studied more intensively. In Pobedimova et al. (Fl. URSS 23: 368–369. 1958) *G. saurense* is reported i.a. from the Tien Shan in the border region of Kazakhstan and Xinjiang, but its description is in conflict with

plate 21, figure 1, which rather corresponds to *G. majmechense* and *G. consanguineum*. W. C. Chen (in FRPS 71(2): 285. 1999) included *G. saurense* as a dubious species and suspected its occurrence in NW China. We have seen no authentic specimens, but vouchers from Xinjiang and Qinghai (and possibly other provinces) fit its description quite well. Nevertheless, their separation from *G. verum* s.s. is partly doubtful.

**47. *Galium serpylloides*** Royle ex J. D. Hooker, Fl. Brit. India 3: 207. 1881, s.l.

隆子拉拉藤 long zi la la teng

Herbs, perennial, ascending, 3–10 cm tall. Rootstock woody, rhizomatous. Stems 4-angled, branched, shortly pubescent. Leaves in whorls of 4(or ?5), sessile; blade drying papery, ovate or elliptic, 4–6 × 2.5–4 mm, glabrous or sparsely hirtellous, base rounded, margins thinly revolute, usually with antrorse microhairs, apex obtuse or slightly acute; principal vein 1 (or with 2 inconspicuous side veins). Inflorescences terminal and in axils of upper leaves, with cymes 5–8 mm, few or usually 3-flowered; pedicels 1–2 mm. Flowers hermaphroditic to subdioecious. Ovary appressed hairy. Corolla yellowish green, rotate, ca. 2 mm in diam.; lobes 4, ovate-triangular, acute. Mericarps up to 2 mm, with straight lanate hairs. Fl. and fr. Jun–Sep.

Mountain slopes; 3600–3800 m. Xizang (Lhünzê) [India, Nepal].

Originally, *Galium serpylloides* was very broadly circumscribed as a species widely distributed throughout the whole Himalayan range. But a critical taxonomic analysis of the group by Schönbeck-Temesy and Ehrendorfer (Pl. Syst. Evol. 155: 77–87. 1987) revealed five vicarious and geographically well-separated species from Kashmir in the west to Nepal in the east: *G. gymnopetalum* Ehrendorfer & Schönbeck-Temesy, *G. lakulense* Ehrendorfer & Schönbeck-Temesy, *G. serpylloides* s.s., *G. saipalense* Ehrendorfer & Schönbeck-Temesy, and *G. nepalense* Ehrendorfer & Schönbeck-Temesy. The above cited locality from E Xizang, Lhünzê, published in FRPS (71(2): 228. 1999), is much further to the east, i.e., SE of Lhasa and NE of Bhutan. We have neither seen authentic material from this nor from other Xizang and Charme province collections in the herbarium BM (e.g., Ludlow, Sheriff & Taylor 6390). At the moment, it is not possible to decide whether they correspond to one of the above mentioned species of the *G. serpylloides* group, or the related *G. glandulosum* group, or represent a still undescribed taxon. Therefore, we provisionally classify these SE Xizang populations under *G. serpylloides* s.l.

Characteristic morphological features of the *Galium serpylloides* group are the whorls of 4 leaves and leaflike stipules, the trend toward palmate leaf veins and sexual differentiation of flowers, and the change from hooked to straight fruit hairs. All this suggests relationships with members of *G. sect. Platygalium* s.l., as the *G. morii* group (in particular *G. nankotaizanum*) or the *G. elegans* group. These trends reappear (probably as a homoplasy?) in the W North and South American *G. sect. Lophogalium* K. Schumann, evidently derived from ancestors similar to *G. sect. Platygalium* s.l.

**48. *Galium sichuanense*** Ehrendorfer, Novon 20: 275. 2010.

四川拉拉藤 si chuan la la teng

Herbs, perennial, from filiform rhizomes ascending to erect, ca. 30 cm tall. Stems single, strongly branched from base, with 4 prominent and whitish angles, glabrous and smooth, only slightly aculeolate at nodes. Middle stem leaves and leaf-like stipules in whorls of 4–6; blade drying papery and greenish-brownish, lanceolate, (12–)15–20(–25) × (3–)4–6(–7) mm, glabrous but on adaxial side near margins with antrorse appressed microhairs, on ± flat margins retrorsely (sometimes

also somewhat antrorsely) aculeolate, subsessile and gradually narrowed into base, largest breadth near middle, apex cuspidate with hyaline point; principal vein 1. Inflorescences broadly ovate, many flowered, cymes terminal and lateral, 2.5–5 cm, slender, leafy and bracteate to last branches, ± divaricate; axes glabrous; peduncles 1.5–2 cm; pedicels 0.5–5 mm. Flowers hermaphroditic. Ovary obovoid, 0.5–0.8 mm, with appressed curved hairs. Corolla dried reddish brown, rotate, 1.5–2 mm in diam.; lobes 4, triangular, cuspidate. Mericarps ovoid, 1.8–2.5 mm, with ± spreading uncinat trichomes 0.2–0.3 mm. Fl. Jul–Aug, fr. Aug–Sep.

• Mountain forests; 3200–4000 m. Sichuan (Daocheng).

Up to now, only two collections of *Galium sichuanense* are known from the type locality. The new species is morphologically isolated and not closely related to any other taxon of the genus. Its character profile, particularly its perennial, hemicryptophytic growth form, the partly retrorsely aculeolate leaf margins, and the fruit with uncinat trichomes, designates it as a member of *G. sect. Trachygalium*, but there are also features reminiscent of *G. sect. Hylaea* (cf. Ehrendorfer et al., Fl. Iranica 176: 181. 2005). Nevertheless, the combination of the branching pattern, the membranous leaves, the predominant glabrescence, the leafy inflorescences, and the small flowers separate it clearly from all other members of the two sections.

Another isolated and apparently relict species from E Asia has to be compared with *Galium sichuanense*, the Japanese *G. kikumugura* (see also under *G. hoffmeisteri*). The two share the leaves in whorls of 4–6, the small flowers, and the hooked fruit trichomes. In contrast, the habit and the somewhat antrorsely rough or even aculeolate leaf margins of *G. kikumugura* are reminiscent of *G. bungei* (*G. sect. Platygalium*). Unique characters of *G. kikumugura* are the very few-flowered cymes on long peduncles with a single bract and the elongate, curved mericarps. Its taxonomic placement within *Galium* also is uncertain.

**49. *Galium glabriusculum*** Ehrendorfer, nom. nov.

无梗拉拉藤 wu geng la la teng

Replaced synonym: *Galium smithii* Cufodontis, Oesterr. Bot. Z. 89: 236. 1940, not *Galium smithii* G. Don, Gen. Hist. 3: 660. 1834 [*Sherardia erecta* Smith, Fl. Graec. 2: 14. 1813].

Herbs, perennial, weakly procumbent to erect. Stems (5–)7–15(–30) cm, 4-angled, glabrous and smooth, rarely shortly hairy at nodes. Leaves in whorls of up to 5 or 6, subsessile; blade greenish brown and subleathery when dried, narrowly lanceolate to narrowly elliptic, 3–12 × 1–2.5 mm, glabrous and smooth, very rarely with straight hairs adaxially or slightly retrorsely aculeolate on margins, base cuneate, margins thinly revolute, apex acute and shortly mucronate; vein 1. Inflorescences with terminal and lateral 1–3-flowered cymes on up to 10 mm long peduncles (often elongating in fruit) and with subsessile flowers on 0.5–3 mm long pedicels. Ovary subglobose, ca. 1 mm, densely covered with undeveloped trichomes. Corolla white, rotate, ca. 1.5 mm in diam.; lobes 4, ovate, obtuse. Mericarps ellipsoid, ca. 3 mm, with dense spreading yellowish brown uncinat trichomes ca. 0.7 mm. Fl. and fr. Jul–Aug.

• Meadows, alpine mountain slopes; 3800–4700 m. Gansu, Qinghai, Sichuan, Xinjiang.

*Galium glabriusculum* is a well-documented species of the alpine subgroup (2) within the *G. asperifolium* complex (see under that species and *G. acutum*). It is similar to *G. sungpanense* and *G. baldensiforme*

and mainly differs from the former by its narrower and more leathery leaves and from both by the nearly total lack of indumentum.

**50. *Galium spurium* Linnaeus, Sp. Pl. 1: 106. 1753.**

猪殃殃 zhu yang yang

*Galium agreste* Wallroth; *G. agreste* var. *echinospermum* Wallroth; *G. agreste* var. *leiospermum* Wallroth; *G. aparine* Linnaeus var. *echinospermum* (Wallroth) T. Durand; *G. aparine* f. *leiocarpum* Makino; *G. aparine* var. *leiospermum* (Wallroth) T. Durand; *G. aparine* var. *spurium* (Linnaeus) W. D. J. Koch; *G. aparine* var. *tenerum* (Grenier & Godron) H. G. Reichenbach; *G. aparine* var. *vallantii* (Candolle) W. D. J. Koch; *G. hongnoense* H. Lévillé; *G. oliganthum* Nakai & Kitagawa; *G. pauciflorum* Bunge (1833), not Willdenow ex Candolle (1830); *G. spurium* var. *echinospermum* (Wallroth) Hayek; *G. spurium* var. *tenerum* Grenier & Godron; *G. vallantii* Candolle; *G. wutaicum* Hurusawa.

Herbs, annual, procumbent or climbing, 30–50 cm tall. Stems 4-angled, 0.5–2.5 mm in diam., ± branched from base, retrorsely aculeate on angles, glabrescent to pilose at nodes. Leaves at middle stem region in whorls of 6–8, subsessile; blade drying papery, narrowly oblanceolate to narrowly oblong-oblanceolate, 5–40 × 1–5(–8) mm, usually pilosulous or hispidulous adaxially, retrorsely aculeolate along midrib abaxially and along margins, base acute, margins flat to thinly revolute, apex acute and shortly mucronate; vein 1. Inflorescences terminal and axillary, cymes 2- to several flowered; axes glabrous to aculeolate; bracts leaflike or none, 1–5 mm; peduncles 1–4 cm; pedicels 0.5–1.5 mm, finally elongating and often curved directly under fruit. Ovary subglobose, 0.3–0.5 mm, with uncinately trichomes or glabrous. Corolla yellowish green or white, rotate, 1–1.5 mm in diam., lobed for 2/3 or more; lobes 4, triangular to ovate, acute. Mericarps subglobose to broadly kidney-shaped, 1–3 mm in diam., glabrous or often densely covered with uncinately trichomes 0.1–1 mm from straight bases. Fl. Mar–Jul, fr. Apr–Nov.

Open fields, riversides, farmlands, mountain slopes; near sea level to 4600 m. Common and widespread throughout China except Hainan and Nanhai Zhudao [Africa, Eurasia, and the Mediterranean; today sporadically adventive worldwide].

This species is occasionally used medicinally.

*Galium spurium* consists of basal elements ( $2x$  and  $4x$ ,  $2n = 20$ ,  $40$ ) of a polymorphic polyploid complex, the *G. aparine* group or *G. aparine* s.l. (see there). Following Ehrendorfer et al. (Fl. Iranica 176: 234. 2005), *G. spurium* is maintained here at the species level, with particular reference to its differential characters in flower and fruit size, and not included under the higher polyploid and aneuploid *G. aparine* s.s., as in Cufodontis (Oesterr. Bot. Z. 89: 245–247. 1940) and W. C. Chen (in FRPS 71(2): 237. 1999). *Galium spurium* is very common and widespread in China, in contrast to the rare and partly doubtful *G. aparine* s.s. To our knowledge, no chromosome counts are yet available from Chinese populations of *G. spurium*. Nevertheless, a report of  $2n = 40$  for this species from Novosibirsk (Krasnikov & Schaulo, Bot. Žurn. 75: 118–120. 1990) suggests the occurrence of  $4x$  *G. spurium* cytotypes in Asia, corresponding to similar  $4x$ -cytotypes reported from Africa.

From the varieties recognized by Cufodontis (loc. cit.) and accepted by W. C. Chen (loc. cit.: 234–237) *Galium spurium* var. *tenerum* refers to reduced specimens, which can appear under extreme conditions as modifications everywhere, and are taxonomically irrele-

vant. But as genetically fixed reduced alpine ecotypes they deserve a name: *G. spurium* subsp. *ibicinum* (Boissier & Haussknecht) Ehrendorfer, described from high mountains in SW Asia (see Ehrendorfer et al., loc. cit.: 236). Some condensed alpine Chinese specimens may belong to this taxon.

In contrast, *Galium spurium* var. *echinospermum* vs. var. *spurium* (= *G. aparine* var. *leiospermum*) refer to genetically fixed forms with uncinately hairy vs. glabrous fruit, which in W Eurasia and the Mediterranean often occur together in the same population and can be separated as taxonomic forms. In China we have seen only the *echinospermum* type, whereas var. *spurium* apparently is missing there. The reference to it by W. C. Chen (loc. cit.: 237) concerns the glabrous fruited *G. ghilanicum* (see there). It is obvious that a more detailed analysis of the *G. aparine*-*G. spurium* polyploid complex in E Asia is badly needed.

The enormous variability of *Galium aparine* and *G. spurium* has caused its many synonyms and common misidentifications with other annual and even perennial taxa of *Galium*. This applies in particular to the annual *G. tricoratum*, which differs by strongly verrucose (but not uncinately hairy) fruit, and to the perennial taxa with retrorsely aculeolate stems and fruit with uncinately hairs, such as *G. sungpanense* (see there), *G. dahuricum*, etc., which often have larger flowers.

**51. *Galium sungpanense* Cufodontis, Oesterr. Bot. Z. 89: 238. 1940.**

松潘拉拉藤 song pan la la teng

Herbs, perennial, slender, with tender rootstock. Stems procumbent or ascending, up to 30 cm, 4-angled, ± retrorsely aculeolate to somewhat hispidulous or smooth. Leaves in whorls of up to 5 or 6, sessile or narrowed to very short petiole; blade drying greenish brown and stiffly papery to subleathery, oblanceolate or narrowly elliptic-oblanceolate, 3.5–12(–15) × 1.5–3.5 mm, glabrous to ± hispidulous, sparsely to densely retrorsely aculeolate along margins and sometimes also on abaxial side of midrib, margins thinly revolute, apex acute and cuspidate; vein 1. Inflorescences with terminal and axillary cymes, 1–3-flowered with lanceolate bracts; peduncles up to 10 mm, glabrous and smooth; pedicels 2–7 mm, straight and elongating in fruit. Ovary obovoid, 0.5–0.8 mm, densely covered by undeveloped uncinately trichomes. Corolla pinkish or ± purplish, rotate, 1.1–1.5 mm in diam., glabrous; lobes 4, triangular, obtuse. Fruit with obovoid mericarps, ca. 2.5 mm, densely covered with spreading yellowish brown uncinately trichomes 0.4–0.8 mm. Fl. and fr. Jul–Sep.

• Thickets or meadows, often in shady places; higher elevations up to 3300 m. Hebei, Sichuan, Xinjiang.

The description of *Galium sungpanense* in FRPS (71(2): 233. 1999) includes some details that do not agree with the material seen and may have been based in part on specimens of other taxa. This has been corrected in the above description.

*Galium sungpanense* belongs to the throughout-perennial *G. sect. Trachygalium* s.l. and the *G. asperifolium* group (see there). It appears to link its montane (1) and alpine (2) subgroups and shares the few-flowered cymes with the latter. From *G. baldensiforme* and *G. glabriusculum*, both also with uncinately fruit hairs, it is separated by marginally stronger retrorsely aculeolate and partly longer leaves.

Remarkable are the close affinities between *Galium sungpanense* and members of the annual *G. sect. Euaparine*. The single decisive difference is the tender perennial (and possibly short-lived?) rootstock of *G. sungpanense*. Only its pinkish to purplish flowers and the never-curved fruiting pedicels allow the separation of plants collected without

subterranean organs from the common *G. spurium*. This suggests that *G. sect. Euaparine* could have originated from *G. sect. Trachygalium*-like ancestors.

**52. *Galium taiwanense*** Masamune, Trans. Nat. Hist. Soc. Formosa 29: 180. 1939.

台湾猪殃殃 tai wan zhu yang yang

Herbs, perennial, procumbent. Stems 4-angled, sparsely scaberulous. Leaves on main stems in whorls of up to 6, sessile; blade drying papery, oblanceolate or narrowly obovate-oblong, (4–)10–20(–31) × (1–)2–4 mm, glabrous and smooth adaxially, glabrous or hairy and retrorsely aculeolate along midrib abaxially and along margins, base acute to cuneate, apex acute or acuminate; vein 1. Inflorescences with terminal and axillary, few- to several-flowered, usually regularly trichotomous cymes; bracts linear, ca. 2 mm; pedicels slender, 3–5 mm. Ovary ovoid, ca. 0.7 mm, glabrous. Corolla white, rotate, 2–2.5 mm in diam., lobed for 2/3 or more; lobes 4, ovate, obtuse. Mericarps ellipsoid, ca. 2 mm, glabrous. Fl. May–Jul, fr. Jul.

- Mountain slopes; 200–2100 m. N Taiwan.

We have seen no material from this taxon. Judging from the information and the holotype photograph presented by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 109, pl. 4, 3+4. 1998), this appears to be close to and possibly even identical with *Galium dahuricum* var. *dahuricum*.

**53. *Galium takasagomontanum*** Masamune, Trans. Nat. Hist. Soc. Formosa 26: 52. 1936.

山地拉拉藤 shan di la la teng

Herbs, perennial (not annual), erect, ca. 30 cm tall. Stems 4-angled, slender, much branched, glabrous. Leaves in whorls of 4 or 5, sessile; blade narrowly ovate or ovate, abaxially pilose along veins, apex acuminate; principal vein 1 or with 2 short and weakly developed lateral veins. Inflorescences terminal, with few-flowered trichotomous cymes; peduncles glabrous; pedicels 1–2 mm, glabrous. Ovary ovoid-subglobose, ca. 1 mm, with undeveloped trichomes. Corolla white, rotate, ca. 3 mm in diam.; lobes 4, acute. Mericarps subglobose, with dense uncinat trichomes. Fl. and fr. Jul.

- Conifer mountain forests; ca. 2800 m. Taiwan.

*Galium takasagomontanum* was not treated or mentioned by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998; Fl. Taiwan, ed. 2, 4: 254–259. 1998), and we have not seen authentic material. According to the protologue it may belong to the condensed Taiwan mountain group of *G. morii* (see there), where it appears similar with its weakly 3-nerved leaves to *G. nankotaizanum* but differs by glabrous stems, somewhat larger flowers, and uncinat trichomes on mericarps. Nevertheless, its quite tall growth, the partly 5-whorled leaves, the exclusively terminal inflorescences, and the flower size are more indicative of its being a synonym of the Taiwanese *G. echinocarpum* from *G. sect. Hylaea*. A definite placement will only be possible after inspection of the type material.

**54. *Galium tarokoense*** Hayata, Icon. Pl. Formosan. 7: 33. 1918.

太鲁阁猪殃殃 tai lu ge zhu yang yang

Herbs, perennial, procumbent to erect, condensed, 5–8 cm

tall. Stems 4-angled, glabrous, smooth. Leaves in whorls of 4, sessile or subsessile; blade drying papery, rhombic-elliptic, elliptic, or obovate, 3–6 × 2–3.5 mm, glabrous, base acute to cuneate, margins flat or thinly revolute, apex acute to somewhat obtuse; vein 1. Inflorescences with terminal and axillary cymes, 1- or few flowered, 0.3–1.5 cm; peduncles glabrous, smooth, ebracteate; pedicels 0–2 mm. Ovary obovoid, ca. 0.4 mm, densely strigillose at sides. Corolla pale yellow, rotate, ca. 2 mm in diam.; lobes 4, triangular-oblong, acute. Mericarps ellipsoid, 1–1.5(–2) mm, with dense, appressed uncinat trichomes ca. 0.3 mm. Fl. and fr. summer–winter.

- Shady sites on limestone substrates; 1400–2700 m. Taiwan.

*Galium tarokoense* belongs to a group of high mountain taxa from Taiwan, including *G. morii* (see there). Its main differential characters are the lack of indumentum on most parts, the only 1-nerved leaves, and the short appressed fruit hairs.

**55. *Galium tenuissimum*** M. Bieberstein, Fl. Taur.-Caucas. 1: 104. 1808.

纤细拉拉藤 xian xi la la teng

Herbs, annual, erect. Stems (10–)30–50(–60) cm tall, with strong, intricate and divaricate branching from base, 4-angled, usually retrorsely aculeolate, more rarely glabrescent to smooth. Leaves at middle stem region in whorls of 6–8, subsessile or sessile; blade drying papery, linear to oblanceolate, (4–)8–15(–20) × 0.5–1(–2) mm, mostly glabrous and sparsely to densely antrorsely aculeolate near margins and on veins abaxially, base straight to acute, apex acute to acuminate-aristate; vein 1. Inflorescences broadly paniculate, very lax and loosely divaricate, cymes axillary and terminal, with 3–11(–14) flowers; axes glabrous or sparsely hispidulous; bracts none or small, leaflike; pedicels 3–15 mm, strongly elongating in fruit up to 20 mm. Ovary obovoid to ellipsoid, ca. 0.8 mm, glabrous. Corolla whitish, pale yellow, or greenish, rotate to slightly cup-shaped, 1.5–2 mm in diam., glabrous; lobes 4, oblong-elliptic, acute to aristate. Mericarps ellipsoid to obovoid, ca. 1 × 1.25 mm, glabrous, smooth or ± tuberculate. Fl. and fr. May–Jul.

Open mountain slopes; 300–2800 m. Xinjiang (Xinyuan) [Kashmir, Kyrgyzstan, Pakistan, Russia, Turkmenistan; SW Asia (Armenia, Georgia, Iran, Iraq, Lebanon, Syria, Turkey), Europe (Balkan Peninsula, Hungary)].

*Galium tenuissimum* is a member of the annual *G. sect. Microgalium*, differentiated by antrorsely aculeolate leaf margins. It is widespread through SE Europe, SW and C Asia, and reaches its eastern limit in NW China.

**56. *Galium tokyoense*** Makino, Bot. Mag. (Tokyo) 17: 72. 1903.

钝叶拉拉藤 dun ye la la teng

*Galium asprellum* Michaux var. *tokyoense* (Makino) Nakai; *G. dahuricum* Turczaninow ex Ledebour var. *tokyoense* (Makino) Cufodontis.

Herbs, perennial, erect or ascending but not clambering. Stems 30–70 cm tall, 4-angled, retrorsely aculeolate. Middle stem leaves in whorls of 5 or 6, subsessile; blade drying papery, subspatulate to obovate, (11–)17–35(–40) × (2.5–)3–7(–10)

mm, mostly retrorsely aculeolate adaxially, along midrib abaxially and always along margins, base acute, apex rounded to emarginate, abruptly cuspidate; vein 1. Inflorescences congested, cymes terminal and in axils of uppermost leaves, several to many flowered, up to 4 cm; axes rough or glabrous and smooth; bracts few and small, only on lower inflorescence branches; pedicels 1–2 mm. Ovary obovoid, ca. 0.8 mm, glabrous. Corolla white, rotate, 1.3–3.5 mm in diam., glabrous; lobes acute to obtuse. Mericarps obovoid, ca. 2 mm, glabrous, smooth or tuberculate. Fl. and fr. Jun–Jul.

Forests, grasslands, meadows, riversides, open fields; 200–900 m. Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shandong [Japan, Korea].

Cufodontis (Oesterr. Bot. Z. 89: 243–244. 1940) and W. C. Chen (in FRPS 71(2): 256. 1999) treated *Galium tokyoense* as a variety of *G. dahuricum* (see discussion under that species), but in the recent *Flora of Japan* (Yamazaki, Fl. Japan 3a: 239. 1993) it is again regarded as a separate species. In view of its erect (not clambering) growth, the abruptly acuminate leaf shape, the short and post-florally not elongated pedicels, and the always glabrous fruit this rank appears quite justified.

**57. *Galium tricornerutum*** Dandy, *Watsonia* 4: 47. 1957.

麦仁珠 mai ren zhu

Herbs, annual, weakly ascending to procumbent or clambering. Stems 5–80 cm tall, 4-angled, often little branched, glabrescent, densely retrorsely aculeolate on angles. Leaves in whorls of 6–8, subsessile; blade drying papery, narrowly oblanceolate to narrowly elliptic, 10–32 × 2–6 mm, glabrescent, upper side glabrous, lower side densely aculeolate along midrib, base acute, margins densely retrorsely and antrorsely aculeolate, apex acute; vein 1. Inflorescences elongated thyrsoid, cymes terminal and axillary on short lateral stems, mostly 3–5-flowered; axes retrorsely aculeolate; bracts none or leaflike and 3–5 mm; pedicels 0.3–2 mm. Ovary ellipsoid to didymous, 0.3–0.5 mm, smooth to verrucose or spinulose. Corolla white, rotate, 1–1.5 mm in diam., lobed for 2/3 or more; lobes triangular. Mericarps subglobose, ca. 3 × 4–6 mm, becoming verrucose to tuberculate but never with uncinat trichomes, pendulous on arching pedicels to 7 mm. Fl. Apr–Jun, fr. May–Mar.

Adventive weeds in meadows on mountain slopes, open fields, river beaches, ditch sides; 400–4000 m. Anhui, Gansu, Guizhou, Henan, Hubei, Jiangsu, Jiangxi, Shaanxi, Shanghai, Shanxi, Sichuan, Xinjiang, Xizang [India, Pakistan; N Africa, SW Asia, Europe, North America].

In general aspect and habit the weedy annual *Galium tricornerutum* from *G. sect. Kolgyda* strongly resembles *G. spurium* and *G. aparine* but can be separated by its above glabrous leaves and its verrucose fruit on arching pedicels. *Galium tricornerutum* apparently is rare in China. The above wide distribution data from FRPS evidently is due to misidentifications of the common *G. spurium*.

*Galium tricornerutum* has long been treated under the illegitimate superfluous name *G. tricorne* Stokes, published in 1787. Stokes's intent was to transfer *Valantia aparine* Linnaeus (= *G. verrucosum* Hudson, 1767) to *Galium*, where the epithet "*aparine*" was blocked by *G. aparine* Linnaeus. The specimens on which Stokes based his name belonged partly to *G. verrucosum* and partly to *G. tricornerutum*, two close but very well-separated species. However, when Stokes published his article, the previously and validly published name in *Galium* by Hudson

(1767) already existed and made his name superfluous. That remained unnoticed and *G. tricorne* was generally used for our species. Only in 1975 did Dandy clarify this situation, designating *G. tricornerutum* as the new name for the long known but misnamed *G. tricorne*.

**58. *Galium trifloriforme*** Komarov, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 18: 428. 1901.

拟三花拉拉藤 ni san hua la la teng

Herbs, perennial, from elongated rhizomes. Stems procumbent to erect, (10–)25–40(–65) cm tall, 4-angled, mostly slightly retrorsely aculeolate, hirtellous at nodes. Leaves on main stems in whorls of up to 6(–8), subsessile; blade drying papery, blackish or green, narrowly obovate to oblanceolate, (12–)18–28(–50) × (3–)5–10(–15) mm, with sparse antrorse microhairs adaxially, moderately retrorsely aculeolate abaxially on vein and at leaf margins, base acute to cuneate, margins flat to thinly revolute, apex acute, obtuse, or rounded and abruptly mucronate; vein 1. Inflorescences with axillary and terminal cymes on upper 2 or 3 nodes, mostly 2–8-flowered; axes glabrous, smooth; bracts none or few, narrowly elliptic to narrowly lanceolate, 2–5 mm; pedicels ca. 1.5 mm. Ovary obovoid, ca. 0.5 mm, densely hispidulous with undeveloped trichomes. Corolla white or pale green, rotate, 1.5–2 mm in diam., glabrous; lobes 4, triangular, acute. Mericarps ellipsoid, 1.5–2.5 mm, with dense uncinat trichomes ca. 1 mm, fruiting pedicels divaricate and elongating to 10 mm. Fl. and fr. Jul–Sep.

Mountain forests, open fields; 2200–3400 m. Heilongjiang, Jilin, Nei Mongol, Qinghai [Japan, Korea, NE Russia].

*Galium trifloriforme* is a variable and problematic taxon from NE Asia. It was either accepted as a separate species (e.g., by Pobedimova et al., Fl. URSS 23: 303. 1958; Yamazaki, Fl. Japan 3a: 239. 1993) or was treated as a synonym of *G. triflorum* (see Cufodontis, Oesterr. Bot. Z. 89: 236–237. 1940) or of *G. hoffmeisteri* (e.g., W. C. Chen in FRPS 71(2): 230. 1999, as *G. asperuloides* subsp. *hoffmeisteri*; Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010). It differs from the very close typical *G. triflorum* by its more condensed inflorescence with cymes terminal and on the upper 1 or 2(or 3) nodes, its always retrorsely aculeolate leaf margins, and its mostly rough stems.

These differential characters make *Galium trifloriforme* a link between members of *G. sect. Hylaea*, with smooth stems and antrorsely directed microhairs on leaf margins, and of the *G. asperifolium* group of *G. sect. Trachygalium*, mostly with retrorsely aculeolate stems and retrorse microhairs on leaf margins (but often also with antrorse microhairs on the adaxial leaf surface). From the available material, it appears that *G. trifloriforme* applies to the central part of this practically continuous morphological series. This series begins with *G. odoratum*, *G. hoffmeisteri*, *G. echinocarpum*, *G. nipponicum*, and typical *G. triflorum* on the side of *G. sect. Hylaea*, continues via *G. triflorum* var. *asprelliforme* Fernald and *G. trifloriforme*, and ends on the other side with *G. asprellum*, *G. dahuricum*, *G. blinii*, and other typical members of the *G. asperifolium* group of *G. sect. Trachygalium*. It is remarkable that this transitional series apparently corresponds to a polyploid complex with marginal taxa including 2x-, *G. triflorum* 4x- and 6x-, and *G. trifloriforme* ± 10x-cytotypes. Thus, phylogenetic reticulation may have caused the still insufficiently resolved taxonomic confusion around *G. triflorum*, *G. trifloriforme*, and their relatives (cf. Pobedimova et al., loc. cit.: 287–381; Cufodontis, loc. cit.; Yamazaki, loc. cit.; Ehrendorfer et al., Fl. Iranica 176: 182. 2005).

Among the relatively few relevant PE, KUN, and WU specimens we have seen from China and the Himalaya only two typical *Galium triflorum* specimens with antorsely aculeolate leaf margins were found (see there); otherwise, only plants corresponding to the above description of *G. trifloriforme* with leaf margins retrorsely aculeolate were seen. This finding is in conflict with W. C. Chen (loc. cit.) who accepted only *G. triflorum* for the Chinese flora, but certainly needs verification from more extensive studies including Korea (from where *G. trifloriforme* was described) as well as adjacent NE Siberia and Japan, where both taxa apparently occur.

**59. *Galium triflorum*** Michaux, Fl. Bor.-Amer. 1: 80. 1803.

三花拉拉藤 san hua la la teng

Herbs, perennial, from slender rhizomes. Stems procumbent, ascending or erect, (15–)25–80(–125) cm tall, 4-angled, usually glabrous and smooth (rarely somewhat retrorsely aculeolate), hirtellous at nodes. Leaves in whorls of up to 6(–8), subsessile; blade drying papery, sometimes blackening, narrowly obovate to broadly (ob)lanceolate, (15–)20–35(–45) × (3–)6–12(–16) mm, ± glabrous but with appressed and antrorse microhairs adaxially and antrorse aculei along margins, base acute to cuneate, margin flat to thinly revolute, apex acute or rounded and abruptly mucronate; vein 1. Inflorescences terminal and axillary, with few- to several-flowered cymes at upper 2–4 stem nodes; axes glabrous and smooth; bracts few, narrowly elliptic to narrowly lanceolate, 2–5 mm; pedicels ca. 1.5 mm. Ovary obovoid, ca. 0.5 mm, densely hispidulous with undeveloped trichomes. Corolla white or greenish, rotate, 1.5–2 mm in diam., lobed for 3/4 or more, glabrous; lobes 4, triangular, acute. Mericarps ellipsoid, 1.5–2.5 mm, with dense uncinat trichomes ca. 1 mm, on pedicels elongating up to 10 mm. Fl. and fr. Jul–Sep.

Mountain forests; 1500–2000 m. Guizhou, Sichuan [Japan, Korea, Russia; Europe, North America].

*Galium triflorum* is obviously rare in China and does not occur in the Himalaya, as already suspected by Pobedimova et al. (Fl. URSS 23: 300–303. 1958). We have seen only two non-flowering specimens from SW China (Guizhou: Northern Qian [Guizhou] Team 907, PE; Sichuan: G. H. Yang 54472, PE), which apparently belong here. Indications for more northern provinces by W. C. Chen (FRPS 71(2): 232. 1999) have been listed here under *G. trifloriforme* (see there), a taxon not recognized as distinct by W. C. Chen (loc. cit.: 230). Both taxa urgently need more detailed study. *Galium triflorum* is very similar and morphologically subcontinuous with *G. trifloriforme* but differs from it by its more elongate inflorescences, mostly smooth stems, and particularly by its antorsely aculeolate leaf margins. This latter character clearly places it into *G. sect. Hylaea* and into the close neighborhood of *G. hoffmeisteri* on the mainland, *G. echinocarpum* on Taiwan, and *G. nipponicum* in Japan.

**60. *Galium turkestanicum*** Pobedimova in Schischkin, Fl. URSS 23: 717. 1958.

中亚拉拉藤 zhong ya la la teng

Herbs, perennial, erect, to 0.55 m tall. Rhizomes slender, reddish. Stems 4-angled, glabrous and smooth except puberulent to hispidulous at nodes. Leaves in whorls of 4, sessile; blade drying papery, linear or linear-lanceolate, 27–40 × 3–9 mm, glabrous or antorsely scabrous along midrib and margins, base obtuse to rounded, apex narrowed then shortly obtuse; principal vein 1, with 2 weaker lateral veins reticulating near middle of blade. Inflorescences terminal, paniculate, many

flowered, 2–15 cm; peduncles glabrous or scabrous; bracts few, oblanceolate, 1–2 mm; pedicels 1–4 mm. Ovary ellipsoid and laterally flattened, ca. 1 mm. Corolla whitish, rotate, 4–5 mm in diam.; lobes 4(or 5), elliptic to lanceolate, acute or mucronulate. Mericarps ellipsoid, at least 2 mm, glabrous or with ± sparse hooked trichomes ca. 0.3 mm. Fl. Jul–Aug, fr. Aug–Sep.

Meadows and dry slopes in the (sub)alpine zone. Expected in Xinjiang [Kazakhstan, Russia].

*Galium turkestanicum* is included as a dubious species for W China by W. C. Chen (FRPS 71(2): 285. 1999). It belongs to the extremely polymorphic *G. boreale* group of *G. sect. Platygali* s.l. and represents a particularly vigorous taxon with very narrow leaves and lateral leaf veins only weakly developed (Ehrendorfer et al., Fl. Iranica 176: 180. 2005). Pobedimova (loc. cit.) gives its distribution as including the Tien Shan. Therefore, it probably also occurs in NW China, Xinjiang.

**61. *Galium uliginosum*** Linnaeus, Sp. Pl. 1: 106. 1753.

沼猪殃殃 zhao zhu yang yang

Herbs, perennial, tender, from slender rhizomes. Stems 10–60 cm tall, somewhat retrorsely aculeolate along 4 angles. Leaves of middle stem region in whorls of 6–8, sessile; blade drying papery and glossy, narrowly oblanceolate or narrowly elliptic-lanceolate, 3–16 × 1–3 mm, glabrous, ± retrorsely aculeolate on veins and margins, base acute, apex acute; vein 1. Inflorescences terminal and in upper leaf axils, with 2- to several-flowered cymes of 2–5 cm; axes glabrous, smooth; bracts none or inconspicuous, 2–4 mm; pedicels 1–5 mm. Ovary ellipsoid, ca. 0.5 mm, glabrous. Corolla white, subcampanulate, 2–3 mm in diam., lobed for ca. 2/3; lobes 4, triangular, acute. Mericarps obovoid, ca. 1 × 1.5–2 mm, glabrous, smooth or granular. Fl. and fr. Jun–Aug.

Wet grasslands; ca. 2600 m. ?Sichuan, Xinjiang, ?Yunnan [Mongolia, Russia; C and SW Asia, Europe].

*Galium uliginosum* is a typical member of *G. sect. Trachygalium* and closely related to the *G. rivale* group, represented in China by *G. karataviense*. It differs from it by a much more slender habit and much shorter corolla tubes. All other Chinese species of *G. sect. Trachygalium* s.l. have rotate corollas.

We have seen specimens of *Galium uliginosum* from Xinjiang only. In view of the more northerly distribution of the species, the indications for Sichuan and Yunnan (in FRPS 71(2): 258. 1999) may refer to another taxon and should be verified.

**62. *Galium verum*** Linnaeus, Sp. Pl. 1: 107. 1753.

蓬子菜 peng zi cai

Herbs, perennial, with rootstock and rhizomes. Stems erect, (5–)15–70(–120) cm tall, 4-angled, densely puberulent, villosulous, or hirtellous to rarely glabrous and smooth. Leaves in middle stem region in whorls of more than 6 and up to 12, sessile; blade drying papery to subleathery, often blackening, adaxially rather shiny, abaxially paler, linear to linear-oblong, 10–30(–50) × 1–2(–2.5) mm, adaxially glabrous to densely hairy, smooth to sparsely aculeolate, abaxially usually densely puberulent to tomentose, rarely glabrescent or glabrous, base acute to cuneate, margins usually strongly revolute and antorsely aculeolate, apex acute and shortly mucronate with tip to 1.5 mm; vein 1. Inflorescences thyrsoid or paniculate, terminal and axillary cymes few to many flowered, rather dense and

bracteose; axes usually densely puberulent, hirtellous, rarely glabrous and smooth; bracts ± leaflike, 1.5–3 mm; pedicels 1–3 mm. Flowers fragrant, hermaphroditic. Ovary ellipsoid to subglobose, 0.5–0.8 mm, glabrous to densely hairy with straight trichomes. Corolla yellow to white, rotate, ca. 3 mm in diam., glabrous, lobed for 3/4 or more; lobes 4, lanceolate-oblong, subobtuse, acute to apiculate. Mericarps ellipsoid and laterally flattened, 1.5–2 mm, glabrous to densely hispidulous with straight trichomes. Fl. Apr–Aug, fr. May–Oct.

Mountains, grasslands, meadows, river beaches, open fields, ditch sides, streamsides, wet places, forests, thickets, valleys; near sea level to 4100 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Zhejiang [India, Japan, Kashmir, Kazakhstan, Korea, Mongolia, Pakistan, Russia, Turkmenistan, Uzbekistan; SW Asia, Europe; adventive in North America and elsewhere].

*Galium verum* is used medicinally and ranks among the most commonly collected species of *Galium* in China, along with *G. bungei*, *G. spurium*, and *G. hoffmeisteri*. Together with closely related taxa (as *G. saurense* and *G. consanguineum* in the Chinese flora), it forms an extremely variable polyploid complex with 2x- and 4x-populations, which is still very badly understood. Together with *G. humifusum*, with which it can form a hybrid, it is placed into *G.* sect. *Galium*.

According to the considerable variation of *Galium verum* with respect to habit, indumentum of leaves, ovaries, and fruit, and flower color, Cufodontis (Oesterr. Bot. Z. 89: 216–219. 1940) and subsequently W. C. Chen (in FRPS 71(2): 266–269. 1999) have rather schematically recognized a number of varieties, which often coexist in one and the same population. Even if they do not correspond to natural entities, they are provisionally treated here for reference, in particular as to the range and adaptation to different habitats in China.

- 1a. Ovary and fruit hairy.
  - 2a. Leaves pubescent and scabrous adaxially ..... 62e. var. *tomentosum*
  - 2b. Leaves glabrous and smooth adaxially ..... 62f. var. *trachycarpum*
- 1b. Ovary and fruit glabrous.
  - 3a. Corolla yellow.
    - 4a. Leaves pubescent and scabrous adaxially ..... 62g. var. *trachyphyllum*
    - 4b. Leaves glabrous and smooth adaxially.
      - 5a. Plants to over 1 m tall; leaves to 5–7 cm ..... 62a. var. *asiaticum*
      - 5b. Plants to 45 cm tall; leaves usually 1.5–3 cm .... 62h. var. *verum*
  - 3b. Corolla pale yellow or white.
    - 6a. Corolla pale yellow ..... 62c. var. *leiophyllum*
    - 6b. Corolla white.
      - 7a. Leaves pubescent and scabrous adaxially ..... 62b. var. *lacteum*
      - 7b. Leaves glabrous and smooth adaxially ..... 62d. var. *nikkoense*

**62a. *Galium verum* var. *asiaticum*** Nakai, J. Jap. Bot. 15: 344. 1939.

长叶蓬子菜 chang ye peng zi cai

*Galium verum* subsp. *asiaticum* (Nakai) T. Yamazaki.

Plants stout, 50–120 cm tall. Leaf blade to 5–7 cm, gla-

brous and smooth adaxially. Corolla yellow. Ovary and mericarps glabrous. Fl. and fr. Jun–Aug.

Mountain grasslands, open fields, river beaches; below 100–1700 m. Anhui, Gansu, Hebei, Heilongjiang, ?Henan, Hubei, Jiangsu, Jilin, Liaoning, Nei Mongol, Shandong, Shanxi, Sichuan, Zhejiang [Japan, Korea, Russia].

According to Yamazaki (Fl. Japan 3a: 240. 1993) *Galium verum* subsp. *asiaticum* includes all Japanese forms of *G. verum* and differs from the typical subspecies by longer leaves and hirsute (not minutely pubescent) stems.

**62b. *Galium verum* var. *lacteum*** Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 283. 1874.

白花蓬子菜 bai hua peng zi cai

*Galium verum* f. *lacteum* (Maximowicz) Nakai.

Leaf blade pubescent and scabrous adaxially. Corolla white. Ovary and mericarps glabrous.

Wet places on mountains and in open fields; 500–1000 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Ningxia, Shaanxi [Japan, Korea].

Yamazaki (loc. cit.: 240) treated this as a form within *Galium verum* subsp. *asiaticum* and listed *G. verum* f. *nikkoense* as a synonym of *G. verum* f. *lacteum*.

**62c. *Galium verum* var. *leiophyllum*** Walldroth, Sched. Crit. 56. 1822.

淡黄蓬子菜 dan huang peng zi cai

Corolla pale yellow. Ovary and mericarps glabrous. Fl. Jun–Jul.

Mountain grasslands, open fields; ca. 600 m. Hebei, Liaoning, Shandong [?Japan; Europe].

Although W. C. Chen (loc. cit.: 268) included Japan in the distribution of this variety, its name is not mentioned in Fl. Japan.

**62d. *Galium verum* var. *nikkoense*** Nakai, J. Jap. Bot. 15: 347. 1939.

日光蓬子菜 ri guang peng zi cai

*Galium verum* f. *nikkoense* (Nakai) Ohwi.

Leaf blade glabrous and smooth adaxially. Corolla white. Ovary and mericarps glabrous.

Shandong [Japan].

Yamazaki (loc. cit.: 240) treated this variety as a synonym of *Galium verum* f. *lacteum*.

**62e. *Galium verum* var. *tomentosum*** C. A. Meyer, Verz. Pfl. Casp. Meer. 54. 1831.

毛蓬子菜 mao peng zi cai

*Galium verum* f. *tomentosum* (C. A. Meyer) Nakai.

Leaf blade pubescent and scabrous adaxially. Ovary and mericarps pilose. Fl. and fr. Jun–Sep.

Forests on mountain slopes, farmland sides, grasslands; 400–3100 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shanxi, Sichuan, Xinjiang [Japan].

The type of the name of this variety comes from SW Asia (S Azerbaijan: Talysh) and may not fully conform to the Chinese popula-

tions listed here. Although Nakai (Bot. Mag. (Tokyo) 34: 50–51. 1920; J. Jap. Bot. 15: 348. 1939) and W. C. Chen (loc. cit.: 269) included Japan in the distribution of this taxon, its name is not mentioned in Fl. Japan. In the older literature, specimens with hairy ovaries and fruit, corresponding to this and the following *Galium verum* var. *trachycarpum*, often have been called *G. ruthenicum* Willdenow.

With respect to the synonymy one has to consider the following: Nakai (loc. cit. 1939) under *Galium verum* var. *tomentosum* “Nakai, comb. nov.,” cited “*Galium verum* var. *luteum* f. *tomentosum* Nakai,” where (loc. cit. 1920) he cited “*G. verum* var. c. Ledebour Fl. Ross. II. p. 415,” where Ledebour wrote “c. caule fructibusque tomento denso vestitis. C. A. Meyer l.c. Hab. in provinciis caucasicis [in m. Talüsch, alt. 1100 hexap. (C. A. Meyer),” giving the reference to Meyer on p. 414 as “Ind. cauc. p. 54,” i.e., Verz. Pfl. Casp. Meer. 54. 1831, where Meyer wrote “[var.] *δ tomentosum*. caule et mericarpis tomento denso vestitis. In cacumine montium Talüsch prope pagum Drych, in rupestribus siccis sterilissimis (alt. 1100 hexap.)” It is evident, therefore, that Nakai in 1920 was not publishing the name of a new taxon but a status novus at the rank of forma with an indirect reference (allowed before 1953; *Vienna Code*, Art. 33.2) to the basionym, i.e., Meyer’s varietal name.

**62f. *Galium verum* var. *trachycarpum*** Candolle, Prodr. 4: 603. 1830.

毛果蓬子菜 mao guo peng zi cai

*Galium verum* var. *lasiocarpum* Ledebour.

Leaf blade glabrous and smooth adaxially. Ovary and mericarps pilose. Fl. and fr. Jun–Sep.

Forests, thickets, or grasslands on mountain slopes, streamsides, open fields, river beaches; 100–3900 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Qinghai, Shanxi, Sichuan, Xinjiang, Xizang, Zhejiang [Japan, Korea, Russia; Europe].

This variety (including its synonym) was included by Ehrendorfer et al. (Fl. Iranica 176: 200. 2005) in *Galium verum* f. *subpubescens* Sergievskaya, to which it corresponds. Yamazaki (loc. cit.: 240) recognized *G. verum* f. *album* Nakai for white-flowered plants of this variety.

**62g. *Galium verum* var. *trachyphyllum*** Wallroth, Sched. Crit. 56. 1822.

粗糙蓬子菜 cu cao peng zi cai

Leaf blade pubescent and scabrous adaxially. Corolla yellow. Ovary and mericarps glabrous. Fl. May–Aug, fr. Aug–Sep.

Forests or grasslands on mountain slopes or in valleys, open fields, river beaches; 300–4100 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Jiangsu, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang [Korea; Europe].

**62h. *Galium verum* var. *verum***

蓬子菜(原变种) peng zi cai (yuan bian zhong)

*Galium luteum* Lamarck; *G. verum* var. *leiocarpum* Ledebour; *G. verum* var. *luteum* (Lamarck) Nakai.

Plants to 45 cm tall. Leaf blade usually 1.5–3 cm, glabrous and smooth adaxially. Corolla yellow. Ovary and mericarps gla-

brous. Fl. Apr–Aug, fr. May–Oct.

Mountains, river beaches, open fields, ditch sides, grasslands, meadows, thickets, forests; near sea level to 4000 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shandong, Shanxi, Sichuan, Xinjiang, Xizang [India, Japan, Korea, Pakistan; SW Asia, Europe; adventive in North America and elsewhere].

The citation here of *Galium luteum*, a long-recognized synonym of *G. verum* based on a type from France, follows W. C. Chen (loc. cit.: 266). Ehrendorfer et al. (loc. cit.: 200–201) recognized two forms within *G. verum* subsp. *verum*, separated by density and distribution of pubescence: f. *verum* with glabrous ovaries and fruit vs. f. *subpubescens* with pubescent ovaries and fruit. Thus, their f. *subpubescens* corresponds to var. *tomentosum* and var. *trachycarpum* of Cufodontis (loc. cit.: 216–219) and W. C. Chen (loc. cit.: 268–269).

**63. *Galium yunnanense*** H. Hara & C. Y. Wu, J. Jap. Bot. 61: 74. 1986.

滇拉拉藤 dian la la teng

*Galium elegans* Wallich var. *angustifolium* Cufodontis; *G. elegans* var. *nemorosum* Cufodontis.

Herbs, perennial, procumbent to scrambling or matted, up to 1 m, from slender rhizomes. Stems glabrescent and smooth to sparsely or moderately pilose to villous or retrorsely hispid, nodes more densely hairy, angles 4, usually thickened. Leaves in whorls of 4, subsessile; blade drying membranous, green, elliptic, ovate-lanceolate, or lanceolate, 5–50 × 3–15 mm, length/breadth index normally above 2.5, adaxially hispidulous to hirsute, abaxially glabrescent to densely pilose and usually glandular-punctate, base cuneate to obtuse, margins sparsely to densely pilose or antrorsely ciliate, apex acute to acuminate and often mucronulate; principal veins 3, palmate. Inflorescences terminal and in axils of uppermost leaves, paniculate, many flowered, 2–12 cm, diffusely branched; peduncles pilose to glabrescent; bracts inconspicuous, ligulate to ovate, 1.5–2.5 mm, often lacking upward; pedicels 2.5–7 mm. Flowers dioecious, polygamous, or ?hermaphroditic. Ovary obovoid, ca. 0.5 mm, densely appressed hairy. Corolla white, rotate, 1–1.5 mm in diam.; lobes 4, ovate, subacute. Mericarps ovoid, 1.5–2 mm, with dense, uncinat, stiff and spreading, basally white to apically brown trichomes ca. 0.8 mm. Fl. and fr. Jul–Nov.

• Forests, meadows on mountains, riversides, streamsides; 700–3300 m. Gansu, Guangxi, Guizhou, Hunan, Sichuan, Yunnan.

As noted in the protologue, *Galium yunnanense* is similar to *G. elegans* and comprises plants that previously have been included in a more broadly circumscribed *G. elegans*. In particular, the two varieties of *G. elegans* described by Cufodontis in 1940 and cited as synonyms above now key to *G. yunnanense*. In spite of its variability and occasional forms approaching *G. bungei* (see there), the specific separation of *G. yunnanense* from *G. elegans* by Chen (Acta Phytotax. Sin. 28: 301. 1990) seems well justified. It reduces the morphological variation within *G. elegans* and results in a much clearer circumscription of the two taxa.

