

Research note

***Ipomoea lacunosa* (Convolvulaceae: *Ipomoea* sect. *Batatas*): a Newly Naturalized Species of Taiwan**

Chien-Ti Chao,¹⁾ Chung-Liang Cheng,²⁾ Chiu-Mei Wang^{3,4)}

[Summary]

Ipomoea sect. *Batatas* (Choisy) Grisebach is comprised of 11 species mainly distributed in North and South America. Among them, 5 species have been recorded in Taiwan. A few years ago, an unrecognized taxon of *Ipomoea* was found during our field investigations in central Taiwan. After consulting the related literature and examining specimens of related species, this unknown plant was confirmed to be *I. lacunosa* L., which is native to North America. A morphological description, photos, and line drawings are provided in this article. The phenology and breeding system of *I. lacunosa* are also discussed to evaluate the possibility of this species becoming an invasive species in Taiwan in the future.

Key words: Convolvulaceae, *Ipomoea lacunosa*, naturalized species.

Chao CT, Cheng CL, Wang CM. 2019. *Ipomoea lacunosa* (Convolvulaceae: *Ipomoea* sect. *Batatas*): a newly naturalized species of Taiwan. Taiwan J For Sci 34(1):55-62.

¹⁾ Jinhu Elementary School, No. 75, Jinhu Village, Beimen District, Tainan 727, Taiwan. 台南市立錦湖國民小學·727台南市北門區錦湖里75號。

²⁾ Dr. Cecilia Koo Botanic Conservation Center, 31 Tongxing Rd., Gaoshu Township, Pingtung County 906, Taiwan. 辜巖倬雲植物保種中心·906屏東縣高樹鄉同興路31號。

³⁾ Department of Biology, National Museum of Natural Science, 1 Guanchien Rd., North District, Taichung 404, Taiwan. 國立自然科學博物館生物學組·404台中市北區館前路1號。

⁴⁾ Corresponding author, e-mail:cmwang@mail.nmns.edu.tw 通訊作者。

Received January 2018, Accepted September 2018. 2018年1月送審 2018年9月通過。

研究簡報

臺灣旋花科(Convolvulaceae)牽牛花屬蕃薯組(*Ipomoea* sect. *Batatas*)的一新歸化植物：白星牽牛(*I. lacunosa*)

趙建棣¹⁾ 鄭仲良²⁾ 王秋美^{3,4)}

摘要

牽牛花屬蕃薯組(*Ipomoea* sect. *Batatas* (Choisy) Grisebach) 包括11種植物，主要分布於南北美洲。台灣過去曾紀錄5種本組植物。近年來我們在中部地區調查時，發現一未知的牽牛花屬植物。經過文獻及標本比對之後，我們確認這是天然分布於北美洲的白星牽牛。文中提供詳細的形態敘述、照片及線繪圖。此外，我們更討論本種的物候現象及繁育系統，以作為評估本種未來在台灣成為入侵物種的可能性。

關鍵詞：旋花科、白星牽牛、歸化植物。

趙建棣、鄭仲良、王秋美。2019。旋花科(Convolvulaceae)牽牛花屬蕃薯組(*Ipomoea* sect. *Batatas*)的一新歸化植物白星牽牛(*I. lacunosa*)。台灣林業科學34(1):55-62。

The genus *Ipomoea* L. comprises over 500 species distributed in tropical and temperate regions, especially in North and South America (Fang and Staples 1995, Staples and Yang 1998). Many species are used as vegetable or ornamental crops, such as sweet potato (*Ipomoea batatas* (L.) Lam.), water spinach (*I. aquatica* Forssk.), and Mexican morning glory (*I. tricolor* Cav.). Seeds of some species, such as *I. violacea* L. and *I. purpurea* (L.) Roth, contain psychoactive substances that are used as recreational drugs (Juszczak and Swiergiel 2013).

In Taiwan, 21 species of *Ipomoea* in total were recorded in the *Flora of Taiwan 2nd edition* (Staples and Yang 1998). Over half of the members of the genus have been naturalized, and thus *Ipomoea* is the genus with the highest proportion of and the greatest number of naturalized species in Taiwan (Wu et al. 2004). Two more recently naturalized species were discovered afterward, viz., *I. eriocarpa* R. Br. (Hsu et al. 2006), and *I.*

leucantha Jacq. (Chen and Yang 2017). These newly naturalized species are often found on fallow ground or roadsides. A few years ago, an unknown *Ipomoea* species was discovered in similar habitats. Therefore, the aims of this article were to describe this newly naturalized species and provide information about the breeding system of this species.

Study materials were collected from wild populations, and voucher specimens were deposited in the Herbarium of the Department of Forestry, National Chung Hsing University (TCF; Taichung, Taiwan), and the Herbarium of the National Museum of Natural Science (TNM; Taichung, Taiwan). The descriptive terminology of 2-dimensional shapes followed the Systematics Association Committee for Descriptive Terminology (1962).

This species was identified as *I. triloba* with white flowers at first glance. However, the unusual corolla morphology together with 1-flowered inflorescence implied this might be a different species. Thus, we re-

viewed related published accounts of *Ipomoea* (van Ooststroom 1940, Austin 1978, Fang and Staples 1995, Staples and Yang 1998), and a new naturalized species of Taiwan was confirmed.

Ipomoea lacunosa L., Species Plantarum 1:161. 1753. Lectotype: South Carolina, USA (OXF), lectotypified by Schmidt (1965). 白星牽牛 (Figs. 1, 2)

I. triloba var. *triloba* f. *lacunosa* (L.) Nishiyama in Bot Mag Tokyo 84:385. 1971.

Annual twining herb. Roots fibrous. Stem dextrorsely twining, up to 2 m long, ca. 2 mm in diam., sparsely villous. Leaves simple, alternate, cordate, 3~4.5 cm long, 2~4 cm wide, chartaceous to membranaceous, green, base cordate, margin entire, apex attenuate to acute, pinnate-reticulate venation, lateral veins 4 or 5 pairs, sparsely puberulent on both surfaces. Petiole 2~4 cm long, ca. 1 mm in diam., grooved, sparsely villous, often purplish-red, stipule absent. Inflorescences solitary, rarely cymes with 2 or 3 flowers, axillary, bracts 2, linear-lanceolate, 2~3 mm long, ca. 1 mm wide, peduncle ca. 1 cm long, 2~3 mm in diam., papillae. Flowers actinomorphic; sepals 5, oblong to lanceolate, concave, ca. 1 cm long, 5 mm wide, membranaceous, glabrous with villous margin, pellucid green; corolla 5-lobed, funnellform, ca. 1.5 cm in diam., ca. 1 cm long, white with 2 purplish strips and 1 horn-like protrusion on each lobe, membranaceous, glabrous; stamens 5, filaments filiform, of different lengths, 8~12 mm long, ca. 0.5 mm in diam., pellucid white, base pubescent; anthers 2-loculed, reddish-purple, ca. 1 mm long, glabrous. Ovary conical, ca. 1.5 mm in diam., with long white hairs at upper part, pale-green; style filiform, ca. 1 cm long, glabrous, pellucid white; stigma capitate, coarse, ca. 2 mm in diam., white. Capsules slight compressed globose, 7~8 mm in diam., 2-loculed, brown, sparsely villous at

upper part. Seeds numerous, trigonous, more or less irregular, glabrous, black.

Chromosomes $2n = 30$ (Wolcott 1937, Nakajima 1963).

This species was found in Taichung City, and Yunlin county, the former population was on a railroad near Taichung Port, and the later one was found beside baru (Yen 1994) (Fig. 3). It is naturally distributed in the central and eastern United States and eastern Mexico (Austin 1978), and was reported to be naturalized in Japan (Yamazaki 1993) and China (Chiu et al. 1994).

Specimens examined: Taichung City, Chingshui District, Linkang Rd., beside the railroad, 10 May 2013, *C. M. Wang 15356* (TNM); same locale, 5 June 2014, *C. T. Chao 3438* (TCF). Yunlin county Taichung town, 4 Aug. 1987, *H. F. Yen 1518* (TNM).

Key to the *Ipomoea* sect. *Batatas* of Taiwan (adapted from Austin 1978)

1. Outer sepals elliptic to obovate-mucronate. 2
1. Outer sepals lanceolate to oblong..... 3
 2. Leaves thickened fleshy *I. littoralis*
 2. Leaves chartaceous..... *I. trifida*
 3. Corolla 4~7 cm in diam.; roots forming fusiform storage roots
..... *I. batatas* (sweet potato)
 3. Corolla 1~2.5 cm in diam.; roots not forming storage roots 4
 4. Calyxes and seeds glabrous 5
 4. Calyxes and seeds pubescent.....
..... *I. triloba*
 5. Inflorescences often solitary; peduncle ca. 1 cm long; corolla white *I. lacunosa*
 5. Inflorescences often cymes; peduncle over 5 cm long; corolla lavender to pink
..... *I. leucantha*

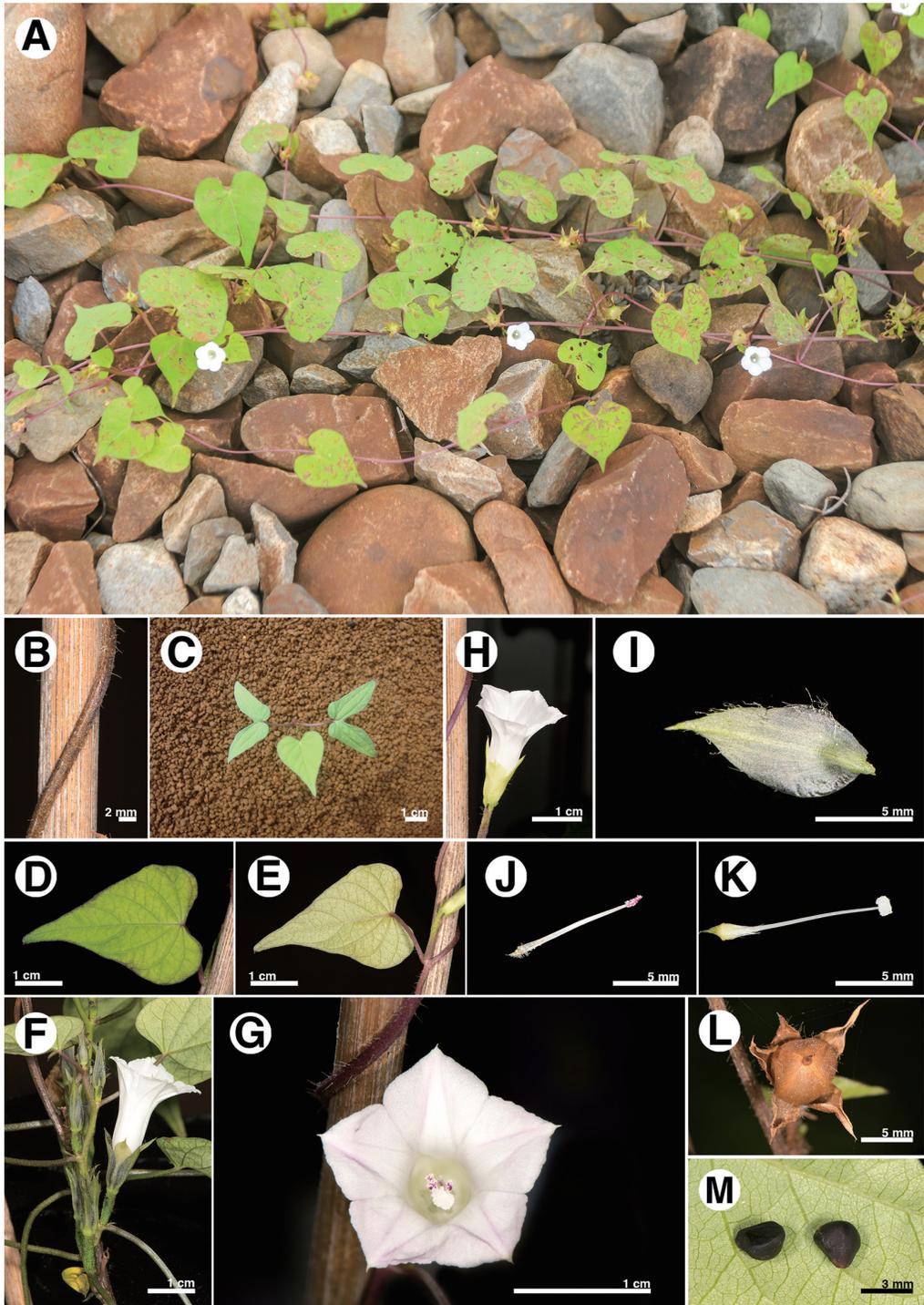


Fig. 1. *Ipomoea lacunosa*. A: Habitat. B: Stem. C: Seedling. D: Leaf adaxial surface. E: Leaf abaxial surface. F: Inflorescences. G: Flower (front view). H: Flower (side view). I: Sepal. J: Stamen. K: Pistil. L: Fruit. M: Seeds.

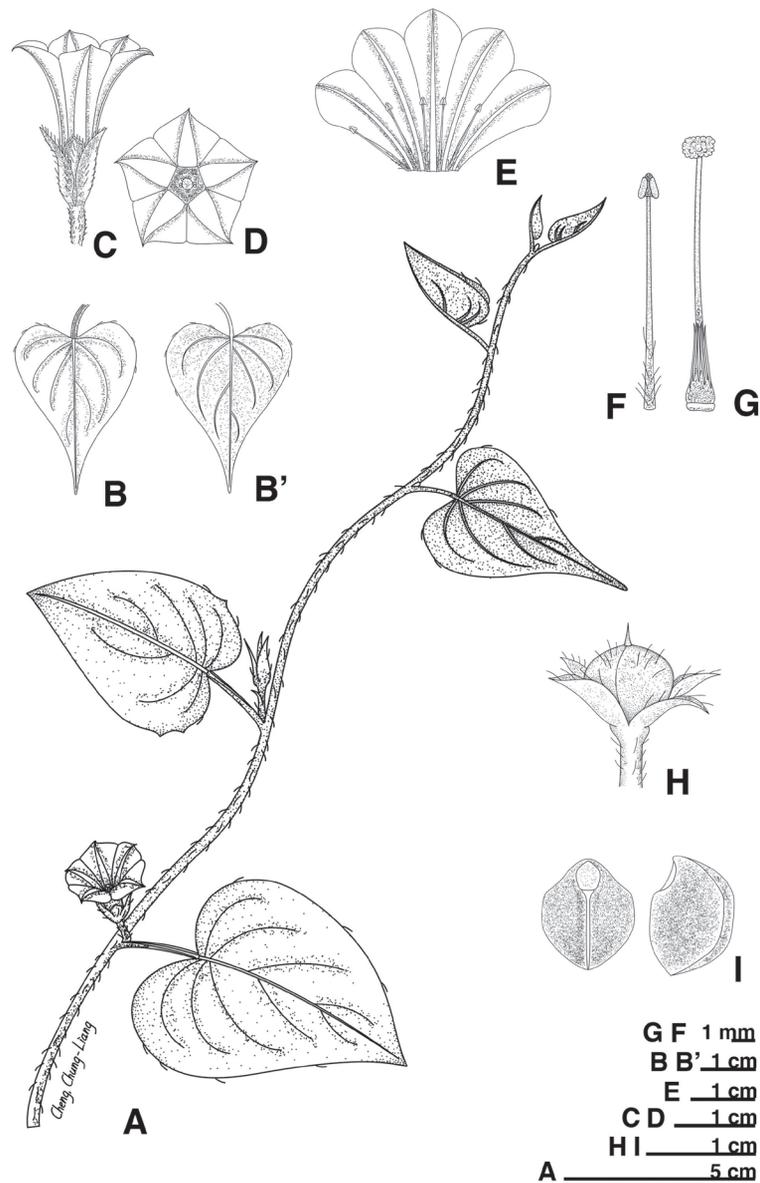


Fig. 2. Line drawings of *Ipomoea lacunosa*. **A**: Habit. **B**, **B'**: Leaf adaxial and abaxial surface. **C**: Flower side view. **D**: Flower front view. **E**: Corolla expansion. **F**: Stamen. **G**: Pistil. **H**: Fruit. **I**: Seeds front and side view.

***Ipomoea* sect. *Batatas* of Taiwan**

Ipomoea sect. *Batatas* (Choisy) Grisebach was first described by Choisy (1834) as the genus *Batatas* Choisy. Later it was transferred to sectional level by Grisebach (1864) and revised by Austin (1978). Members of this sec-

tion are mainly distributed in North and South America (Austin 1978). Diagnostic characters of this section include an annual or perennial habit, both inbreeding and outcrossing breeding systems, polyploid chromosomes from $2n = 30$ to 90 , funnellform corolla white, pink,

purple to lavender, chartaceous to coriaceous and ellipsoid to rotund sepals, and glabrous to pubescent seeds (Austin 1978). In Taiwan, over half of the section (6 species) were recorded, all cultivated or naturalized except the native *I. littoralis* Blume. This implies that local environments are suitable for these plants. Some of them have similar morphological characters, and thus they are easily confused with known species. Therefore, careful examination of Taiwanese populations of this section is an important task for elucidating the true number of species of sect. *Batatas* in Taiwan.

Ipomoea lacunosa resembles *I. triloba* L., *I. leucantha*, and *I. biflora* (L.) Pers. in morphological features, such as the herbal habit and small flower sizes. However, *I. lacunosa* can be distinguished from them by the white corolla, solitary inflorescence, elliptic sepals,

and glabrous seeds.

Phenology and breeding system of *I. lacunosa*

Ipomoea lacunosa was presumed to be an annual species usually with the habit of dying back after fruit maturation. But our observations showed that even though the stem withered, when a water supply was restored and persisted, new buds would sprout, grow, bloom, and successfully fruit. This phenomenon implies that *I. lacunosa* is potentially a perennial species, and could form perennial populations under certain conditions. This trait would be advantageous for population expansion. In addition, the breeding system of *I. lacunosa* is highly selfing (McDonald et al. 2011, Duncan and Rausher 2013), and the so-called “selfing syndrome” is also found

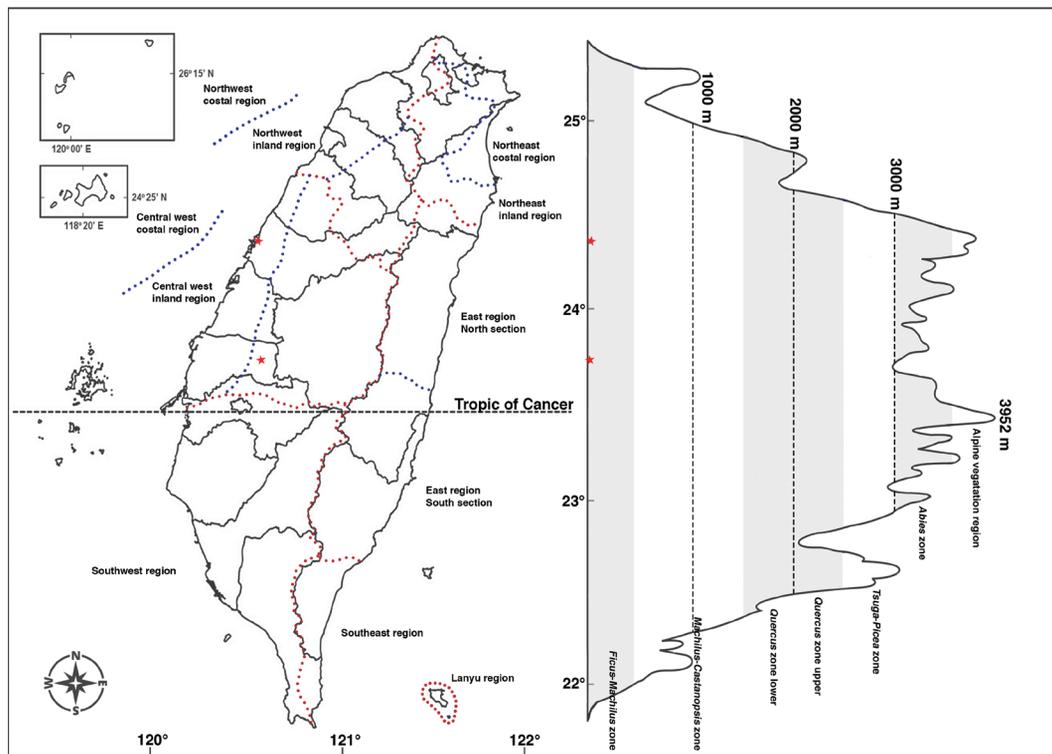


Fig. 3. Distribution of *Ipomoea lacunosa* in Taiwan.

in this species, like a reduced corolla size, shortened anther-stigma distance, loss of corolla pigmentation, and a relatively low pollen/ovule ratio (Duncan and Rausher 2013). These features possibly promoted *I. lacunosa* to become a troublesome weed in the United States (Webster 2001, Stephenson et al. 2006, Burgos et al. 2011). The population dynamics should be closely monitored in Taiwan.

In this study, a newly naturalized species *Ipomoea lacunosa* was confirmed. Considering the highly selfing breeding system and its annual to perennial habit, the monitoring of the invasiveness of this species is necessary in Taiwan. On the basis of morphological similarities to other species of sect. *Batatas* in Taiwan, the population of *I. lacunosa* could be greater than is now known.

LITERATURE CITED

- Austin DF. 1978.** The *Ipomoea batatas* complex-I. Taxonomy. Bull Torrey Bot Club 105(2):114-29.
- Bergos NR, Stephenson DO, Agrama HA, Oliver LR, Bond JA. 2011.** A survey of genetic diversity of the weedy species *Ipomoea lacunosa* L. in the USA mid-South. Am J Plant Sci 2:396-407.
- Chen PH, Yang SZ. 2017.** *Ipomoea leucantha* Jacq. (Convolvulaceae), a newly naturalized species in Taiwan. J Natl Taiwan Mus 70(1):1-8. [in Chinese with English summary].
- Chiu PL, Chen ZH, Zhang XH. 1994.** Some newly recorded taxa to China and the Chinese mainland from Zhejiang Province. Acta Bot Yunnanica 16(3):231-4. [in Chinese].
- Choisy JD. 1834.** Convolvulaceae orientales. Mém Soc Physique d'Hist Nat Genève 6:49-502.
- Duncan TM, Rausher MD. 2013.** Evolution of the selfing syndrome in *Ipomoea*. Frontiers Plant Sci 4:1-8.
- Fang RC, Staples G. 1995.** Convolvulaceae. In: Wu ZY, Raven PH, editors. Flora of China, Vol. 16. St. Louis, MO: Missouri Botanical Garden Press; Beijing: Science Press. p 271-325.
- Grisebach A. 1864.** Flora of the British West Indian islands. London: L. Reeve. 468 p.
- Hsu TW, Chiang TY, Tsai KC, Huang CC. 2006.** *Ipomoea eriocarpa* R. Br. (Convolvulaceae), newly naturalized to Taiwan. Endemic Species Res 8(2):103-7. [in Chinese with English summary].
- Juszczak GR, Swiergiel AH. 2013.** Recreational use of D-lysergamide from the seeds of *Argyrea nervosa*, *Ipomoea tricolor*, *Ipomoea violacea*, and *Ipomoea purpurea* in Poland. J Psychoactive Drugs 45(1):79-93.
- McDonald AJ., Hansen DR, McDill JR, Simpson BB. 2011.** A phylogenetic assessment of breeding systems and floral morphology of north American *Ipomoea* (Convolvulaceae). J Bot Res Inst Texas 5:159-77.
- Nakajima G. 1963.** Karyotype of genus *Ipomoea*. Cytologia 28:351-9.
- Schmidt S. 1965.** Der "Hortus Elthamensis" aus der bibliothek Carl von Linnés. Feddes Repertorium 70:69-108.
- Staples G, Yang SZ. 1998.** Convolvulaceae. In: Editorial Committee of the Flora of Taiwan, editors. Flora of Taiwan 2nd edition - Vol. 4. Taipei, Taiwan: Editorial Committee of the Flora of Taiwan. p 341-84.
- Stephenson DO, Oliver LR, Burgos NR, Gbur EE. 2006.** Identification and characterization of pitted morning glory (*Ipomoea lacunosa*) ecotypes. Weed Sci 54(1):78-86.
- Systematics Association Committee for Descriptive Terminology. 1962.** Systematics association committee for descriptive biological terminology, IIa. Terminology of simple symmetrical plane shapes (Chart I). Taxon 11(8):245-7.
- van Oostroom SJ. 1940.** The Convolvulaceae of Malaysia, III. Blumea 3(2):481-582.

Webster TM. 2001. Weed survey-southern states: broadleaf crops subsection. Proc Southern Weed Sci Soc 54:244-59.

Wolcott GB. 1937. Chromosome numbers in the Convolvulaceae. Am Naturalist 71(733):190-2.

Wu SH, Hsieh CF, Chaw SM, Rejmánek M. 2004. Plant invasions in Taiwan: insights from the flora of casual and naturalized alien spe-

cies. Divers Distributions 10:349-62.

Yamazaki T. 1993. Convolvulaceae. In: Iwatsuki K, Yamazaki T, Boufford DE, Ohba H, editors. Flora of Japan, Vol. IIIa. Tokyo: Kodansha. p 195-205.

Yen HF. 1994. The collection of related world species of sweet potato and its distributions in Taiwan. Root Crop Yield Improvement, Processing and Utilization 87-134.