

Pluchea Cass. (Asteraceae: Inuleae) in Taiwan

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Abstract. Four species of the *Pluchea* (Asteraceae) are recognized from Taiwan: *P. carolinensis* (Jacq.) G. Don, *P. indica* (L.) Less., *P. pteropoda* Hemsl., and *P. sagittalis* (Lam.) Cabera. Both *P. indica* and *P. pteropoda* occur in littoral habitats. The former is widespread mainly along the western coastline, and the latter is restricted to the southwestern seashore. Previous reports of *P. pteropoda* as a rare, alpine species in Taiwan are erroneous. In recent years *P. carolinensis* has abundantly naturalized in southern Taiwan. *Pluchea sagittalis*, a second adventive species in Taiwan, grows rampantly in the north. Both were originally native to the New World and are documented in Taiwan for the first time. A taxonomic treatment, line drawings, and a distribution map of *Pluchea* species in Taiwan are provided. Meiotic chromosome counts of $n = 10$ are reported for the naturalized *P. carolinensis* and $n = 20$ for an indigenous population of *P. pteropoda* and a sample collected from Cape D'Aguilar, Hong Kong.

Keywords: Asteraceae; Chromosome number; Inuleae; *Pluchea*; *Pluchea carolinensis*; *Pluchea indica*; *Pluchea pteropoda*; *Pluchea sagittalis*; Taiwan; Taxonomy.

Pluchea Cass., a genus of ca. 40 (Merxmüller et al., 1977; Mabberley, 1997)—80 (Anderberg, 1991, 1994) species, is distributed in warm tropical and subtropical regions of the Old and New World in both hemispheres. Many are characteristic of brackish marshes and other saline habitats (McVaugh, 1984). Two species are native and were previously reported from Taiwan, *P. indica* (L.) Less. and *P. pteropoda* Hemsl. (Li, 1978). *Pluchea indica* is widespread along the western coastline of the island, often associated with mangroves; *P. pteropoda*, incorrectly reported previously in Taiwan as an alpine species, is a strictly littoral plant confined to seashores in the southwest. In this study we document the recent naturalization of two adventive species, *P. carolinensis* (Jacq.) G. Don and *P. sagittalis* (Lam.) Cabera, in the lowlands of Taiwan. A taxonomic treatment of the genus in Taiwan is also presented.

PLUCHEA Cass.

Shrubs or herbs with alternate, simple leaves, more or less aromatic. Capitula many-flowered, disciform, usually numerous, in panicle, elongate to terminal flat-topped inflorescences. Involucral bracts imbricated. Outer florets numerous, in several peripheral rows, filiform, pistillate and fertile; achenes 4–5 angled, longitudinally grooved. Central florets much fewer, tubular, hermaphrodite, functionally staminate; anthers obtuse at apex, tailed at base; style entirely or almost undivided, sometimes divided; achenes often indistinct or vestigial as a small

ring consisting of basal sclerenchymatous cells of the carpodium. Pappus of free, barbellate bristles. —Asia, North and South America, Africa, Australia (Anderberg, 1994).

Key to the Species of *Pluchea* in Taiwan

- 1a. Plant erect and shrubby; branches densely pubescent; leaves chartaceous, lateral veins prominent.
 - 2a. Stems and branches conspicuously winged by the decurrent leaves; capitula hemispheric (when fresh); central florets ca. 50–60. 4. *P. sagittalis*
 - 2b. Stems and branches not winged; capitula campanulate (when fresh); central florets usually less than 25.
 - 3a. Branches densely tomentose; leaves thin, petiolate, margins subentire; central florets ca. 20–25; receptacles glabrous 1. *P. carolinensis*
 - 3b. Branches finely crisp-hairy; leaves thick, subsessile, margins dentate; central florets ca. 2–7; receptacles densely hirsutulous 2. *P. indica*
- 1b. Plant decumbent-ascending, herbaceous with a slightly woody base; branches glabrous or sparingly puberulent; leaves somewhat succulent, lateral veins inconspicuous 3. *P. pteropoda*

1. *Pluchea carolinensis* (Jacq.) G. Don in Sweet, Hort. Brit. ed. 3: 350. 1839; Adams, Fl. Jamaica 762. 1972; Khan and Jarvis, Taxon 38: 659. 1989.

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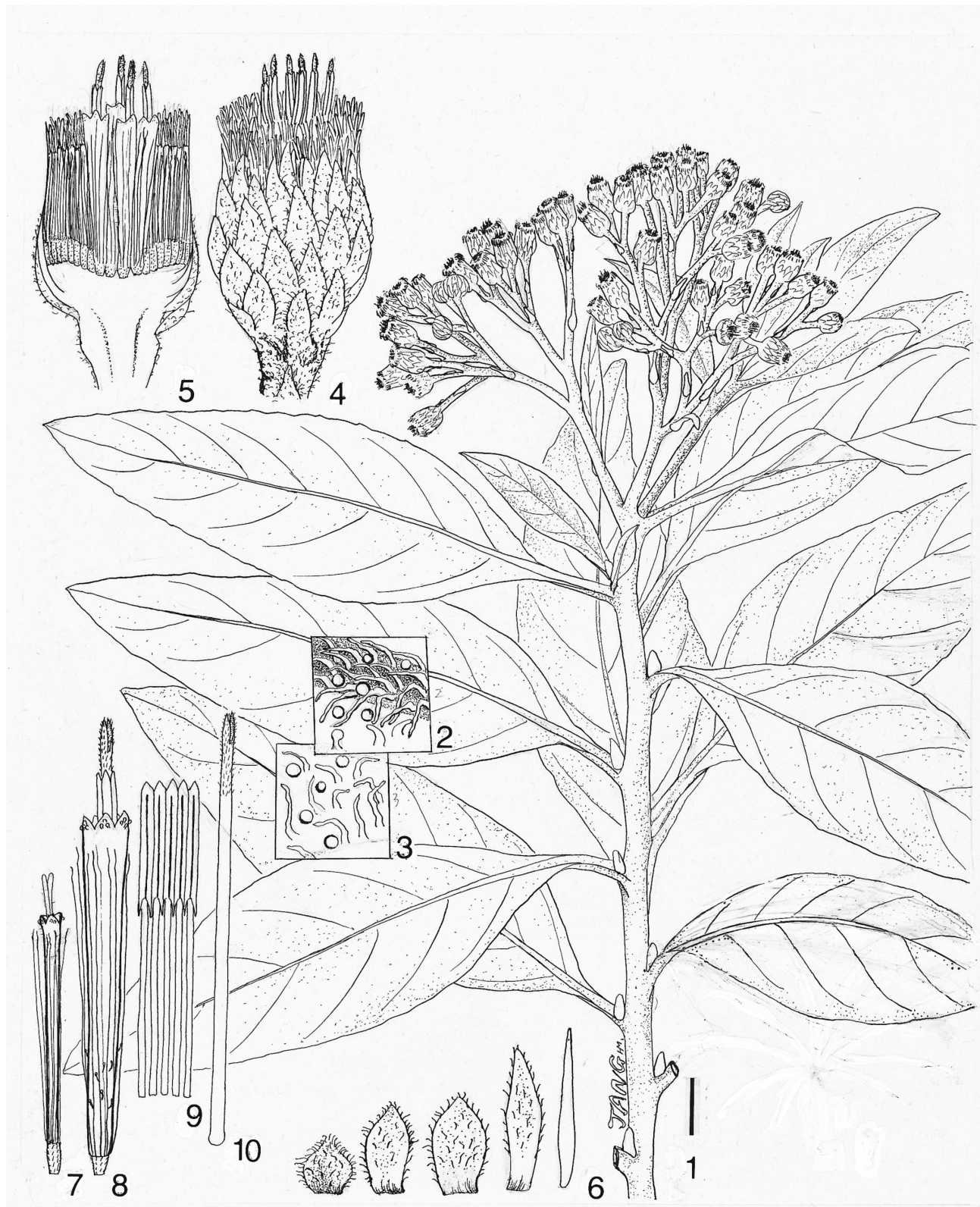


Figure 1. *Pluchea carolinensis* (Jacq.) G. Don. 1: Habit; 2: Portion of leaf, adaxial surface; 3: Portion of leaf, abaxial surface; 4: Capitulum; 5: Capitulum, longitudinal section; 6: Involucral bracts; 7: Outer floret; 8: Central floret with rudimentary ovary; 9: Stamens; 10: Style of central floret. All from Peng 10540 (HAST). Bar = 1 cm.

Conyza carolinensis Jacq., *Collectanea* 2: 271. 1789.

Erect shrub 1–2.5 m tall, much branched, branches densely tomentose. Leaves oblong-ovate to elliptic, 6–15 cm long, 2–6 cm wide, thinly tomentose and glandular on both surfaces, upper surface green, lower surface grayish, apex mucronulate-obtuse, margins entire or nearly so, base attenuate, petioles 1–2.5 cm long. Capitula 5–7 mm (when fresh) or ca. 10 mm (in dried specimens) in diam., 6 mm long, peduncles 3–8 mm long, densely congested into terminal and axillary corymbs. Involucres ovate to campanulate, bracts greenish-purplish, 4–5-seriate; the outer very widely elliptic to very widely obovate, rounded at apex, 2–4 mm long, 1.5–2 mm wide, tomentose abaxially, ciliate at margins; the inner lanceolate to linear-lanceolate, acute at apex, 4–5 mm long, 0.5–1 mm wide, sparingly pubescent to glabrous. Receptacles flat, glabrous. Outer florets numerous, corolla filiform, pale greenish white, pinkish toward summit, 3.5–4 mm long, tip 3-lobed; pappus white, slightly shorter than corolla; mature achenes not available for examination. Central florets ca. 20–25; corolla whitish, pinkish toward summit, 4–5 mm long, sparingly glandular hairy at base; anthers obtuse at apex, shortly tailed at base; anthers and style exserted; achenes vestigial as a small, cartilaginous ring.

Specimens examined. **TAIWAN.** CHIAYI HSIEN: Chuchi Hsiang, Kuanghua Village, Chiehung, along dry, traffic roadside, 200 m alt., 6 Feb 1987, *Peng 10455* (HAST). TAINAN HSIEN: Tsochen Hsiang, Tongpingtso, en route from Tsochen to Yuching, 60–80 m alt., 19 Feb 1987, *Peng 10554* (HAST), Tsailiao, Rd. 20 by Tsailiaohsi, under Niusshshui Bridge, slope above stream, outside of a bamboo grove, 5 Nov 1991, *Peng 14718* (HAST); Nanhua Hsiang, en route from Nanhua to Neimen, on Provincial Hwy 3, on barren slope of mudstone along the road, 50–80 m alt., 19 Feb 1987, *Peng 10540* (HAST). KAOHSIUNG HSIEN: Meinung Town, Yuehkuangshan, 18 Jan 1991, *Yen 4559* (HAST); Neimen Hsiang, Taiping, roadside slope, abundant along traffic way, 50 m alt., 10 Aug 1990, *Peng et al. 13437* (HAST). TAITUNG HSIEN: Yenping Hsiang, Yenping Village, roadside of dry paddies, 8 Nov 1997, *Yen 16265* (HAST).

Distribution and Notes. Native of warm regions of the New World, mainly from coastal regions of the Florida Keys, the West Indies, Central America south to Ecuador and Venezuela, and also in West Africa [Gills, 1977, as *Pluchea symphytifolia* (Miller) Gills]. In Taiwan, *P. carolinensis* is naturalized in disturbed ruderal places of the countryside, often seen on barren mudstone slopes or associated with scrubby vegetation along roads. It occurs at ca. 50–200 m alt. Since the first discovery of this adventive species in Taiwan in 1987, its range has extended considerably on the island (Figure 2).

The naturalization of *P. carolinensis* adds to the long list of exotic Asteraceae documented in Taiwan during the past two and a half decades, e.g., *Ambrosia elatior*, *Gaillardia pulchella*, *Galinsoga paraviflora*, *Senecio*

vulgaris, *Solidago altissima* (Hsu, 1973); *Hypochaeris radicata*, *Taraxacum officinale* (Peng and Hsu, 1978); *Eclipta zippeliana* (Chen, 1981); *Sonchus asper* (Ou and Liu, 1981); *Calyptocarpus vialis* (Peng and Kao, 1984); *Lapsana apogonoides* (Chen, 1984); *Parthenium hysterophorus* (Peng et al., 1988); *Soliva pterosperma* (Boufford and Peng, 1993).

Pluchea carolinensis has had an erratic nomenclatural history. Based on an erroneous interpretation of the original material associated with the name *Conyza symphytifolia* Miller, Gills (1977) made the combination *Pluchea symphytifolia* (Miller) Gills for the species in question, which has been followed by recent authors (McVaugh, 1984; Wagner et al., 1990). Khan and Jarvis (1989) pointed out the error and reinstated *Pluchea carolinensis* (Jacq.) G. Don as the correct name for this species.

Chromosome cytology. A study of meiosis of a collection of *P. carolinensis* from southern Taiwan (*Peng 10540*, HAST) revealed $n = 10$ in diakinesis (Figure 3A).

2. *Pluchea indica* (L.) Less., *Linnaea* 6: 150. 1831; Li, *F1. Taiwan* 4: 920. 1978; Chang & Tseng, *F1. Reipubl. Popul. Sin.* 75: 51, pl.1: figs. 9–11. 1979.

Figure 4

Baccharis indica L., *Sp. Pl.* 861. 1753.

Erect shrub to 2 m tall, sulcate-striate, much branched, branches finely shortly crisp-hairy, later becoming glabrate. Leaves thickly chartaceous, obovate, 2.3–8 cm long, 1–4 cm wide, minutely puberulent above, loosely puberulent to subglabrous with distinct veinlets beneath, apex acute to mucronate, margins acutely dentate, base attenuate, sessile or very shortly petiolate. Capitula narrowly cylindrical to campanulate, ca. 5–6 mm (when fresh) or 9–10 mm (in dried specimens) in diam., 6–7 mm long, peduncle sessile to 10 mm long, forming dense terminal and axillary corymbs. Involucres ovate, 4–6 mm long, bracts 6–7 seriate; the outer obtuse, 2–2.5 mm long, 1.5 mm wide, ciliolate on margins; the inner lanceolate to linear, obtuse, 4–6 mm long, 0.25–1 mm wide, entire. Receptacle densely hirsutulous. Outer florets numerous, corolla 3–5 mm long; style far exserted; pappus white, 5 mm long, slightly exceeding corolla; achenes brown, cylindrical with 5–7 pale ribs, slightly curved, 1 mm long, 0.3 mm wide, subglabrous. Central florets 2–7, corolla 4.5–5.5 mm long, 5-lobed at tip, lobes glandular; anthers and style far exserted; pappus white, as long as corolla; achenes vestigial as a small cartilaginous ring.

Specimens examined. **TAIWAN.** TAIPEI HSIEN: Tanshui, *Yang 876* (TAI); Chuwei, *Peng 4507* (HAST), with *Kandelia candel* near brackish water, *Peng 5408* (HAST). TAOYUAN HSIEN: Lungtan, 5 Aug 1991, *Kao s.n.* (TNM). HSINCHU HSIEN: Hungmao, *Ou & Kao 8850* (TAI). MIAOLI HSIEN: Chunan Town, seaside, in *Kandelia candel* stand, 0 m alt., *Lin 583* (HAST); Yuanli, *Jeng 482* (TAI). TAICHUNG HSIEN: Shengkang Hsiang, Peichuang, beside rice paddy, 176 m alt., *Wang 1824*

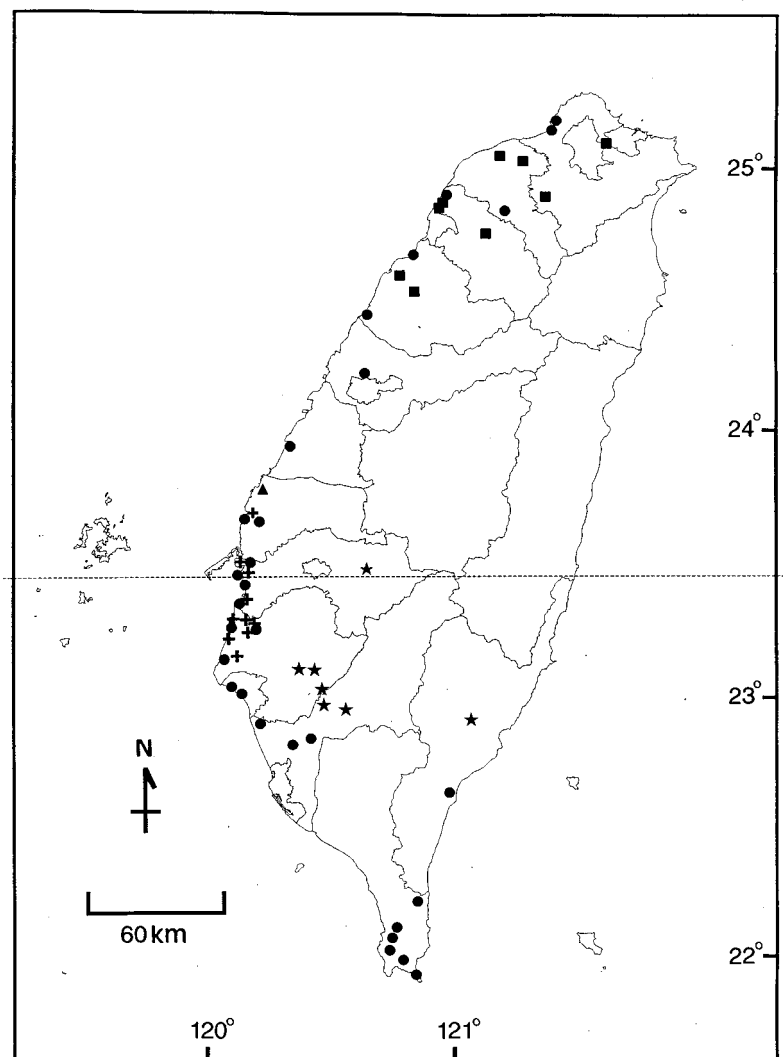


Figure 2. Distribution of *Pluchea carolinensis* (◐), *P. indica* (|), *P. pteropoda* (+), and *P. sagittalis* (⊖) in Taiwan.

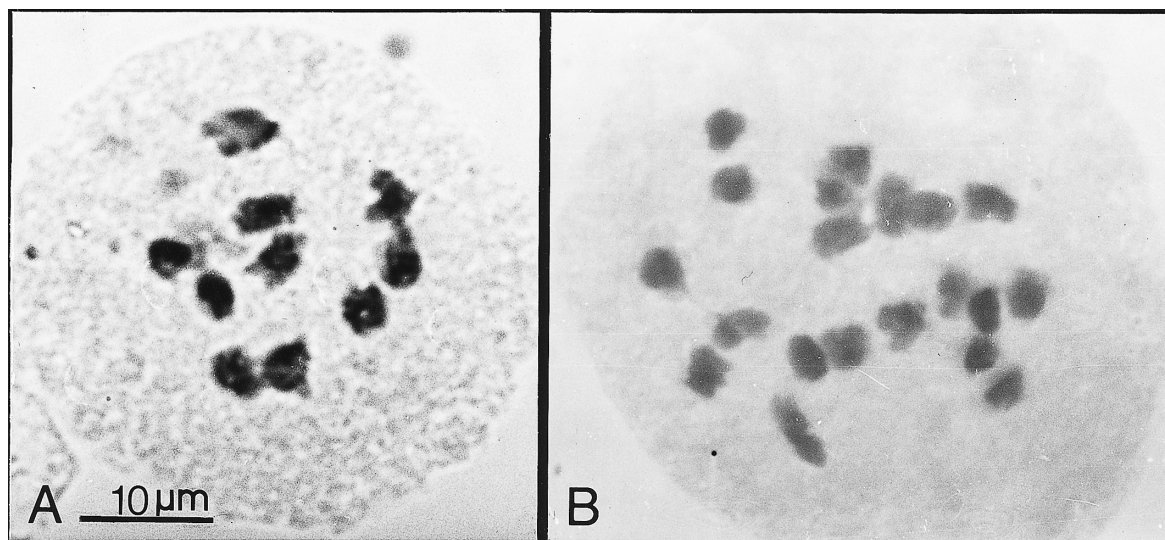


Figure 3. Meiotic chromosome spreads of *Pluchea*. A: *Pluchea carolinensis* (Jacq.) G. Don. Diakinesis, $n = 10$, from Peng 10540 (HAST); B: *Pluchea pteropoda* Hemsl. Diakinesis, $n = 20$, from Peng 10527 (HAST). Bar = 10 μm .

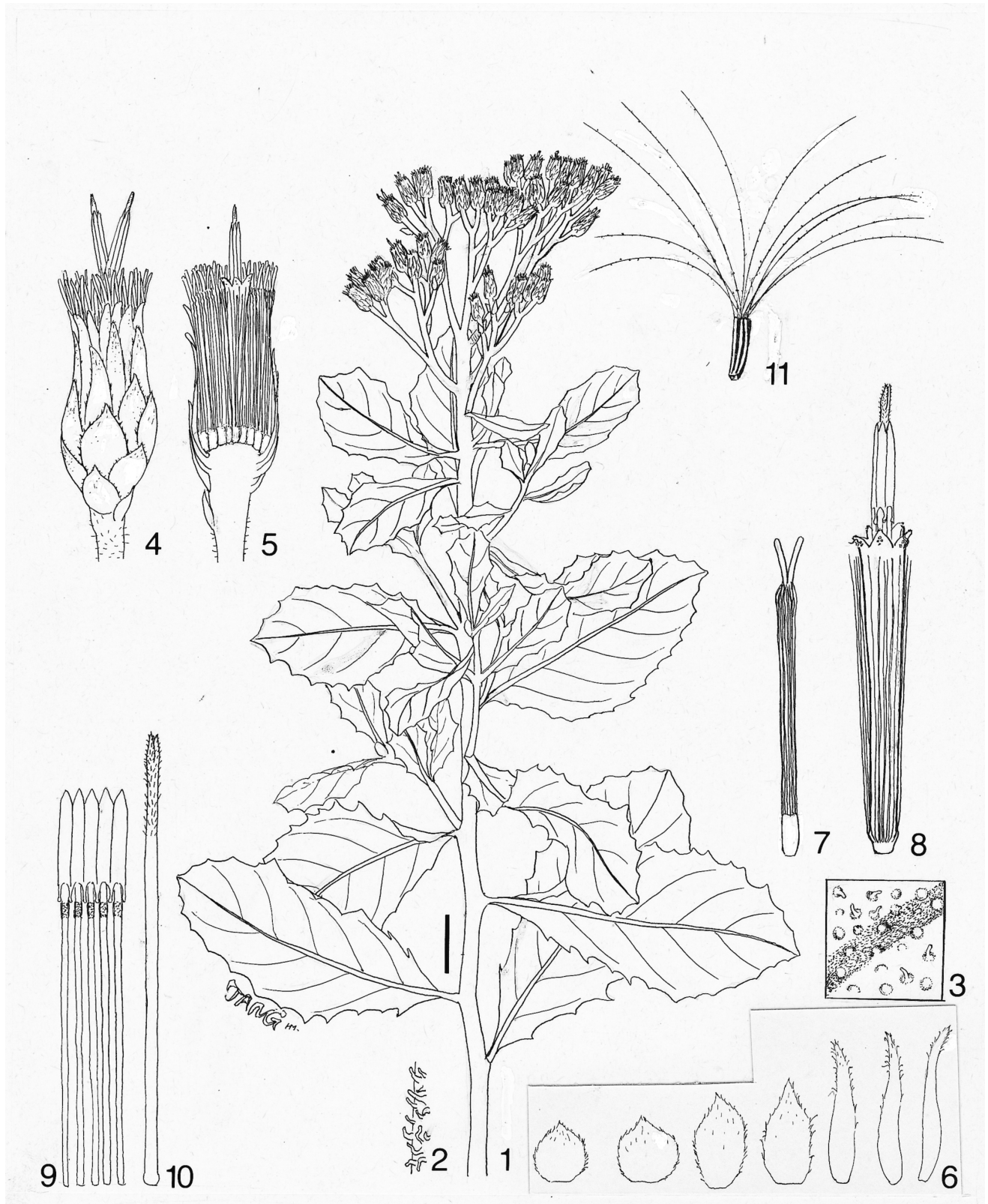


Figure 4. *Pluchea indica* Less. 1: Habit; 2: Pubescence of a branch; 3: Portion of leaf, adaxial surface; 4: Capitulum; 5: Capitulum, longitudinal section; 6: Involucral bracts; 7: Outer floret; 8: Central floret with rudimentary ovary; 9: Stamens; 10: Style of central floret; 11: Achene. All from *Chen 215* (HAST). Bar = 1 cm.

(HAST, TAIF, TNM). CHANGHUA HSIEN: Fangyuan Hsiang, Wangkung, 0 m alt., *Yen 10219* (HAST). YUNLIN HSIEN: Peihshili, *Shih 125* (Herbarium, National Pingtung Polytechnic Institute); Taihsi, *Wang 2539* (TAI); between Tungshih and Taihsi, *Ou 6072* (TCF). CHIAYI HSIEN: Tungshih Hsiang, *Peng 6206* (HAST), mixed with mangrove vegetation, abundant at very sunny place, *Hu 1345* (HAST), Aoku Village, along Provincial Rd. 17, by Peikang River, 0 m alt., *Peng 13463* (HAST), Taiwan Sugar Company at Auko, sugarcane and sweet potato plantation and scattered ponds on reclaimed tidal land, *Liao 1688* (HAST, TNM, TNS), Shanliao Village, roadside ditch banks by fish ponds near the sea, 0 m alt., *Peng 13468* (HAST), Wenkang ("Wenkong"), 7 Nov 1991, *Hwang et al., s.n.* (TNM); Putai Town, *Kuoh 11000* (Herbarium, Dept. Biology, National Cheng-Kung University), Hsinwen, Haomeiliao, vast saltern with scattered ponds, 0 m alt., at ridges between salterns, plants ca. 1.5 m tall, *Liao 1706* (HAST, TNM, TNS). TAINAN CITY: Szutsao, in shady soil, full sun, graveyard behind Tachung Temple, 0 m alt., *Wang 891* (HAST); Szutsao ("Ssutiao"), 15 Feb 1989, *Ou s.n.* (TNM); Anping, 6 Nov 1921, *S. Suzuki s.n.* (TAI). TAINAN HSIEN: Hsuehchia Town, 0 m alt., *Chen 215* (HAST); Putai Town, abandoned dormitory area of Hsintso Salt Factory, ca. 2 km from current coastline, 0 m alt., *Peng 17128* (HAST). Chiku Hsiang, between Chiangchun and Tainan City, W of Chiali, ca. 1 km N of Duchia, by a mangrove swamp, *Peng 13175* (HAST); Peimen Hsiang, Hsiaokeliao, along a graveyard that leads to a garbage burning ground, ca. 3 km NE of Nankuenshen, *Peng 10526* (HAST). KAOHSIUNG CITY: Chihou Peninsula, *Chang 1928* (PPI). KAOHSIUNG HSIEN: Hunei Hsiang, village roadside, *Peng 14816* (HAST); Yenchao Hsiang, Yuehshihchieh, 0–50 m alt., *Peng 13444* (HAST), Yangnuhu, *Chen 531* (HAST). PINGTUNG HSIEN: Hengchun Town, *Chang 7238* (PPI); Tachienhsishan, 23 Aug 1980, *Lin & Chiu s.n.* (PPI); Sheting ("Kueitzuchia"), a small shrub in thickets at low altitudes, *Chuang 1140* (HAST); Checheng Hsiang, Paoli Forest Plantation, *Chang 9687, 17400, Yang 763, 764, 799, 800* (all at PPI); Szuchunghsi, *Peng 6821* (HAST), *Chang 15505* (PPI); Mutan Hsiang, Hsuhai-Tungyuan, exposed site in unplowed land, 30 m alt., *Wang 2104* (HAST, TAIF, TNM). TAITUNG HSIEN: Taimali Hsiang, Provincial Hwy 9, in forest, 150 m alt., *Wang & Lin 1376* (TNM).

Distribution and notes. Found in India, Thailand, Indo-China, southern China, Japan, Philippines, Malaysia, N. Australia and Hawaiian Islands (non-indigenous), often in brackish marshes and other saline habitats. In Taiwan, widespread all along the western coastline (Figure 2), commonly occurring in littoral areas such as mangroves, brackish swamp, tidal flats, etc., occasionally found in forested land at low elevations.

Many authors of regional floras (Chang and Tseng, 1979; Cronquist, 1994; Dillon and Sagástegui, 1991; Hooker, 1881; Kitamura, 1937; Koster, 1972; Li, 1978; McVaugh, 1984; Walker, 1976; Wagner et al., 1990)

described the genus *Pluchea* as having flat and glabrous receptacles. An examination of herbarium specimens of *P. indica* from Taiwan, Kwangtung, Hainan, Hong Kong, and Singapore at HAST and TAI consistently revealed densely hirsutulous receptacles.

Chromosome cytology. A somatic chromosome count of $2n = 20$ for a plant collected from Santimen, Pingtung Hsien, Taiwan (*Hsu & Peng 16638*, TAI) was reported previously by the senior author (Peng and Hsu, 1978).

3. *Pluchea pteropoda* Hemsl., J. Linn. Soc. Bot. 23: 422, Pl. 11. 1888; Kitamura, Acta Phytotax. Geobot. 6: 79. 1937 et Mem. Coll. Sci., Kyoto Univ. ser. B. 13: 260. 1937; Li, F1. Taiwan 4: 920. 1978; Chang et Tseng, F1. Reipubl. Popul. Sin. 75: 51. Pl. 9: 6–8. 1979. 蕁麻 ` 苘

Figure 5

Pluchea leptophylla T. H. Hong & M. Y. Chen, in T. H. Hong, C. L. Meng, Y. C. Li, and M. Y. Chen, Seaside Plants of Taiwan 3: 273. 1981, nom. illegit.

Well branched herb or subshrub, procumbent to ascending, stems sulcate-striate, glabrous, rarely sparingly puberulent, branches ascending. Leaves obovate to oblanceolate, 3–5 cm long, 0.7–1.7 cm wide, apex obtuse to rounded, base attenuate, sessile, margins irregularly and sparsely dentate, both surfaces glabrous; upper leaves smaller and narrower. Capitula 6–8 mm (when fresh) or 10 mm (dried specimens) in diam., ca. 7 mm long, shortly pedunculate or sessile, densely congested, forming terminal corymbs on branches. Involucres ovoid to widely campanulate, bracts glabrous, 5–6-seriate; the outer broadly ovate, apex obtuse to rounded, margins nearly entire, 2.5–4 mm long, 2–3 mm wide; the inner linear to lanceolate, apex acute, margins nearly entire, 4–5 mm long, 0.5–1 mm wide. Receptacle flat, foveolate. Outer florets numerous, corolla filiform, narrowed toward tip, 3.5–4 mm long, glandular; pappus nearly as long as corolla; achenes cylindrical, reddish brown with pale ribs, 1–1.4 mm long, 0.2–0.3 mm wide, appressed strigillose and glandular. Central florets 18–22, corolla 4–5 mm long, 5-lobed at tip, lobes triangular, glandular; anthers and styles slightly exerted; pappus shorter than corolla; achenes yellowish, cylindrical, grooved, 0.8–1.2 mm long, 0.4–0.5 mm thick, strigillose.

Specimens examined. TAIWAN. YUNLIN HSIEN: between Santiaolun and Chinhu, *Ou 5326* (HAST, TCF); Mailiao Hsiang, windbreak on Chungshan sand dune, at NE corner, inside seashore dike, ca. 50 m from border of Liuching Industrial Area, 0 m alt., *Peng 17134* (HAST). CHIAYI HSIEN: Tungshih Hsiang, Shanliao Village, roadside ditch bank by fish ponds, near the sea, *Peng 13470* (HAST), *Yen 1561* (HAST), Taiwan Sugar Company at Auko, sugarcane and sweet potato plantation and scattered ponds on reclaimed tidal land, at ridges between abandoned fields, 0 m alt., plants ca. 1.5 m tall, *Liao 1705* (HAST, TNM, TNS), *Peng 17131* (HAST); Tingliao Village, ca. 500 m away from the sea, around a graveyard surrounded by a ditch, *Peng 13476* (HAST). TAINAN



Figure 5. *Pluchea pteropoda* Hemsl. 1: Habit; 2: Leaf; 3: Capitulum; 4: Capitulum, longitudinal section; 5: Involucral bracts; 6: Outer floret; 7: Central floret; 8: Stamens; 9: Style of central floret; 10: Achene, cross section; 11: Achene. All from Peng 10527 (HAST). Bar = 2 cm.

HSIEN: Chiku Hsiang, *Yang et al.* 6504 (TAIF); Chiangchun Hsiang, Changsha Village, Mashakou, by a public cemetery in tidal creek at Chiangchun fish port, associated with mangroves, 0 m alt., *Peng 17117* (HAST), by a seaside drainage ditch, *Yen 1004* (HAST); Peimen Hsiang, *Kao 10862* (TAI), Hsiaokeliao, along a graveyard that leads to a garbage burning ground, ca. 3 km NE of Nankuenshen, *Peng 10527* (HAST); Hsuehchia Town, 0 m alt., *Chen 213* (HAST), "Suaehchia", *Kao 10388* (TAI); Yenshui Town, seaside, 10 Jun 1978, *Hong s.n.* (KYO). **HONG KONG.** Cape D'aguilar, seaside, ca. 20–50 m alt., *Peng 12838* (HAST).

Distribution and notes. Southern China, Indo-China. In Taiwan, in coastal brackish area and tidal flats, often associated with mangroves or near graveyards along the seashore in the southwest. Kitamura (1937) first reported the occurrence of *Pluchea pteropoda* in Taiwan, based on a single specimen collected on Mt. Chilaichushan, Hualien Hsien, 2,500 m altitude, Oct 1918, *Y. Shimada 4414* (TI). This report was taken up by Li (1978), Hsu (1980), Hsu and Lu (1984), and Lai (1991), all of whom listed *P. pteropoda* as a rare species at high altitudes in Central Mountain Range in eastern Taiwan. An examination of *Y. Shimada 4414* deposited at TI confirmed its identity as *P. pteropoda*. However, a thorough botanical inventory of Taiwan, study of relevant literature, and examination of abundant herbarium materials revealed that *P. pteropoda* is a coastal species confined to southwestern Taiwan. We suspect that the exceptional collection of *Y. Shimada 4414* is mis-labeled and was actually collected from a coastal area.

Achenes of central florets in both *Pluchea carolinensis* and *P. indica* are vestigial as a small ring consisting of basal sclerenchymatous cells of the carpodium, as in the generic description of *Pluchea* by Anderberg (1994). *Pluchea pteropoda*, however, is exceptional in having well formed achenes in the central florets, which are slightly shorter and broader than those of outer florets. They are however somewhat shrunken and grooved and are possibly sterile as in the other congeners.

Hong and Chen (1981) proposed a superfluous name, *Pluchea leptophylla*, with only Chinese description and no mention of type specimen.

Chromosome number. Gametic chromosome counts of $n = 20$ (Figure 3B) were obtained from a plant collected from Tainan Hsien, Taiwan (*Peng 10527*, HAST). The same result was obtained for the plants collected from Cape D'aguilar, Hong Kong by the senior author (*Peng 12838*, HAST).

4. *Pluchea sagittalis* (Lam.) Cabera, Bol. Soc. Argent.

Bot. 3: 36. 1949.  Figure 6

Conyza sagittalis Lam., Encycl. 2: 94. 1786.

Gnaphalium suaveolens Vell., Fl. Flumin. Icon. 8: t. 100. 1827 [1831].

Pluchea suaveolens (Vell.) Kuntze, Revis. Gen. Pl. 3(3): 168. 1898.

Erect, aromatic, coarse, perennial herb, 1–1.5 m tall, 1.5 cm in diam. at base, much branched, branches densely tomentose, stems conspicuously winged by decurrent leaves. Median leaves lanceolate to broadly lanceolate, 6–12 cm long, 2.5–4 cm wide, thinly tomentose with viscid glands on both surfaces, apex acuminate, margins serrate, base attenuate, sessile. Capitula 7–8 mm (when fresh) to ca. 10 mm (dried specimen) in diam., 4–5 mm long, peduncles 5–25 mm long, in compound terminal and axillary corymbs. Involucres hemispheric, bracts greenish-brownish, 4–5-seriate, the outer very widely elliptic to very widely obovate, acuminate at apex, 1–2 mm long, 1–1.5 mm wide, tomentose abaxially, ciliate at margins, the inner lanceolate to linear-lanceolate, 3–4 mm long, 0.4–0.6 mm wide, grading to glabrous. Receptacles flat, glabrous. Outer florets numerous, corolla white, 3–3.5 mm long, tip 3-lobed; pappus white, slightly longer than corolla; achenes brown, cylindrical with 5 pale ribs, 0.6–0.8 mm long, 0.2 mm wide, with viscid glands. Central florets ca. 50–60, corolla white, purplish toward summit, 2.5–3 mm long, sparingly glandular hairy at base; anthers acute at apex, shortly tailed at base; anthers and style exerted; achenes vestigial as a small, cartilaginous ring.

Specimens examined. **TAIWAN.** TAIPEI HSIEN: Pali Hsiang, Juiping Village, 5 Oct 1994, *Yen s.n.* (HAST); Hsichih, in grassy field around residential area, ca. 50 m alt., 20 Jul 1998, *Leu 2303* (HAST); Sanhsia, ca. 50 m alt., *Leu 2301* (HAST). TAOYUAN HSIEN: Luchu Hsiang, Fuhsien, ca. 60 m alt., around paddy fields, 25 Aug 1995, *Wang & Lin 1652* (HAST, TNM); Tayuan Hsiang, Tayuan, ca. 0–20 m alt., 26 Jun 1996, *Wang et al. 9988* (TNU), same locality, 4 Jan 1996, *Liu et al. 499* (TAIF, TNU). HSINCHU HSIEN: between Hsinpu and Kuanhsi, ca. 100–300 m alt., 15 Jul 1998, *Leu 2302* (HAST); Hsinfeng Hsiang, Lienhuassu, ca. 10 m alt., 30 Aug 1996, *Yang et al. 4873* (TAIF, TNU), same locality, coastal hill, exposed seeping slope along paved road, locally rare, only two plants seen, ca. 70 m alt., 16 Oct 1997, *Kao 107* (HAST), same locality, flat ground, aquatic vegetation, open place, loam soil, high humidity, full sun, numerous, *Yang et al. s.n.* (HAST, TAIF). MIAOLI HSIEN: Houlung, seaside, *Yen s.n.* (TNM); Tienhuahu, ca. 300 m alt., *Yen s.n.* (TNM).

Distribution and notes. Native of South America, widely distributed in moist, open habitats in Columbia, Venezuelan Guyana, Trinidad, Ecuador, Peru, Brazil, Bolivia, Paraguay, Argentina, Uruguay, and adventive in moist coastal areas of Florida and Alabama (Godfrey, 1952; Pruski, 1997). Recently naturalized in northwestern Taiwan (Figure 2), occurring in exposed, flat areas in clayish soil or moist sandy soil such as riverbeds, or in swampish land, often in large numbers in abandoned rice paddies or grassy fields. Flowering and fruiting from March to October.



Figure 6. *Pluchea sagittalis* (Lam.) Cabera. 1: Habit; 2: Portion of stem; 3: Leaf; 4: Portion of leaf blade; 5: Capitulum; 6: Capitulum, longitudinal section; 7: Involucre bracts; 8: Outer floret; 9: Central floret; 10: Stamens and style branch of central floret; 11: Achenes, pappus in one of them not shown; 12: Achene, cross section; 13: Pappus. All from *Leu 2303* (HAST). Bar = 2 cm.

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