

Cuscuta L. (Convolvulaceae) in Taiwan

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ABSTRACT: The genus *Cuscuta* (Convolvulaceae) in Taiwan is revised according to the results of the field investigations and examination of specimens at major herbaria. We recognize three species and two varieties of *Cuscuta* in Taiwan including *C. australis*, *C. campestris*, *C. chinensis*, *C. japonica* var. *formosana* and *C. japonica* var. *japonica*, in which, *Cuscuta chinensis*, a species neglected or unknown by many Taiwan authors, is introduced in detail. *Cuscuta campestris*, although collected as early as in 1964, is a new record. A key to the species and varieties of *Cuscuta* in Taiwan is provided based on the characteristics of reproductive organs, and maps of the presently known distribution of *C. campestris* and *C. japonica* var. *formosana* are also given.

KEY WORDS: Dodder, *Cuscuta australis*, *Cuscuta campestris*, *Cuscuta chinensis*, *Cuscuta japonica* var. *formosana*, *Cuscuta japonica* var. *japonica*, Taiwan.

INTRODUCTION

The dodders (genus *Cuscuta* L.) are parasitic plants belonging to the Convolvulaceae. Staples and Yang (1998) made the latest taxonomic treatment of *Cuscuta* in Taiwan. These authors treated two species and one variety, i. e., *C. australis*, *C. chinensis*, and *C. japonica* var. *formosana* in Taiwan. However, according to our field studies, examination of herbarium specimens, and a literature review (Yuncker, 1932; Lu, 1972; Chang, 1978; Fang and Huang, 1979; Liao and Tsai, 1990; Liao *et al.*, 1990; Liao *et al.*, 1991; Kuoh and Liao, 1993; Fang *et al.*, 1995; Staples and Yang, 1998), we recognize three species and two varieties of this genus in Taiwan. The key to five taxa and its descriptions are provided in this paper.

Key to Species and Varieties of *Cuscuta* in Taiwan

1. Style 1, stigmas 2, longer than broad.
 2. Corolla 3-5 mm long; stigma lobes tongue-shaped. 4a. *C. japonica* var. *japonica*
 2. Corolla 4-7 mm long; stigma lobes quadrangular. 4b. *C. japonica* var. *formosana*
1. Styles 2, stigma 1 per style, capitate.
 3. Capsule enclosed in corolla; calyx lobes ridged on outer surface. 3. *C. chinensis*
 3. Capsule exposed; calyx lobes not ridged.
 4. Corolla lobes obtuse; infra-staminal scales bifid. 1. *C. australis*
 4. Corolla lobes acute, often flexed upwards; infra-staminal scales exerted, fimbriate, not bifid. 2. *C. campestris*

1. *Cuscuta australis* R. Br., Prodr. Fl. Nov. Holl. 491. 1810; Chang, Fl. Taiwan 4: 351, pl. 1034. 1978. 菟絲子 Fig. 1A

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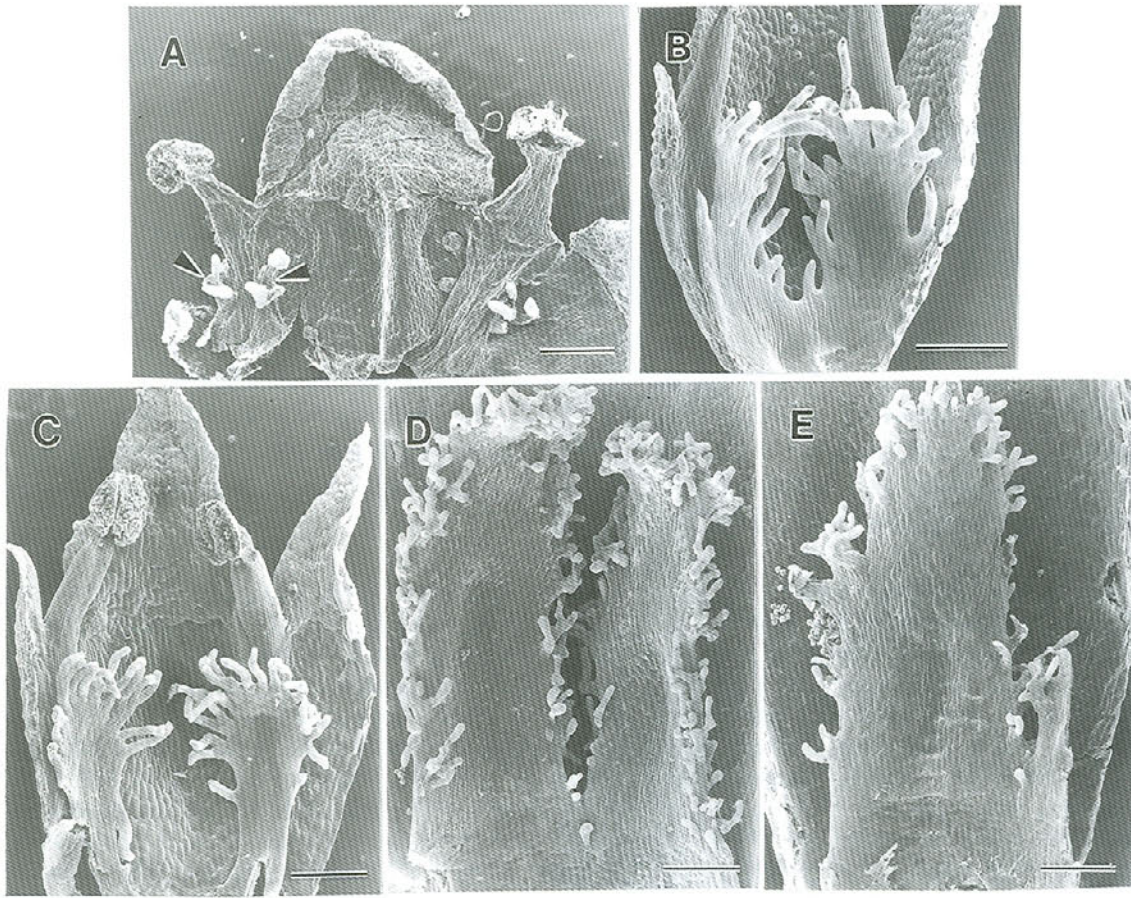


Fig. 1. SEM micrographs of infra-staminal scale of *Cuscuta*. A, *Cuscuta australis* (arrowheads); B, *C. campestris*; C, *C. chinensis*; D, *C. japonica* var. *formosana*; E, *C. japonica* var. *japonica*. (A, material collected from herbarium specimen of PPI; B-E, fresh materials collected from fields; bar=400 μ m)

Cuscuta obtusiflora Kunth var. *australis* Engelm., Trans. Acad. Sci. St. Louis 1: 492. 1859.

Cuscuta kawakamii Hayata, Icon. Pl. Formosan. 5: 125. 1915.

Herbs, parasitic. Stems twining, filiform, glabrous, yellowish, ca. 1 mm across. Leaves reduced to minute scales. Inflorescences lateral, compact clusters; bracts scaly. Flowers white; calyx cupular, 4 or 5-lobed, broadly elliptic to orbicular, often unequal, apex obtuse; corolla ca. 2 mm long, short-campanulate, 5-lobed, lobes broadly elliptic, apex rounded, erect; infra-staminal scales shorter than tube, deeply bifid, fimbriate; stamens exserted, anthers ovoid; ovary ellipsoid, locules 2, ovules 4; styles 2, slender, shorter than ovary; stigmas capitate. Capsules depressed-globose, 3-4 mm broad, with large interstyler opening; pericarp thin, irregularly opening, not circumscissile. Seeds 4, broadly ovate, ca. 1.5 mm long, yellowish brown, smooth.

Distribution: Europe, East and South Asia to Australia. In Taiwan, in the northern, central and southeastern parts.

Specimens examined: TAIPEI CITY: Yangmingshan, 1972, *Chang 6951* (PPI). TAIPEI HSIEN: 1910, *Shimada s. n.* (TAIF); 1910, *Kawakami & Shimada s. n.* (TAI); Hsintien, 1918, *Sasaki s. n.* (TAI); Tanshui, 1908, *Kawakami & Shimada s. n.* (TAIF). TAITUNG HSIEN: Hopingtsun, 1971, *Chang s. n.* (PPI). NANTOU HSIEN: 1906, *Kawakami s. n.* (TAIF).

Notes: Most collections were misidentified as *Cuscuta chinensis* Lam. in Taiwan.

2. *Cuscuta campestris* Yuncker, Mem. Torr. Bot. Club 18: 138. 1932.

平原菟絲子 Figs. 1B, 2, 4A

Cuscuta australis auct. non R. Br.: Liao *et al.*, Ann. Taiwan Mus. 33: 111-119. 1990; Liao *et al.*, Ann. Taiwan Mus. 34: 103-119. 1991; Kuoh & Liao, Taiwania 38: 99-108. 1993.

Herbs, parasitic. Stems twining, filiform, glabrous, yellowish to orange, ca. 1 mm across. Leaves reduced to minute scales. Inflorescences lateral, compact clusters; bracts scaly. Flowers white; calyx lobes 4-5, lobes broadly elliptic to orbicular, overlapping at the base, apex obtuse; corolla 2.5-3 mm long, short-campanulate, 4 or 5-lobed, lobes broadly triangular, apex acute, spreading horizontally, tips inflexed; infrastaminal scales big, exceeding bases of filaments, long fimbriate, often exserted; stamens exserted, anthers ovoid; ovary ellipsoid, locules 2, ovules 4; styles 2, slender; stigmas capitate. Capsules depressed-globose, ca. 3.8 mm broad; pericarp thin, irregularly circumscissile at the base. Seeds 2-4, broadly ovate, ca. 1.5 mm long, yellowish brown to brown, smooth.

Specimens examined: TAIWAN. CHILUNG CITY: Paotoutso, 1995, *Wang 02033* (HAST). TAIPEI CITY: 1978, *Huang 190* (TAI). TAIPEI HSIEN: Kuantu, 1979, *Yang 2628* (TAI); Kuanyinshan, 1983, *Peng 6037* (HAST); same loc., 1984, *Yang 345* (TAI); Linkao, 1984, *Yang 834* (TAI); Pali, 1979, *Lin 571*, *Yang 2370* (TAI); Shihmen, 1985, *Wang 3333* (TAI). TAOYUAN HSIEN: Hsiahaihu, 1996, *Liou 232* (HAST; TAIF); Kuanyin, 1996, *Liou 243* (TAIF); Shalun, 1994, *Chuang 175* (PPI); Tayuan, 1996, *Liou 242* (HAST; TAIF). HSINCHU CITY: 1983, *Peng 5158* (HAST); same loc., 1984, *Peng 6379* (HAST); same loc., 1991, *Leu 933* (HAST). HSINCHU HSIEN: Chupei, 1992, *Peng 15232* (HAST); Hsinfeng, 1999, *Liao 625* (NCKU); Lienhuassu, 1996, *Yang 4955* (TAIF); Longkang, 1964, *Chuang 3063* (TAI). MIAOLI HSIEN: Houlung, 1971, *Kuoh 2607*, *2608* (TAI); same loc., 1972, *Huang & Kao 6003* (TAI); same loc., 1977, *Ou & Kao 8840* (TAI); same loc., 1978, *Chang 2417* (TAIF); Tunghsiao, 1988, *Peng 11575* (HAST); Yuanli, 1987, *Peng 11107* (HAST). TAICHUNG CITY: 1978, *Ou s. n.* (TCF). TAICHUNG HSIEN: Tachia, 1982, *Kao 9690* (TAI); Tatu, 1976, *Lu & Ou s. n.* (TCF). NANTOU HSIEN: Chungliao, 1999, *Liao 580* (NCKU). CHANGHUA HSIEN: Pakuashan, 1992, *Huang 4604* (TAI); Shenkung, 1985, *Tang 1016* (TAI). CHIAYI HSIEN: Chuchi, 1999, *Liao 599* (NCKU). KAOHSIUNG CITY: Shoushan, 1996, *Yang 696* (TAIF). PINGTUNG HSIEN: Chiopeng, 1987, *Hsu 0483* (TAI); same loc., 1996, *Wang 02033* (HAST; TAIF). TAITUNG HSIEN: Taimali, 1988, *Chen s. n.* (HAST). HUALIEN HSIEN: Chian, 1999, *Liao 755* (NCKU).

Distribution: North and South America, Europe, Africa, East and South Asia to Australia. In Taiwan, the species is present at low elevation throughout the island, especially in coastal areas.

Notes: *C. campestris* is a dodder commonly found worldwide. However, this species is a new record in Taiwan. In 1964, specimen was first collected at Longkang in Hsinchu Hsien by Chuang and was identified as *C. chinensis*. In 1971, specimens were collected at Houlung in Miaoli Hsien by Kuoh and were identified as *C. australis*. Later, the species was still collected by many people in many localities, and again misidentified as *C. australis*. *C. australis* is similar to *C. campestris*, but can be distinguished from the latter by its obtuse, erect corolla lobes and bifid infrastaminal scales.

3. *Cuscuta chinensis* Lam., Encycl. 2: 229. 1786; Lu, Quart. J. Chin. Forest. 6: 114. 1972; Staples and Yang, Fl. Taiwan 2nd. 4: 347. 1998.

中國菟絲子 Figs. 1C, 3

Herbs, parasitic. Stems twining, filiform, glabrous, yellowish or pale yellowish, ca. 1 mm across. Leaves reduced to minute scales. Inflorescences lateral, few to many-flowered clusters or racemes; bracts scaly. Flowers white; calyx lobes 4-5, lobes triangular ovate, ridged on

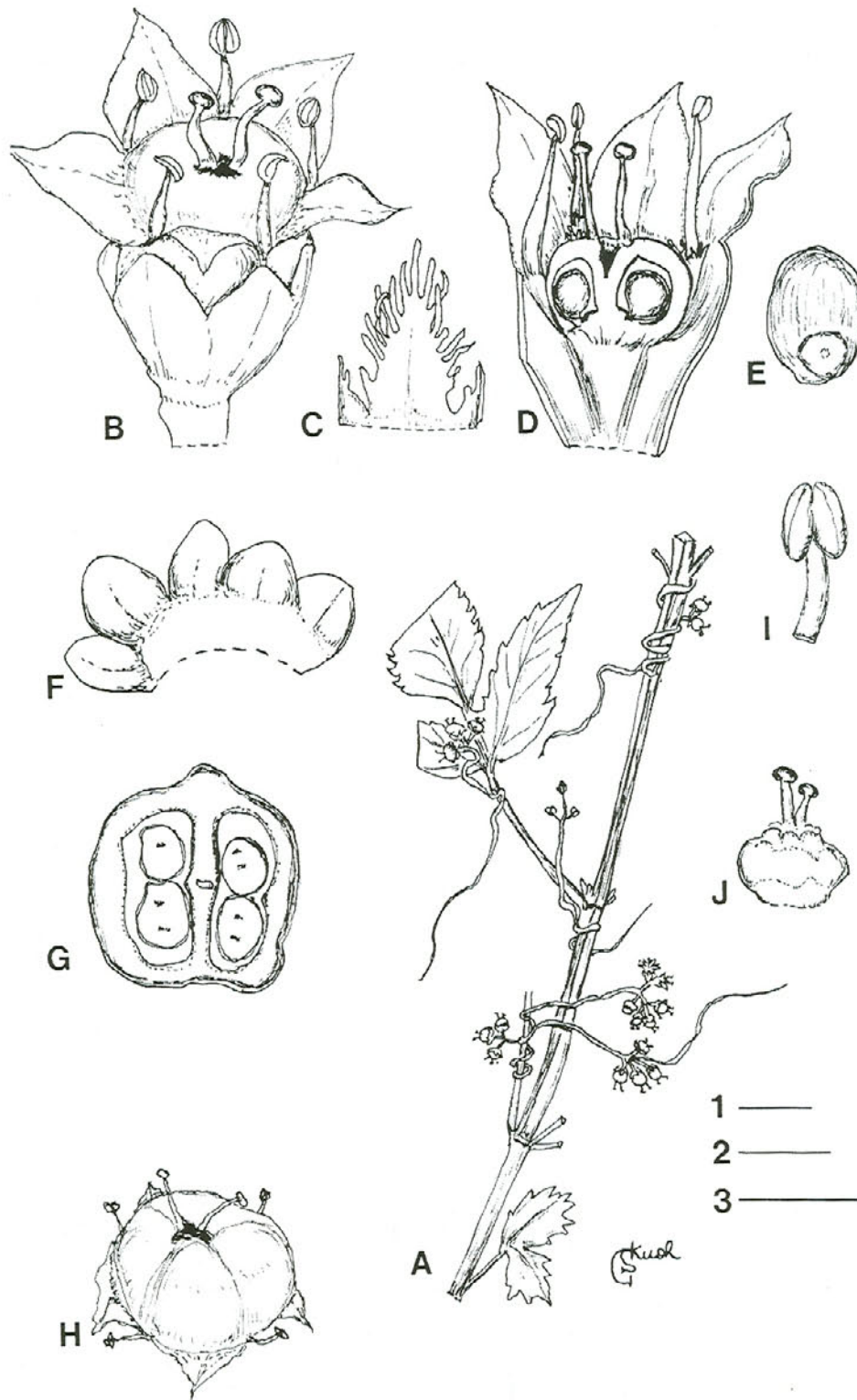


Fig. 2. *Cuscuta campestris* Yuncker. A, part of plant body on host, *Bidens* sp.; B, side view of flower; C, part of fimbriate scale; D, median longitudinal section of flower; E, seed with hilum; F, dissected calyx; G, cross section of ovary with 4 ovules; H, side view of capsule; I, adaxial view of stamen; J, young pistil. (bar =1mm; bar 1: B, D, F; bar 2: G, H; bar 3: C, E, I, J)

outer surface, apex obtuse; corolla 3-3.5 mm long, white, urceolate, 4 or 5-lobed, lobes deltoid-ovate, apex acute or obtuse, spreading horizontally; infrastaminal scales shorter than tube, fimbriate; stamens exerted, anthers ovoid; ovary globose, locules 2, ovules 4; styles 2, slender; stigmas capitate. Capsules globose, ca. 3 mm wide, enclosed by persistent corolla; pericarp thin, circumscissile. Seeds 2-4, broadly ovate, 1-2 mm long, pale brown, not smooth.

Specimens examined: TAIWAN. TAICHUNG HSIEN: Tatu, 1907, *Shimada s. n.* (TAIF). PINGTUNG HSIEN: Chialu, 1999, *Liao 687* (NCKU); Fangliao, 1906, *Kawakami s. n.* (TAIF); Tungkuang, 1999, *Liao 795* (NCKU). PENGHU HSIEN: Wangan, 1999, *Liao 778* (NCKU).

Distribution: Africa, Russia, throughout Asia, Indonesia to Australia. In Taiwan, the species is present at low elevation in central and southern parts.

Notes: This species can be distinguished from *C. campestris* by its calyx lobes ridged on outer surface and the capsules enclosed by persistent corolla.

4. *Cuscuta japonica* Choisy, Zoll. Syst. Verz. Ind. Arch. Pflanz. 2: 134. 1854. Liao and Tsai, Quart. J. Chin. Forest. 23: 23-25. 1990.

4a. *Cuscuta japonica* Choisy var. *japonica*

日本菟絲子 Fig. 1E

Herbs, parasitic. Stems slender, glabrous, terete, yellowish, often with purple-reddish thick spots, 1-3 mm across. Leaves reduced to minute scales. Inflorescences spicate clusters, rachis terete; bracts ovoid, apex acute. Sepals 5, ovate, apex acute or rounded, sometimes with purple-reddish thick spots in dorsal side; corolla short cylindrical or trumpet-shaped, 3-5 mm long, white or pale reddish, 5-lobed, lobes triangular, obtuse, denticulate, glabrous; infrastaminal scales spatulate, fimbriate; stamens sessile, anthers ovoid; ovary globose, 2-locular, ovules 4; style 1; stigma forked, stigma lobes tongue-shaped. Capsules ovoid. Seeds 1-2.

Specimens examined: TAIWAN. NANTOU HSIEN: Tungpu, 1979, *Liao 312* (TCB).

Distribution: Russia and Eastern Asia. In Taiwan, the variety is present at medium altitude (ca. 1800 m), growing mostly on roadside.

Notes: This variety can be distinguished from *C. japonica* var. *formosana* by its tongue-shaped stigma lobes and shorter corolla.

4b. *Cuscuta japonica* Choisy var. *formosana* (Hay.) Yuncker, Mem. Torr. Bot. Club 18: 253. 1932; Chang, Fl. Taiwan 4: 352, pl. 1035. 1978; Staples and Yang, Fl. Taiwan 2nd. 4: 347, pl. 155. 1998.

台灣菟絲子 Figs. 1D, 4B

Cuscuta formosana Hay., Icon. Pl. Formosan. 2: 124. 1912; Lu, Quart. J. Chin. Forest. 6: 114. 1972.

Herbs, parasitic. Stems slender, glabrous, terete, yellowish, sometimes with purple-reddish spots, 1-3 mm across. Leaves reduced to minute scales. Inflorescences spicate clusters, rachis terete; bracts oblong, obtuse. Sepals 5, ovate, apex rounded; corolla cylindrical or trumpet-shaped, 4-7 mm long, pale green-white or pale reddish, 5-lobed, lobes triangular, obtuse, denticulate, glabrous; infrastaminal scales spatulate, fimbriate; stamens sessile, anthers ovoid; ovary globose, 2-locular, ovules 4; style 1; stigma forked, stigma lobes quadrangular. Capsules ovoid. Seeds 1-4.

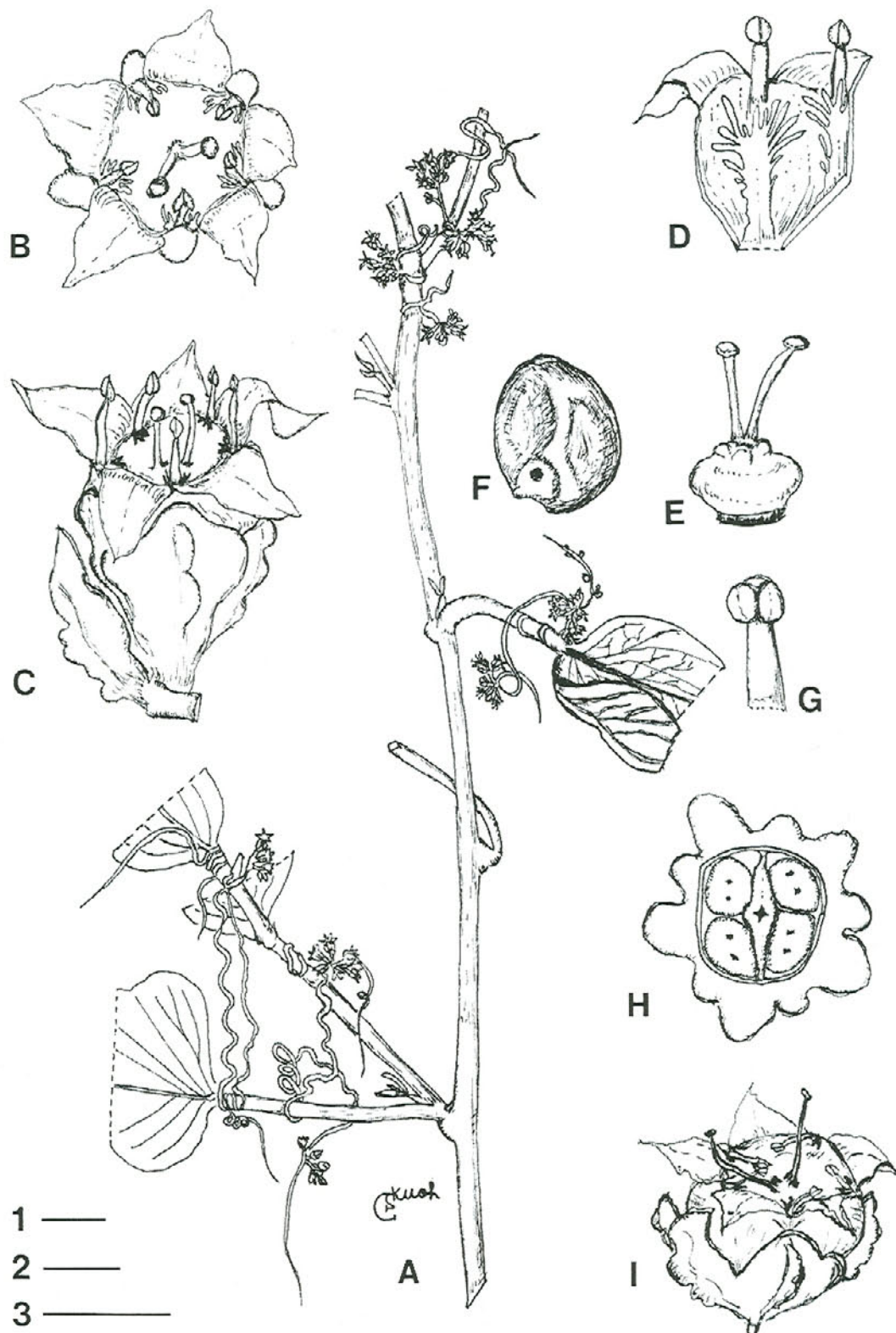


Fig. 3. *Cuscuta chinensis* Lam.. A, part of plant body on host, *Ipomoea pes-caprae* subsp. *brasiliensis*; B, surface view of flower; C, side view of flower with bract; D, part of corolla with stamens and fimbriate scales; E, young pistil; F, seed with hilum; G, adaxial view of stamen; H, cross section of flower near ovary with 4 ovules, note the ridges of calyx; I, side view of capsule. (bar = 1mm; bar 1: B, C, H, I; bar 2: D, E; bar 3: F, G)

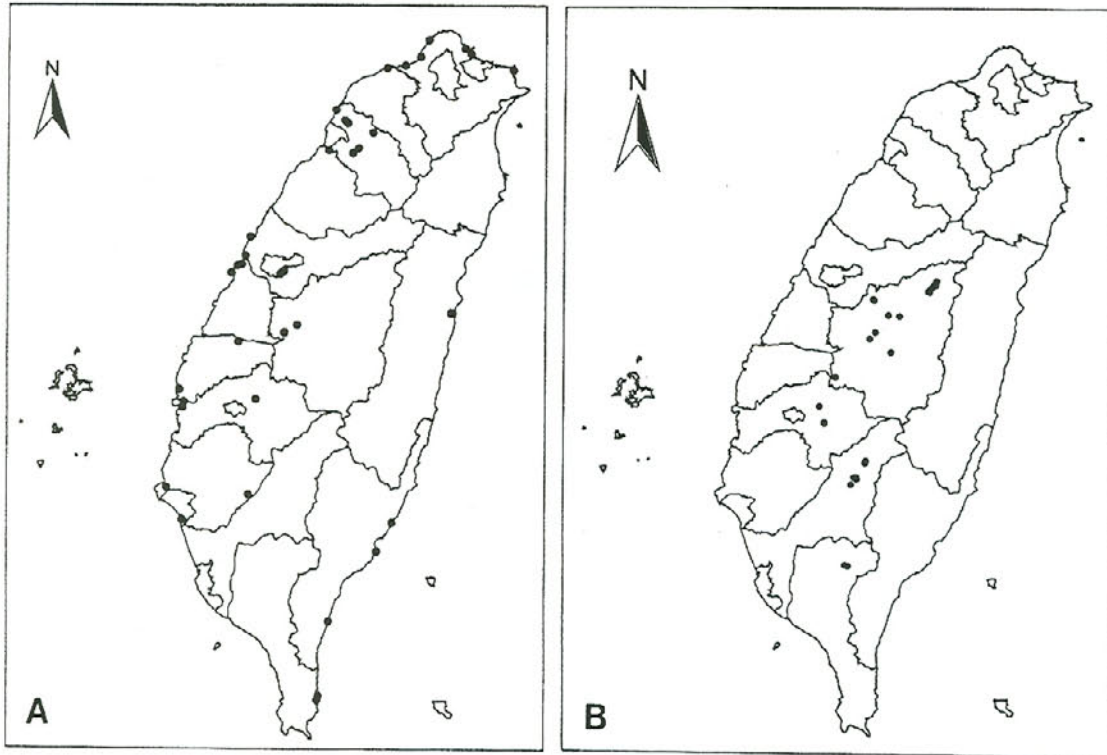


Fig. 4. Distribution maps of *Cuscuta campestris* (A) and *C. japonica* var. *formosana* (B) based on collections of the first author during 1998-1999 in Taiwan.

Distribution: Endemic to Taiwan, at low to medium altitudes (400-2200 m), growing mostly along the roadside.

Specimens examined: TAIWAN. NANTOU HSIEN: Chungliao, 1999, *Liao* 572 (NCKU); Howang, 1998, *Liao* 531 (NCKU); Hsinyi, Peng *et al.* 16970 (HAST); Lushan, Peng 6158 (HAST). CHIAYI HSIEN: Sungchiao, 1999, *Liao* 605 (NCKU). KAOHSIUNG HSIEN: Meishankou, 1998, *Liao* 513 (NCKU); Taoyuan, 1998, *Liao* 516 (NCKU). PINGTUNG HSIEN: Ali, 1999, *Liao* s. n. (NCKU); Ila, 1999, *Liao* s. n. (NCKU).

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LITERATURE CITED

- Chang, C.-E. 1978. Convolvulaceae. In: Li, H.-L., T.-S. Liu, T.-C. Huang, T. Koyama and C. E. DeVol (eds.). *Flora of Taiwan*, vol. 4. Epoch Publ. Co., Ltd., Taipei, Taiwan, pp. 351-354.
- Fang, R.-C. and S.-H. Huang. 1979. Convolvulaceae. In: Wu, C.-Y. (eds.). *Flora Reipublicae Popularis Sinicae* 64: 11-53.
- Fang R.-C., L. J. Musselman, and U. Plitmann. 1995. *Cuscuta*. In: Wu, C.-Y. and P. H. Raven,

- (eds.). Flora of China. Volume 16. Beijing: Science Press and St. Louis: Missouri Botanical Garden, pp. 322-325.
- Kuoh, C.-S. and G.-I. Liao. 1993. Flower initiation and development in *Cuscuta australis* R. Br. (Convolvulaceae). *Taiwania* **38**: 99-108.
- Liao, G.-I. and J.-L. Tsai. 1990. A new record species in Taiwan – *Cuscuta japonica* Choisy. *Quart. J. Chin. Forest.* **23**: 23-25.
- Liao, G.-I., J.-L. Tsai, and M.-I. Chen. 1990. The self-parasitism and hyperparasitism of *Cuscuta* and *Cassytha* in Taiwan. *Ann. Taiwan Mus.* **33**: 111-119.
- Liao, G.-I., J.-L. Tsai, and M.-I. Chen. 1991. Studies on the genus *Cuscuta* of Taiwan. *Ann. Taiwan Mus.* **34**: 103-119.
- Lu, F.-Y. 1972. The Convolvulaceae of Taiwan. *Quart. J. Chin. Forest.* **6**: 105-165.
- Staples, G. W. and S.-Z. Yang. 1998. Convolvulaceae. In: Editorial Committee of the Flora of Taiwan, Second Edition (eds.). *Flora of Taiwan*, 2nd, vol. 4. Department of Botany, National Taiwan University, Taipei, Taiwan, pp. 341-384.
- Yuncker, T. G. 1932. The genus *Cuscuta*. *Mem. Torr. Bot. Club* **18**: 109-331.

台灣產旋花科菟絲子屬 (*Cuscuta* L.) 植物之分類訂正廖國女^(1,3)、陳明義⁽²⁾、郭長生⁽¹⁾

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摘 要

本文訂正台灣產旋花科(Convolvulaceae)菟絲子屬(*Cuscuta* L.)植物。依據野外調查採集及歷年來的文獻與蠟葉標本，認定有3種及2變種，包括菟絲子(*C. australis* R. Br.)、平原菟絲子(*C. campestris* Yuncker)、中國菟絲子(*C. chinensis* Lam.)、台灣菟絲子(*C. japonica* Choisy var. *formosana* (Hay.) Yuncker)及日本菟絲子(*C. japonica* Choisy var. *japonica*)。本文確認中國菟絲子之存在；首次記錄平原菟絲子。另外，對各物種之形態及分佈加以描述，並以繁殖器官之特徵作一檢索表。

關鍵詞：菟絲子屬，菟絲子，平原菟絲子，中國菟絲子，台灣菟絲子，日本菟絲子，台灣。

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