

THE GENUS *GALIUM* L. (RUBIACEAE) IN TAIWAN

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ABSTRACT—This is a taxonomic study of the genus *Galium* L. (Rubiaceae) in Taiwan. Ten taxa, including 9 species and one forma are recognised. A key to the species followed by taxonomic descriptions and distribution maps are given.

KEY WORDS: *Galium*, Rubiaceae, taxonomy, Taiwan

INTRODUCTION

Galium L. is one of the largest genera of Rubiaceae with some 400 species (Willis, 1985; Mabberley, 1987). The herbaceous genus has consistently been placed in the subfamily Rubioideae, tribe Rubieae by all authors dealing with the tribal classification of the family (Schumann, 1891; Verdcourt, 1958; Bremekamp, 1966; Robbrecht, 1988).

The first report of genus *Galium* in Taiwan was by Matsumura and Hayata (1906). Since then numerous taxonomic papers have been published by Hayata, Masamune and Masamune *et al.* and Ohwi (1934) which formed the base for the last revision of the genus in Taiwan by Chao (1978). Some Taiwanese taxa were included in the work of Cufodontis (1940). Moore (1975) has made studies on one widespread species. Ten taxa are recognised by the authors, 7 of which are considered to be endemic to Taiwan, 2 taxa are widespread and are found in Europe, only 1 species is both on Isls. Ryukyus and Taiwan.

Geographical and altitudinal distribution maps for Taiwan are given for all taxa. There is a key to the species followed by descriptions and citation of the specimens studied. *G. maborasense* Masamune is reduced to a synonym of *G. nankotaizanum* Ohwi and further some specimens previously identified as *G. taiwanense* are identified as *G. trifidum* L.

MORPHOLOGICAL CHARACTERS

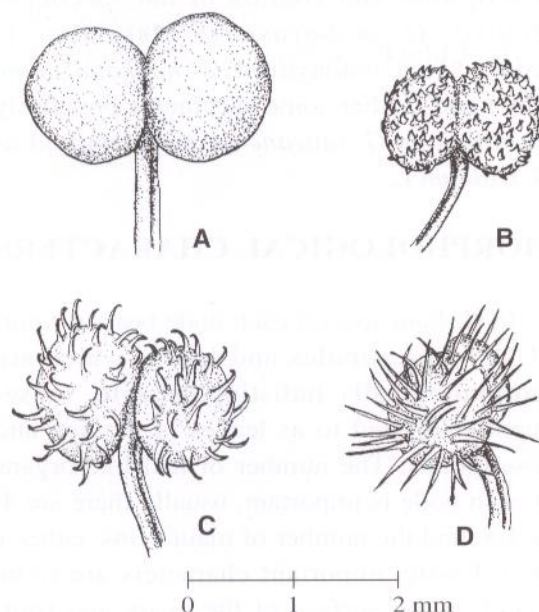
In *Galium* species each node bears a whorl of leaf-like stipules and leaves which are morphologically indistinguishable, subsequently referred to as leaves in the key and descriptions. The number of leaf-like organs at each node is important, usually there are 4, or 4-8, and the number of main veins, either 1 or 3. Lastly, important characters are to be found on the surface of the ovary and fruit, here 4 different types are recognised (text-fig 1), i.e. glabrous, papillate, hooked hairs and straight hairs.

TAXONOMIC TREATMENT

Galium L. 豬殃殃屬

Perennial or annual procumbent or erect herbs; branches 4-angled, glabrous, pubescent or barbed. Leaves and leaf-like stipules 4-8-verticillate, oblong, elliptic, ovate, oblanceolate to linear-lanceolate, glabrous, pubescent or bristles; main veins 1 or 3; sessile or shortly petiolate. Inflorescence cymes, terminal and axillary. Flowers minute, white, yellow or green; corolla rotate, 4-lobed, rarely 3 or 5, valvate in bud; stamens as many as corolla-lobed, alternated to the lobes, filaments short; style short, stigma bifid, ovary 2-celled. Fruits small, didymous, dry or nearly so, glabrous, papillate or hairy. Seeds adhering to the pericarp.

About 400 species, chiefly temperate, 10 species in Taiwan.



Text-figure 1

Fruit surfaces of Taiwanese *Galium*. A. glabrous (*G. trifidum*; Chen & Liao 161, HAST); B. papillate (*G. gracilens*; Chen & Sang 762, TNM); C. hooked hairs (*G. spurium* form. *echinospermum*; Yang 1792, TAI); D. straight hairs (*G. nankotaizanum*; Fukuyama & Suzuki 15064, TAI).

Key to species

1. Leaves regularly 4-verticillate.
 2. Main veins 3.
 3. Ovary and fruits with straight hairs; lateral nerves obscure 6. *G. nankotaizanum*
 3. Ovary and fruits with hooked hairs; lateral nerves distinct.
 4. Leaves glabrous, elliptic, 4-8 mm long, 2-4 mm wide 5. *G. morii*
 4. Leaves pubescent, ovate, 10-20 mm long, 5-9 mm wide 2. *G. formosense*
 2. Main vein 1.
 5. Leaves glabrous.
 6. Leaves elliptic, apex acute; corolla 4-lobed; fruit with hooked hairs 9. *G. tarokoense*
 6. Leaves oblanceolate, apex round to obtuse; corolla 3-lobed; fruit glabrous 10. *G. trifidum*
 5. Leaves pilose.
 7. Ovary and fruit with papillate 4. *G. gracilens*
 7. Ovary and fruits with depressed hooked hairs 3. *G. fukuyamai*
1. Leaves variably 4-8-verticillate.
 8. Branches glabrous 1. *G. echinocarpum*
 8. Branches barbed.
 9. Ovary and fruits glabrous 8. *G. taiwanense*
 9. Ovary and fruits with hooked hairs 7. *G. spurium* form. *vaillantii*

1. *Galium echinocarpum* Hayata, Journ. Coll. Sci. Univ. Tokyo **30**(1): 147.1911, Icon. Pl. Form. **2**: 102.1912; Masamune, Short Fl. Form. 201. 1936, List Vasc. Pl. Taiwan 118. 1954; Chao, Fl. Taiwan **4**: 260. 1978.

刺果豬殃殃; text-fig. 2; pl.2, figs. 3, 4

A procumbent herb; branches slender,

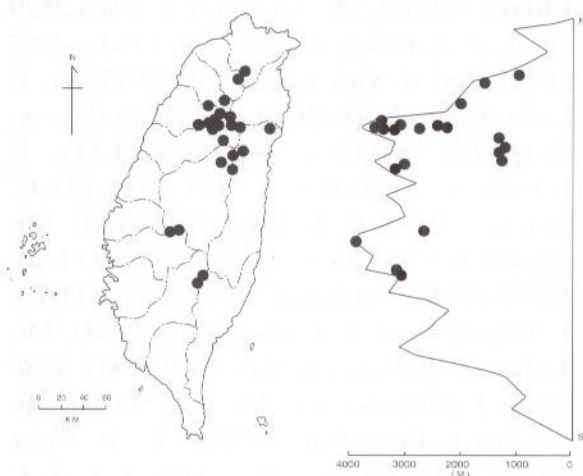
glabrous. Leaves sessile, 4-6-verticillate, oblanceolate to oblong, (6-)14-20(-27) mm long, 2-4 mm wide, margins remotely serrate-ciliate, scarcely hairy above, glabrous or scarcely hairy on the midrib beneath; apex mucronate, base attenuate; main vein 1, penninerved. Flowers 3 mm in diameter, pedicellate; corolla rotate, 4-lobed, lobes ovate; stamens 4; ovary covered with hooked hairs. Fruits with densely spreading long-hooked hairs.

Endemic to Taiwan. At altitudes 900 m to 3,500 m mountainous regions around middle to north of this Island.

Specimens examined:

Ilan: Tatung, Chilienting Ridge, *T. C. Huang* 7707 (TAI). **Taipei:** Wulai, Mt. Takuanshan, *K. Y. Wang et al.* 864 (TNM). **Taoyuan:** Fuhsin, Paling to Mt. Lalashan, *T. Y. A. Yang et al.* 2921 (TNM). **Hsinchu:** Chienshih, Ssumakussu, 1550 m, *S. T. Chiu* 2205 (TNM). **Maioli:** Taian, 230 forest track 12 Km, 2500 m, *C. M. Wang* 1125 (TNM), 2000-2300 m, *J. C. Wang et al.* 4974 (TAI), Mt. Tahsuehshan, 2380 m, *C. M. Wang* 1703 (TNM), Kuanwu to Kuaishan, 1800-2000 m, *J. C. Wang & Yang* 4786 (TAI), Mt. Tapachienshan, *S. Sasaki s. n.* Jul 1932 (TAI).

Taichung: Hoping, 710 forest track, *S. T. Chiu* 1888 (TNM), Mt. Hsuehshan, *S. P. Li* 192 (TNM), *S. Sasaki s. n.* Jul 1932 (TAI), *K. Mori s. n.* Oct 1936 (TAI), Mt. Shenmachengshan to Yunlin lodge, 2700-2900 m, *C. M. Wang* 956 (TNM), Wuling to Chika lodge, 1700-2400 m, *J. C. Wang et al.* 4384 (TAI), Chika lodge to 369 lodge, *T. Y. A. Yang et al.* 5620 (TNM), 5624 (TNM), 2400-3200 m, *J. C. Wang et al.* 4496 (TAI), *T. C. Huang & Hsieh* 7183 (TAI), Hsinta Campus to Shancha Shelter, 2700-3200 m, *J. C. Wang et al.* 4544 (TAI), Mt. Chihchiayangtashan, *S. Suzuki* 5263 (TAI), Mt. Nanhutashan, *C. M. Kuo* 5027 (TAI), Lishan, *F. S. Feung & Kao* 4590 (TAI), 1800 m, *J. C. Wang* 3060 (TAI). **Nantou:** Hsinyi: Kuankao (Kanko), *S. Sasaki s. n.* Dec 1923 (TAI), Mt. Mabolashan, *T. Suzuki* 13607 (TAI); Jenai, Wusheh, *C. C. Chuang & Kao* 4235 (TAI), Nengkao, *Y. Kudo & Mori* 135 (TAI), Tayuling to Mt. Hohuanshan, 2565-3250 m, *C. C. Hsu* 3806 (TAI). **Chiayi:** Alishan, Paiyun lodge to Mt. Yushan, 3550-3997 m, *C. C. Hsu* 6267 (TAI), Mt. Yushan (Niitaka or Morrison), *T. Wakatsuki s. n.* Jul 1930 (TAI), 2700-3400 m, *T. C. Huang et al.* 14239 (TAI), 3952 m, *S. T. Chiu* 2427 (TNM). **Kaohsiung:** Taoyuan, along S. cross Island Highway, near Mt. Takuanshan, *T. Y. Liu et al.* 521 (TNM), Mt. Kuanshan, 2600 m, *N. Fukuyama s. n.* Jul 1935 (TAI). **Hualien:** Hualien (Karenkocho), *T. Nakamura s. n.* Dec 1940 (TAI); Hsiulin, Loshao, *Y. C. Chang s. n.* Jun 1991 (TNM), Mt. Tarokotashan, *S. Sasaki s. n.* Jun 1933 (TAI), Mt. Hoshan, *T. C. Huang* 4649 (TAI), Tayuling, *C. C. Chuang & Kao* 4448 (TAI), Mt. Tungnengkao, *S. Sasaki s. n.* Aug 1929 (TAI), *S. Suzuki* 2000 (TAI), Hoping forest track, 41-36 Km, 1900-1700 m, *S. F. Huang et al.* 5184 (TAI); Panpien to Chilai, *S. Sasaki s. n.* Aug 1929 (TAI).



Text-figure 2
Distribution of *Galium echinocarpum* Hayata.

2. *Galium formosense* Ohwi, Fedde, Rep. Sp. Nov. 36: 55. 1934; Masamune, Short Fl.

Form. 201. 1936, List Vasc. Pl. Taiwan 119. 1954; Chao, Fl. Taiwan 4: 261. 1978.

圓葉豬殃殃; text-fig. 3; p1. 1. figs. 3, 4

Galium rotundifolium auct. non L.: Hayata Journ. Coll. Univ. Tokyo 30(1): 148. 1911, Icon. Pl. Form. 2:103. 1912.

Galium kwanzanense Ohwi, Fedde, Rep. Sp. Nov. 36: 56. 1934.

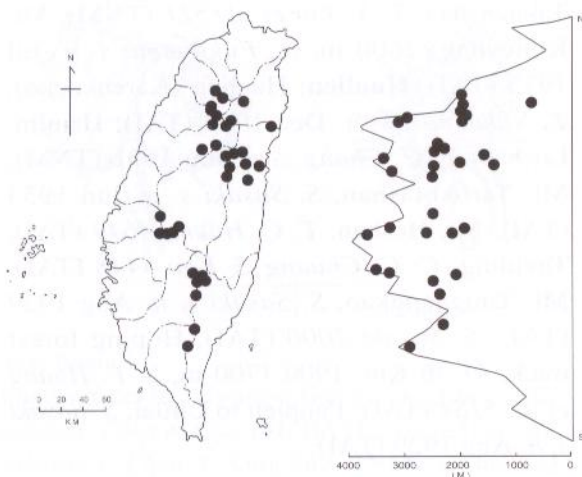
A procumbent herb; branches slender, hairy. Leaves sessile, 4-verticillate, ovate-elliptic to elliptic, (4-)10-20(-21) mm long, (3-)5-9(-11) mm wide, hairy on both surfaces; leaves on the lower branch usually smaller than the upper ones, 4-5 mm long, 2-3 mm wide; apex mucronate or acute, base cuneate; main veins 3. Flowers ca. 1.5 mm in diameter, yellowish-white, pedicellate; corolla rotate, 4-lobed, lobes ovate; stamens 4; ovary covered with hooked hairs. Fruits didymous, densely covered with hooked hairs.

Endemic to Taiwan. Found above 600 m altitude on high mountainous regions around the Island.

Specimens examined:

Ilan: Tatung, Nanshantsun (Piyanan-anbu), S. Suzuki 5044 (TAI), T. Hosokawa 2216 (TAI), Tucheng, S. Suzuki 6328 (TAI), en route to

Mt. Nanhutashan, Yunlin lodge, S. F. Huang 862 (TAI); Nanau, Mt. Taipingshan, M. T. Kao et al. 4690 (TAI), 4788 (TAI), 4808 (TAI), S. Suzuki s. n. Aug 1928 (TAI). **Hsinchu:** Wufeng, Kuanwu, C. H. Ou s. n. Sept 1990 (TNM). **Maioli:** Taian, Kuanwu to Kuaishan, J. C. Wang & Yang 4786b (TAI), Madalahsi, C. F. Hsieh 1291 (TAI), Mt. Tapachienshan, en route to Mt. Yitseshan, S. Sasaki s. n. Jul 1932 (TAI), 99 lodge, 2780 m, C. M. Wang & Lin 2388 (TNM), Talu forest track 28-35Km, J. C. Wang & Yang 4844 (TAI). **Taichung:** Hoping, Chingshan to Tech, 1320 m, C. M. Wang 2743 (TNM), Mt. Pahsienshan, T. S. Liu et al. 321 (TAI), T. I. Chuang et al. 2656 (TAI), Lishan to Mt. Hohuanshan, Y. C. Jeng 1734 (TAI), Ssuyuan to 710 forest track, Mt. Nanhutashan, 1900-2350 m, J. C. Wang et al. 3603 (TAI), 3864 (TAI), Chika lodge to 369 lodge, C. C. Hsu 14661 (TAI), Mt. Tahsuehshan forest track, 2200 m, S. P. Li 628 (TNM). **Nantou:** Hsinyi, Mt. Yushanchienshan, 3000 m, C. C. & R. Hsu 3981 (TAI), Mt. Luantashan, T. Kawakami & Mori s. n. Aug 1908 (TAI); Jenai, Mt. Hohuanshan, S. Y. Liu et al. 295 (TAI), Tungpu to Patungkuan, 1700 m, M. Tamura et al. 21900 (TAI), Nengkao, S. Suzuki 2094 (TAI), 2522 (TAI), s. n. Aug 1926 (TAI). **Chiayi:** Alishan, Mt. Alishan, Y. F. Chen 2529 (TAI), F. S. Feung & Kao 4846 (TAI), 4895 (TAI), Jan & Kao s. n. Jul 1957 (TAI), Y. Kudo & Suzuki 16326 (TAI), S. Sasaki s. n. Oct 1928 (TAI), s. n. 1929 (TAI), Y. Yamamoto & Mori s. n. Nov 1932 (TAI), Sisters' Pond, C. S. Kuoh 5743 (TAI), Mt. Alishan to Chushan, C. S. Kuoh 80360 (TAI), 80397 (TAI), Chushan, C. C. Hsu 8942 (TAI), Y. Yamamoto & Nakamura 4131 (TAI), Mt. Tashan, F. S. Feung & Kao 4900 (TAI), 4980 (TAI), Y. Hashioka s. n. Nov 1932 (TAI), Mt. Alishan to Fengshan, 2250 m, C. M. Wang 297 (TNM), Tataka-anbu, 2600 m, T. & F. Yamazaki 946 (TAI), Tataka to Mt. Alishan, 2300 m, M. Tamura et al. 22207 (TAI), Tataka



Text-figure 3

Distribution of *Galium formosense* Ohwi.

to Paiyun lodge, *C. C. Hsu* 6252 (TAI), Mt. Yushan 3952 m, *S. T. Chiu* 2444 (TNM), *T. Kawakami & Sasaki* s. n. Oct 1909 (TAI), *G. Masamune* s. n. Mar 1943 (TAI), *S. Sasaki* s. n. Aug 1935 (TAI), Mts. Yushan to Alishan, *S. Sasaki* s. n. Oct 1927 (TAI), Shihshan, *C. H. Ou* s. n. Jul 1991 (TNM). **Kaohsiung:** Taoyuan, Kuanshan, 2600 m, *N. Fukuyama* s. n. Jul 1935 (TAI), Kuaiku to Mt. Takuanshan, 2700 m, *N. Fukuyama* s. n. Jul 1935 (TAI), Mt. Takuanshan, *S. Sasaki* s. n. Oct 1933 (TAI), Tienchih, 2200 m, *T. C. Huang & Yang* 1856 (TAI), Tienchih to Mt. Takuanshan, *S. T. Chiu* 1307 (TNM), Sehshan, *T. C. Huang* 6522 (TAI), Liukuei to Mt. Peinanchushan along Stream Laonunghsi, 2300 m, *T. Yamazaki et al.* 350 (TAI). **Pingtung:** Taiwu, Mt. Tawushan, *T. C. Huang et al.* 13655 (TAI). **Hualian:** Hsiulin, Mt. Tarokotashan, *S. Sasaki* s. n. Jun 1933 (TAI), Pilu, *C. M. Wang* s. n. Jul 1992 (TNM), Hoping forest track, 41-36 Km, *S. F. Huang et al.* 5182 (TAI), Mt. Tungnengkaoshan, *N. Fukuyama* 4661 (TAI), Tayuling, 2600 m, *C. C. Chuang & Kao* 4437 (TAI), *C. C. & R. Hsu* 3766 (TAI), Mt. Luanshan, *C. S. Kuoh et al.* 6927 (TAI), 24th forest Station, 1900-2100 m, *C. C. Hsu* 3592 (TAI), 3611 (TAI), Hualuhsi to Rosao, *T. Y.*

Yang et al 4391 (TAI), Mt. Chilaichunanshan, *S. Sasaki* s. n. Aug 1929 (TAI), Mt. Mukuashan, *M. T. Kao* 4140 (TAI), Nagamineyama, *T. Suzuki* 9251 (TAI). **Taitung:** Haituang, Yakou, *S. F. Huang et al.* 3634 (TAI); Chuyun to Chiengchin, *Y. Yamamoto & Mori* 579 (TAI); Chinfeng, Mt. Tawushan, *G. Masamune* s. n. Dec 1930 (TAI), *T. Suzuki & Fukuyama* 15052 (TAI), Lake Kucihu, 1600 m, *C. C. Hsu* 3333 (TAI).

3. *Galium fukuyamai* Masamune, Trans. Nat. Hist. Soc. Form. **33**: 621. 1943; Chao, Fl. Taiwan **4**: 261. 1978.

福山氏猪殃殃; text-fig. 4; pl. 2, figs. 1, 2

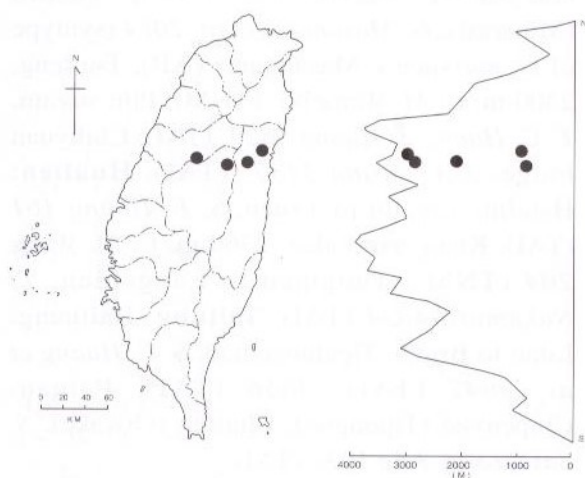
A small herb, 10-20 cm high, branches glabrous. Leaves sessile, 4-verticillate, oblong to lanceolate, (5-)7-12(-13) mm long, 1-2 mm wide, pilose on both surfaces; apex acuminate, base cuneate; main vein 1. Flowers 1 mm in diameter, pedicel 1.0-2.5 mm long; corolla rotate, 4-lobed, lobes ovate; stamens 4; style short, stigma bifid, ovary with depressed hooked hairs. Fruits didymous, with depressed hooked hairs.

Endemic to Taiwan. Limited distributed on hill sides at medium altitude in the eastern part mountain areas.

Specimens examined:

Taichung: Hoping, Mt. Paikutashan, 3100 m, *C. I. Huang et al.* 163 (TNM). **Nantou:** Jenai, Meifeng, *S. H. Woo* 563 (TNM), Yuanfeng to Mt. Hohuanshan, 3020 m, *C. M. Wang et al.* 3289 (TNM). **Hualian:** Hsiulin, Nengkaoyueh, Mt. Chilaishan (Kira) to Panpien (Sakahen), 1000 m, *N. Fukuyama* 4411 (holotype: TAI!), Chiulu (Suiroku), *S. Suzuki* 9079 (TAI).

4. *Galium gracilens* (A. Gray) Makino, Bot. Mag. Tokyo **17**: 74. 1903; Hara, Enum. Sperm. Jap. **2**: 6. 1952; Masamune, Sci. Rep. Kanazawa Univ. **4**: 95. 1955; Hatusima, Fl. Kag. Rev. ed. 155. 1986; Shimabuku, Vasc. Fl. Ryukyu 374. 1990,



Text-figure 4

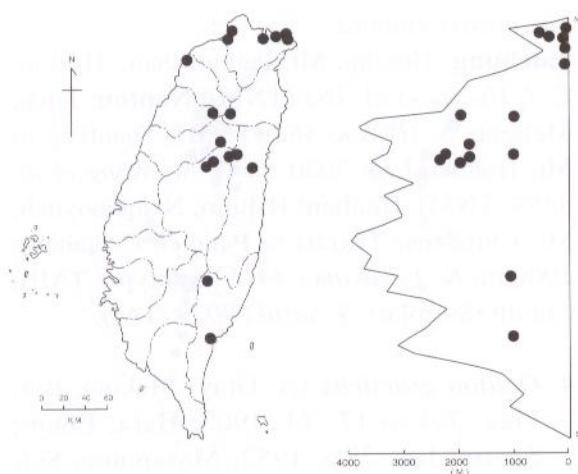
Distribution of *Galium fukuyamai* Masumune.

Checklist Vasc. Fl. Ryukyu 434. 1997.

琉球猪殃殃; text-fig. 5; pl. 1, figs. 1, 2

Galium trachyspermum A. Gray var. *gracilens* A. Gray, Mem. Amer. Acad. N. Ser. 6: 393. 1859.*Galium gracile* Bunge form. *rotundifolia* Hayata, Icon. Pl. Form. 5: 81. 1915. = *G. kiirunense* Masamune, S. Suzuki & K. Mori, Trans. Nat. Hist. Soc. Form. 24: 412. 1934, Masamune, l.c. 29: 29. 1939 = *G. gracilens* (A. Gray) Makino var. *rotundifolium* (Hayata) Hatusima, Fl. Ryukyu 580. 1971, *invalid comb.**Galium lutchuense* Nakai ex Kitag., Bot. Mag. Tokyo 48: 618. 1934; Masamune, Trans. Nat. Hist. Soc. Form. 29: 239. 1939; Chao, Fl. Taiwan 4: 262. 1978. = *G. miltiorrhizum* Hance var. *lutchuense* (Nakai ex Kitag.) Hara, Acta Phytotax. Geobot. 12: 199. 1950. = *G. gracilens* (A. Gray) Makino var. *lutchuense* (Nakai) Yamazaki, Journ. Jap. Bot. 66: 51. 1991.*Galium musyaense* Masamune, Trans. Nat. Hist. Soc. Form. 30: 38. 1940.*Galium gracile* auct. non Bunge : Matsumura & Hayata, Journ. Coll. Sci. Univ. Tokyo 22: 200. 1906.

A slender herb; branches glabrous. Leaves sessile, 4-verticillate, oblong to linear-lanceolate, (2-)4-9(-11) mm long, (1-)2-4(-4.5) mm wide, scatter hairs on both surfaces; apex acute, base cuneate; main vein 1. Flowers ca. 1 mm in diameter, white; corolla rotate, 4-lobed, lobes ovate; stamens 4; ovary covered with papillae. Fruits didymous, covered with dense papillae.



Text-figure 5

Distribution of *Galium gracilens* (A. Gray) Makino.

The Isls. Ryukyus and Taiwan. Very common species in Taiwan, sea level to 2,400 m altitude.

Specimens examined:

Ilan: Tatung, Nanshan (Piyanan), C. C. Chuang 2423 (TAI), S. Sasaki s. n. Sept 1925 (TAI). **Keelung:** S. Sasaki s. n. Sept 1908 (TAI), Hsientung, S. Suzuki 4714 (TAI), Isl. Keelungyu, S. Sasaki s. n. May 1910 (TAI). **Taipei:** Juifang, Chingkuashih, C. H. Chen & Sang 762 (TNM), Pitouchiao, S. P. Li 90 (TNM); Kungliao, Homei, S. F. Huang 4283 (TAI); Pali, Mt. Kuanyingshan, C. C. Chuang 2168 (TAI), N. Fukuyama 4657 (TAI); Sanchih, K. C. Yang s. n. Feb 1995 (TNM); Shimen, S. Sasaki s. n. May 1932 (TAI), Fukueichiao (Hukikaku), S. Suzuki s. n. Jun 1930 (TAI); Tanshui, H. Simada 1187 (TAI). **Hsinchu:** Y. Kudo & Suzuki s. n. Apr 1929 (TAI), Chupei, Temple Lienhuassu, Shanshiao, C. C. Hsu 13938 (TAI). **Miaoli:** Taian, Madalahsi, C. F. Hsieh 1252 (TAI). **Taichung:** Hoping, Lishan, F. S. Feung & Kao 4564 (TAI); Sheliaochiao, G. Masamune 1786 (TAI). **Nantou:** Jenai, Wusheh, F. S. Feung & Kao 4520 (TAI), Y. Simada 2772 (TAI), Chunyang (Sakura-Onsen), G. Masamune et al. 2092 (holotype of *G. musyaense* Masamune; TAI!), Yushih (Miharasi), G. Masamune et al. 2074 (syntype of *G. musyaense* Masamune; TAI!), Tsuifeng, 2300 m, C. M. Wang 65 (TNM), Pilu stream, T. C. Huang & Huang 9829 (TAI), Chihyuan lodge, J. C. Wang 3137 (TAI). **Hualien:** Hsiulin, Tayulin to Tzuen, S. F. Huang 161 (TAI), Kuanyuan lodge, 2360 m, C. M. Wang 204 (TNM), Tungmen to Lungchien, T. Nakamura 4834 (TAI). **Taitung:** Haituang, Litao to Bridge Tienlungchiao, S. F. Huang et al. 3647 (TAI), 3656 (TAI); Peinan, Chipenyue (Tipongoe), Chuifen (Oiwake), S. Sasaki s. n. Aug 1932 (TAI).

5. *Galium morii* Hayata, Icon Pl. Form. 7: 32. 1918; Masamune, Short Fl. Form. 201.

1936, List Vasc. Pl. Taiwan 119. 1954; Chao, Fl. Taiwan 4: 262. 1978.

森氏猪殃殃; text-fig. 6; pl. 3, figs. 1, 2

Galium sigeyosii Masamune, Trans. Nat. Hist. Soc. Form. 33: 620. 1943.

Galium brachypodium auct. non Maxim.: Hayata, Journ. Coll. Sci. Univ. Tokyo 25: 117. 1908.

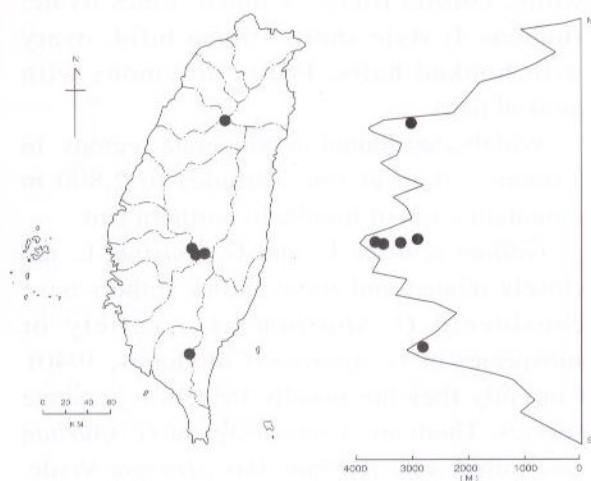
A small herb; branches glabrous or hairy. Leaves sessile, 4-verticillate, obovate to elliptic, (3-)4-8(-10) mm long, 2-4(-5) mm wide, pubescent when young becoming glabrous at maturity; apex acuminate, base cuneate; main veins 3. Flowers ca. 2 mm in diameter, pedicel 2 mm long; corolla rotate, 4-lobed, rare 5, lobes ovate; stamens 4; ovary densely covered with appressed hooked hairs. Fruits didymous, densely covered with appressed hooked hairs.

Endemic to Taiwan. At above 2,500 m altitude mountainous regions.

Specimens examined:

Taichung: Hoping, Mt. Taoshan to Wuling Farm, J. C. Wang & Huang 4105 (TAI).

Nantou: Hsinyi, Mt. Yushanchiengshan, S. Suzuki 13241 (TAI), Paiyun lodge to Mt. Yushan, C. C. Chen & Hung 1093 (TAIF), C. I. Peng et al. 14378 (TAIF, TNM). **Taichung:** Malung, New Basinshan, 2700 m, H. Keng s.



Text-figure 6

Distribution of *Galium morii* Hayata.

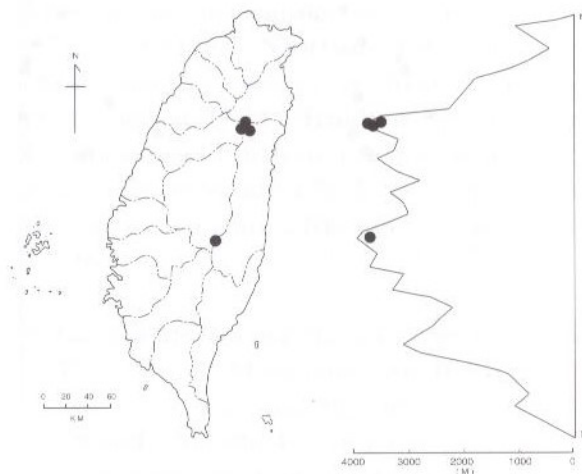
n. Nov 1950 (L, photocopy at TNM). **Chiayi:** Alishan, Paiyishan to Tungpu, T. C. Huang 4585 (TAI), Mt. Yushan, 2700-3400 m, T. C. Huang et al. 14268 (TAI), 14288 (TAI), T. & F. Yamazaki 947 (TAI), C. C. Chuang & Kao 4518 (TAI), R. Kanehira & Sasaki s. n. Oct 1918 (TAIF), T. Kawakami & Mori s. n. Oct 1906 (TAIF). **Pingtung:** Taiwu, en route to Mt. Tawushan, T. C. Huang et al. 13653 (TAI).

6. *Galium nankotaizanum* Ohwi, Fedde, Rep. Sp. Nov. 36: 56. 1934; Masamune, Short Fl. Form. 201. 1936, List Vasc. Pl. Taiwan 119. 1954; Chao, Fl. Taiwan 4: 262. 1978.

南湖大山猪殃殃; text-fig. 7; pl. 3, figs. 3, 4

Galium maborasense Masamune, Trans. Nat. Hist. Soc. Form. 29: 219. 1939; syn. nov.

A small erect herb, pubescent, 6-12 cm high, internodes usually short, 5-20 mm long. Leaves sessile, 4-verticillate, ovate-elliptic, (4-)6-9(-10) mm long, (2-)3-4(-5) mm wide; apex acute, base cuneate to obtuse; main veins 3, lateral nerves obscure. Flowers 2-3 mm in diameter, pedicel 2-3 mm long; corolla rotate, 4-lobed, rare 5, lobes ovate; stamens 4; ovary densely covered with straight hairs. Fruit densely covered with straight hairs.



Text-figure 7

Distribution of *Galium nankotaizanum* Ohwi.

Endemic to Taiwan. In the Central Mountain areas above 3,000 m altitude.

The diagnostic characters of *G. maborasense* are stems, leaves and ovaries pubescent, and with obovate leaves. After comparing the specimen of *G. maborasense* and *G. nankotaizanum*, both of them have straight hairs on ovaries and fruits, and also with pubescent stems and leaves. So we recognised they are the same taxon and then treated *G. maborasense* as a synonym of *G. nankotaizanum*.

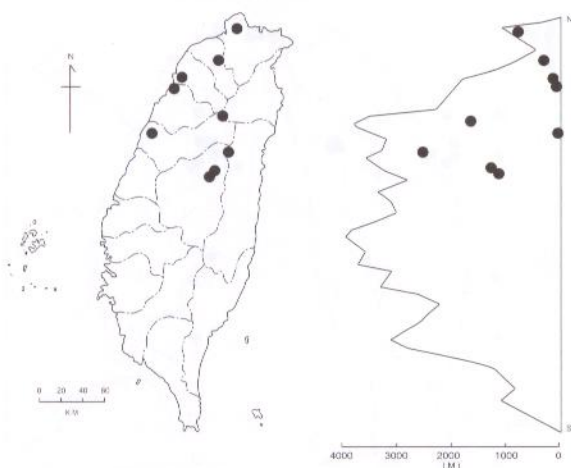
Specimens examined:

Taichung: Hoping, Mt. Nanhutashan, *G. Masamune et al.* 3136 (TAI), 3400 m, *G. Masamune* 3204 (TAI), 3207 (TAI), *T. Yamazaki et al.* s. n. Sept 1969 (TAI), 3500 m, *T. Suzuki et al.* 17380 (TAI), 3600 m, *T. Suzuki et al.* 18109 (TAI), 3400-3500 m, *C. M. Wang* 907 (TNM). **Nantou:** Hsinyi, Mt. Mapolassushan, *T. Suzuki* 13619 (holotype of *G. maborasense* Masamune; TAI!). **Hualien:** Hsiulin, Mt. Chungyangchienshan, 2800 m, *N. Fukuyama & Suzuki* 15064 (TAI).

7. *Galium spurium* L. form. *vaillantii* (DC.)

R.J. Moore, *Canad. J. Bot.* **53**: 882. 1975.

豬殃殃; text-fig. 8; pl. 4, figs. 1, 2



Text-figure 8

Distribution of *Galium spurium* form. *vaillantii* (DC.) R. J. Moore in Taiwan.

Galium vaillantii DC., Lam. & DC., *Fl. Fr.* ed. 3, **4**: 236. 1805. = *G. spurium* L. ssp. *vaillantii* (DC.) Gaudich., *Fl. Helv.* **1**: 442. 1828. = *G. aparine* L. var. *vaillantii* (DC.) Koch, *Syn. Fl. Germ.* ed. 1, 330. 1837. = *G. spurium* var. *vaillantii* (DC.) Gren. & Godr., *Fl. Fr.* **2**: 44. 1850. = *G. aparine* form. *vaillantii* Maxim., *Mél. Biol.* **9**: 259. (1873) 1874. = *G. aparine* ssp. *vaillantii* (DC.) Lindb.f., *Enum. Pl. Fennoscandia*, 1901.

Galium infestum Waldst. & Kit., *Descr. Et Icon. Pl. Rar. Hung.* **3**: 224, *tab.* 202. 1810. = *G. aparine* var. *infestum* (Waldst. & Kit.) Wimm. & Grab., *Fl. Siles.* **1**: 120. 1827. = *G. spurium* ssp. *infestum* (Waldst. & Kit.) Janch., *nom. Superl.* (incl. *G. vaillantii*) *Phyton* **5**: 97. 1953.

Galium agreste Wallr. var. *echinospermum* Wallr., *Sched. Crit. Pl. Fl. Hallen.* **59**. 1822. = *G. spurium* var. *echinospermum* (Wallr.) N. H. F. Desp., *Fl. Sarthe* 118. 1838; Hayek, [*Fl. Steierm.* **2**: 393. 1912 name without rank] Hegi, *Ill. Fl. Mittel-Europa* **6**(1): 229. 1914; Chao, *Fl. Taiwan* **4**: 264. 1978. = *G. aparine* var. *echinospermum* (Wallr.) DeWild. & Durand, *Prodr. Fl. Belg.* **3**: 718. 1899; Farwell, *Mich. Acad. Sci. Rep.* **19**: 260. 1918 (comb. Superfl.); Cuf., *Österr. Bot. Zeitschrift* **89**: 245. 1940 (comb. Superfl.).

Galium aparine auct. non L. : Hayata, *Icon. Pl. Form.* **2**: 102. 1912.

A procumbent herb; branches slender, barbed. Leaves sessile, 5-8-verticillate, obovate to oblanceolate, (9-)15-27(-38) mm long, (2-)3-4(-9) mm wide, thinly barbed on both surfaces; apex mucronate to acuminate, base attenuate or cuneate; main vein 1. Flowers 2-2.5 mm in diameter, yellowish white; corolla rotate, 4-lobed, lobes ovate; stamens 4; style short, stigma bifid, ovary with hooked hairs. Fruits didymous with hooked hairs.

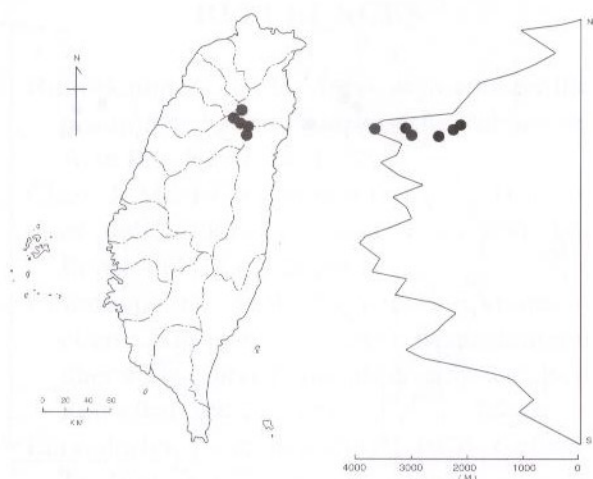
Widely distributed in temperate regions. In Taiwan, found at low altitudes to 2,800 m mountain areas of middle to northern part.

Galium aparine L. and *G. spurium* L. are closely related and some earlier authors have considered *G. spurium* as a variety or subspecies of *G. aparine* (Cufodontis, 1940). Currently they are usually treated as separate species. There are 3 subspecies of *G. spurium* recognised, ssp. *spurium*, ssp. *africana* Verdc. and ssp. *ibicinum* (Boiss. & Hausskn ex Boiss.) Ehrend. The majority of recent

European floras place *G. vaillantii* in synonym with the type subspecies (Ehrendorfer & Krendl, 1976). Moore (1975), however, has recognised two forms within the type subspecies, forma *vaillantii* differing in its spiny (hooked hairs) fruits. This name is valid on the interpretation that the infraspecific names in Hayek (1912) are names without rank unless otherwise indicated, which he does in some other cases indicating a rank of forma or variety to the name in the synonym, where his own publication is included.

Specimens examined:

Taipei City: Mt. Tatunshan, K. Odashima 17765 (TAI). **Ilan:** Tatung, Ssuyuanyako, 43 Km, C. M. Wang & Lin 2328 (TNM). **Taipei:** Hsintien, Kuanghsing (Koko), Y. Simada 1442B (TAI). **Taoyuan:** Tahsi, S. Sasaki s. n. May 1934 (TAI). **Hsinchu:** Chupei, Chingtsaohu, 100 m, S. F. Huang 1446 (TAI). **Miaoli:** Chunan, Chungkang, near Chunan, C. C. Hsu 5295 (TAI). **Taichung:** Chinshuei, Temple Nanshansi, T. Y. Yang 1792 (TAI). **Nantou:** Jenai, Wusheh, F. S. Feung & Kao 4516 (TAI), Lushan to Wusheh, S. F. Huang 1561 (TAI). **Hualien:** Hsiulin, Tayuling, C. C. Hsu 3771 (TAI).



Text-figure 9

Distribution of *Galium taiwanense* Masamune.

8. *Galium taiwanense* Masamune, Trans. Nat. Hist. Soc. Form. **29**: 180. 1939, List Vasc. Pl. Taiwan 119. 1954; Chao, Fl. Taiwan **4**: 264. 1978.

臺灣豬殃殃; text-fig. 9; pl. 4, figs. 3, 4

A procumbent herb; branches slender, barbed. Leaves sessile, 4-6-vericillate, oblanceolate, (4-)10-20(-31) mm long, (1-)2-4 mm wide, glabrous above, barbed on the midrib beneath and margin; apex mucronate to acuminate, base attenuate; main vein 1. Flowers ca. 2.5 mm in diameter, pedicel 3-5 mm long; corolla rotate, 4-lobed, lobes ovate; style short, stigma bifid, ovary glabrous. Fruit glabrous.

Endemic to Taiwan. At above 2,000 m altitude mountain regions of northern part of Taiwan.

Specimens examined:

Ilan: Tatung, Mt. Nanhutashan, G. Masamune et al. 2949 (TAI), S. Suzuki s. n. Jul 1937 (TAI), Nanshan to Chiliting (Kirittoi), G. Masamune & Mori s. n. Jul 1931 (holotype; TAI!), T. Hosokawa s. n. Jul 1931 (TAI). **Taichung:** Hoping, Nanhushi to Mt. Touchiatunshan to 710 forest track, J. C. Wang et al. 3840 (TAI), Ssuyuan to 710 forest track, J. C. Wang et al. 3609 (TAI), Ssuyuanyako to Nanshan, C. H. Chen et al. 1284 (TAIF). **Nantou:** Mt. Yushan (Morrison), s. leg. s. n. May 1966 (L; photocopy at TNM). **Hualien:** Hsiulin, Mt. Chungyangchienshan (Tyuosenzan), N. Fukuyama & Suzuki 15237 (TAI), Tausaishe (Tausai Kenkaigun), 2100 m, T. Suzuki et al. 17716 (TAI).

9. *Galium tarokoense* Hayata, Icon. Pl. Form. **7**: 33. 1918; Masamune, Short Fl. Form. 201. 1936, List Vasc. Pl. Taiwan 119. 1954; Chao, Fl. Taiwan **4**: 264. 1978.

太魯閣豬殃殃; text-fig. 10, pl. 5, figs. 1, 2

A small glabrous herb; internodes short, less than 1 cm long. Leaves sessile or shortly

petiolate, 4-verticillate, elliptic, (3.5-)4-5(-6) mm long, 1-3 mm wide, margins entire; apex acute, base cuneate to attenuate; main vein 1. Flowers 2-3 mm in diameter; corolla rotate, 4-lobed, lobes ovate; ovary covered with depressed hooked hairs. Fruit didymous, densely covered with depressed hooked hairs.

Endemic to Taiwan. Eastern Taiwan distributed around Taroko and the Central Mountains limestone areas between altitudes 1,400 and 2,700 m.

Specimens examined:

Nantou: Hsinyi, Mt. Yushan, *S. Sasaki s. n.* Aug 1935 (TAI). **Hualien:** Hsiulin, Mt. Chinshueishan, 2200-2400 m, *T. C. Huang et al.* 12927 (TAI), 2000m, *T. Nakamura* 3752 (TAI), Tienchang cliff (Tencyo), *S. Suzuki* 1876 (TAI), *Y. Kudo & Mori* 2045 (TAI), Chilai to Panpien, *N. Fukuyama* 4808 (TAI), *T. Nakamura* 4993 (TAI), Mt. Fongshan, *C. M. Kuo et al.* 6947 (TAI), Luanshan, 1800-1900 m, *C. C. & R. Hsu* 3655 (TAI), 3661 (TAI), 3673 (TAI), Tatuanyai (Dangai, Taroko), *S. Suzuki* 10490 (TAI), Mt. Haishushan (Namakoyama), *S. Suzuki* 10572 (TAI), Yenhai forest track, *S. P. Li* 374 (TNM), *T. Y. A. Yang* 5458 (TNM); uncertain place: Formosa: Cliff side, *J. L. Gressitt* 444

(L; photocopy at TNM).

10. *Galium trifidum* L., Sp. Pl. 105. 1753; Hayata, Icon. Pl. Form. **9**: 65. 1920; Wang et al. Quart. Journ. Chin. For. **5**(4): 3. 1972.

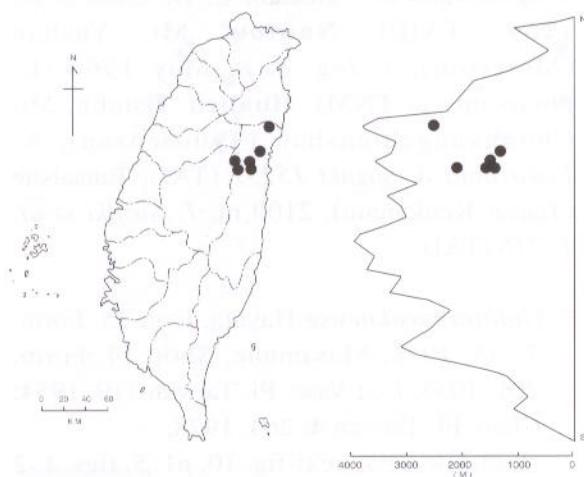
小葉四葉葎; text-fig. 11, pl. 5, figs. 3, 4

Galium trifidum L. var. *pacificum* auct. non Wiegand.: Masamune, List Vasc. Pl. Taiwan 119. 1954.

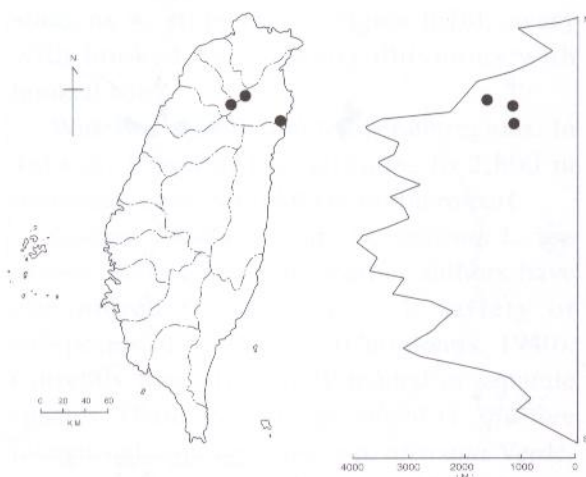
A procumbent herb; branches slender, 4-angled, sparsely short barbed. Leaves sessile, 4-verticillate, narrow oblanceolate to oblanceolate, (3-)4-8(-9) mm long, 1-3 mm wide, sparsely short barbed beneath; margins sparsely short barbed; apex round or obtuse, base attenuate; main vein 1. Flowers 1-1.5 mm in diameter, pedicel 3-9 mm long; corolla rotate, 3-lobed, lobes ovate; ovary glabrous. Fruit glabrous.

Widely distributed around temperate North hemisphere, including Europe, North America, China, Japan, and Taiwan. In Taiwan, limited represented in wet places of northern part lake districts.

This species was first reported in Taiwan by Hayata (1920) and Wang et al. (1972), but the former one published it as *G. trifidum* "Michx.", and then it was treated as a



Text-figure 10
Distribution of *Galium tarokoense* Hayate.



Text-figure 11
Distribution of *Galium trifidum* L. in Taiwan.

synonym of *G. taiwanense* by Chao (1978). However, the species with 3-lobed corolla and smaller leaves (4-8 mm long) could be easier distinguished from *G. taiwanense* so we treated them as different taxa.

Specimens examined:

Ilan: Tatung, Mingchih, 1000 m, S. Y. Lu 22143 (TAIF); Nanao, Lake Shenmihu, S. Y. Lu 20776 (TAIF). **Hsinchu:** Chienshih, Lake Yuanyanghu, C. H. Chen & Liao 161 (HAST).

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臺灣豬殃殃屬（茜草科）之植物

楊宗愈、李松柏

摘要

本文是有關臺灣茜草科豬殃殃屬 (*Galium* L.) 植物的分類學研究報告。共處理十個分類群，包括九種及一型。文中對每一分類群皆有詳細描述，並附其檢索表及在臺之分布圖。

關鍵詞：豬殃殃屬、茜草科、分類學、臺灣

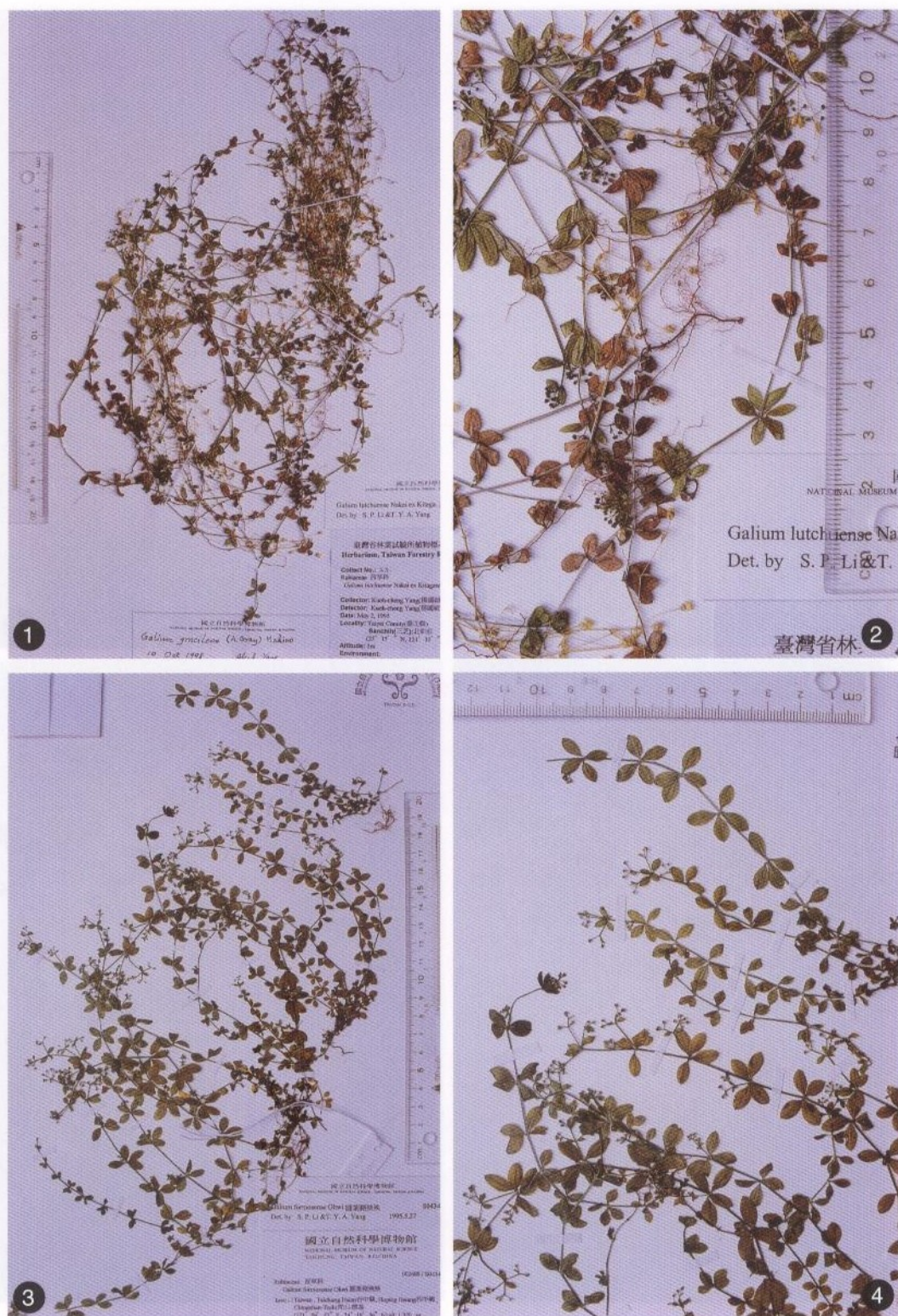


Plate 1

1, 2, *G. gracile*; Taipei: Sanchih, Yang s.n. Feb 1995; 3, 4, *G. formosense*; Taichung, Wang 2743.

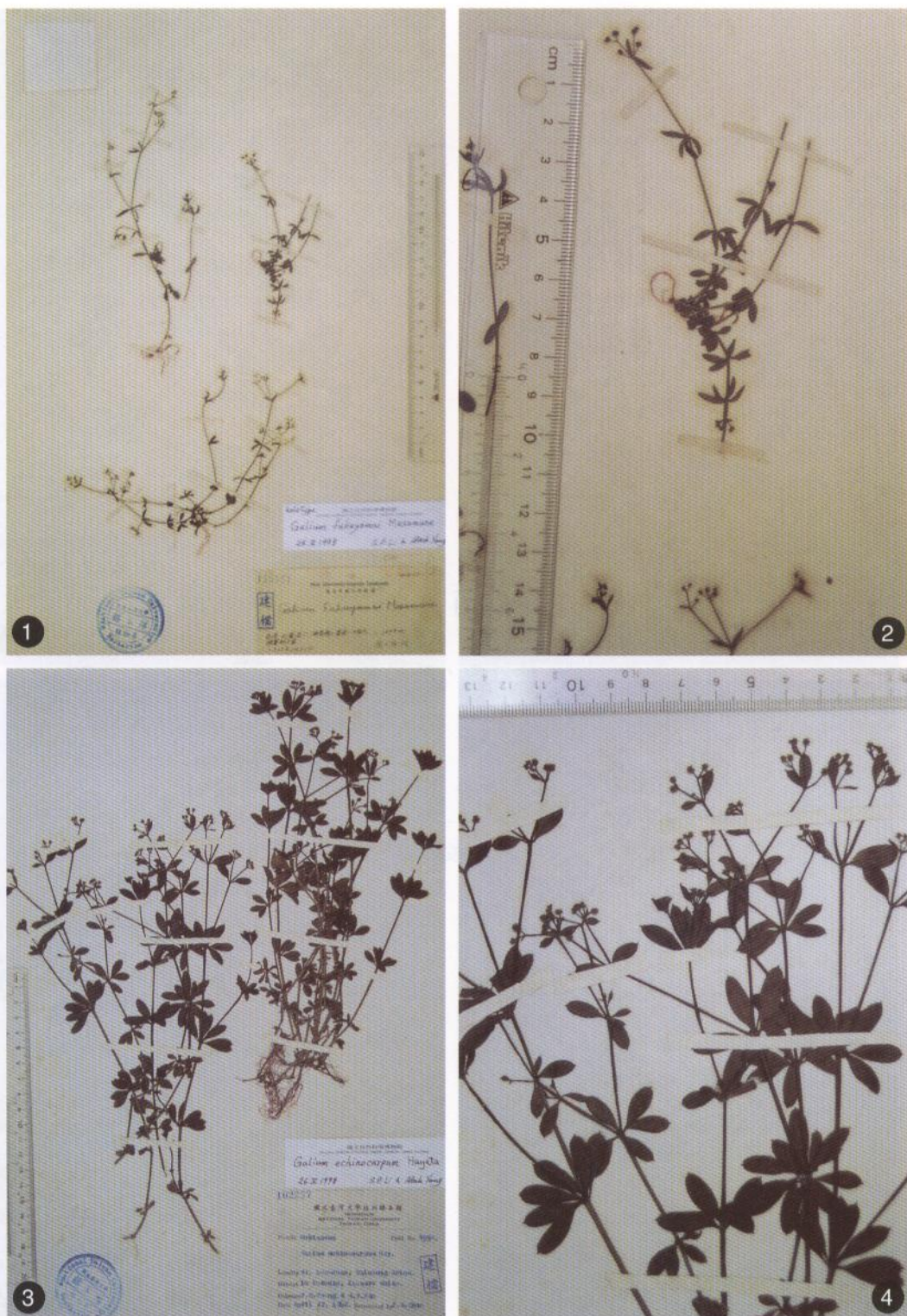


Plate 2

1, 2, Holotype of *Galium fukuyamai*; Hualian, Fukuyama 4411; 3, 4, *Galium echinocarpum*; Taichung, Feung & Kao 4590.



Plate 3

1, 2, *Galium morii*; Chiayi, Chuang & Kao 4518; 3, 4, *G. nankotaizanum*; Nantou, Suzuki 13619 (holotype of *G. maborasense*).



Plate 4

1, 2, *Galium spurium* form. *vaillantii*; Taichung, Yang 1792; 3, 4, Holotype of *G. taiwanense*; Hualien, Masamune & Mori s. n. Jul 1931.

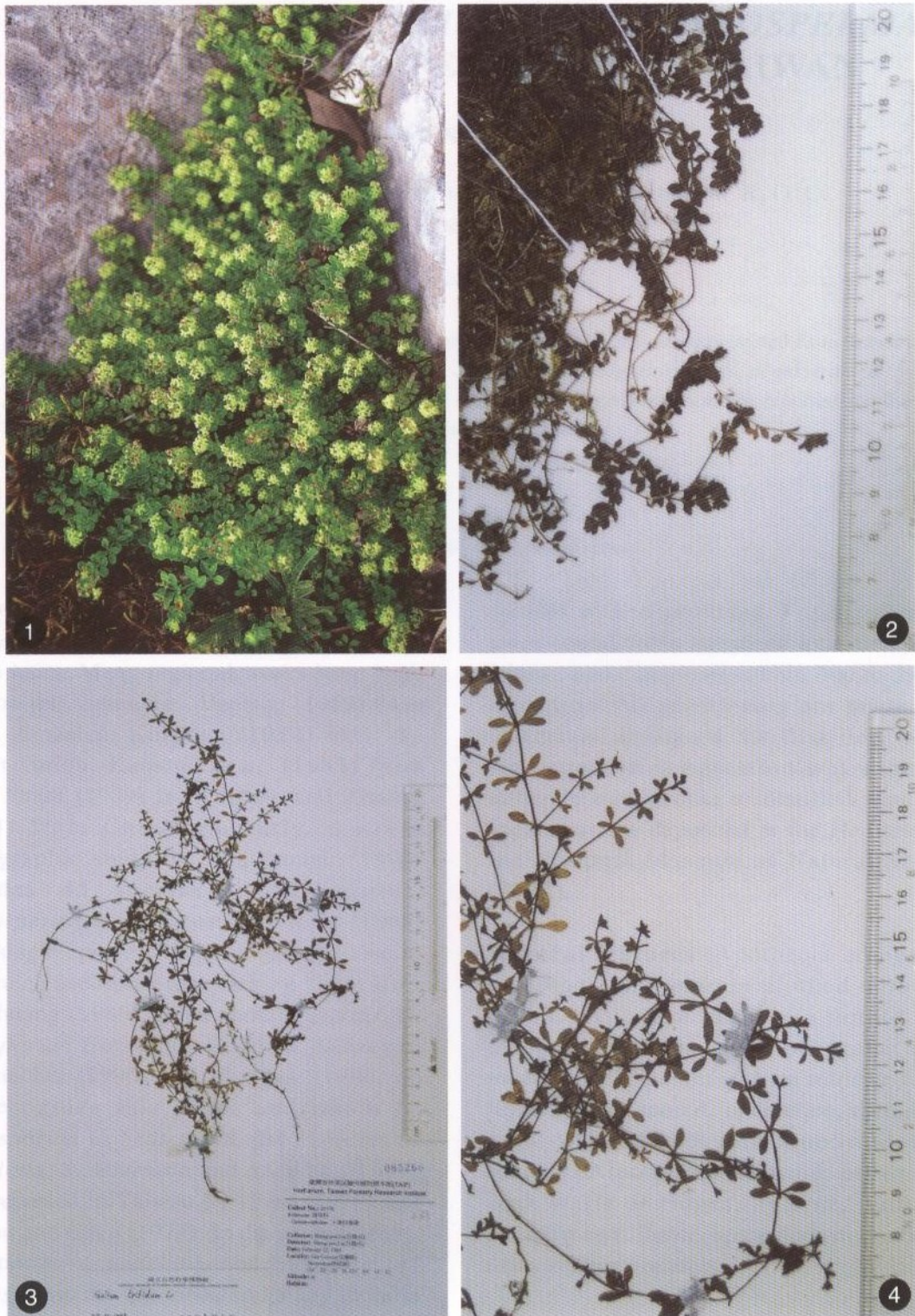


Plate 5

1, 2, *Galium tarokoense*; Hualien: Yang 5458 (both photo and specimen); 3, 4, *G. trifidum*; Ilan, Lu 20776.