Three Newly Naturalized Species of the Genus *Ludwigia* (Onagraceae) to Taiwan

台灣新歸化水丁香屬(柳葉菜科)植物

Tsai-Wen Hsu[1, 2], Ching-I Peng[3], Tzen-Yuh Chiang[2] and Chao-Ching Huang[1, 2, *]

許再文[1, 2]　彭鏡毅[3]　蔣鎮宇[2]　黃朝慶[1, 2, *]

[1] Endemic Species Research Institute, Jiji, Nantou, Taiwan

[2] Department of Life Sciences, Cheng-Kung University, Tainan, Taiwan

[3] Biodiversity Research Center, Academia Sinica, Taipei, Taiwan

[1] 行政院農業委員會特有生物研究保育中心　南投縣集集鎮民生東路 1 號

[2] 國立成功大學生命科學系　台南市大學路 1 號

[3] 中央研究院生物多樣性研究中心　台北市南港區研究院路二段 128 號

* Corresponding author: huang@tesri.gov.tw

* 通訊作者：huang@tesri.gov.tw

Abstract

The genus *Ludwigia* comprises about 80 species. It is one of the largest genera of the family Onagraceae. Six species and one natural hybrid of *Ludwigia* have been recorded from Taiwan. In our recent plant inventory surveys, three species were found to be new records from Taiwan. They are *Ludwigia palustris* (L.) Elliott in the northern region, *Ludwigia decurrens* Walt. in the northern and central regions, and *Ludwigia erecta* (L.) Hara in the central region of the island. This paper describes these species of *Ludwigia* with photos and distribution, and provides a key to all ten naturally occurring species of *Ludwigia* in Taiwan for identification.

摘 要

水丁香屬植物爲柳葉菜科的一個大屬約共有 80 種。《台灣植物誌》第二版記載了 6 種及 1 天然雜交種。本研究報導 3 新歸化種，分別是歸化於台灣北部地區的沼生水丁香； 歸化於台灣北部及中部地區的翼莖水丁香；以及歸化於台灣中部地區的美洲水丁香。本文提供台灣所產野生水丁香屬植物的檢索表，3 種新歸化植物的描述、分布及彩色照片。

關鍵詞：柳葉菜科、翼莖水丁香、美洲水丁香、沼生水丁香、台灣

Key words: Onagraceae, *Ludwigia decurrens*, *Ludwigia erecta*, *Ludwigia palustris*, Taiwan

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Introduction

Onagraceae is a well-defined family of flowering plants, which comprises seven tribes, 16 genera, and approximately 652 species with worldwide distribution (Raven 1979, 1988). Most of its genera are present in the western North America. Four genera, namely *Circaea*, *Epilobium*, *Ludwigia*, and *Oenothera*, are native to the Old World, with 22 species represented in Taiwan (Raven and Peng 1993). They have been revised respectively by Boufford (1983: *Circaea*); Chen *et al*. (1992: *Epilobium*); Raven (1963: *Ludwigia*), Chao (1966: *Ludwigia*) and Peng (1983, 1990: *Ludwigia*); and Peng and Huang (1986: *Oenothera*) in the past few decades.

The genus *Ludwigia* L. comprises about 80 species (Raven and Peng 1993) in pantropical distribution but mostly in the New World and in the temperate region. In Taiwan six species and one natural hybrid of *Ludwigia* have been reported (Raven and Peng 1993). In our recent inventory survey of the flora of Taiwan, three newly naturalized species of *Ludwigia* were found. They are *Ludwigia palustris* (L.) Elliott from the northern region; *Ludwigia decurrens* Walt. from the northern and central regions, and *Ludwigia erecta* (L.) Hara from the central region of the island. The above three newly recorded species make Taiwan to have nine known species and one hybrid of the genus *Ludwigia*. They are easily distinguishable by the following key to the species of the genus *Ludwigia* of Taiwan:

1. Plant prostrate or ascending; rooting freely at nodes.
   2. Leaves to 7.5 cm long, narrowly elliptic to spatulate-oblong; petals 5; stamens 10.
      3. Petals creamy white with a yellow base; ovaries mature into capsules..... *L. adscendens*

3. Petals yellow; ovaries abortive ..... *L.* x *taiwanensis*

2. Leaves to 2.5 cm long, ovate to elliptic ovate; petals 0; stamens 4.

4. Leaves alternate; seed with an inflated raphe..... *L. ovalis*

4. Leaves opposite; seed without an inflated raphe..... *L. palustris*

1. Plant erect; rooting at stem base.

5. Stamens twice as many as sepals.

6. Stem and fruits conspicuously winged..... *L. decurrens*

6. Stem and fruits not winged.

7. Petals elliptic, apex acute.

8. Capsules oblanceolate-obconic, 4-angled; seeds all free..... *L. erecta*

8. Capsules subcylindric, nearly terete; seeds free in upper half of the capsule, embedded in chunks of endocarp in lower half of the capsule..... *L. hyssopifolia*

7. Petals broadly obovate and emarginate..... *L. octovalvis*

5. Stamens as many as sepals.

9. Capsules oblanceolate; seeds 0.3-0.5 mm long, all free..... *L. perennis*

9. Capsules linear or narrowly elliptic-lanceolate; seeds 0.7-1 mm long, all embedded in chunks of endocarp..... *L. epilobioides*

1. *Ludwigia decurrens* Walt., Fl. Carol. 89. 1788; Raven, Reinwardtia 6: 347. 1963; Ramamoorthy & Zardini, Monogr. Syst. Bot. Missouri Bot. Gard. 19: 88, *fig. 41*. 1987.

翼莖水丁香 Figs. 1

Jussiaca decurrens (Walt.) DC. Prod. 3: 56. 1828.

Fig. 1. *Ludwigia decurrens* Walt. A, habit; B, flower; C, crossection of fruit.

Erect glabrous herbs up to 2m tall. Stems 4-winged from the decurrent leaf-bases. Stipules 2, minute, red. Leaves alternate, lanceolate to elliptical, 2-10 cm long, 1-3 cm wide, acute or acuminate at tip, acute or rounded at base, sessile and continuing on the stem as decurrent base, entire. Flowers solitary in upper axils. Pedicels 0.2-0.4 cm long. Sepals 4, lanceolate, acuminate at tip, 0.7-1 cm long, 3-4 mm wide. Petals 4, orbicular-obovate, yellow, 7-10 mm long, 7-10 mm wide. Stamens 8, filaments 1.5-2.5 mm long, light yellow. Ovary 4-cells, about 1 cm long, 4-5 mm thick, sharply 4-angled and 4-winged, obconic. Style short, stigma globose, light yellow. Capsule 1-2 cm long, 4-5 mm thick, 4-angled and 4-winged. Seeds pluriseriate in each locule of the capsule, free, elongate-obovoid, 4-5 mm long, pale brown.

Specimen examined: Taiwan. Taoyuan County: Luchu, about 100m, *Peng 17673* (HAST), *Wang & Lin 1643* (HAST, TNM); Yangmei, 250m alt., *Peng 17703* (HAST). Taichung County, Taan near Tachia Hsi, *Li 489* (HAST), *Huang 2253*. Nantou City: wet fallow paddy, *Hsu 10035* (TAIE).

Distribution and notes: *Ludwigia decurrens* is native to the New World and introduced to the Old World: Cameroon, Gambia and Nigeria in Africa, Honshu and Shikoku in Japan (Raven 1963), the Philippines and France (Ramamoorthy and Zardini 1987), and recently to Taiwan. It is found in wet lands, such as wet fallow paddies, taro fields, waste swampy grounds, and banks around fish ponds or reservoirs in lowlands of the northern and central regions of the island. It is often intermixed with other aquatic weeds such as *Ludwigia octovalvis* (Jacq.) Raven, *Ludwigia hyssopifolia* (G. Don) Exell, and *Typha* sp.

Ludwigia decurrens is robust in shape, well branched, sometimes woody at the base and becoming shrubby, and has showy flowers resembling to those of *L. octovalvis*. However *L. decurrens* is throughly glabrous and has conspicuously winged stems and fruits, and cuneate leaf base, while *L. octovalvis* has densely villous, square stem but not winged fruits and acute leaf bases.

2. *Ludwigia erecta* (L.) Hara, J. Jap. Bot. 28: 292. 1953; Raven, Reinwardtia 6: 348. 1963; Ramamoorthy & Zardini, Monogr. Syst. Bot. Missuri Bot. Gard. 19: 96. *f. 44*. 1987.

美洲水丁香 Figs. 2

Jussiaea erecta L., Sp. Pl. 1: 388. 1753.

Erect glabrous herbs up to 3m tall. Stems reddish, 4-6-angled from the decurrent leaf-bases. Stipules 2, minute. Leaves alternate, narrowly lanceolate to elliptical, 5-10 cm long, 1-3 cm wide, acute at tip and base, with 15-20 veins on each side of midrib, entire, petioles 2-10 mm long and continuing on the stem as decurrent base. Flowers solitary in upper axils, subsessile. Sepals 4, lanceolate, 4-5 mm long, 1.5-2 mm wide, acuminate at tip. Petals 4, elliptical or obovate, yellow, 3-5 mm long, 1.5-3 mm wide, acute at tip. Stamens 8, subequal, filaments about 1.5 mm long, light yellow. Ovary 4-cell, 5-7 mm long, about 1 mm thick, 4-angled, obconic, style short, 1 mm long, stigma globose, yellow. Capsule, 1.5-2.5 cm long, about 3 mm thick, 4-angled. Seeds pluriseriate in each locule of the capsule, free, elongate-ovoid, 0.3-0.5 mm long, brown.

Specimen examined: Taiwan. Changhua County: Tianwei, wet sandy ditches, *Hsu 10022* (HAST). Nantou City, wet fallow paddy, *Hsu 10036* (TAIE).

Distribution and notes: *L. erecta* is native to Central and Southern America (Ramamoorthy and Zardini 1987). It is naturalized to Taiwan in

wet lands, such as banks of ponds and wet sandy ditches in the central region of the island. It is often intermixed with weeds like *Ipomoea aquatica* Forsk., *Ludwigia hyssopifolia* (G. Don) Exell, *Ipomoea triloba* L., and *Bidens chilensis* DC.

Fig. 2. *Ludwigia erecta* (L.) Hara: A, habit; B, flower; C, fruits.

It is an erect annual herb with acute petals at apex and 8 stamens. This species is similar to *L. hyssopifolia* but easily distinguishable from the latter by 4-angled oblanceolate-obconic capsulesand free seeds. *Ludwigia hyssopifolia* has subterete capsules, and seeds in upper portion of the capsule free, but embeded in endocarp in lower part of the capsule.

3. *Ludwigia palustris* (L.) Elliott, Sketch Bot. S. Carolina 1(3): 211. 1817; Raven, Reinwardtia 6: 399. 1963.

沼生水丁香 Figs. 3

Isnardia palustris L., Sp. Pl. 1: 120. 1753.

Fig. 3. *Ludwigia palustris* (L.) Elliott: A, habit; B, fruits.

Glabrous herbs, creeping and rooting at the nodes. Leaves opposite, elliptical, 0.7-1 cm long, 0.5-0.7 cm wide, acute at tip, broadly cuneate at base, and abruptly narrowed to a broadly winged petiole, petioles about 5 mm long, with 3-4 veins on each side of midrib, entire. Flowers solitary and usually paired, sessile. Sepals 4, deltoid, 1.4-1.6 mm long, 1.4-1.6 mm wide, usually minute, strigillose along margin. Petals 0. Stamens 4-5, filaments short, pale green. Ovary 3-4 loculose, obconic, style short, stigma globose, pale green. Capsule, 3-4 mm long, 2-3 mm thick. Seeds pluriseriate in each of the capsule, free, elongate-ovoid.

Specimen examined: Taiwan. Taipei City: Nankang, campus of Academia Sinica, about 50m alt. *Peng 18163* (HAST), *Hsu 10076* (TAIE).

Distribution and notes: *L. palustris* is native to tropical America. It is naturalized to Taiwan in wet lands like fallow and rice paddies in lowlands in the northern region of the island, often intermixed with other aquatic weeds such as *Alternanthera sessilis* (L.) R. Br. *ex* Roem. & Schultes, *Ludwigia octovalvis* (Jacq.) Raven, *Ludwigia hyssopifolia* (G. Don) Exell, *Lindernia antipoda* (L.) Alston, and *Lindernia crustacea* (L.) F. Muell.

Ludwigia palustris is prostrate with ascending tips, rooting freely at nodes, and its flowers are apetalous with stamens. Its habit and appearance are fairly similar to those of *L. ovalis* Miq. of the eastern Asia, but it is distinguishable from the latter by having opposite leaves and seed without enlarged raphe.

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