



## Taxonomic identity of *Dioscorea coreana* (Prain & Burkill) R. Kunth

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**ABSTRACT:** The identity of *Dioscorea coreana* (Prain & Burkill) R. Kunth is recognized during the re-identification process of Korean *Dioscorea* specimens. Given the relatively few pieces of information, including few descriptions and research papers, this species has been misidentified as *D. tokoro*, which has a similar leaf shape, but *D. coreana* is distinguished from *D. tokoro* by the absence of a pedicel in the male flower, the green color of the tepal, and the shapes of the fruit and seed. Thus, detailed descriptions, illustrations, and photographs of *D. coreana* and a key to the Korean *Dioscorea*, including this species, are presented.

**Keywords:** *Dioscorea coreana*, *D. tokoro*, pedicel, tepal, fruit, seed

*Dioscorea* L. belongs to Dioscoreaceae of Liliales, and ca. 600 species of this genus are distributed mainly in tropical regions, East Asia, the Mediterranean coast, and North and South America (Coursey, 1969; Li et al., 1978; Ohwi, 1984; Im, 2000; Lee, 2006). The species of this genus had been described first by Linnaeus (1753) as a morphological difference of leaves, and the type of underground parts, the presence of bulbil, the shape of the leaves and flowers, the shape of the fruits and seeds had been treated as the main traits of the taxa among the genus (Knuth, 1850; Beccari, 1870; Engler and Prantl, 1897; Burkill, 1960). Recently, molecular research using DNA sequences have led to the debate about the relationships and evolutionary trends among the taxa in the genus (Wilkin et al., 2005; Gao et al., 2008; Hsu et al., 2013; Gawande et al., 2015).

After *D. tenuipes* Franch. & Sav. had been recorded first by Palibin (1901), eight species of *Dioscorea*, *D. polystachya* Turcz., *D. japonica* Thunb., *D. nipponica* Makino, *D. quinquelobata* Thunb., *D. tokoro* Makino ex Miyabe, *D. septemloba* Thunb., *D. bulbifera* L., are distributed in Korea (Lee, 2003; Lee, 2006; Oh and Lee, 2007), but the habitats of *D. septemloba* Thunb., and *D. bulbifera* L. is unclear in

Korea (Chung and Chung, 2016).

Conversely, *Dioscorea coreana* (Prain & Burkill) R. Kunth is recognized as an accepted name and distributed in Korea on Internet search sites of the scientific name (e.g., <http://plantsoftheworldonline.org>, <http://www.theplantlist.org>, <http://gbif.org>, etc.), but this species was only mentioned as the scientific name *D. coreana* Kunth by Lee (1976). Also, this species is called Pu-Reun-Ma as a common name without taxonomic reviews (Kim et al., 2016; Chung et al., 2017; KNA, 2017; Kim et al., 2019). But the identity of *D. coreana* is recognized during the re-identification process of the Korean *Dioscorea* specimens. Thus, the purpose of this study was to provide detailed descriptions, illustrations, and photographs of the taxa and a key of Korean *Dioscorea* including this species.

### Taxonomic Treatment

*Dioscorea coreana* (Prain & Burkill) R. Kunth in Engl., Pflanzenr. 87: 175, 1924.

*Disocrea villosa* L. var. *coreana* Prain & Burkill, J. Proc. Asiat. Soc. Bengal 10: 15, 1914.—**TYPE:** Korea. Prov.

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Incheon, May 1884, *W. R. Carles 178* (holotype: K!).

Herbs unisexual, perennial, vine, dioecious. Rhizomes horizontal, subcylindrical. Roots fibrous, came out from lower side of rhizomes. Stems twining to left, grooved, smooth. Bulbils absent. Leaves alternate, rarely whorled, unicellular hair, petiole 5.3–9.3 cm long, base non-protuberance; leaf blade cordiform, 5.9–8.6 × 4.3–7.7 cm, apex acuminate, base cordate. margin entire. Male Inflorescences spike, 4.6–9.2 cm long, absent pedicel. Female Inflorescences spike, 4.1–7.5 cm long, absent pedicel. Male Flowers green, 1.6–2.1 × 3.3–4.2 mm; outer tepals narrowly-ovate, 2.2–2.5 × 1.2–1.5 mm; inner tepals narrowly-ovate, 2.1–2.5 × 1.1–1.5 mm; stamens 6, 0.7–0.9 × 0.1–0.2 mm; anther 0.5–0.6 × 0.2–0.3 mm, in frank position. Female Flowers green, 2.0–2.6 × 2.4–3.2 mm; outer tepals narrowly-ovate, 1.5–2.0 × 0.9–1.2 mm; inner tepals narrowly-ovate, 1.4–2.0 × 0.8–1.2 mm; ovary 4.4–5.2 × 1.3–1.9 mm; staminodes 6; pistil 3-lobed, 0.7–0.9 × 0.6–0.9 mm; stigma not cracked. Fruits capsule, ovate-globose, erect, 3-winged, 21.5–25.1 × 25.5–30.5 mm. Seeds 4.5–5.8 × 3.8–4.5 mm, situated at center of the membranous wing; wings 8.8–11.2 × 14.1–16.1 mm, hemispheric.

**Korean name:** Pu-Reun-Ma (푸른마).

**Flowering:** May to Jun.

**Fruiting:** Jun to Jul.

**Distribution:** Restricted to Korea.

**Korea:** Endemic (Gyeonggi-do, Gangwon-do, Gyeongsangbuk-do, Chungcheongnam-do).

**Specimen examined:** KOREA. Gyeonggi-do: Maoksan Mt., 26 May 2007, *G. Y. Chung et al.*, ANH-0009175 (ANH), Paldalsan Mt., 31 May 1967, *T. B. Lee*, 00072835 (SNUA). Gangwon-do: Jangseongsogak-Park, 28 May 2010, *S. H. Cho and Y. I. Kim*, *YoungdongKim 2010-0029* (HUH), Deungseon-falls, 27 May 1995, *H. G. Lee et al.*, 0003645 (HUH), Yonghwasan Mt., 30 May 1998, *D. M. Choi et al.*, 0003644 (HUH), Geumbyeongsan Mt., 19 Jun 2007, *G. E. Yu*, 063114 (KWNU), Hugogyaksu, 4 Jun 1999, *C. S. Chang*, 00070596 (SNUA), Cheongnyeongpo, 13 Aug 2004, *J. M. Chung et al.*, 04080073 (KH), Garisan Mt., 15 Jun 2011, *K. O. Yoo et al.*, *koyoo0118* (KH). Chungcheongbuk-do: Guryongsan Mt., 17 May 1997, *B. U. Oh et al.*, 07317 (CBU), Geumdangsan Mt., 22 May 1999, *C. S. Chung et al.*, 04202 (CBU),

Gaseopsan Mt., 30 Apr 2000, *S. H. Paeng et al.*, 04204 (CBU), Dutasan Mt., 25 May 2002, *B. U. Oh et al.*, 04206 (CBU), Seondosan Mt., 31 May 1997, *B. U. Oh et al.*, 08908 (CBU), Ingyeongsan Mt., 21 May 2011, *B. U. Oh et al.*, 22620 (CBU), Sosokisan Mt., 13 May 2005, *B. H. Oh et al.*, *eumseonggun (sosogisan)-0505* (KH). Chungcheongnam-do: Sanan-ri, 11 Jun 2006, *E. S. Jeon*, *esjeon60608* (KH). Gyeongsangbuk-do: Podosan Mt., 7 Jul 2007, *G. Y. Chung et al.*, ANH-0001504 (ANH), Muposan Mt., 2 Oct 2010, *G. Y. Chung et al.*, ANH-000012103 (ANH), Joosan Mt., 20 May 1999, *D. R. Choi and S. G. Kwon*, 00072844 (SNUA), Bibongsan Mt., 6 Aug 2000, *S. W. Lee et al.*, 218 (KNU), Gallasan Mt., 6 Jun 2008, *M. S. Park*, ANH-000014010 (ANH), Maengdongsan Mt., 28 Aug 2006, *G. Y. Jeong*, *Jeong210* (KH), Jachosan Mt., 13 May 2010, *G. Y. Chung et al.*, ANH-100513125 (ANH).

**Taxonomic note:** After being recorded as *Dioscorea* sp., based on the specimen (Carles, 178) collected in May 1884 at Incheon Chemulpo by Wright (1903), *D. coreana* was reported as *Dioscorea* sp. by Nakai (1911), who cited Wright's statement. Later, this taxon was reported as *D. villosa* var. *coreana* by Prain and Burkill (1914), because this taxon was similar to *D. villosa*, but the fruits of this taxon had a patternless, shiny trait. But *D. coreana* as a new combination name was announced by Kunth (1924). Since then, only the scientific name has been mentioned by Lee (1976), there is no mention of this species in books and papers at home and abroad. In the studies of Korean *Dioscorea* (Kang et al., 1992; Oh et al., 1995, 1996; Chung and Chung, 2016), *D. coreana* may be misidentified as *D. tokoro*. The reason for the misidentification is because the two species have a relatively similar leaf as heart shape and morphological information of *D. coreana* was scant except for the original description. In this study, *D. coreana* is distinguished from *D. tokoro* by the absence of the pedicel in the male flowers, the green color of tepal, the ovate-globose shape of the fruit, and the hemispherical shape of the membranous wing surrounding the seeds (Table 1, Figs. 1, 2, 3).

After checking the voucher specimens in the domestic herbaria to confirm the distributional information of *D. coreana* and *D. tokoro*, *D. coreana* has been found to grow natively in Gyeonggi, Gangwon, Chungbuk, Chungnam, and

**Table 1.** Comparison of morphological characters between *Dioscorea coreana* and *D. tokoro*.

Taxon	MI	MIP	FC	TS	FS	SPW	WS
<i>D. coreana</i>	Spike	Absent	Green	Ovate	Ovate-globose	Center	Hemispheric
<i>D. tokoro</i>	Raceme	Present	Yellowish	Obovate	Obovate-elliptic	One-side	Eliptical

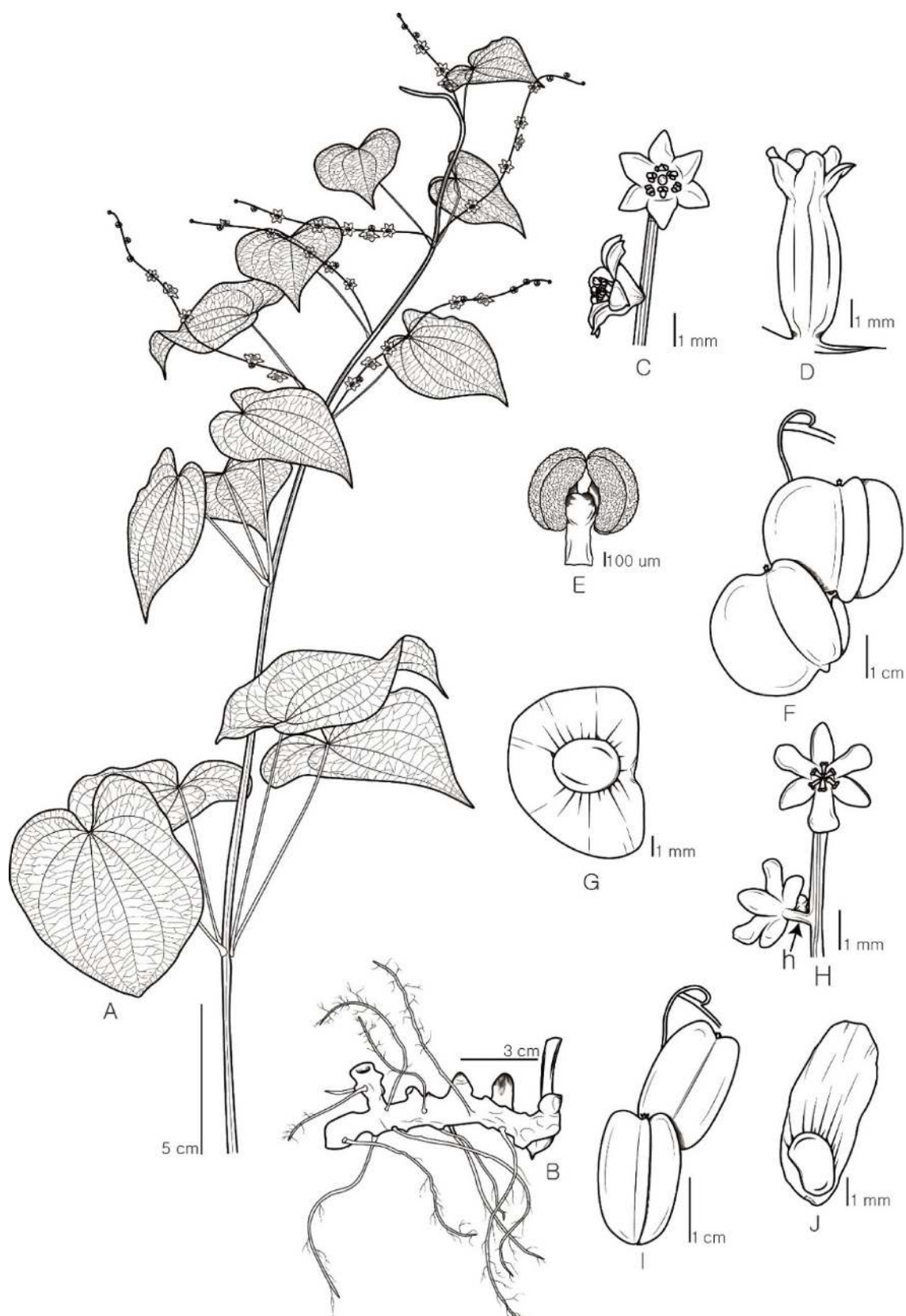
MI, male inflorescence; MIP, male inflorescence pedicel; FC, flower color; TS, tepal shape; SPW, seed position wing; WS, wing shape.



**Fig. 1.** Photographs of *Dioscorea coreana* (Prain & Burkill) R. Kunth. **A.** Habit. **B.** Rhizome. **C.** Flower (♂). **D.** Flower (♀). **E.** Fruit. **F.** Seed.

Gyeongbuk but not in Gyeongnam, Jeonbuk, Jeonnam, and Jeju (Fig. 4). Conversely, *D. tokoro* was unable to confirm the distribution in Korea. Some specimens of *D. tokoro* are identified as *D. coreana*, and the other specimens from southern region are identified as *D. polystachya* or *D. tenuipes*.

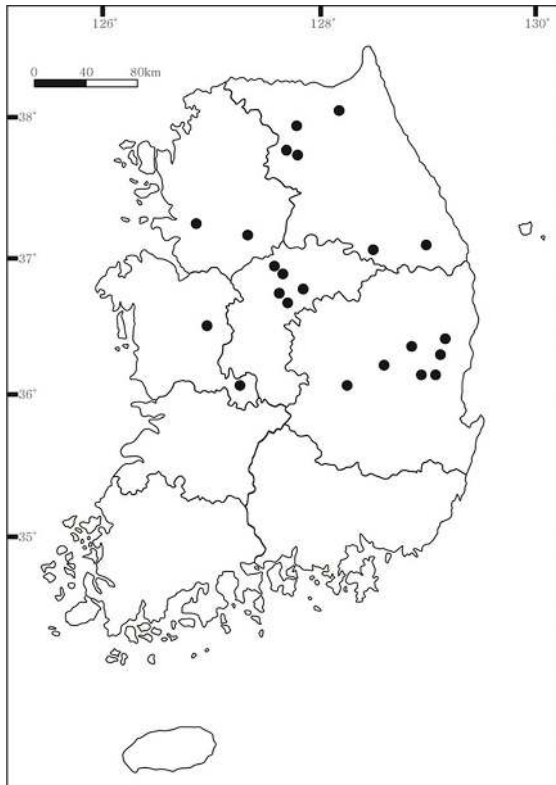
Considering the geographical characteristics of China and Japan (Ding and Gilbert, 2000; Iwatsuki et al., 2016) around the Korean Peninsula, *D. tokoro* may be distributed in Korea. So if this is considered, the distributional surveys of *D. tokoro* are needed.



**Fig. 2.** Illustrations of *Dioscorea coreana* and *D. tokoro*. **A–G.** *D. coreana*. **A.** Habit. **B.** Rhizome. **C.** Flower (♂). **D.** Flower (♀). **E.** Stamen. **F.** Fruit. **G.** Seed. **H–J.** *D. tokoro*. **H.** Flower (♂), h, male inflorescence pedicel. **I.** Fruit. **J.** Seed.



**Fig. 3.** Holotype of *Dioscorea coreana* and *D. tokoro*. **A.** *D. coreana* (Prain & Burkill) R. Kunth (in K herbarium). **B.** *D. tokoro* Makino ex Miyabe (in DAO herbarium). **C.** Label of *D. coreana*. **D.** Label of *D. tokoro*.



**Fig. 4.** Distribution of *Dioscorea coreana* (Prain & Burkill) R. Kunth in Korea.

**Key to Korean *Dioscorea* L.**

1. Rootstock vertical, tuber, bulbil
  2. Leaves deltate, male flower peduncle zigzagged, fruit 16.6–17.9 mm wide ..... *D. polystachya* 마
  2. Leaves triangular, male flower peduncle straight, fruit 24.6–29.5 mm wide ..... *D. japonica* 참마
1. Rootstock horizontal, rhizome, non-bulbil
  3. Protrude papillae at axillary
    4. Leaves 1–4 pair lobed, tapal non-reflexed-shape ..... *D. quinquelobata* 단풍마
    4. Leaves margin entire, tapal reflexed-shape ..... *D. tenuipes* 각시마
  3. Non protrude papillae at axillary
    5. Leaves 1–4 pair lobed ..... *D. nipponica* 부채마
    5. Leaves margin entire
      6. Male inflorescence raceme, present pedicel on the male flower, flower color yellowish, seeds situated at base of the membranous wing ..... *D. tokoro* 도꼬로마
      6. Male inflorescence spike, absent pedicel on the male flower, flower color green, seeds situated at center of the membranous wing ..... *D. coreana* 푸른마

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## Conflict of Interest

The authors declare that there are no conflicts of interest

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