

Notes on Three Newly Naturalized Plants (Asteraceae) in Taiwan

Ching-I Peng^(1,2), Kuo-Fang Chung⁽¹⁾ and Wen-Pen Leu⁽¹⁾

(Manuscript received 28 October, 1998; accepted 27 November, 1998)

ABSTRACT: In this report we document the naturalization of three species of Asteraceae, *Ageratina adenophora*, *Galinsoga quadriradiata*, and *Vernonia elliptica*, in Taiwan. A taxonomic treatment, line drawings of all three species and of *Vernonia gratiosa*, an indigenous plant in Taiwan, to aid in identification, a distribution map showing the location of these introduced species in Taiwan and notes on these adventive species are provided.

KEY WORDS: Adventive species, Asteraceae, *Ageratina adenophora*, *Eupatorium adenophora*, *Galinsoga parviflora*, *Galinsoga quadriradiata*, *Vernonia elliptica*, *Vernonia gratiosa*, Taxonomy, Taiwan, Weed.

INTRODUCTION

In recent years we have witnessed the naturalization of many alien species of Asteraceae in Taiwan (e.g., Hsu, 1972; Peng, 1978; Peng and Kao, 1984; Boufford and Peng, 1993; Peng *et al.* 1988, 1998; Peng and Yang, 1998). In this report we document the invasion of three additional adventive composites, one from the Old World and the other two from the New World, to this island. A taxonomic account with notes on their distribution and ecology is provided.

TAXONOMIC TREATMENT

1. *Ageratina adenophora* (Spreng.) R. M. King & H. Rob., Phytologia 19: 211. 1970.

Fig. 1 假蓬香薷

Eupatorium adenophorum Spreng., Syst. Veg. 3: 420. 1826.

Perennial coarse herbs to 1.5 m tall; stems green or purplish, terete, erect, glandular puberulent. Leaves opposite, median ones larger, ovate-deltoid, 7-10 cm long, 4-7 cm wide, apex acuminate, base obtuse to very broadly cuneate or truncate, sparsely pilose on both surfaces, 3-nerved, margin crenate, petiole 4-5 cm long, upper leaves gradually smaller toward inflorescence. Inflorescences loose compound corymbs, heads ca. 6.5 mm long, 6 mm in diam., peduncle 8-14 mm long, densely pubescent; involucre cylindrical, ca. 3-4 mm long; bracts ca. 25, 3 or 4 seriate, outer ones narrowly lanceolate, inner ones narrowly oblong, apex acute, base obtuse, margins membranaceous, ciliate; florets ca. 70-80, white; receptacle

1. Institute of Botany, Academia Sinica, Nankang, Taipei 115, Taiwan, Republic of China.

2. Corresponding author.



Fig. 1. *Ageratina adenophora* (Spreng.) R. M. King & H. Rob. 1. Habit; 2. Head; 3. Involucral bracts; 4. bracteoles on peduncle; 5, 6. vestiture on involucral bracts; 7. Head, longitudinal section; 8. Floret; 9. Stamens; 10. Achene; 11. Achene, cross section. 12. Pappus bristle.

glabrous, areolate. Achenes black, 1.5 mm long, 5-angled, glabrous. Pappus of 8-10 bristles, ca. 3.5 mm long. Fl. Mar–May.

Specimens examined: **Kaohsiung:** Taoyuan Hsiang, Tengchih to Shihshan, ca. 1,500 m alt., 19 Jan 1991 (sterile specimen collected from the wild; flowering specimen from living plants brought back for cultivation, 28 Apr 1993), *Yen 4616* (HAST). **Taitung:** Haituan Hsiang, en route from Litao to Litao Bridge, elev. ca. 900 m, 27 Apr 1988, *Chen 14333* (HAST).

Distribution and notes

Based on floral anatomical characters, King and Robinson (1970) resurrected the genus *Ageratina* to include nearly 200 species from the polymorphic genus *Eupatorium*. *Eupatorium* differs from *Ageratina* mainly by its smooth corolla lobes, hairy styler bases, indistinct carpodium, glands only on the corolla and achene, and blunt tipped pappus setae (King and Robinson, 1970). *Ageratina* contains ca. 250 species native to Mexico, Central America, the West Indies and South America, with a few species adventive in the warmer regions of the Old World (King and Robinson, 1987; Pruski, 1997).

Ageratina adenophora is native to Mexico. It resembles *Ageratum* in habit, foliage, involucre and inflorescence, but is readily distinguishable by its setaceous pappus (vs. pappus of 5 lanceolate scales in *Ageratum*). Because of its numerous heads that give a spectacular white display, it is sometimes cultivated as an ornamental. However, it is an aggressive weed that has invaded Asia (northern India, northern Thailand, mainland China, southeast Asia), Australasia (subtropical Australia, New Zealand), the Pacific Islands, including Hawaii, southern and western Africa and North America (California) (Cronk and Fuller, 1995; Holm *et al.*, 1979). In Taiwan, *A. adenophora* is known from two localities in the south, at ca. 900 m and 1,500 m respectively (Fig. 2). Although frequent in moist to wet places, *A. adenophora* can be found also in sunny or semi-shaded habitats.

2. *Galinsoga quadriradiata* Ruiz & Pav., Syst.

Veg. 1: 198. 1798. Fig. 3 粗毛小米菊

Galinsoga ciliata (Raf.) Blake, Rhodora 24: 35. 1922.

Annual branching herbs, 20-70 cm tall, stems sparingly pilose toward base, branchlets and peduncles densely strigose and pilose, often intermixed with red stipitate glandular hairs. Petiole 3-7 mm long. Leaves ovate to lanceolate, coarsely toothed, 2.5-7 cm long, 1.2-5 cm wide. Heads numerous, pedunculate; involucre bracts scattered stipitate glandular, unequal, in two series, outer bracts ca. 2 mm long, 1 mm wide, inner bracts ca. 3.8-4 mm long, 2 mm wide, margin scarious, entire to minutely lacinate. Ray florets 5 (rarely 4 or 8); ligules obovate to quadrangular, ca. 0.8-0.9 mm long, 0.5 mm wide; tube 0.8-0.9 mm long, densely patently hairy; achenes black, 1.3-1.8 mm long, strigillose; pappus of 10-20 elliptic to obovate, often aristate, fimbriate, white to brownish scales,

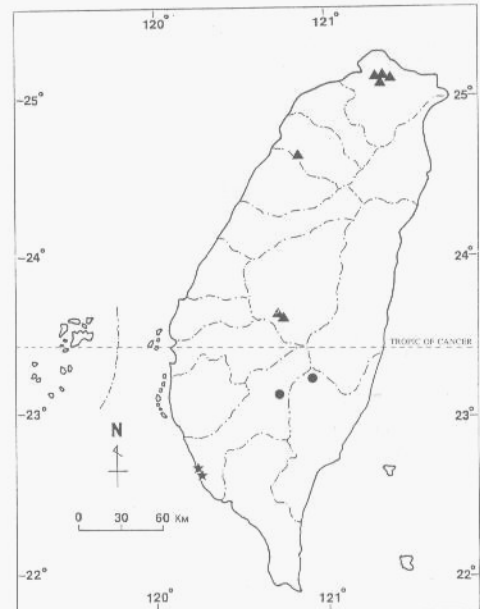


Fig. 2. Distribution of *Ageratina adenophora* (circles), *Galinsoga quadriradiata* (triangles), and *Vernonia elliptica* (stars) in Taiwan.

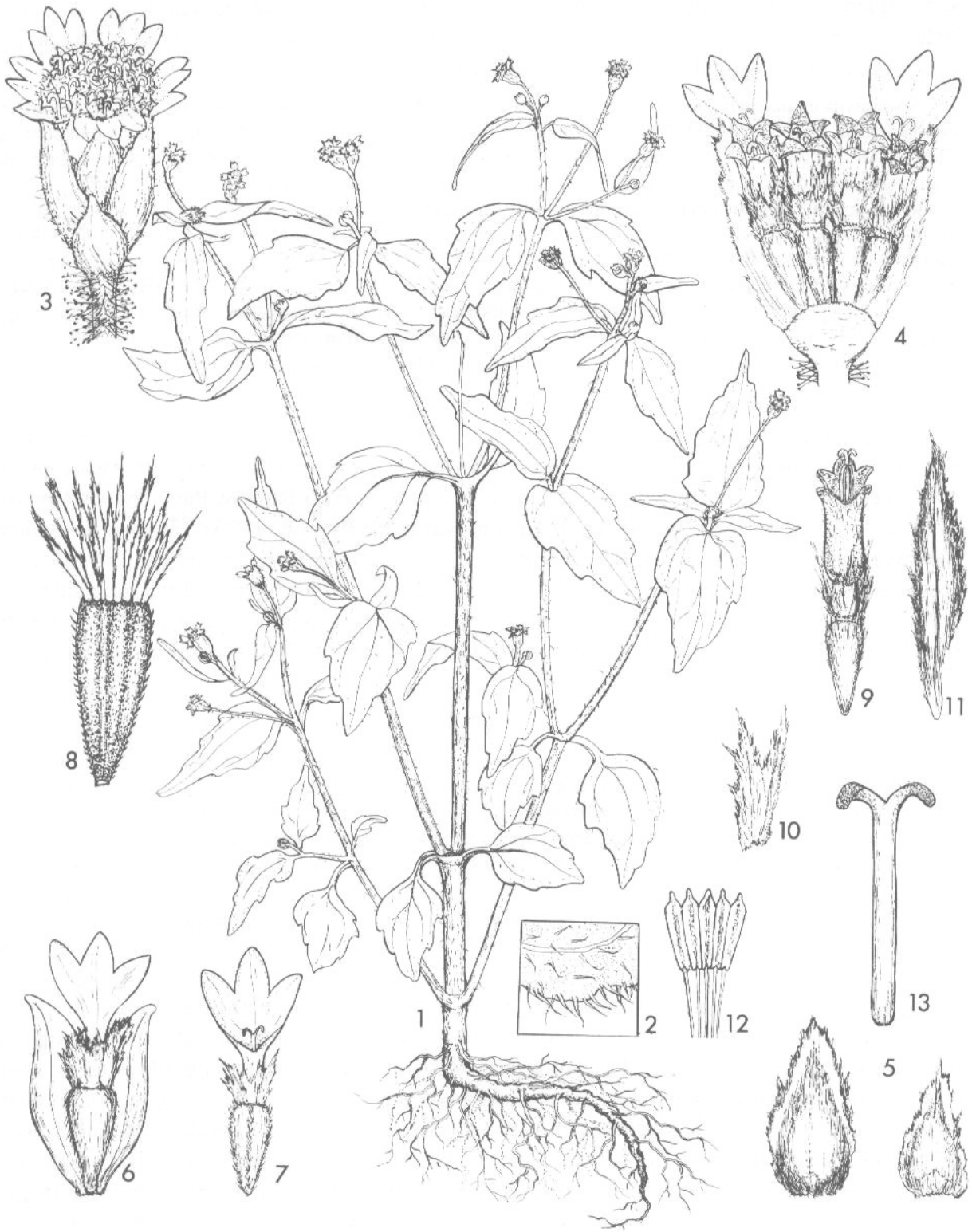


Fig. 3. *Galinsoga quadriradiata* Ruiz & Pav. 1. Habit; 2. Leaf vestiture; 3. Head; 4. Head, longitudinal section; 5. Involucre bracts; 6. Ray floret with inner involucre bracts, 7. Ray floret; 8. Achene; 9. Central floret; 10. Pappus scale; 11. Inner paleae; 12. stamens; 13. style branches.

to 1.5 mm long. Disc corollas yellow, 0.8 mm long, 0.4 mm wide; achenes black, obconical, 4-5 angled, 1.3 mm long, 5 mm wide, brownish strigillose; pappus scales ca. 20, buff, oblanceolate, 0.9-1.5 mm long, 0.2-0.3 mm wide. Paleae narrowly oblong-lanceolate, ca. 2.5 mm long, entire to irregularly and shallowly trifid.

Specimens examined: **Taipei:** Yangmingshan, campus of Chinese Culture University, in Chinese Garden, ca. 400 m alt., *Peng 13507* (HAST); Yangmingshan National Park, by Yangmingshan bus station, along Yang-Chin Road, 13 May 1987, *Chang s.n.* (HAST); Shihlin District, en route from Shantzuhou to Chingshan Camping Ground, *Chen 787* (HAST); Yangmingshan, Chingshan Road, *Wu 809* (HAST, TAIF); Yangmingshan, Chutzuhu, sunny roadside by cultivated field of *Zantederchia aethiopica* (L.) Spreng., ca. 670 m alt., *Liu 229* (HAST); Chutzuhu, ca. 600 m alt., weed in vegetable field, very abundant, *Peng 12666* (HAST); Yangmingshan National Park, Tsutzuh, ca. 700 m alt., *Leu 894* (HAST); Pingtengli, southern border of Yangmingshan National Park, roadside, by a local house, ca. 540 m alt., *Peng 11344* (HAST). **Hsinchu:** Shihtoushan, en route from mt. hiking entrance to parking area. Disturbed broadleaf forest, ca. 200-300 m alt., *Peng 14849* (HAST). **Nantou:** Luku Hsiang, Hsitou Forest Recreation Area, Sacred Tree (*Chamaecyparis*) Area, ca. 1280 m alt., *Peng 16774* (HAST); Hsitou, 1,100 m alt., *Chiu et al. 3140* (HAST, TNM).

Distribution and notes

The genus *Galinsoga* consists of about 14 annual species native from the southern United States to Argentina, but mainly in tropical America (McVaugh, 1984), with two widespread cosmopolitan weeds, *G. parviflora* Cav. and *G. quadriradiata* Ruiz & Pav. The first report of the naturalization of *G. parviflora* in Taiwan was made by Hsu (1973). Here we document the invasion of the second adventive species, *G. quadriradiata*, in Taiwan, where it is thoroughly naturalized in the northern and central part of the island along roadsides, in cultivated fields and at the borders of disturbed forests and plantations from 200 to 1,300 m elevation (Fig. 2). The following key readily distinguishes the two species of *Galinsoga* in Taiwan.

Key to species of *Galinsoga* in Taiwan

1. Involucral bracts usually completely glabrous; inner paleae often deeply bifid or trifid; ray florets without pappus scales; pappus scales of disc florets not awn-tipped 1. *G. parviflora*
1. Involucral bracts usually with some stipitate glands; inner paleae entire or shallowly and irregularly trifid; ray florets with fimbriate pappus scales, about equaling the floral tube; pappus scales of central florets awn tipped 2. *G. quadriradiata*

3. ***Vernonia elliptica*** DC. in Wight, Contrib. Bot. Ind. 5: 1834; Koyama, Bull. Natl. Mus. Tokyo, B. 23 (4): 160. 1997. Fig. 4 光耀藤

Shrubby climbers, grayish sericeous throughout; branches elongate, finely grooved. Leaves elliptic-oblong, 2-6.5(-10) cm long, 1-4(-6) cm wide, short petiolate, entire, slightly undulate when dry, apex acute, base cuneate to obtuse, venation reticulate, elevated on both surfaces, midrib densely sericeous, otherwise glabrous to slightly sericeous on upper surface, densely sericeous on lower surface; petioles curved, ca. 2 mm long. Heads subsessile, many in narrow, terminal, short, loose panicles at end of rigid divaricate branches; peduncle puberulous; involucre tubular, 3-4 mm long, 1.5-2.5 mm across, bracts 4-seriate, manifestly imbricate, ovate to obovate-oblong, obtuse, sericeous and tinged purple toward summit. Florets usually 5 per head, corollas pinkish on upper half, 5-6 mm long, sparingly glandular, lobes 5, ca. 2 mm long. Achenes brownish, clavate, 5-angled, 1.8-2.2 mm long, densely and minutely glandular. Pappus bristles whitish tawny, 4-5.5 mm long.

Specimens examined: Kaohsiung: Shoushan, sprawling along exposed trail on raised coral rocky hills, abundant locally, elev. ca. 50 m, Peng 16180 (HAST); South Shoushan, mining area, Yang 388, 427, 519 (HAST, TAIF).

Distribution and notes

Vernonia elliptica DC. is native to India, Burma, Singapore, Cochin-China and Malaysia (Koyama, 1997). In Taiwan where it is occasionally cultivated as a hanging ornamental, it is naturalized and forms large, local populations in the southern part of the island (Fig. 2). Of the six taxa of *Vernonia* in Taiwan, *V. gratioiosa* Hance (Fig. 5) [sect. *Decaneurum* (DC.) Oliver] and *V. elliptica* (sect. *Strobocalyx* Bl.) are the only shrubby climbers. The following key serves to readily distinguish the two.

Key to shrubby climbing species of *Vernonia* in Taiwan

1. Leaves elliptic-oblong, subcoriaceous, silvery-sericeous on lower surface; involucre 3-4 mm long; florets 5 per head; achenes 5-angled, 1.8-2.2 mm long, glandular; pappus 4-4.5 mm long *V. elliptica*
1. Leaves oblong to ovate, chartaceous, brownish tomentose on lower surface; involucre 6.5-8 mm long; florets ca. 10 per head; achenes 10-ribbed, 3-3.5 mm long, strigillose; pappus 9-11 mm long *V. gratioiosa*

ACKNOWLEDGEMENTS

We thank David E. Boufford for helpful comments on the manuscript. This study was supported in part by a grant from the National Science Council, Taiwan, R.O.C. to Ching-I Peng.

LITERATURE CITED

- Boufford, D. E. and C.-I Peng. 1993. *Soliva* Ruiz & Pavon (Anthemideae, Asteraceae) in Taiwan. Bot. Bull. Acad. Sin. **34**: 347-352.
- Cronk, Q. C. B. and J. L. Fuller. 1995. Plant Invaders: The Threat to Natural Ecosystems. Chapman & Hall, London.
- Hsu, C. C. 1973. Some noteworthy plants found in Taiwan. *Taiwania* **18**: 62-72.
- Holm, L., J. V. Pancho, J. P. Herberger, and D. L. Plucknett. 1979. A Geographical Atlas of World Weeds. John Wiley & Sons, New York.
- King, R. M. and H. Robinson. 1970. Studies in the Eupatorieae (Compositae). XIX. New combinations in *Ageratina*. *Phytologia* **19**: 201-207.
- King, R. M. and H. Robinson. 1987. The genera of the Eupatorieae (Asteraceae). Missouri Botanical Garden, St. Louis.
- Koyama, H. 1997. Taxonomic studies in the Compositae of Thailand 11. *Vernonia* Schreb. Sect. *Strobocalyx* Bl. Bull. Natl. Mus. Tokyo, B. **23**: 160. 1997.
- McVaugh, R. 1984. Vol. Compositae. In: William R. Anderson (eds.), *Flora Novo-Galiciana: a Descriptive Account of the Vascular Plants of Western Mexico*. The University of Michigan press, Ann Arbor, 1157 pp.



Fig. 4. *Vernonia elliptica* DC. 1. Habit. 2. Leaves. 3. Portion of a leaf, showing vestiture. 4. Outermost involucre bract. 5. Head. 6. Head, longitudinal section; 7. Inner involucre bracts. 8. Floret. 9. Stamens. 10. Style branches. 11. Achene. 12. Achene, pappus removed. 13. Achene, cross section. 14. Pappus bristle.

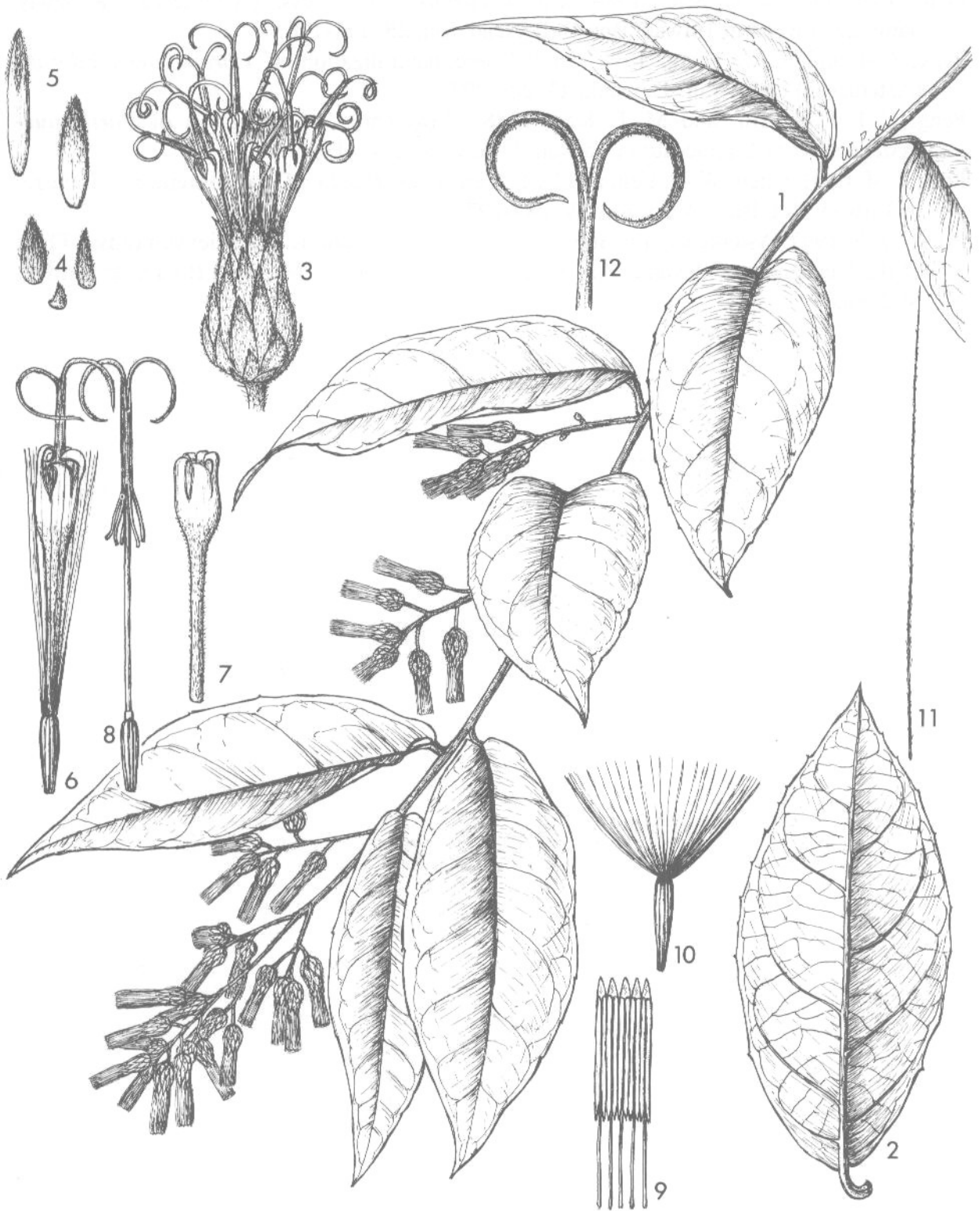


Fig. 5. *Vernonia gratiosa* Hance. 1. Habit. 2. Leaf. 3. Head. 4, 5. Involucral bracts. 6. Floret. 7. Corolla. 8. Floret, corolla removed. 9. Stamens. 10. Achene. 11. Pappus bristle.

- Peng, C.-I. 1978. Some new records for the Flora of Taiwan. *Bot. Bull. Acad. Sin.* **19**: 83-86.
- Peng, C.-I and M.-T. Kao. 1984. *Calyptocarpus vialis* Less. (Asteraceae), a newly naturalized weed in Taiwan. *Bot. Bull. Acad. Sin.* **25**: 171-176.
- Peng, C.-I and K.-C. Yang. 1998. Unwelcome naturalization of *Chromolaena odorata* (Asteraceae) in Taiwan. *Taiwania* **43**: 289-294.
- Peng, C.-I, L.-A. Hu, and M.-T. Kao. 1988. Unwelcome naturalization of *Parthenium hysterophorus* (Asteraceae) in Taiwan. *J. Taiwan Mus.* **41**: 95-101.
- Peng, C.-I, C.-H. Chen, W.-P. Leu, and H.-F. Yen. 1998. *Pluchea* Cass. (Asteraceae: Inuleae) in Taiwan. *Bot. Bull. Acad. Sin.* **39**: 287-297.
- Pruski, J. F. 1997. Asteraceae. In: Berry, P. E., B. K. Holst, and K. Yatskievych (eds.), *Flora of the Venezuelan Guayana*, Vol. 3. Araliaceae-Cactaceae. Missouri Botanical Garden, St. Louis.

記三種台灣新歸化之菊科植物

彭鏡毅^(1,3)、鍾國芳⁽¹⁾、呂文賓⁽¹⁾

(收稿日期: 1998 年 10 月 28 日; 接受日期: 1998 年 11 月 27 日)

摘 要

原產亞洲之光耀藤(*Vernonia elliptica* DC.)及美洲之假藿香薊(*Ageratina adenophora* (Spreng.) R. M. King & H. Rob.)、粗毛小米菊 (*Galinsoga quadriradiata* Ruiz & Pav.)等三種菊科植物，由引種栽培或其他管道來台後已呈歸化狀態，其中以粗毛小米菊之分布最廣。本文除提供其分類性狀描述、植物繪圖 [包括原生之過山龍(*Vernonia gratioiosa* Hance)]、以及其在台灣之分布圖以資比對辨識，並對其分布及生態加以討論。

關鍵詞：歸化植物、菊科植物、假藿香薊、小米菊、粗毛小米菊、光耀藤、過山龍、分類、台灣、雜草。

1. 中央研究院植物研究所，台北市 115，台灣，中華民國。

2. 通信連絡員。