Korean J. Pl. Taxon.
47(1): 23–26 (2017)
https://doi.org/10.11110/kjpt.2017.47.1.23

pISSN 1225-8318
eISSN 2466-1546
Korean Journal of
Plant Taxonomy

A new record of *Galium bungei* var. *miltorrhizum* (Hance) Jeong & Pak (Rubiaceae) in Korea

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(Received 31 January 2017; Revised 21 February 2017; Accepted 17 March 2017)

ABSTRACT: We reported an unrecorded plant species, *Galium bungei* var. *miltorrhizum* (Hance) Jeong & Pak in Korea. This species is found in Gyeonggi-do, Chungcheongbuk-do, Jeollabuk-do, Gyeongsangbuk-do, and Gyeongsangnam-do. *G. bungei* var. *miltorrhizum* is distinguished from related taxa by glabrous stem and glabrous or rarely short papillate mericarps. This taxon was named 'Dung-geun-ne-ip-gal-kwi' in Korean based on shapes of leaves. We provided a description, illustrations, photographs, and a key of related taxa in Korea. And we propose a new combination (*Galium bungei* var. *miltorrhizum*).

Keywords: new combination, new record, *Galium*, Rubiaceae

Genus *Galium* L., the largest genera in the tribe Rubieae of the Rubiaceae, is comprises about 650 species distributed predominantly in temperate regions of the world (Ehrendorfer et al., 2005).

The genus *Galium* includes annual and perennial herbs characterized by leaves in whorls of 2-4, 3 or 4-lobed corollas, rudimentary corolla tubes, and dry mericarps (Elkordy and Schanzer, 2015). Identification of the taxa in this genus is difficult because of the considerable morphological variations (Pobedimova, 1958). Based on morphological characters, including ovary and fruit indumentum, leaf shape, and inflorescence, 16 sections are recognized within the genus (Ehrendorfer et al., 2005). The section *Platygalium* W. Koch consists of about 70 taxa distributed in Asia and America (Chen and Ehrendorfer, 2011). This section is characterized by leaves in whorls of 4 and terminal and axillary cymes and/or panicles 3–20 flowers (Dempster and Stebbins, 1968; Ehrendorfer et al., 1976, 2005; Dempster, 1981; Ehrendorfer and Schönbeck-Temesy, 1982; Yamazaki, 1993). The type of indumentum of the ovary and fruit is important taxonomic character for identification of species in the sect. *Platygalium* (Elkordy and Schanzer, 2015).

Galium bungei Steudel (sect. *Platygalium*) is an annual herb with leaves in whorls of 4 and rotate corollas. The species is widely distributed in eastern Asia (Yamazaki, 1991; Chen and Ehrendorfer, 2011). Chen and Ehrendorfer (2011) recognized 6 varieties within *G. bungei* based on the shape of leaves and the morphology of hairs on the stem, node, and leaves based on classification of Cufodontis (1940).

While conducting the revision of the genus *Galium*, we discovered an unrecorded plant in Korea; however, researches on these species in China and Japan been already been published several times elsewhere (Yamazaki, 1991; Chen and Ehrendorfer, 2011). The unrecorded variey of genus *Galium*, *Galium bungei* var. *miltorrhizum* (Hance) Jeong & Pak, are reported to exist in Korea for the first time and are described and illustrated in detail. In addition, we provide an identification key for the sect. *Platygalium*.

Taxonomic Treatment

Galium bungei* var. *miltorrhizum (Hance) Jeong & Pak, comb. nov. (Fig. 1)

Galium miltorrhizum Hance, J. Bot. 6: 114, 1868; *Galium*

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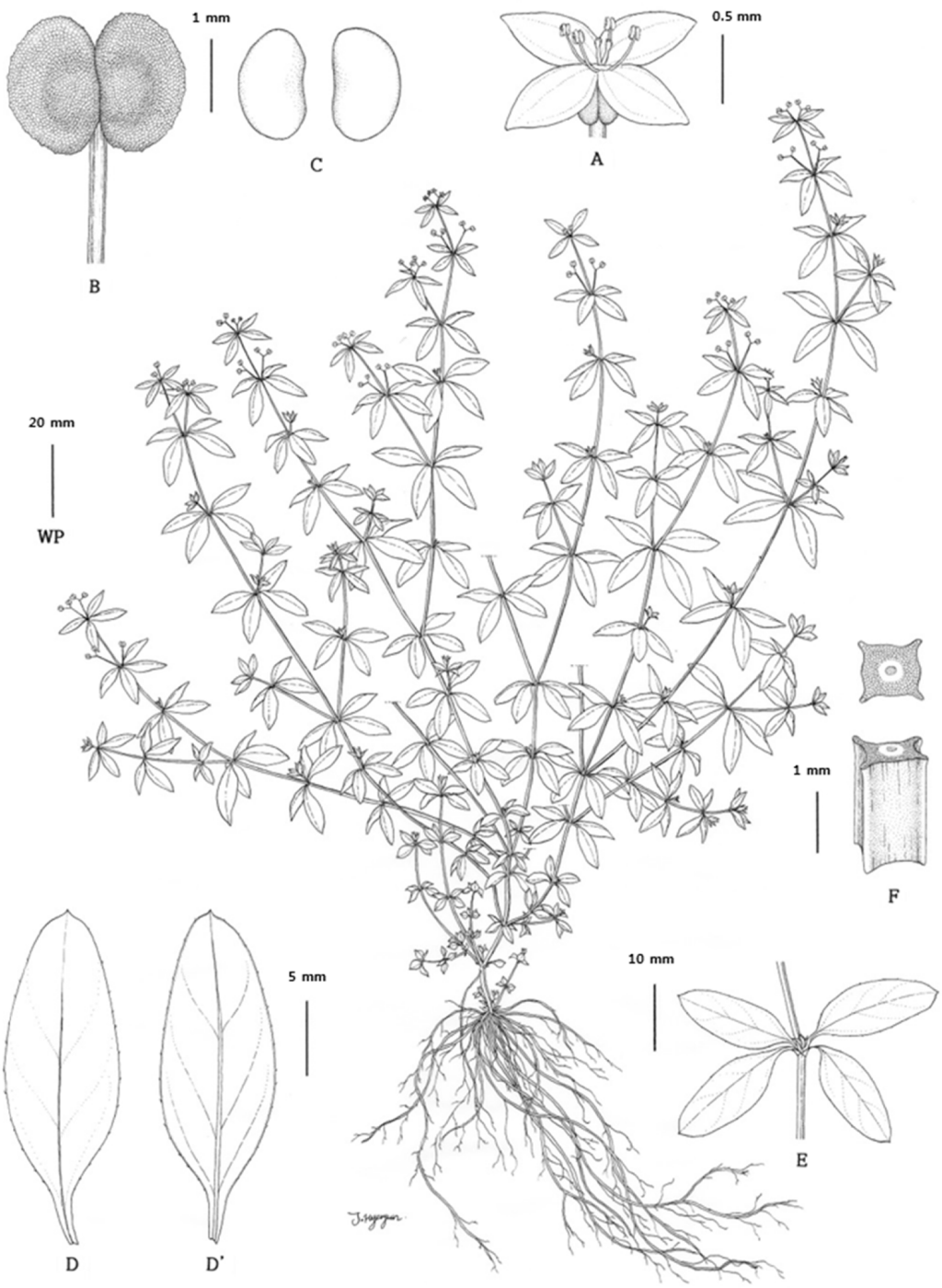

Fig. 1. *Galium bungei* var. *miltorrhizum* habit with a inflorescence and leaves on stem. **A.** Flower. **B.** Fruit. **C.** Seed. **D.** Leaf. **E.** Leaves at node. **F.** Stem. WP - Whole plant.

gracile var. *miltorrhizum* (Hance) Loes., B.B.C.-Bl. 37: 182, 1920; *Galium trachyspermum* var. *miltorrhizum* (Hance) T. Yamazaki., J. Jap. Bot. 66: 51, 1991.

Galium trachyspermum var. *nudicarpum* Honda, Bot. Mag. Tokyo 53: 385, 1939.

Korean name: Dung-geun-ne-ip-gal-kwi (둥근네잎갈퀴).

Plants annual or biennial herbs; rhizomes slender with a papery fibrous; commonly 10–18 cm tall. Stems erect or sometime decumbent at fruiting times, usually dichotomously

branching, branched from tip of reddish fibrous roots; 0.1–0.2 mm diam. angles slender, 4-angled, glabrous. Leaves in whorls of 4, simple, exstipulated, 2 leaves are bigger than others; petiole less than 0.5 cm, subsessile in lower leaves, 1-veined, ovate-obovate or broadly lanceolate, 8–24 × 5–7 (8) mm, apex cuspidate with very short hyaline apiculum ca. 0.1 mm long, base attenuate, upper surface dull, glabrous, lower surface glabrous, inconspicuous scabrous glandular cell, rarely papillate on the upper and lower vein; margins entire, subrecurved or narrowly revolute, glabrous or with a few to several minute hairs on margins. Inflorescences terminal and/or axillary, cymose to paniculate, congested to lax, cymes predominantly 2, 3-flowered or few to several flowered, peduncles erect, slender, quadrangular, glabrous, 0.3–1.2 cm at flowering, 1.5–3.0 cm in fruit, sometimes glandular cells, pedicel erect, capillary, slender, glabrous, 0.1–0.2 cm, bracts none. Flowers small, hermaphrodite, calyx absent; corolla yellowish green, rotate, 1.0–2.2 mm in diam., glabrous; lobes 4, petals ovate or oblong, apex acute, shortly attenuate and curved outward, margins entire; androecium with 4 stamens filament slender, adnate to the corolla, glabrous, 0.1–0.3 mm, anther ovate to elliptic, 0.1–0.2 mm. Ovary globose, 0.9–1.5 × 1.5–2.3 mm, composed of two mericarps, surface generally dull, glabrous; style 0.3–0.5 mm, two-branched, stigma capitate. Fruit schizocarp; mericarps 1.5–2.3 mm long, reniform, glabrous, rarely short papillate, purple to brown. Seeds reniform yellow to yellow-brown.

Flowering: Apr. to Sep.

Distribution: China, Japan, Korea.

Specimens examined: CHINA. Shijiazhuang, 23 Apr 1997, *Deng & Fang 11002* (PE); Hengren County, 21 Jun 2001, *Z. Hu 59* (PE).

KOREA. Gyeonggi-do: Pocheon-si, 27 Sep 2016, *K.S. Jeong KS2016058* (KH); Chungcheongbuk-do: Danyang-gun, 13 Jun 2016, *J.K. Shin Shin20160523* (KH); Jeollabuk-do: Namwon-si, 22 Aug 2012, *K.S. Jeong et al. KS20120308* (KNU); Gyeongsangbuk-do: Gimcheon-si, 23 Jun 2012, *K.S. Jeong et al. KS20120589* (KNU); Gyeongsangnam-do: Sancheong-gun, 2 Oct 1902, *T. uchiyama s.n.* (TI); Sancheong-gun, 20 Jul 2008, *K.S. Jeong 200820589* (KNU).

Taxonomic note: Hance (1868) published a new species, *Galium miltorrhizum* Hance, characterized by leaves in whorls of 4 and glabrous ovaries and fruits, for the flora of China. However, Yamazaki (1991) treated this taxon as synonym of *Galium trachyspermum* var. *nudicarpum* Honda, which occurs in Japan, based on glabrous ovaries and mericarps. In addition, Yamazaki (1991) regarded *Galium trachyspermum* A. gray as a distinct species from *G. bungei* based on curved short antrorse hairs on their mericarps (Yamazaki, 1991). Meanwhile, Chen and Ehrendorfer (2011) treated *Galium trachyspermum* A. Gray as a variety of *G. bungei,* which has hooked hairs on the surface of its mericarp according to the classification of Cufodontis (1940).

The Dung-geun-ne-ip-gal-kwi which was first reported in Korea, is similar to varieties of *G. bungei*. in having whorls of 4 leaves and terminal or (and) axillary cymes. This taxon includes annual or perennial herbs that are all glabrous except for minute hairs on leaf margins. It is distinguished from other varieties of *G. bungei* recognized by Chen and Ehrendorfer (2011) by glabrous stems, ovaries and mericarps (Fig. 2). Additionally, this taxon differs drastically from *G. bungei* by having glabrous mericarps with mostly sparse indumentum of minute papillae. *Galium bungei* var. *miltorrhizum* can be easily distinguished from *Galium bungei* var. *angustifolium* (Loesener) Cufodontis by having ovate-obovates and broad lanceolate leaves with short petioles while *Galium bungei* var. *angustifolium* have narrow lanceolate leaves. We propose a new combination name for this unrecorded plant species, *Galium bungei* var. *miltorrhizum* (Hance) Jeong & Pak, according to Cufodontis (1940)'s work. This variety grows

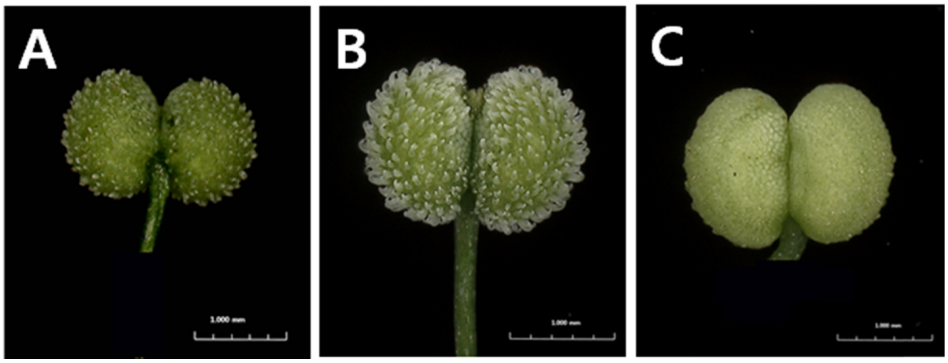

Fig. 2. Phtographs of fruit. *Galium bungei* var. *trachyspermum* (**A**), *Galium bungei* var. *angustifolium* (**B**), *Galium bungei* var. *miltorrhizum* (**C**) (scale bars=1 mm).

predominantly on mountain slopes in mixed forests and humid areas. It occurs with more than 30 individuals in a mixed forest on mountain slopes in Pocheon-si, Gyeonggi-do along with *Pinus koraiensis* Siebold & Zucc., *Quercus variabilis* Blume, *Rubus oldhamii* Miq., *Galium dahuricum* Turcz., *Erythronium japonicum* (Balrer) Decne., *Primula sieboldii* E.Morren. We also found a population of the species in forests with altitudes of c. 1,100 m in Sancheong-gun, Gyeongsangnam-do growing with *Acer pseudosieboldianum* (Pax) Kom., *Sasa borealis* (Hack.) Makino, *G. dahuricum*, *Persicaria filiformis* (Thunb.) Nakai ex Mori, *Rubus crataegifolius* Bunge. This given name for this taxon 'Dung-geun-ne-ip-gal-kwi' is based on shapes of leaves.

Key to the *Galium* sect. *Platygalium* in Korea

1. Corolla white, leaves more than 3 cm long, 3-veined
   2. Mericarps covered hooked hairs, plant less than 10 cm ····· *G. kamtschaticum* var. *yakusimense* (Masamune) Yamazaki (털둥근갈퀴)
   2. Mericarps clothed pubescence or glabrous, plant more than 15 cm
      3. Mericarps clothed pubescence (or glabrous), leaves oblong-lanceolate, apex acute ····· *G. boreale* L. (긴잎갈퀴)
      3. Mericarps glabrous, leaves ovate, apex acuminate ····· *G. kinuta* Nakai & Hara (민둥갈퀴)
1. Corolla yellowish green, leaves less 3 cm long, 1-veined
   4. Leaves linear-lanceolate, mericarps spreading uncinate trichomes ·· *G. pogonanthum* Franch. & Sav. (산갈퀴)
   4. Leaves ovate-oblong, mericarps glabrous or short upward sub-appressed hairs
      5. Mericarps covered curved short upward sub-appressed hairs, leaves 5–18 × 3–6 mm ····· *G. bungei* var. *trachyspermum* (A. Gray) Cufodontis (네잎갈퀴)
      5. Mericarps glabrous (or rarely short papillate), leaves 8–17 × 4–7(8) mm ····· *G. bungei* var. *miltorrhizum* (Hance) Jeong & Pak (둥근네잎갈퀴)

Acknowledgments

This study was supported by the Korea National Arboretum project 'KNA1-1-13, 14-1.'

Literature Cited

Chen, T. and F. Ehrendorfer. 2011. *Rubia*. *In* Flora of China. Vol 19. Cucurbitaceae through Valerianaceae, with Annonaceae and Berberidaceae. Wu, Z.-Y., P. H. Raven & D. Y. Hong (eds.), Science Press, Beijing and Missouri Botanical Garden Press, St. Louis, MO. Pp. 104–141.

Cufodontis, G. 1940. Revision der ehinesisehen *Galium*-Arten. Oesterreichische Botanische Zeitschrift 89: 211–251.

Dempster, L. T. and G. L. Stebbins. 1968. A cytotaxonomic revision of the fleshy-fruited *Galium* species of the Californias and southern Oregon (Rubiaceae). University of California Publications in Botany 46: 1–52.

Dempster, L. T. 1981. The genus *Galium* (Rubiaceae) in South America, II. Allertonia 2: 393–426.

Ehrendorfer, F., F. Krendl and C. Puff. 1976. *Galium* L. *In* Flora Europaea, Vol. 4. Tutin, T. G., V. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters & D. A. Webb (eds.), Cambridge University Press, New York. Pp. 14–36.

Ehrendorfer, F. and E. Schönbeck-Temesy. 1982. *Galium* L. *In* Flora of Turkey and the East Aegean Islands, Vol. 7. Davis P. H. (ed.), Edinburgh University Press, Edinburgh. Pp. 767–849.

Ehrendorfer, F., E. Schönbeck-Temesy, C. Puff and W. Rechinger. 2005. Rubiaceae. *In* Flora Iranica. No. 176. Rechinger, K. H. (ed.), Verlag des Naturhistorischen Museums Wien, Vienna. Pp. 1–287.

Elkordy, A. M. and I. A. Schanzer. 2015. Fruit morphology in *Galium* section *Platygalium* (Rubiaceae) and its potential taxonomic significance. Turczaninowia 18: 82–89.

Hance, H. F. 1868. *Sertulum chinense*: a decade of interesting new Chinese plants. Journal of Botany, British and Foreign, London. 6: 114–116.

Pobedimova, E. G. 1958. *Galium* L. *In* Flora USSR. Vol. 23. Schischkin, B. K. (ed.), Academiia Nauk SSSR, Moscow and Leningrad. Pp. 287–381.

Yamazaki, T. 1991. Notes on the infraspecific taxa of *Galium* in eastern Asia. Journal of Japanese Botany 66: 49–52.

Yamazaki, T. 1993. Angiospermae. Vol. IIIa. *In* Flora of Japan. Iwatsuki K., T. Yamazaki, E. B. David & H. Ohba (eds.), Kodansha, Tokyo. Pp. 233–240.