

Soapberries Belonging to the Genus *Cardiospermum* L. (Sapindaceae) from Taiwan

台灣倒地鈴屬(無患子科)植物之分類

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Abstract

Soapberries of the genus *Cardiospermum* (Sapindaceae) comprises 15 species worldwide with only a species that has been reported from Taiwan. In our recent plant inventory surveys, *Cardiospermum grandiflorum* Sw. that is native to America was found to be naturalized in the central Taiwan. This paper briefly describes the two species with a key and photographs for their identification.

摘要

倒地鈴植物為無患子科的一個屬共有 15 種。台灣植物誌第二版記載了 1 種，最近我們發現另一種原產於美洲的大花倒地鈴(*Cardiospermum grandiflorum* Sw.)歸化於台灣中部。本文提供台灣產倒地鈴屬的檢索表、描述、分布及彩色照片。

Key words: *Cardiospermum*, *Cardiospermum grandiflorum*, Naturalized plant, Sapindaceae, Taiwan, Taxonomy

關鍵詞：倒地鈴屬、大花倒地鈴、歸化植物、無患子科、台灣、分類

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Introduction

The family Sapindaceae (soapberry) *sensu lato* comprises 141 genera and about 1,900 species worldwide (Acevedo-Rodriguez *et al.* 2011). Most of them are found in tropical and subtropical regions with a few genera in the sub-temperate region. In a broader view, Sapindaceae (*sensu lato*) often incorporates the families Aceraceae and Hippocastanaceae (Harrington 2005).

Cardiospermum L. (tribe *Paullinieae*) is characterized by inflated capsules and consisted of approximately 15 species (Acevedo-Rodriguez *et al.* 2011) of herbaceous vines and some

subshrubs in the Neotropic region (Ferrucci and Urdampilleta 2011). The centers of their distribution are in the west-central Brazil and the north-central Mexico (Ferrucci and Acevedo-Rodriguez 1998) with three nearly cosmopolitan species (Ferrucci and Urdampilleta 2011).

In Taiwan only one species of *Cardiospermum*, *C. halicacabum* L., was previously known (Chen 1993). In our recent field survey, an additional vinyl species *C. grandiflorum* Sw. was found to have been naturalized in Taiwan. This paper describes the two species and provides a key and field photograph for the identification.

Taxonomic Treatment

Cardiospermum L. 倒地鈴屬

Cardiospermum L., Sp. Pl. 1: 366-367. 1753. Type: *Cardiospermum halicacabum* L.

Key to the species of *Cardiospermum* in Taiwan

- A1: Plant with dense yellow hairs; flowers 8-10 mm long; filaments glabrous; fruits acute at both ends *C. grandiflorum*
- A2: Plant with sparsely or densely white hairs; flowers 2-4 mm long; filaments villous; fruits obtuse at apex and acute at base *C. halicacabum*

Cardiospermum grandiflorum Sw., Prodr. 64.
1788. 大花倒地鈴 Figs. 1, 2.

Cardiospermum grandiflorum Sw. forma *hirsutum*
(Willd.) Radlk., Sitz.-Ber. Bayer. Akad. 8:
260. 1878.

Cardiospermum hirsutum Willd., Sp. Pl. ed. 4.
2(1): 467. 1799.

Description: Monoecious liana; tendrils axillary. Stems cylindrical with dense hairs. Leaves alternate, biternate and estipulate. Petioles 2-2.5 cm long, cylindrical, with dense hairs. Leaflets 9, membranous, sessile, with sparse hairs on both surfaces; apex acuminate, base attenuate, margin serrate and pinninerved. Inflorescences axillary; peduncles long. Flowers unisexual; buds green. Sepals 4: 2 large and 2 small, glabrous, green; large ones ca. 8 mm long, 5 mm wide; small ones ca. 2 mm long, 3 mm wide. Petals 4, ca. 8 mm long, 5 mm wide, white, glabrous, fused at base, each bearing 1 appendage at base; appendages slightly shorter than petals, 6-7 mm long, white at base and yellow at apex, enclosing stamens or pistil. For staminate flowers, stamens 8, fused at base; filaments white, 6-8 mm long, hairy at base; anthers 2-celled, 1mm long, basifixed, white, glabrous, longitudinally dehiscent; appendages 2, free, 3 mm long. For pistillate flowers, same shape as staminate flowers but with longer pedicel. Sterile stamens 8, 2 mm long, glabrous; appendages 2, hairy. Ovary densely pilose, 3 mm long, 3-celled; placentation axile. Ovules 1 per cell. Style 1, 3-partite, 2 mm long, sparsely pubescent; stigmas plumose, 1.5-2 mm long.

Ripe ovary swollen. Capsules fusiform, 3.5 cm across, 5.5 cm long, with dense hairs, apex acute, calyx and the two appendages persistent. Seeds 3, globose, 7 mm across, black-brown in color.

Specimen examined: TAIWAN. Nantou County: Lugu Hsiang (鹿谷鄉), Alt. 250 m, 9 March 2006, *T. W. Hsu 12125* (TAIE), Lugu Hsiang (鹿谷鄉), Alt. 400 m, 3 April 2012, *T. W. Hsu 17283* (TAIE) .

Distribution and notes: *C. grandiflorum* is widely distributed in its native Neotropical region from southern Mexico to Brazil and in the Caribbean islands. It is considered as a noxious weed in Australia (Carroll *et al.* 2005) and in South Africa (Olckers 2004). It has been newly naturalized along forest edges in the central Taiwan. Its broadly spindle-shaped and inflated fruits are septicidal and septifragal. The dissepiments split into three elliptic membranous wings, which are nearly the same length and width as the fruit. Each seed is well affixed to the centre of one of these wings. This differs from the dispersal of *C. halicacabum* of that fruits are more strongly inflated; more globular or even broader like little balloons (Adema *et al.* 1994).

Cardiospermum halicacabum L., Sp. Pl. 366.
1753; Forbes & Hemsl., J. Linn. Soc., Bot.
23: 138. 1886; Chen, Fl. Taiwan 2nd edn.
3:601. 1993. 倒地鈴 Fig. 3.

Cardiospermum halicacabum L. var. *microcarpum*
(Kunth.) Blume, Rumphia 3:130. 1847.

Cardiospermum microcarpum Kunth., Nov. Gen.

Sp. (quarto ed.) 5:81. 1821; Kurita, Bot. Mag. Tokyo 2:230. 1888.

Cardiospermum luridum Blume, Rumphia 3:184. 1847.

Cardiospermum halicacabum L. var. *luridum* (Blume) Adelb., Blumea 6:322. 1948.

Description: Rambling monoecious herb; tendrils axillary; stems sulcate, green or purple red in color; young stems pubescent. Leaves alternate, biternate, subdeltooid, 6.5-10 cm long, 6-16 cm wide. Petioles green or purple red in color, grooved, pubescent, 1.8-8 cm long, 1.2-2 mm across; petioles of pinnae 1.2-3 cm long, 0.8-1.5 mm across; petiolules 2-10 mm long. Leaflets ovate to rhombic ovate, 2-5 cm long, 1.3-3.7 cm wide, thinly chartaceous, green adaxially, yellow green abaxially, pubescent on both surfaces; apex acute; base obtuse or rounded, decurrent as wings; margin coarsely serrate, ca. 3-6 teeth on each side. Midrib impressed adaxially, elevated abaxially. Lateral veins 5-7 on each side of midrib. The base of lateral leaflets oblique. Inflorescences axillary, cymule or cyme, almost flowering on all nodes. The basal-most pair of lateral axis turned into tendrils; tendrils ca. 1.8-3 cm long, green, spiral. Peduncles 6.5-11 cm long, pubescent; pedicels 5-7 mm long. Bracts 2, green, elongate-ovate or elongate-deltoid, pubescent; one at tendrils, green, pubescent, ca. 1mm long, 0.6 mm wide; the other ca. 1.6 mm long, 0.6 mm wide. Bracteole elongate ovate or elongate deltoid, pubescent, green white tinged purple red, ca. 1mm long, 0.5 mm wide. Buds obliquely ovoid, light purple red to yellow white, 1.1-2.5

mm across. Flowers unisexual, zygomorphic, white, white tinged red or white tinged green, ca. 5 mm across. Sepals 4, 2 large and 2 small; small ones arc like, ca. 1.6 mm long and wide; large ones ovate, ca. 3.2 mm long, 1.7 mm wide. Petals 4, white, obovate, ca. 3.3 mm long, 2.5 mm wide; each with 1 appendage. Appendages obovate, 1.7-2.1 mm long, 1.3-1.5 mm wide; two pure white and the other two white with yellow apex. For staminate flowers, stamens 8, filaments free, grouped aside; appendages 2, opposite to the stamens. For pistillate flowers, staminodes 8, filaments white, subequal, 1.8-2.2 mm long, hairy. Anthers light yellow, 2-celled, versatile. Ovary 3-celled, hypogynous, placentation axile. Ovules 1 per cell, light green, tri-prismatic globose. Style white, ca. 0.4 mm long. Stigma 3 forked, white translucent, ca. 0.8-1mm long. Carpodiums green, 2-2.6 mm long. Fruits tri-prismatic globose, sac like, 3 celled. Seeds 1 per cell, globose, 4-5.3 mm across, black when ripen; hilum white, cordate.

Specimen examined: TAIWAN. Taipei: Shihlin, *Nakamura-Taizo* s.n. (TAI). Taichung: Toupienkeng, *Kuang-Yuh Wang* 798 (HAST). Changhua County: Pakuashan, *S. F. Huang* 4610 (TAI). Nantou County: Jiji, Alt. 235 m, *T. W. Hsu* 17147 (TAIE). Yunlin County: Taihsi, *J. C. Wang* 2547 (TAI). Chiayi County: Chiayi Farm, *T. C. Huang* 14182 (TAI). Tainan County: Mado, *M. T. Kao* 10142 (TAI). Kaohsiung County: Meinung, *W.-F. Ho* 1606 (TAIF). Pingtung County: Kaoshu, *M. T. Kao* 9562 (TAI), Hengchun, *M. T. Kao* 7891 (TAI). Taitung County: Kanatoro, *Y. Yamamoto*,

K. Mori (TAI). Taitung County : Lanyu , Hungtous ,
T. C. Huang 9358 (TAI). Penghu County: Chimeitao,
S. F. Huang 110 (TAI)

Distribution and notes: *C. halicacabum* is probably American origin and a fairly common weed in the Tropic and Subtropic regions (Adema *et al.* 1994). Usually the flower developing first in every cymule is female, while the others are male (Adema *et al.* 1994). It has been commonly found on open wastelands and field lands at elevations less than 500 m in Taiwan. Forbes and Hemsley (1886) made the first record of *C. halicacabum* from Taiwan but did not cite its specimen. Kurita (1888) recorded the *C. microcarpum* Kunth from the southern Taiwan. *C. halicacabum* has slight variation in the sizes of flowers and fruits. *C. halicacabum* var. *microcarpum* has relatively smaller fruits, while *C. halicacabum* var. *luridum* has larger fruits. But these varieties do not deserve to be species status (Adema *et al.* 1994).

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Fig. 1. *Cardiospermum grandiflorum* Sw. (A. habitat; B. branch).



A



B



C



D

Fig. 2. *Cardiospermum grandiflorum* Sw. (A. pistillate flower, bar=5 mm; B. staminate flower, bar=5 mm; C. seedling; D. fruits, bar=1.8 cm).



A



B



C

Fig. 3. *Cardiospermum halicacabum* L. (A. habitat; B. pistillate flower, bar=2.5 mm; C. staminate flower, bar=2.5 mm).