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Notes on Four Newly Naturalized Plants in Taiwan

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ABSTRACT: *Cyperus esculentus* L, *Cyperus eragrostis* Lam., *Laportea aestuans* (L.) Chew and *Amaranthus dubius* Mart. *ex* Thell. were recently found naturalized in eastern Taiwan. The present study gives descriptions and line drawings of the four species. In addition, their distribution and notes on ecology and taxonomy are provided.

KEY WORDS: Cyperaceae, Urticaceae, Amaranthaceae, *Cyperus esculentus*, *Cyperus eragrostis*, *Laportea aestuans*, *Amaranthus dubius*, taxonomy, weeds, naturalized plant.

INTRODUTION

In the course of a botanical survey for a biodiversity study in eastern Taiwan, four newly naturalized species were collected. There were two species of *Cyperus* (*C. esculentus* L. and *C. eragrostis* Lam.), one species of *Laportea* (*L. aestuans* (L.) Chew), and one species of *Amaranthus* (*A. dubius* Mart. *ex* Thell.). *Cyperus* L. is a cosmopolitan genus with 500 to 600 species, and is abundant in the tropics (Koyama, 1985; Kukkonen, 2001). Taiwan is comparatively poor in species of *Cyperus*, and only 24 species of this genus are presently known in Taiwan (Koyama, et al., 2000). The present report brings the total number of *Cyperus* species to 26. Locally *C. esculentus* is occasional to common in dry to moist disturbed areas in the eastern part of Taiwan, and *C. eragrostis* grows in wetlands in the lowlands of eastern and northern parts. *Laportea* Gaudich. is a weedy genus of more than 20 species mostly in tropical and subtropical regions (Chew, 1969; Friis, 1989; Correll and Correll, 1996). Only two species of this genus were listed in the Flora of Taiwan (Yang, et al., 1996). The species *L. aestuans* is possibly native to tropical Africa and is pantropic in distribution (Chew, 1969; Friis, 1989). It occurs as a weed in semi-shaded areas along roadsides and on margins of gardens. *Amaranthus* L. is a genus of 50 to 60 species, distributed in tropical and temperate regions of both hemispheres (Townsend, 1985; Eliasson, 1987). Four weedy species of this genus are represented in the Flora of Taiwan (Hsieh and Hsieh, 1996), among the four species *A. patulus* Bertol. and *A. lividus* L. (Ou and Liu, 1981) have been introduced and naturalized in recent twenty-five years. The newly found species *A. dubius* Mart. *ex* Thell. is found along roadsides and in waste ground in Hualien area. It usually grows together with *A. spinosus* L.

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TAXONOMIC TREATMENTS

1. ***Cyperus esculentus*** L., Sp. Pl. 45. 1753; McGivney, Catholic Univ. Amer., Biol. Ser. 26: 14. *pl. 3*. 1938; Holm et al., World's Worst Weeds 125. *fig. 46*. 1977; DeFilipps in Tutin et al., Fl. Europ. 5: 286. 1980; Kukkonen in Ali & Qaiser, Fl. Pak. 206: 100. *fig. 17- D.E.F.* 2001; Shimizu, Nat. Pl. Japan 298. *pl. 159-1.2.3*. 2003.
黃土香（新擬） Figs. 1 & 3

Perennial herbs, 50-80 cm tall, rhizomes white, 2-3 mm wide, covered with brown scales, terminated by a ovoid tuber; tubers up to 20 mm long and 5-10 mm wide, zonate. Culms trigonous, glabrous, 50-80 cm tall. Leaves 40-70 cm long, shorter than the culm; blades linear, 5-8 mm wide, flattish-plicate, gradually narrowed to acuminate apex; sheaths light brown.

Anthela simple to compound, loose, 3-15 cm long, 2-10 cm wide; 2 to 10, slender, primary rays 1-12 cm long, patent; spikes sub-loosely bearing 3 to 10 spiklets; leafy bracts 6 to 9, rarely up to 10, mostly shorter than the anthela, the lowest overtopping and 2 to 3 times as long as the corymb, the second slightly surpassing the corymb. Spiklets spreading to patent, linear, acute at apex, 1-3.5 cm long, 1.5-3 mm wide, compressed, subdensely 8- to 28-flowered, yellow-brown; rachilla 1 mm long, 0.3 mm wide, winged.

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Glumes narrowly ovate, 3.5 mm long, 1 mm wide, 5- to 7-nerved, brown, the midrib green. Stamens 3, filament 3 mm long, white, anther linear, yellow, 1.5 mm long. Style whitish brown, 2.5 mm long, stigmas 3, brown, 2 mm long, ovary green, trigonous, 0.8-1 mm long. Achene trigonous, obovate-oblong, 1 mm long, 0.4 mm wide, brown, minutely puncticulate.

Specimens examined: Hualien City, Nanbin, along roadsides and borders of paddy fields, 28 April 2005, *Chen s. n.* (Herbarium, National Hualien University of Education; NHU); Sinhsing Rd., on traffic island, 10 July 2006, *Chen s. n.* (NHU); Gian Hsiang, Nanhua, along borders of paddy fields, 19 May 2006, *Chen & Yu s. n.* (NHU).

Distribution and notes: *Cyperus esculentus* L. is possibly a native of Europe (Takematsu and Ichizen, 1997) and is now widespread throughout the tropical and subtropical regions of the world, also in North America north to Canada and Alaska (Correll and Correll, 1996; Takematsu and Ichizen, 1997), and also naturalized in Japan (Shimizu, 2003).

It is abundant in Taiwan as a weed distributed in sunny, wet, and dry habitats such as plantations, fallow land and the margins of paddy fields. This plant is easily confused with *C. rotundus* L., the most common and most widespread weed on the island, however the two are quite distinct. Apart from the comparatively smaller habit and the less numbered rays of anthela, the latter has tubers developed along the length of its rhizomes.

2. *Cyperus eragrostis* Lam., Tabl. Encycl. 1: 146. 1791; McGivney, Catholic Univ. Amer., Biol. Ser. 26: 37. *pl. 6.* 1938; Walker, Fl. Okin. & S. Ryuk. Isl. 261, 1976; Kitamura et al., Coloured Illust. Herb. Pl. Japan 3: 242. 1977; DeFilipps in Tutin et al., Fl. Europ. 5: 286. 1980; Osada, Coloured Illustr. Nat. Pl. Japan 370. *pl. 60.* 1989; Press & Short, Fl. Madeira 460. 1994; Tucker et al. in Fl. N. Amer. Ed. Comm., Fl. N. Amer. 23: 154. *fig. 153.* 2002; Shimizu, Nat. Pl. Japan 297. *pl. 158-3,4.* 2003.

頭穗莎草（新擬） Figs. 2 & 4

Robust perennial, tufted, 80-100 cm tall; rhizomes black, short, up to 8 mm across; roots fibrous, reddish brown to black. Culms trigonous, glabrous, 50-70 cm tall, 3 mm wide. Leaves 3-6, up to 90 cm long; blades elongated linear, 30 cm long, 6-8 mm wide, flattish-plicate, herbaceous, scaberulous on distal margins; sheath 10-18 cm long, pale greenish, flushed with reddish brown at base.

Anthela compound to decompound; leafy bracts 7-9, very unequal, erect-patent, spreading or reflexed, 5-60 cm long, 2-7 mm wide; primary rays 6-9, very unequal, 0-8 cm long, erect-patent; secondary rays short, up to 2 cm long; bracteoles lanceolate to ovate-lanceolate, 3-6 mm long, 1.5-3 mm wide. Spikelets clustered in 7-50 forming a globose head at apex of raylets, linear lanceolate, flattened, 6-12 mm long, 2-2.2 mm wide, densely 10-20 flowered; rachilla straight, 0.3 mm wide. Glumes ovate to ovate-lanceolate, 2-2.2 mm long, 0.8-1 mm wide, 3-nerved, straw-colored, the midrib green, apex scabrid. Stamen 1, filament 0.4 mm long, white, anther whitish yellow, 1 mm long, linear with subulate appendage at apex. Style green, 0.2 mm long, stigmas 3, 1.2 mm long, pale brown, ovary green, trigonous, 0.8 mm long. Achenes trigonous, beaked at apex, 1.5 mm long, 0.8 mm wide, brown, minutely puncticulate, conspicuously stipitate, the stipe broadened at base.

Specimens examined: Hualien Co.: Gian Hsiang, Tzuyun Bridge, along Gian Hsi (River), 10 August 2001, *Hua s. n.* (NHU). Ilan Co.: Loutung, in back of Loutung Forest District Office, Forestry Bureau, along a wood-storing reservoir, 6 May 2006, *Yu s. n.* (NHU). Taipei Co.: Lujou Hsiang, along a branch of Tanshui River, in muddy ground, 10 May 2005, *Huang s. n.* (NHU).

Distribution and notes: *Cyperus eragrostis* Lam. is of tropical America origin (DeFilipps, 1980), but is now found in the United States, South Europe, Asia and Australia, also naturalized to Japan and the Ryukyu Islands (Walker, 1976; Takematsu and Ichizen, 1997; Shimizu, 2003). It occurs in the lowlands of the eastern and northern parts of Taiwan.

It is occasional to locally abundant in moist places, in shallow water and on edges of streams and ponds, and is usually associated with other wetland plants such as *Leersia hexandra* Sw., *Cyperus exaltatus* Retz., *Cyperus iria* L., *Ludwigia octovalvis* (Jacq.) P. H. Raven and *Oenanthe javanica* (Bl.) DC.

This tufted sedge can be distinguished from the other species by its straw-colored, linear-lanceolate spikelets (6-12 mm long) in dense terminal heads or at the end of unequal primary and secondary rays, and 7-9 leafy, unequal bracts up to 60 cm long.

3. *Laportea aestuans* (L.) Chew, Gard. Bull. Singapore 21: 200. 1965 & 25: 164. *fig. 19.* 1969; Friis in Polhill, Fl. Trop. E. Africa, Urticaceae 23. 1989; Acevedo-Rodriguez, Fl. St. John, U.S. Virgin Isl. (Memoirs) 437. 1996; Correll & Correll, Fl. Bah. Archip. 421. *fig. 170.* 1996.

腺花桑葉麻（新擬） Figs. 5 & 7

Perennial herbs, monoecious, plant erect, 30-80 cm tall. Stems quadrangular, succulent, longitudinally grooved at each side, green flushed with purplish red, covered with 2-3 mm long white stinging and glandular hairs, the base woody, up to 2

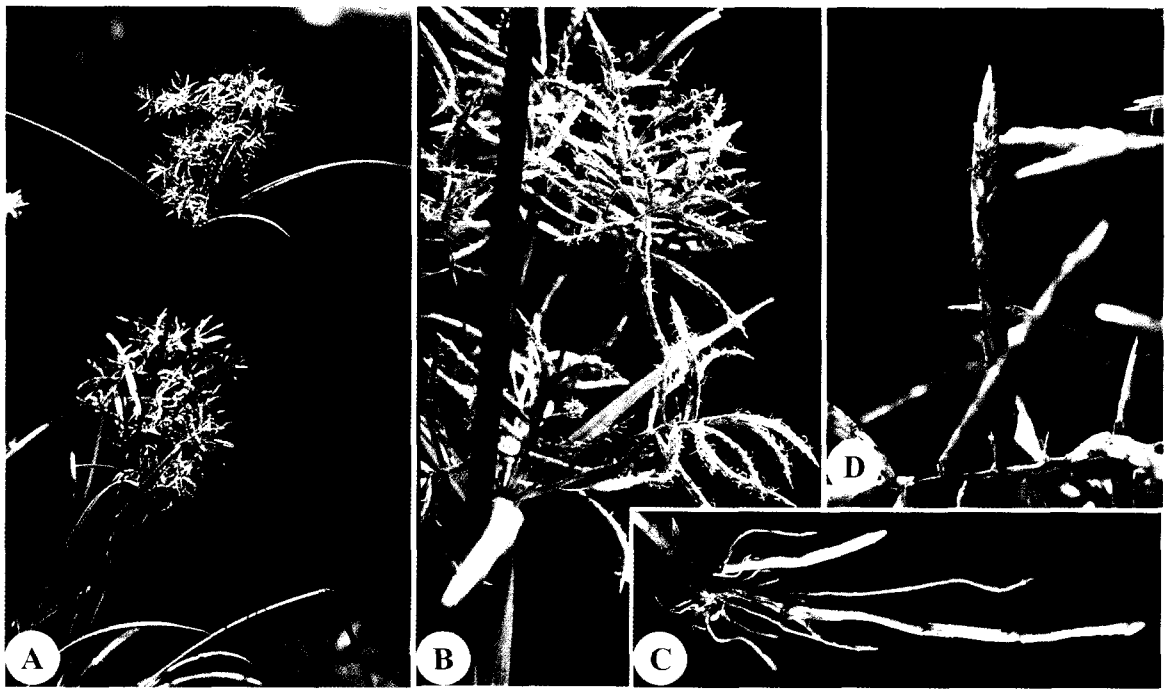


Fig. 1. *Cyperus esculentus* L. A: Habit. B: Portion of inflorescence. C: Lower part of plant with rhizomes and tuber. D: Part of spike with some spikelets.



Fig. 2. *Cyperus eragrostis* Lam. A: Habit. B: Spikelets in a globose head. C: Upper part of plant with inflorescence. D: Spikelet.

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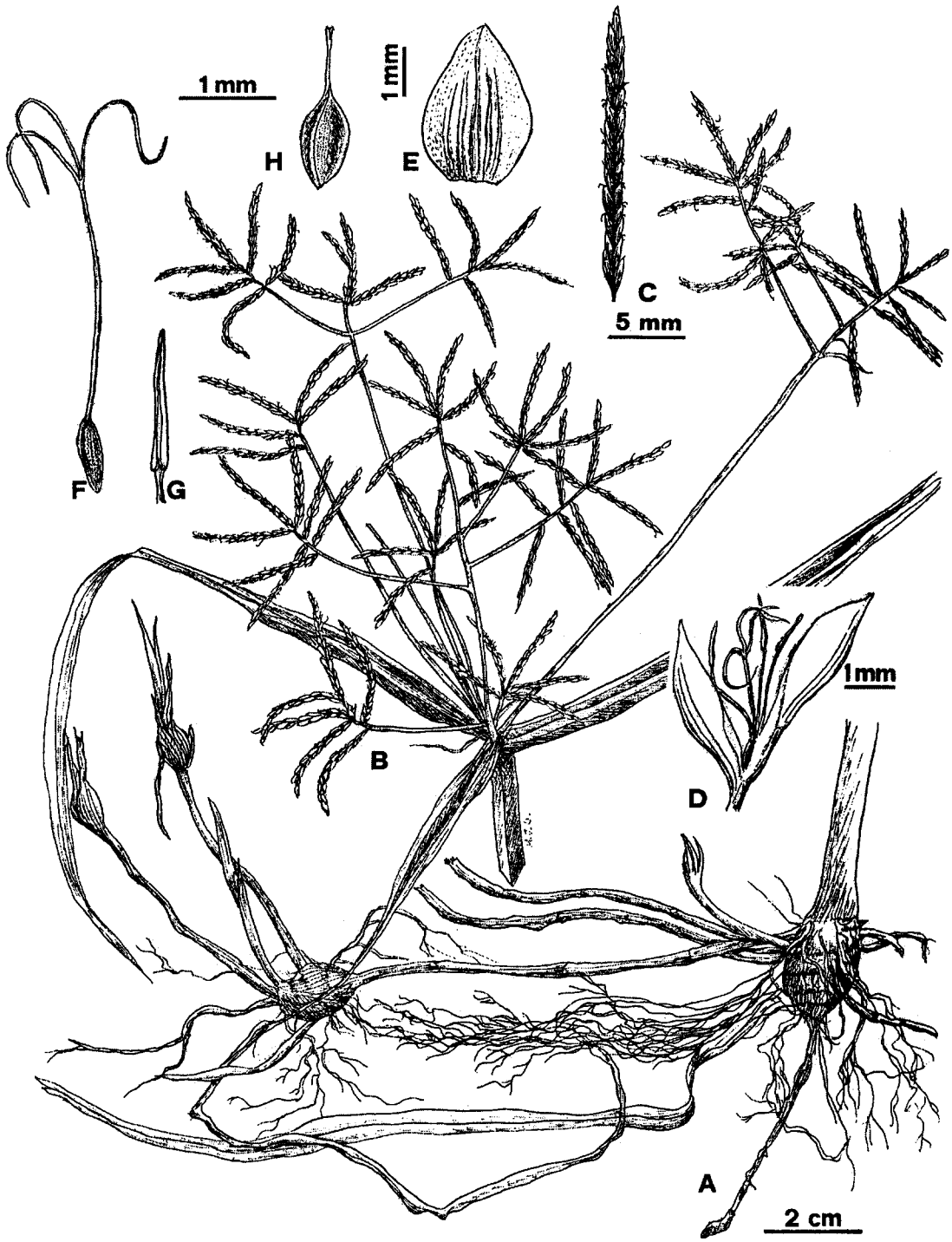


Fig. 3. *Cyperus esculentus* L. A: Rhizome. B: Inflorescence. C: Spikelet. D: Floret. E: Glume. F: Pistil. G: Upper portion of stamen. H: Achene.

cm wide, hollowed as the plant increases in size. Leaves alternate, simple, long-petiolate; blades chartaceous, ovate to broadly ovate, up to 14 cm long and 12 cm wide, stinging hairs scattered on upper surface and veins of the lower surface, the base cordate, subpeltate, the apex acute to acuminate, the margins coarsely dentate, the teeth up to 3 mm long with base 5 mm wide, cystoliths linear on the lower veins; petioles green flushed with purplish red, 10-20 cm long, densely covered with stinging and long

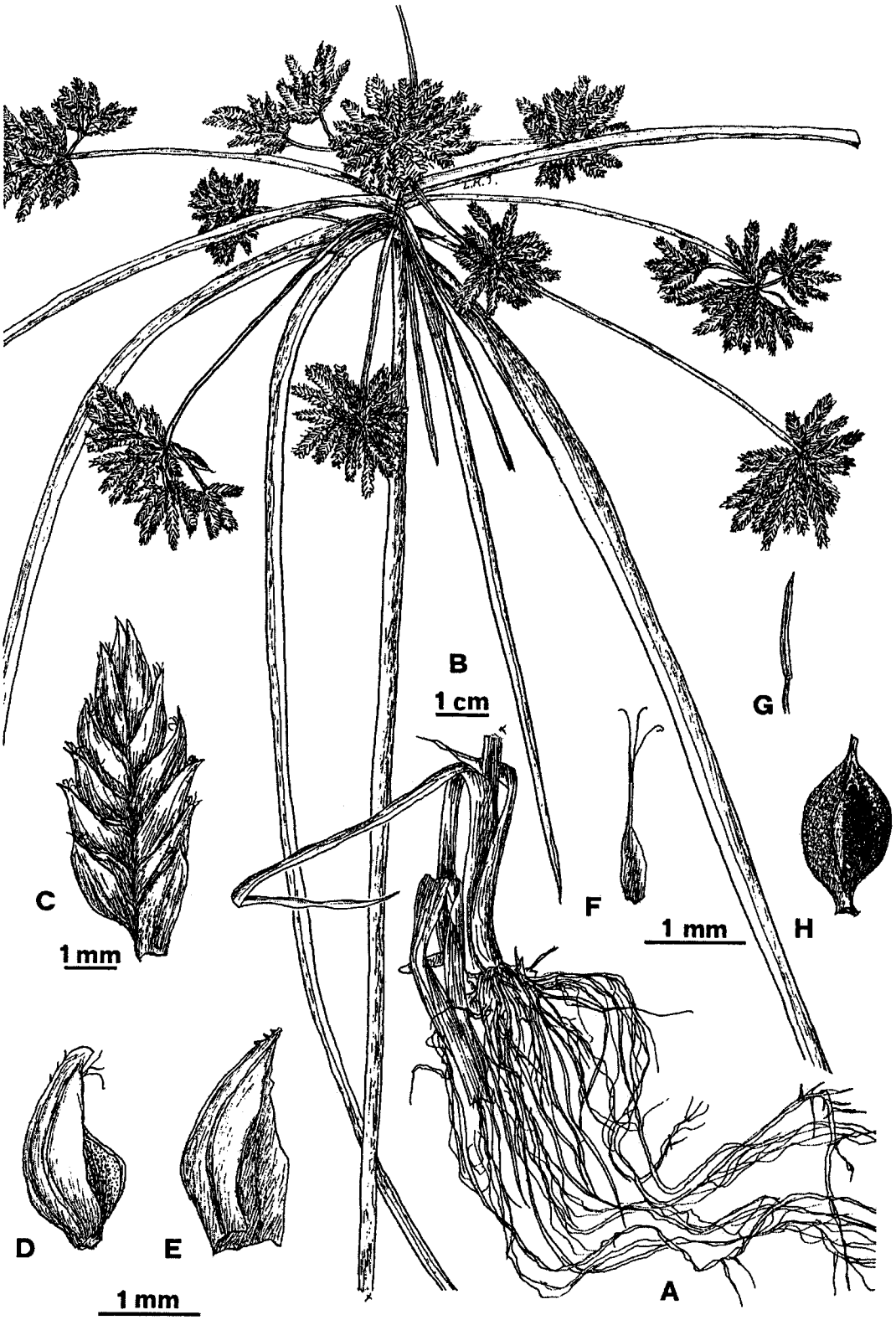


Fig. 4. *Cyperus eragrostis* Lam. A: Root. B: Inflorescence. C: Spikelet. D: Floret. E: Glume. F: Pistil. G: Upper portion of stamen. H. Achene.

glandular hairs; stipules axillary, whitish green, linear lanceolate, up to 10 mm long and 1.5 mm wide, connate in the lower parts, with numerous distinct cystoliths as well as covered with short stinging hairs on the lower surface of midrib and margins, the midrib distinct, keel-shaped.

Inflorescence bisexual, axillary, paniculate, shorter than subtending leaf, 5-25 cm long, peduncle loosely covered with stinging hairs and glandular hairs; flowers in cymes, crowned on apex of branches of the inflorescence, androgynous, the male flowers expanding and falling off before the females. Male flowers pedicellate, subsessile to 2 mm long, articulated at the apex, with stinging hairs and glandular hairs; tepals 4 or 5, oblong or ovate-oblong, 1.5-2 mm long and 1 mm wide, connate at base, whitish green sometimes flushed with purplish red, green midveined, corniculate at the apex, tips with 3-5 stinging hairs up to 1 mm long; stamens equal in number to the tepals, anthers white, 1 mm long, the filaments reflexed in buds, 1.5 mm long when expanding, pistillode obpyramidal, fleshy, white, 0.5 mm long and wide. Female flowers pedicellate, pedicel slightly winged dorsiventrally, glabrous, sessile to 0.5 mm long, up to 1.5 mm long when fruiting, articulated at the apex, bracts minute, 0.2-0.4 mm long at base, the receptacle enlarging or not as the fruit mature, white and fleshy, up to 0.8 mm long when enlarging; tepals 4, the dorsal green, geniculate, 0.2 mm long, tips with 3-5 stinging hairs, the two lateral whitish green, ovate, 0.4 mm long, with minute gland hairs at margins, the ventral whitish green, smaller, 0.1 mm long, lanceolate, serrate at margins, all tepals enlarged when fruiting; ovary green, 0.2 mm long, ovoid, laterally compressed, stigma white, linear, 0.3 mm long, with glandular hairs on dorsal surface. Achenes ovoid, laterally compressed, 1-2 mm long and 1 mm wide, gymnophore shortly stipitate 0.2 mm long, with a recurved tip and a narrow membranous wing, the lateral side with warty depressions, more than half covered by the lateral tepals, light brown when mature.

Specimens examined: Hualien City, Fuhsing St., along ditches, 9 April 2006, *Chen s. n.* (NHU); Meilung, Minchuang 7th St., along margins of Garden, 15 October 2006, *Chen s. n.* (NHU).

Distribution and notes: *Laportea aestuans* (L.) Chew is possibly native to tropical Africa, but is now distributed to Central America, the West Indies and Africa (Correll and Correll, 1996; Friis, 1989), also found in India, Sumatra and Java (Chew, 1969).

In Taiwan, it occurs in the lowlands of eastern part. It is seen in shaded, relatively moist, disturbed places such as roadside ditches, rock walls and along garden margins, and is associated with other weedy plants such as *Centella asiatica* (L.) Urb., *Eragrostis ciliaris* (L.) R. Br., *Phyllanthus tenellus* Roxb. and *Pilea microphylla* (L.) Liebm. Flowering is year round.

This herb can be distinguished from its related species, *Laportea interrupta* (L.) Chew, by its larger blades 10-14 cm long and 8-12 cm wide, inflorescence not surpassing the subtending leaves, and by its female flowers with glandular hairs on the margins of the lateral tepals and a linear unbranched stigma.

4. *Amaranthus dubius* Mart. *ex* Thell. Fl. Adv. Montpellier 203. 1912; Backer & Bakh. f., Fl. Java 1: 235. 1963; Townsend in Dassanayake & Fosberg, Rev. Handb. Fl. Ceylon 1: 11. 1980 & in Polhill, Fl. Trop. E. Africa, Amaranthaceae 27. *fig. 4-11.* 1985; Brenan, J. S. Afr. Bot. 47 (3): 464. 1981; Eliasson in Harling & Anderson, Fl. Ecuad, No. 28: 24. *fig. 5-D. E.* 1987; Acevedo-Rodriguez, Fl. St. John, U. S. Virgin Isl. (Memoirs) 58. 1996.

假刺莧（新擬） Figs. 6 & 8

Annual herbs, erect or ascending, monoecious, 50-80 cm tall. Stems stout, ridged, 5-7 mm across, branched, glabrous below, puberulent on the upper parts, green flushed with purplish red. Leaves glabrous to subglabrous, more or less fleshy; blades rhombic-ovate, 8-12 cm long, 7-9 cm wide, cuneate at base, obtuse at apex, the apex notched, with a fine mucuro; petioles up to 16 cm long, green flushed with purplish red. Flowers clustered into axillary or terminal spikes or panicles, the terminal inflorescence usually paniculate, 15-25 cm long, with puberulent rachis, the apical branches 4-10 mm wide, drooping. Male flowers restricted to the tips of the spike; bracts deltoid-ovate, 1.4-1.8 mm long and 0.6-1 mm wide, with a erect awn about 0.8 mm long; tepals 5, oblong-elliptic with pungent tip, outer tepals 2.3-3 mm long and 1 mm wide, inner ones 1.8-2 mm long and 0.6-0.8 mm wide, anthers yellow, 1 mm long, filament white, 0.8 mm long. Female flowers scattered in the spike except the spike-tips; bracts ovate to deltoid-ovate, 1.5-2 mm long and 0.8 mm wide; tepals 5, ovate to oblong-elliptic, more or less with pungent tips, 1.5-2 mm long and 0.6-0.8 mm wide; pistils 2-2.3 mm long, stigmas 3, reflexed, 0.8 mm long, style 0.5 mm long, ovary ovoid, 1 mm long and wide. Utricles, ovoid-urceolate, 1.5 mm long, with a inflated beak below the style base, circumscissile, the lid 1 mm long. Seeds lens-shaped, 1 mm across, reddish brown.

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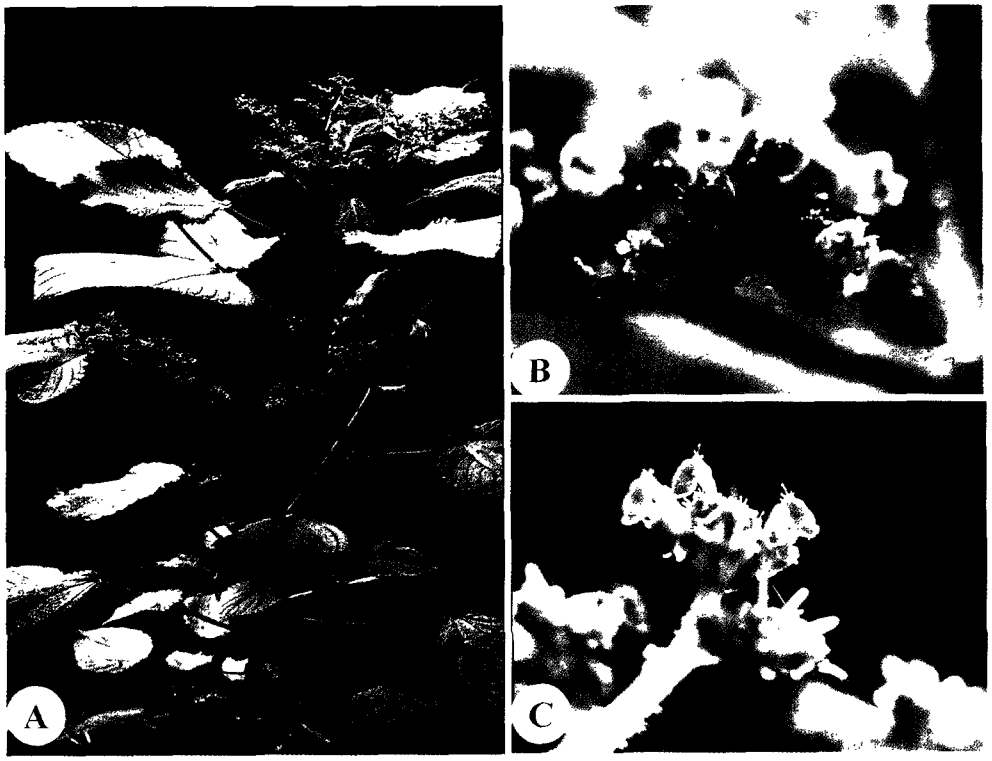


Fig. 5. *Laportea aestuans* (L.) Chew. A: Habit. B: Staminate inflorescence. C: Pistillate inflorescence with achenes.

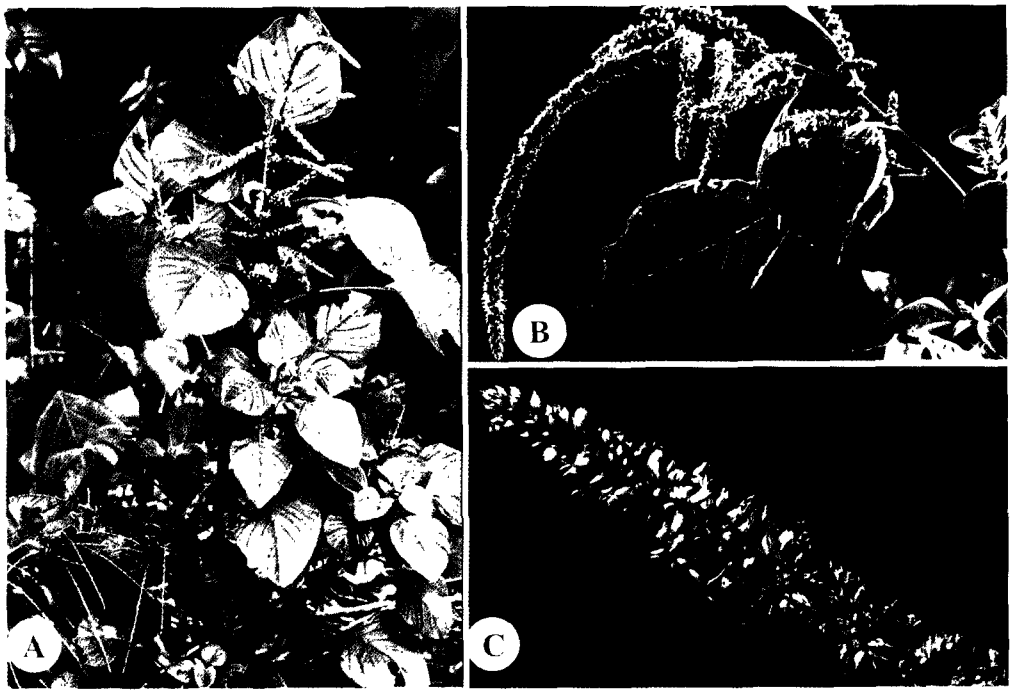


Fig. 6. *Amaranthus dubius* Mart. *ex* Thell. A: Habit. B: Fertile branch. C: Portion of inflorescence showing staminate flowers at the tip only.

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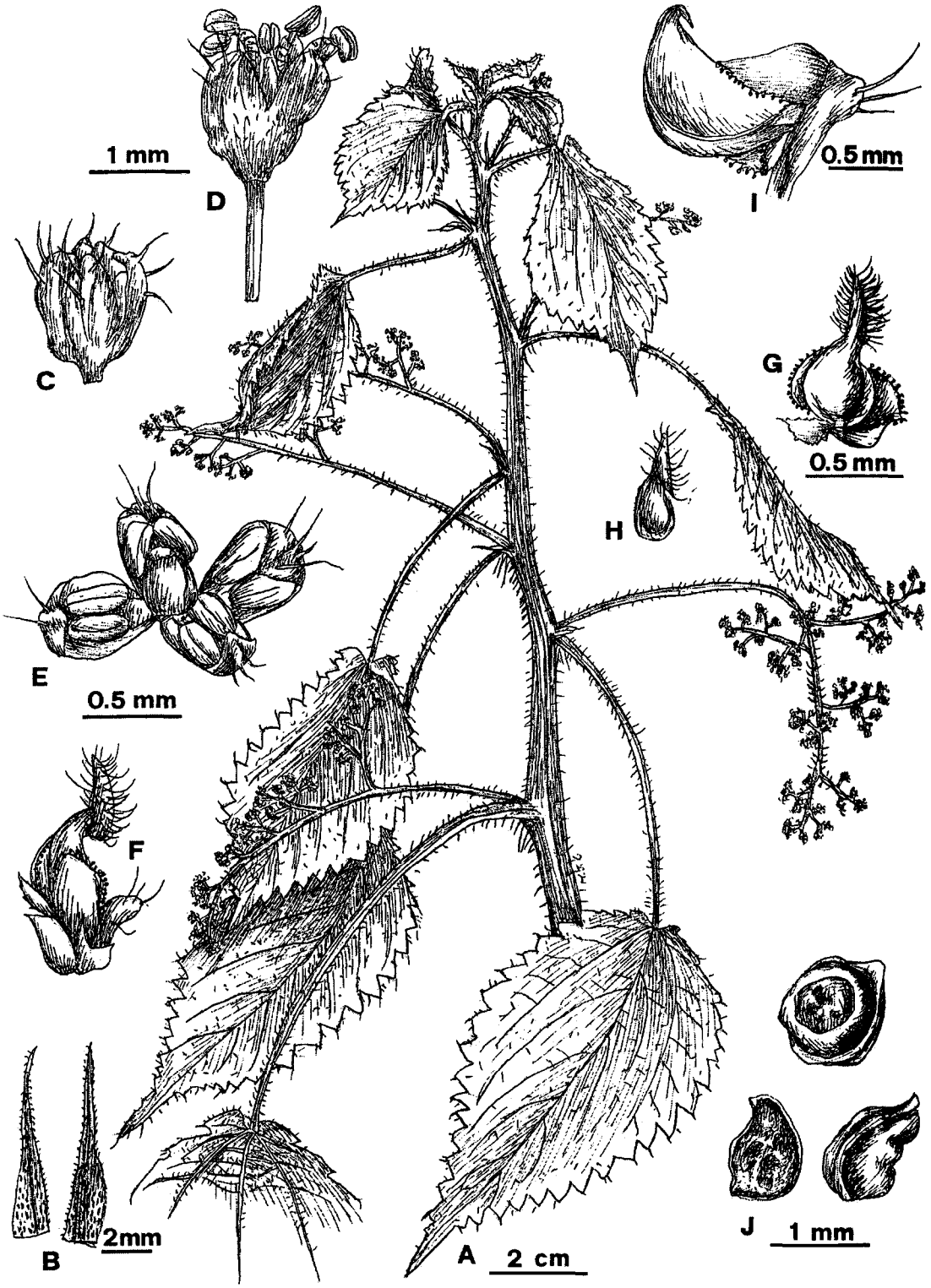


Fig. 7. *Laportea aestuans* (L.) Chew. A: Branch with inflorescence. B: Stipules. C: Staminate flower, tepals closed. D: Staminate flower, side view. E: Staminate flower, tepals opened. F: Pistillate flower, side view. G: Pistillate flower, front-side view. H: Pistil. I: Pistillate flower, tepals with achene attached. J: Achenes.

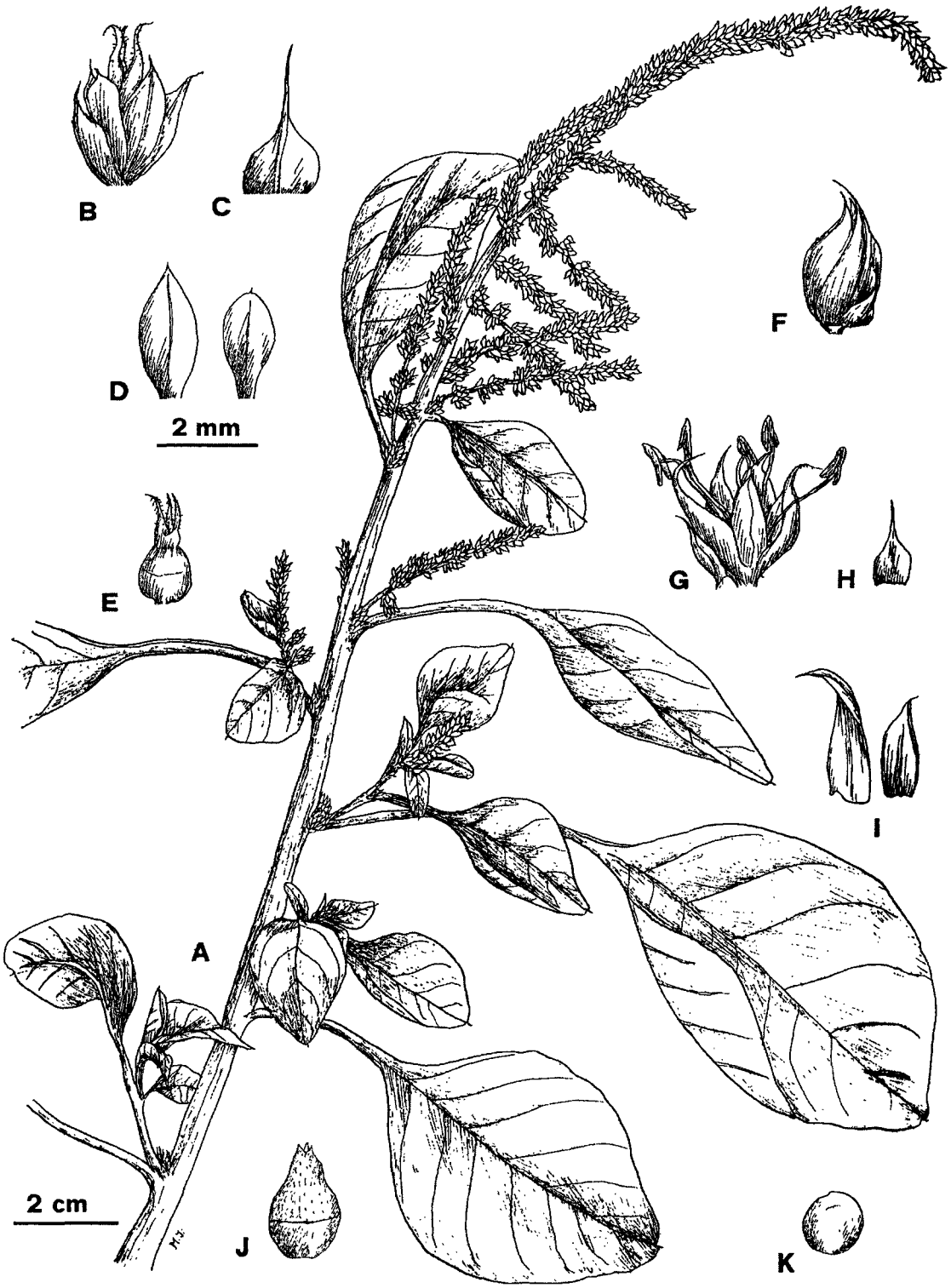


Fig. 8. *Amaranthus dubius* Mart. *ex* Thell. A: Branch with inflorescence. B: Pistillate flower. C: Bract. D: Outer (left) and inner tepals of pistillate flower. E: Pistil. F: Staminate flower, tepals closed. G: Staminate flower. H: Bract. I: Outer (left) and inner tepals of staminate flower. J: Fruit. K: Seed.

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Specimens examined: Hualien Co.: Hualien City, Biyun Village, along roadside, 6 June 2002, *Chen s. n.* (NHU); Kuangtung St., in waste ground and borders of vegetable fields, 28 September 2002, *Chen s. n.* (NHU).

Distribution and notes: *Amaranthus dubius* Mart. *ex* Thell. is a native of the New World (Eliasson, 1987), but is now widely naturalized in the tropics and subtropics (Sauer, 1950; Townsend, 1980, 1985; Eliasson, 1987).

In Taiwan, it occurs in the lowlands of eastern part, growing along roadsides or waste places, and is associate with other obnoxious weeds: *Amaranthus spinosus* L., *Bidens pilosa* L. var. *radiata* Schultz-Bip., *Chamaesyce hirta* (L.) Millsp., *Chloris barbata* Sw. and *Ipomoea triloba* L. Flowering is year round. Aborigines in Hualien area use leaves and stems of this species as a kind of portherb (personal obs.).

This species at first sight might be mistaken for *Amaranthus spinosus* L. of much wider distribution on this island, from which it differs primarily in its stem without axillary spines and male flowers confined to upper part of terminal inflorescence.

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記四種臺灣新歸化植物

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摘　　要

黃土香 (*Cyperus esculentus* L.)、頭穗莎草(*Cyperus eragrostis* Lam.)、腺花桑葉麻（*Laportea aestuans* (L.) Chew）及假刺莧 (*Amaranthus dubius* Mart. *ex* Thell.) 為新歸化於臺灣東部之雜草。本文描述這四種植物，除提供形態、解剖圖外並報告其分布、生態及與近似種之差異。

關鍵詞：莎草科、蕁麻科、莧科、黃土香、頭穗莎草、腺花桑葉麻、假刺莧，分類學，雜草，歸化植物。

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