

Notes on Three Newly Naturalized Plants in Taiwan

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ABSTRACT: *Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides, *Boerhavia coccinea* Mill., and *Hyptis pectinata* (L.) Poit. are recently found naturalized in Taiwan. The present study gives the taxonomic description and line drawings of the three species. In addition, their distribution and notes on ecology and taxonomy are provided.

KEY WORDS: *Boerhavia coccinea*, *Chloris divaricata* var. *cynodontoides*, *Hyptis pectinata*, Lamiaceae, naturalized plant, Nyctaginaceae, Poaceae, Taiwan, taxonomy, weed.

INTRODUCTION

In this paper we report the recent finding of following adventive species from Taiwan: *Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides, *Boerhavia coccinea* Mill., and *Hyptis pectinata* (L.) Poit. The first species is from Australia and the later two are of tropical America origin. *Chloris divaricata* var. *cynodontoides* and *H. pectinata* occur in the eastern and central parts of Taiwan (Fig. 1), where they grow on dry waste area. *Boerhavia coccinea* mostly grows in moist soils in the eastern part and range south to Tainan (Fig. 1). A taxonomic treatment of these species is given below. The species description and illustration that follow are based on live plants in wild.

TAXONOMIC TREATMENT

1. *Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides in Austral. J. Bot. Suppl. Ser. 5: 17-18. 1972; Wagner *et al.*, Man. Flowering Pl. Hawaii (Rev. ed.) 2: 1514-1515. 1999.
澳洲虎尾草 Figs. 2 & 3

Perennial herbs, tufted compact at the base, stoloniferous; culms erect or ascending, 20-45 cm tall, 1-1.2 mm across, more or less compressed, green flushed with purple, 2-4 noded, the nodes swelled, 2.5 mm long and 1.5 mm across, purplish red. Leaves bluish green, blades linear, flattened, 3-8 cm long and 2-5 mm wide, obtuse, mucronate, with scabrid margins; ligule a ciliate membrane, truncate apically, 0.5 mm long, scabrous on the back; sheaths 4-6 cm long, conduplicate-keeled, with pilose orifice. Inflorescence of 4-10 racemes, digitate in 1-2 whorls, the primary axis 0-5 mm long; racemes 5-6 cm long, spreading or reflexed, densely bearing many spikelets on one side of the axis; rachis triquetrous and flattened, scabrous on the angles, spikelets 2-flowered, 3 mm long (excluding awns), pale-brownish and usually flushed with purple; callus covered with silky hairs *ca.* 0.5 mm long. Glumes hyaline,

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Fig. 1. Distribution of *Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides (—), *Boerhavia coccinea* Mill. (---), and *Hyptis pectinata* (L.) Poit. (····) in Taiwan.

narrowly lanceolate, unequal, folded, 1-nerved, the nerve without scabrous; the lower one 1-1.8 mm long and 0.2-0.3 mm wide, the upper 2-2.8 mm long and 0.2-0.4 mm wide; lower lemma laterally folded, chartaceous, ovate-lanceolate, 3-nerved, 2.5-3 mm long and 0.6-0.8 mm wide, scabrous on the upper portions of abaxial surface, 2-lobed, awned from the sinus, the awn 5-15 mm long, apical lobes acuminate, 0.5 mm long; lower palea linear-lanceolate, 1-2 mm long and 0.1 mm wide, 2-nerved, scabrous on margins, puberulous or pubescent on apical portions; lodicules 2, 0.1 mm long; stamens 3, anthers 0.4 mm long, yellow, filament filiform 0.4 mm long; style 2, 0.3 mm long; stigma 0.5 mm long, blackish purple, plumose, included; ovary ovate to obovate, pale yellow, 0.3 mm long; upper lemma filiform, 2-2.5 mm long, apically dilated to 0.2 mm wide and bifid, puberulous on apical lobes, apical lobes narrowly acuminate, 0.4 mm long, the awn from the sinus, 2-8 mm long. Caryopsis pale brown, oblong, trigonous, 1.7 mm long, the hilum oblong, 0.6 mm long.

Specimens examined: TAIWAN. Hualien co.: Gi-an Hsiang, Nanpu, Experimental Farm, along road sides, 13 December 2001, *Chen s. n.*; Hualien city, Geilin 9th St., along roadsides, 8 March 2004, *Chen s. n.*; Quang-fu Hsiang, near Mataian Hsi (river), on parking lot, 10 October 2003, *Chen s. n.*; Shou-fong Hsiang, near Liyu Lake, along roadsides and on borders of field, 9 May 2004, *Chen s. n.* (all at Herbarium, National Hualien Teachers College, HLTC). Nantou co.: Puli, Liyutan, 26 March 2004, *Chung w032602* (National Cheng-Kung University Herbarium, NCKU).

Distribution and notes: *Chloris divaricata* var. *cynodontoides* is native to Australia and ranges from the Australia mainland to New Caledonia, New Herbrides, Fiji Islands and Hawaiian Islands (Lazarides, 1972).

Chloris divaricata var. *cynodontoides* occurs at lowlands in the eastern and central parts of the island. It is seen along road sides, wastelands and borders of fields, associate with other weedy plants commonly found in disturbed areas, such as *Aster subulatus* Michx., *Bidens pilosa* L. var. *minor* (Bl.) Scherff, *Eleusine indica* (L.) Gaertn., *Eragrostis ciliaris* (L.) R. Br., and *Ipomoea triloba* L. Flowering is year round.



Fig. 2. *Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides. A: its natural habitat, and racemes (insert), noting spikelets with long awns. B: erect culms and inflorescence.

Occasionally a related species common in Taiwan, *Chloris barbata* Sw., with a smaller habit than usual, might appear to be close to the present species, but its erect racemes of inflorescence in contrast to the spreading or reflexed ones of *C. divaricata* var. *cynodontoides* are quite different.

2. *Boerhavia coccinea* Mill., Gard. Dict., ed. 8 (*Boerhavia* no. 4) 1768; Shreve & Wiggins, Veget. and Fl. Sonoran Desert 1: 477. 1964; Wagner *et al.*, Man. Flowering Pl. Hawaii (Rev. ed.) 1: 978, pl. 139. 1999. 紅花黃細心 Figs. 4 & 5

Perennial herbs, prostrate to ascending, up to 60 cm tall. Stems terete, 2-5 mm across, green flushed with purplish red, glandular puberulent and sparsely pilose. Leaves somewhat fleshy, opposite, in unequal pairs; blades ovate, broadly ovate to suborbicular, upper surface yellowish green, green to bluish green, obscurely glandular to glabrous, lower surface pale, pubescence on veins, margins entire, undulate to slightly lobed, distinctly long-ciliate *ca.* 1 mm long, obtuse at the apex, truncate to subcordate at the base, the larger one 3-8 cm long and 2-7 cm wide, with a long petiole up to 4 cm long, the smaller 1.5-3 cm long and 1-2.5 cm wide, with petiole less than 1 cm long; petioles pale flushed with purplish red, with long hairs. Inflorescences of cymes, in an open panicle, up to 60 cm long, the panicle 4-8 branched, more or less zigzag, ascending, the peduncles stout at base, capillary at apex, green flushed with purplish red, obscurely glandular, each branch of inflorescence subtended by a bract, bracts ovate and ciliate, 1.5 mm long and 1 mm wide, caducous. Flowers 3-6, clustered at the apex of panicle, subsessile; bracteoles usually 2, subtending a flower, in an unequal pair, the smaller slightly above, linear-lanceolate, 0.8 mm long and 0.2 mm wide, the larger below, lanceolate, 1.2 mm long and 0.5 mm wide, all those pale yellow flushed with purple, pilose and glandular on margins and abaxial surface; perianth constricted near the middle, the limb

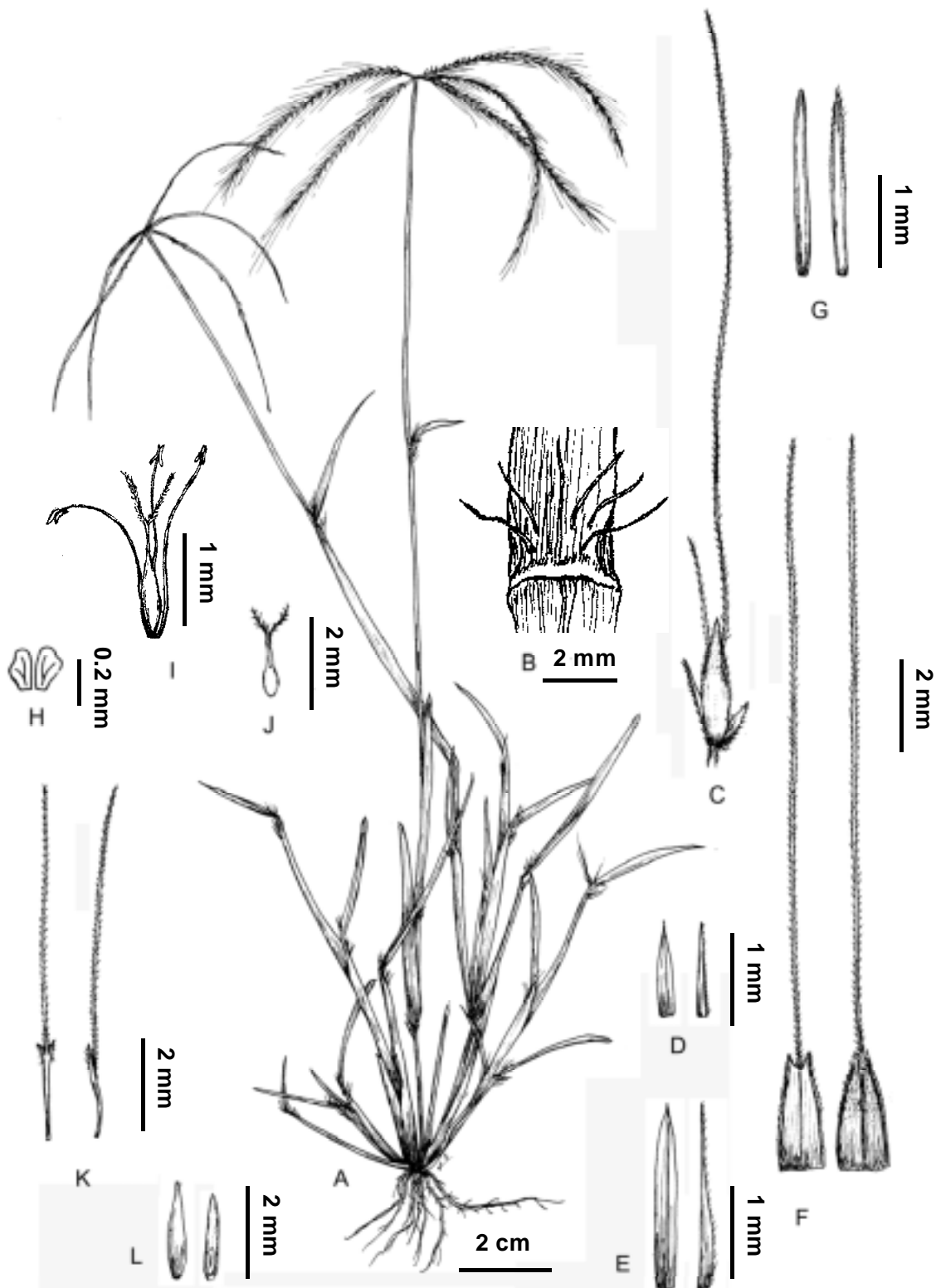


Fig. 3. Illustration of *Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides. A: habit. B: ligule. C: spiklet. D: lower glume at adaxial and side views. E: upper glume at adaxial and side views. F: lower lemma at adaxial (left) and abaxial (right) views. G: lower palea at adaxial (left) and abaxial (right) views. H: lodicules. I: stamens and pistil. J: pistil. K: upper lemma at adaxial and side views. L: caryopsis.



Fig. 4. *Boerhavia coccinea* Mill. A: habit and its natural habitat. B: leaves and inflorescence, noting long hairs on the leaf margins, and anthocarps.

campanulate-tubular 1.2-2 mm long, 2 mm across when opening, magenta to dark red, shallowly 5-lobed, the lobes 0.8 mm wide, emarginated, with protuberance bearing hairs on the sinus, the abaxial side with a calyx-like surface, pilose above and glandular below; stamens 1 or 2, filament 0.6 mm long, purple, anthers dithecal, orbicular, 0.4 mm across, purple to orange red; style 1 mm long, purple; stigma capitate, purplish red, 0.3 mm across; ovary 1.2 mm long. Anthocarps obconical-clavate, 4-4.5 mm long and 1.8 mm wide, rounded-subtruncate at apex, 5-ribbed, the ribs green, 0.3-0.4 mm wide, prominently stipitate glandular, the furrows pale, wider than ribs, 0.5-0.6 mm wide, densely puberulent, occasionally mixed with a few glandular hairs, straw-colored when mature.

Specimens examined: TAIWAN. Hualien co.: Hualien city, Meilung, 13 August 1990, *Yung s. n.*; Meilung Shan (mountain), near a community park, on mountain slope, 11 June 1996, *Wang s. n.*; Hualien city, nearby Tzu-chi High School, on lawns along Meilung Hsi (river) bank, 13 December 2001, *Chen s. n.*; same loc., 30 October 2002; same loc., 1 June 2003, *Chen s. n.*; Hualien city, by Hualien jail, on lawns under planted trees, 10 December 2004, *Chen s. n.* (all at HLTC). Taitung co.: Lutao (Green Island), 22 October 2002, *Hua s. n.*; same loc. and date, *Li s. n.*; Lutao, Chonliu Hsiang, along trail to mountain, 29 March 2003, *Su & Hsu s. n.*; Lutao, Turkey Rock, 30 March 2003, *Su & Hsu s. n.*; Lutao, Tzu-Ping, 30 March 2003, *Su & Hsu s. n.* (all at HLTC). Tainan co.: Tainan city, on lawns of Yen-Pin-Chung-Wang-Chi (Kuo-Sin-Ya Temple), 6 January 1988, *Chen s. n.* (HLTC).

Distribution and notes: *Boerhavia coccinea* is native to tropical America, perhaps to the Caribbean Islands, and was naturalized in Hawaii (Wagner *et al.*, 1999). In North America it is also known along the Pacific coast from southern California to the southeastern states (Shreve & Wiggins, 1964).

In Taiwan, it occurs at dry or moist lowlands in waste places, roadsides, river banks and lawns, and associates with other weedy plants commonly found in disturbed areas, such as *Bidens pilosa* L. var. *radiata* Schultz-Bip., *Oxalis corniculata* L., *Desmodium triflorum* (L.) DC., *Alysicarpus vaginalis* (L.) DC., *Vernonia cinerea* (L.) Less. var. *cinerea*. Flowering is year round.

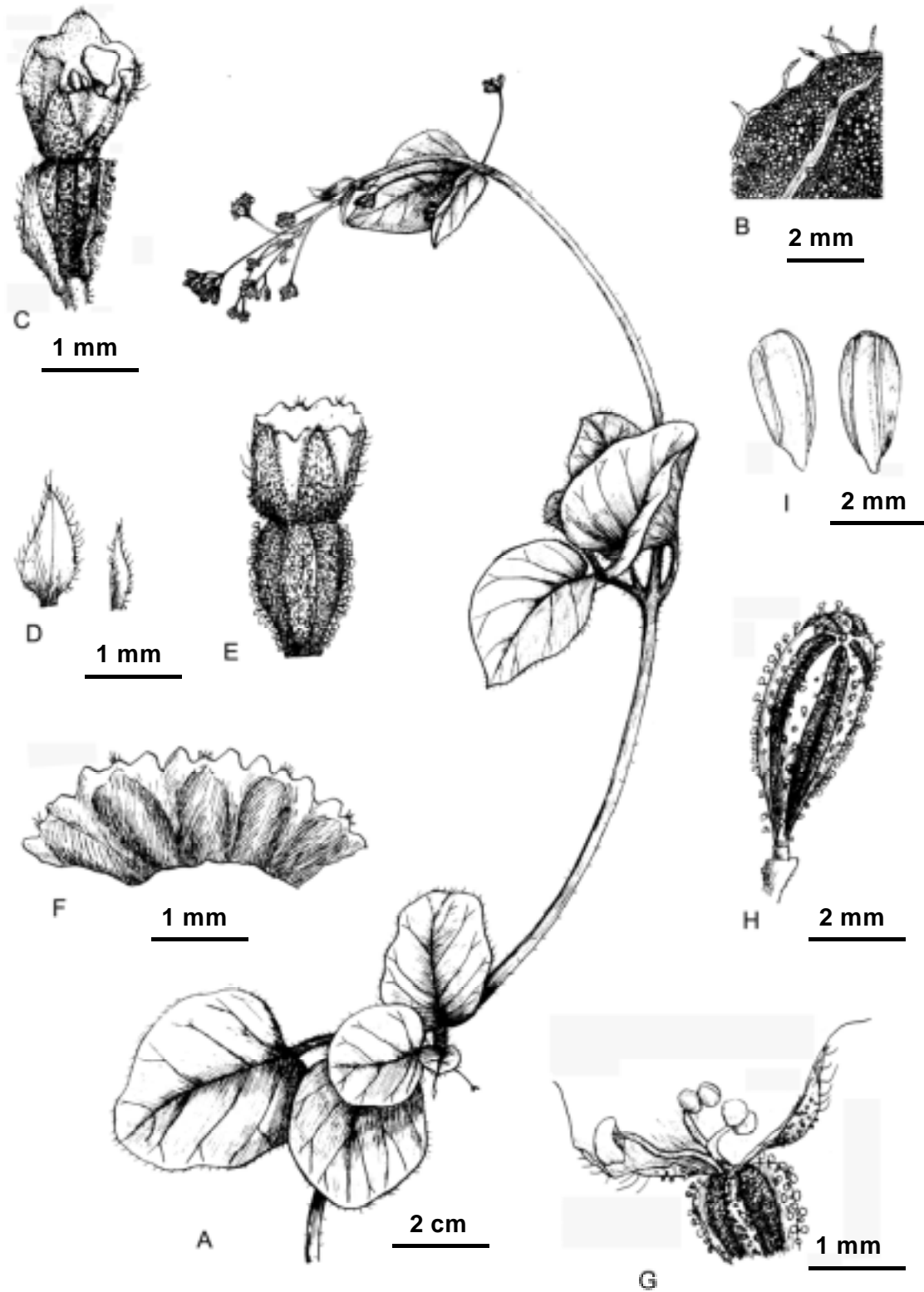


Fig. 5. Illustration of *Boerhavia coccinea* Mill. A: habit. B: hairs on leaf margin and lower surface. C: flower with bracteoles at the pedicel. D: bracteoles; E: perianth with campanulate-tubular limb. F: dissected corolla. G: style and stamens. H: anthocarp. I: seeds.

According to Fosberg (1978), *Boerhavia coccinea* is a member of the *Boerhavia diffusa* complex and not well separated from its related forms. However, to us, the present species was definitely not conspecific with the plants commonly thought to be *B. diffusa* of some Taiwanese botanists (e.g. Hong, *et al.* 1978; Ying, 1996; Yang and Lu, 1996; Cheng, 2000). The plant has decumbent habit with diffuse, widely branching, ascending panicles of magenta or dark red flowers, the leaves suborbicular and with distinctly long-ciliate margins, and usually occurring in disturbed areas, are apparently different from *B. diffusa*. In fact, the present species has been reported in Taiwan by Jeng (1987) in his *Seaside Plants of Taiwan*, in which he applied the name "*Boerhavia diffusa* L." Since the taxonomy of *B. diffusa* was chaotic in Taiwan, the present authors prefer to use the name "*Boerhavia coccinea* Mill." for the taxon.

3. *Hyptis pectinata* (L.) Poit., Ann. Mus. Natl. Hist. Nat. (Paris) 7: 474, pl. 30. 1806; Backer & Bakh. f., Fl. Java 2: 634, 1965; Nowicke & Epling, Ann. Missouri Bot. Gard. 56: 86-87. 1969; Correll & Correll, Fl. Bah. Archip. 1255-1256, fig. 541. 1966; Acevedo-Rodriguez, Fl. St. John, U. S. Virgin Isl. (Memoirs) 276-277, fig. 127d-f. 1996; Wunderlin, Guid. Vasc. Pl. Florida 531. 1998; Harley in Berry *et al.*, Fl. Venez. Guayana 5: 688, fig. 585. 1999; Wagner *et al.*, Man. Flowering Pl. Hawaii (Rev. ed.) 1: 802, pl. 110. 1999.

櫛穗香苦草 Figs. 6 & 7

Perennial herbs, up to 3 m tall. Stems woody at the base, much branched, pubescent, 4-angled. Leaves aromatic, opposite, simple, blade ovate to broadly ovate, 2-8 cm long and 2-7 cm wide, acute to obtuse at the apex, subcordate, rounded to truncate at the base, with glandular spots on both surfaces; upper surface slightly puberulent to glabrous, lower densely pubescent; margins serrate to double serrate; petioles 0.5-3.5 cm long. Inflorescences of verticillate cymes ca. 5 mm long and wide, axillary with 1-4 cm peduncles or terminal in panicles up to 15 cm long. Flowers sessile; bracts filiform, 3 mm long, pubescent; calyx campanulate-tubular, 10-ribbed, pubescent, 2-3 mm long including 5 lobes, the lobes bristle-like, 1.3-1.5 mm long, with tufts of white trichomes ca. 0.3 mm long between lobes; corolla tubular, pink or white flushed with violet, 3-4 mm long, puberulent above the middle, the limb bilabiate, with remotely trichomes on the lower surface, upper lip oblong ovate to ovate, emarginate to bilobed, ca. 1.5 mm long and 1.7 mm wide, with a depression below the middle, puberulent within below the depression, lower 3-lobed, lateral lobes lanceolate ovate 1 mm long and 0.7 mm wide, middle lobes broadly ovate, emarginate, 1 mm long and wide, the edges abruptly incurved and forming a pouch, dark violet; stamens 4, didynamous, inserted the base of the corolla lobes, shortly exerted, filament white flushed with violet, the anterior pair 1 mm long, glabrous, the posterior shorter, 0.8 mm long, long white haired on the upper surface, anthers reddish brown, 0.3 mm long; style gynobasic shortly exerted, 2.5 mm long, white flushed with violet; stigma 2-parted, 0.1 mm long, white when anthesis; ovary 4-parted, whitish yellow, each part oblong, 0.2 mm long; disk 0.3 mm long, whitish yellow. Nutlets 4, oblong, compressed, 1.2 mm long and 0.5 mm wide, black, subrugose, enclosed within the persistent calyx.

Specimens examined: TAIWAN. Hualien co.: Gi-an Hsiang, Chonyung Rd., roadside, on waste ground, 20 April 2004, *Chen s. n.*; Hualien city, Chenkuo Rd., roadside, August, 2000, *Chen s. n.* (all at HLTC). Ilan co.: Chiau-shi Hsiang, near Longtan Lake, 11 May 2002, *Yeng s. n.* (HLTC).

Distribution and notes: *Hyptis pectinata* is a weedy plant native to tropical America, commonly distributed from Mexico, South Florida to Venezuela (Harley, 1999), also naturalized to Hawaii (Wagner *et al.*, 1999) and Java (Baker and Bakhuizen, 1965).



Fig. 6. *Hyptis pectinata* (L.) Poit. A: its natural habitat, and persistent calyx in comb-shaped cymes. B: stems and inflorescences, and flowers in cymes.

In Taiwan, it occurs at lowlands in the eastern part. It is seen along roadsides or waste places, and associates with other obnoxious weeds: *Conyza canadensis* (L.) Cronq. var. *canadensis*, *Bidens pilosa* L. var. *radiata* Schultz-Bip., *Ipomoea triloba* L., *Chloris barbata* Sw. and *Chamaesyce hirta* (L.) Millsp. Flowering is year round.

This herb can be distinguished from its similar species, *Hyptis suaveolens* (L.) Poit., by its comb-shaped cymes, pink or whitish violet flowers, and smaller calyx with white trichomes between bristly calyx-lobes.

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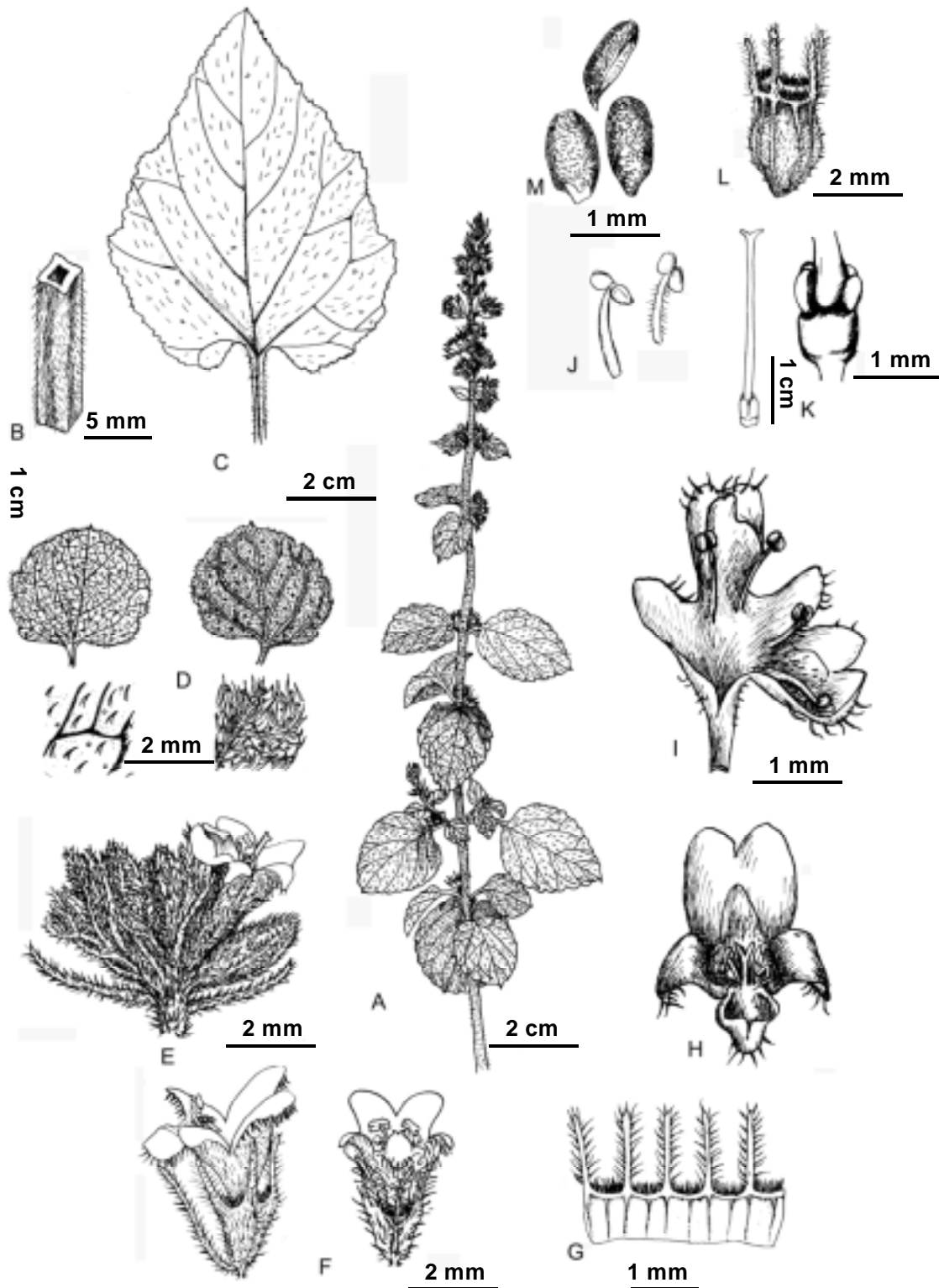


Fig. 7. Illustration of *Hyptis pectinata* (L.) Poit. A: habit. B: portion of stem. C: basal leaf. D: adaxial (left) and abaxial (right) surfaces of upper leaf. E: cyme. F: flower at different views. G: dissected calyx. H: corolla. I: dissected corolla. J: anterior (left) and posterior (right) stamens. K: pistil (left) and ovary on disk (right). L: persistent calyx. M: nutlets.

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三種台灣新歸化植物

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摘 要

澳洲虎尾草(*Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides)(新擬中名)、紅花黃細心(*Boerhavia coccinea* Mill.)(新擬中名)及櫛穗香苦草(*Hyptis pectinata* Poit.)(新擬中名)為新歸化於台灣之雜草。本文描述這三種植物，除提供形態、解剖圖外並報告其分佈與生態。

關鍵詞：紅花黃細心、澳洲虎尾草、櫛穗香苦草，唇形科、歸化植物、紫茉莉科、禾本科、台灣、分類學、雜草。

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