Bot. Bull. Acad. Sin. (1999) **40:** 53–60

Novelties in Asteraceae of Taiwan: *Blumea linearis* and *Senecio tarokoensis*

Ching-I Peng[1] and Wen-Pen Leu

Institute of Botany, Academia Sinica, Nankang, Taipei 115, Taiwan

(Received October 23, 1998; Accepted December 4, 1998)

Abstract. Two new species of Asteraceae, *Blumea linearis* C.-I Peng & W. P. Leu and *Senecio tarokoensis* C.-I Peng, from Taiwan are described and illustrated. *Senecio tarokoensis* is very rare, presently known only from three populations on semishaded to open, moist rocky ridges and cliff faces in the limestone mountains of Taroko National Park, ca. 1,000–2,000 m, in eastern Taiwan. It is a very distinct member of sect. *Flexicaulis* C. Jeffrey & Y. L. Chen. Although it is somewhat similar to *S. fukienensis* Ling ex C. Jeffrey & Y. L. Chen of southeastern China, it differs in having simple stems, triangularly ovate to lanceolate lower and middle cauline leaves (vs. oblong-elliptic or narrowly so), long petiole (vs. leaves auriculate and amplexicaul), and ray florets more numerous (8–12 vs. 7–8) with much longer corollas (15–17 mm vs. 7.5–9.5 mm). *Blumea linearis*, also endemic to Taiwan, is sporadic from sea level to 700 m mainly in the eastern half of Taiwan. It is a member of sect. *Macrophyllae* DC. and is somewhat similar to *B. lanceolaria*, but differs in having rugose and herbaceous (vs. smooth and somewhat succulent), linear to linear-lanceolate (vs. oblong to oblanceolate), narrower (2.5–3.5 cm vs. 4–8 cm wide) leaves, which are green and pilose to short-villous (vs. dark green and glabrous) on the upper surface and lack the small auricles on the leaf bases and petioles.

Keywords: Asteraceae; *Blumea linearis*; Limestone flora; New species; Rare species; *Senecio tarokoensis*; Taiwan; Taxonomy.

In the course of the botanical inventory of Taiwan, two Asteraceae species heretofore unknown to science were discovered and are described below.

1. Blumea linearis C.-I Peng & W. P. Leu, sp. nov. — TYPE: Taiwan, Taipei Hsien, Juifang, above hiking entrance of Chintzupei, along cement road at margin of disturbed broadleaf forest, ca. 300 m, 121°50'00" E, 25°05'30" N, associated with *Histiopteris incisa*, *Miscanthus*, *Rubus*, *Mallotus*, *Blastus*, *Ficus* and *Schefflera* and many tall tree ferns. Common locally. 21 Apr 1993, *C.-I Peng 15410* (holotype: HAST; isotypes: A, CAS, HAST, KUN, MO, PE).fU,›f°fl¨»
Figure 1

A sect. *Macrophyllae* pertiens, ad *Blumea lanceolariam* similis, sed in laminis rugosis herbaceis (haud glabris aliquantum succulentis) linearis vel linearilanceolatis (haud oblongis vel oblanceolatis) angustioribus (2.3–3.5 cm, vs 4–8 cm latis), paginis superioribus viridibus, pilosis vel breviter villosis (haud atroviridibus, glabris), et basi vel in petiolis auriculis parvis haud praeditis, differt.

Subshrubs to 1.5–2.5(–4) m tall. Stems striate, center hollow, base woody, 1.5–2.5(–10) cm in diam., puberulous or sometimes glabrate; main stems usually simple or 2–4-branched from middle. Leaves herbaceous, rugose, linear to linear-lanceolate, 25–38 cm long, 2.5–3.5 cm wide, apex acute, base attenuate into a short petiole, margins remotely doubly serrate, pilose to short-villous (sometimes nearly glabrous), glandular punctate on both surfaces, veins 24–30 pairs. Heads numerous, pedunculate, terminal and axillary, in a pyramidal panicle to 50 cm long, 30 cm wide. Involucre globose-campanulate, bracts in 3 or 4 imbricate series; outer ones shorter, linear-lanceolate, 1–3 mm long, ca. 0.3 mm wide, compressed, abaxially with numerous sessile glands and multicellular hairs; inner ones linear-lanceolate, 8–10 mm long, ca. 1 mm wide, margins scarious, margins and apices ciliate. Receptacle convex, 1.5–2 mm across, alveolate, sparsely pilose. Central florets yellowish, 6–7 mm long; lobes 5, triangular, with sessile glands and sparse multicellular hairs. Outer florets ca. 6 mm long, 2 or 3 lobed, glabrous. Achenes pale brown, oblong-terete, 1.1–1.3 mm long, ca. 0.3 mm in diam., pilose, 10-ribbed. Pappus pale brown to yellowish white, ca. 5–6 mm long. Flowering Mar–May; fruiting Apr–May.

Additional specimens examined. **TAIWAN.** TAIPEI HSIEN: Wulai Hsiang, en route from Hsiaoyi to Tunghou. Disturbed broadleaf forest and *Cryptomeria* plantation, 400–500 m, 12 Feb 1992, *Leu 1682* (sterile, HAST). HUALIEN HSIEN: Taroko National Park, en route from

[1]Corresponding author. Fax: 886-2-2782-7954; E-mail: bopeng@gate.sinica.edu.tw

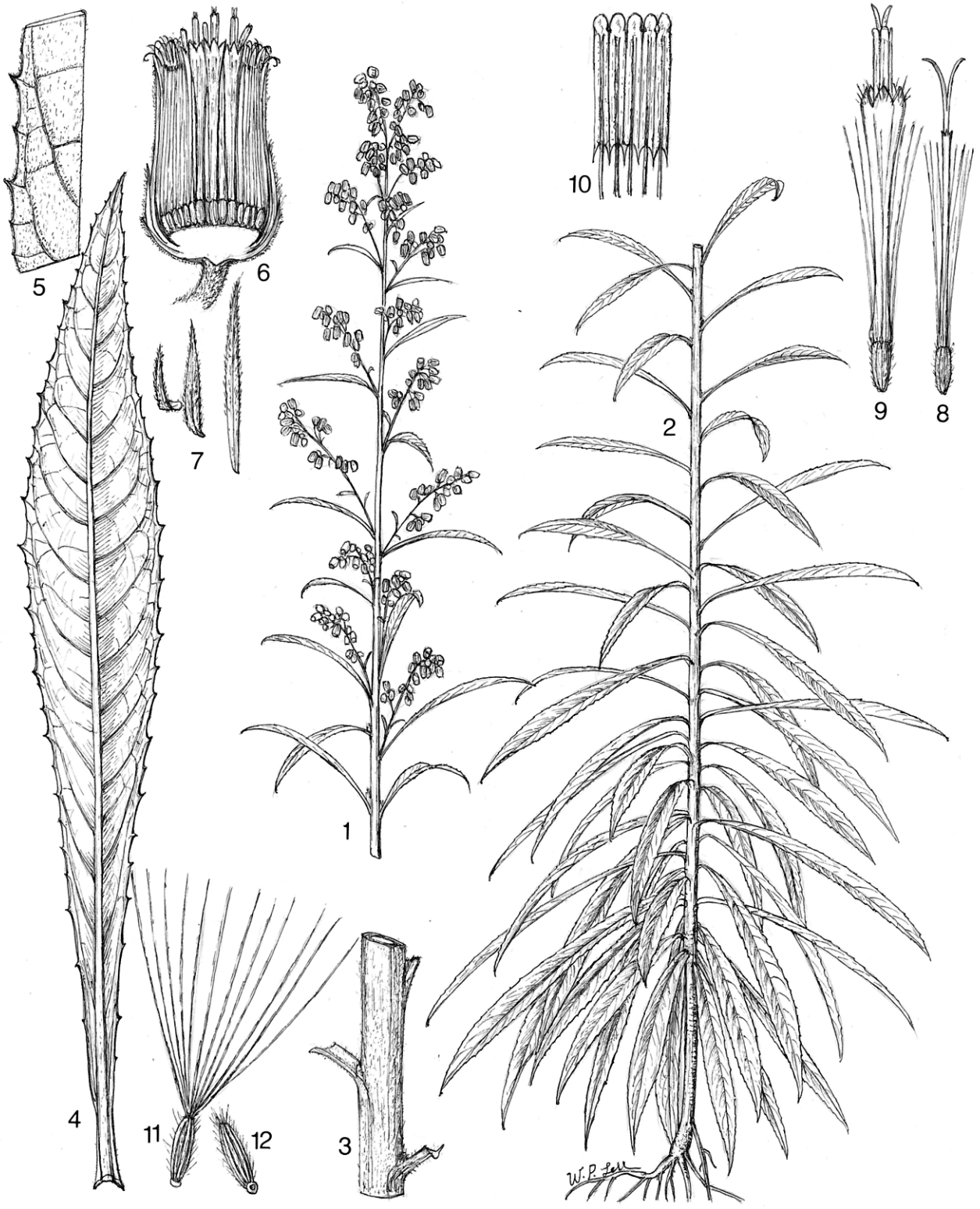

Figure 1. *Blumea linearis*. 1, Upper flowering stem; 2, Lower stem; 3, Portion of stem; 4, Leaf; 5, Portion of leaf, showing remotely doubly serrate margin; 6, Head, longitudinal section; 7, Involucral bracts; 8, Outer floret; 9, Central floret; 10, Stamens; 11, Achene; 12, Achene, pappus removed.

Tali to Tatung, ca. 850 m, *Chen 164* (sterile, HAST). Juishui Hsiang, Fuyuan Village, Butterfly Valley, 200–280 m, 4 Jul 1988, *Peng 11670* (sterile, HAST); Hsiulin Hsiang, logging road beside Paipaohsi (a river), from Pingho to Yuanlaonaoshan, ca. 200 m alt., 21 Jul 1992, *Leu 1441* (HAST); Wanjung Hsiang, at road mileage sign 17 km on Wanjung Forest Road, sunny roadside, bordering *Miscanthus* stands, ca. 700 m alt., 3 Apr 1996, *Kao 414* (flowering, HAST). TAITUNG HSIEN: Lanyu Is., Tungching, 14 Feb 1981, *Chang 15625* (flower buds, HAST); Lanyu Is., Langtao village, along coastal highway, 7 Apr 1983, *Huang et al. 9301* (flowering, TAI); Lanyu Is., Langtao village, along paved road, at margin of dwarf coastal monsoon forest, 10 May 1984, *Peng 6763* (fruiting, HAST); 14 Apr 1985, *Peng 7640* (flowering, HAST).

Distribution and notes. Endemic; sporadic from sea level to 700 m mainly in eastern half of Taiwan; margins of coastal forests, along road cuts through forests, at borders of *Cryptomeria* plantations and on river banks. Considering the huge inflorescence with the enormous quantities of achenes *B. linearis* produces, it is surprising that it is not more widespread in Taiwan (Figure 2).

Blumea linearis is a member of sect. *Macrophyllae* DC. It is somewhat similar to *B. lanceolaria* (Figure 3), but differs in the rugose, herbaceous (vs. smooth and somewhat succulent leaves), linear to linear-lanceolate (vs. oblong to oblanceolate), narrower leaves (2.5–3.5 cm vs. 4–8 cm wide), which are green and pilose to short villous (vs. dark green and glabrous) on the upper surface, and in lacking small auricles on the leaf base and petioles. *Blumea* DC., a genus of ca. 49 (Randeria, 1960)–100 (Bremer, 1994) species, is distributed mainly in tropical Asia, with some species also in Australia and Africa. In Taiwan it is represented by twelve taxa, which can be distinguished by the following key.

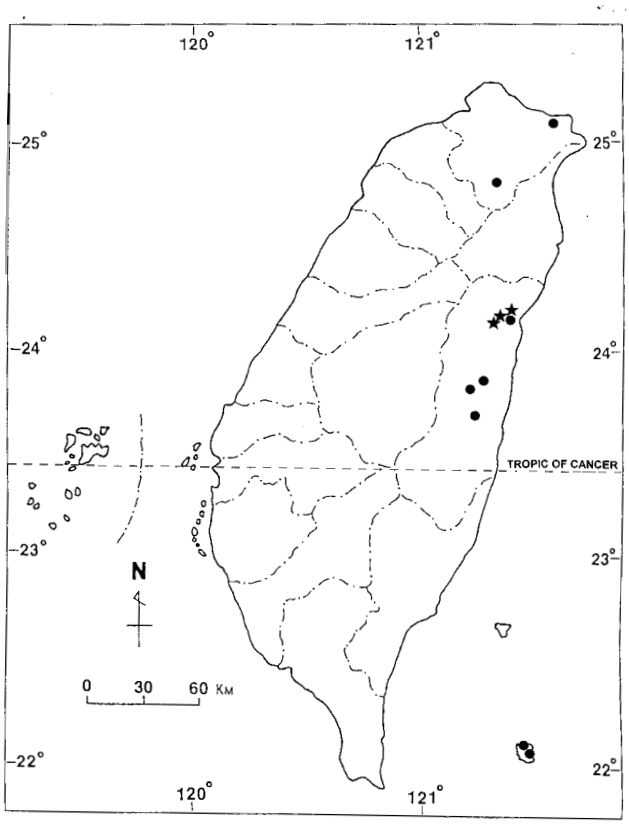

Figure 2. Distribution of *Blumea linearis* (dots) and *Senecio tarokoensis* (stars) in Taiwan.

Key to Taxa of *Blumea* in Taiwan

1. Plants scandent; heads 10–15 mm across ..... *B. riparia* var. *megacephala*
1. Plants erect herbs or subshrubs; heads 3–6 mm across.
   2. Involucre glandular hairy only; involucral bracts recurved at tips ..... *B. aromatica*
   2. Involucre both glandular hairy and villous; involucral bracts appressed or ascending.
      3. Leaves distinctly petiolate; lobes of disc corollas purplish or pink ..... *B. mollis*
      3. Leaves sessile or subsessile; corollas yellow or rarely pinkish.
         4. Leaves laciniate ..... *B. laciniata*
         4. Leaves dentate or doubly serrate.
            5. Leaf base or petiole with small auricles.
               6. Plants nearly glabrous; leaves herbaceous, upper surface dark green; receptacle woolly ..... *B. lanceolaria*
               6. Plants densely wooly-villous, leaves subcoriaceous, upper surface pale green; receptacle glabrous ..... *B. balsamifera*
            5. Leaf base and petiole without auricles.
               7. Plants 1.5–3 m tall; leaves 30–45 cm long.
                  8. Leaves linear to linear-lanceolate, 2.5–3.5 cm wide ..... *B. linearis*
                  8. Leaves obovate or lanceolate, 10–15 cm wide ..... *B. conspicua*
               7. Plants less than 1.5 m tall; leaves less than 25 cm long.
                  9. Center of receptacle pubescent ..... *B. oblongifolia*
                  9. Center of receptacle glabrous.
                     10. Heads nearly sessile, densely aggregated in a compact spicate panicle ..... *B. hieracifolia*
                     10. Heads pedunculate, in a loose panicle.
                        11. Leaves oblong or broadly lanceolate, margins serrulate; achenes hairy and with sessile glands.. *B. formosana*
                        11. Leaves oblanceolate, margins doubly serrate; achenes sparsely hirsute, eglandular. ..... *B. lacera*

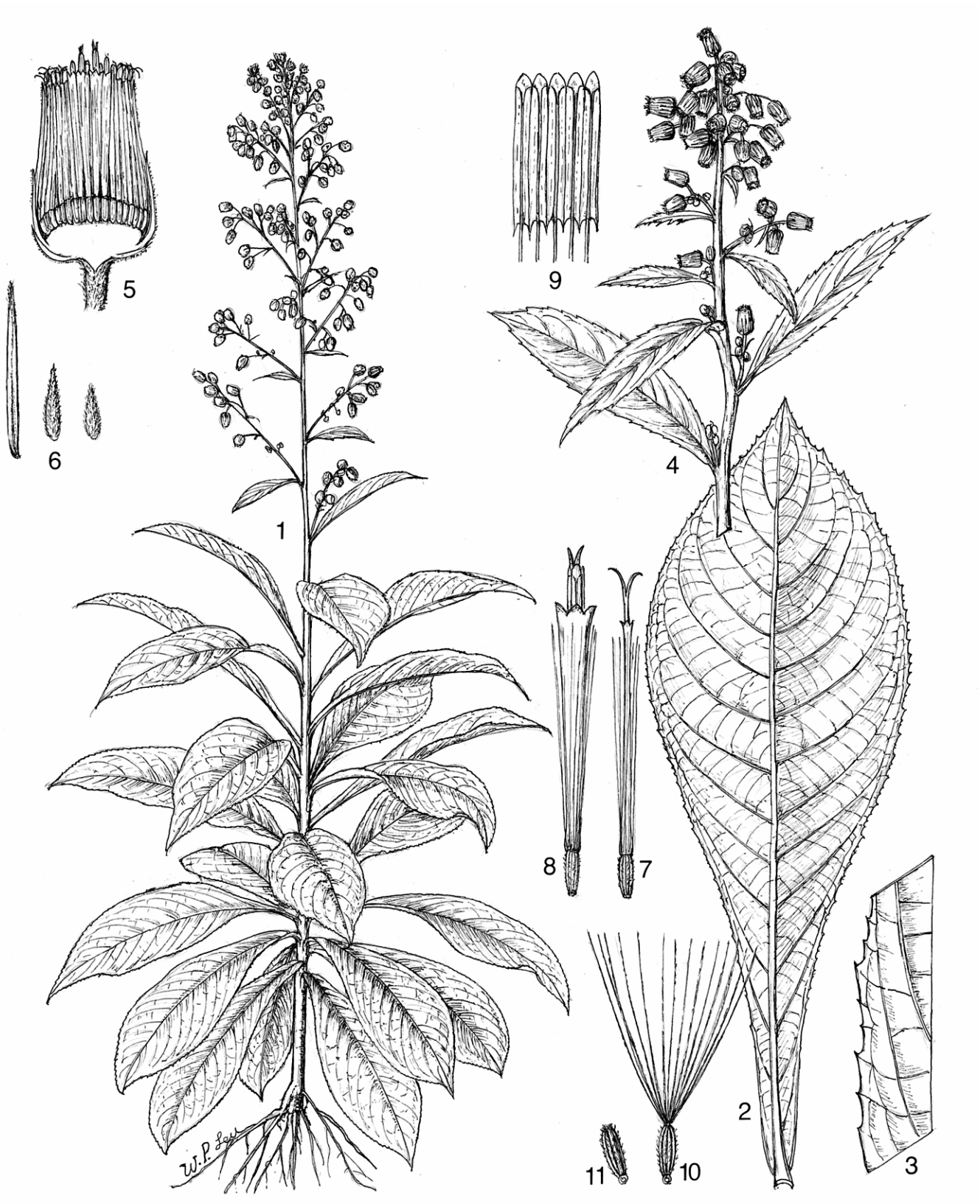

Figure 3. *Blumea lanceolaria*. 1, Habit; 2, Portion of stem; 3, Leaf; 4, Portion of leaf; 5, Portion of a flowering branch; 6, Head, longitudinal section; 7, Involucral bracts; 8, Outer floret; 9, Central floret; 10, Stamens; 11, Achene; 12, Achene, pappus removed.

2. Senecio tarokoensis C.-I Peng, sp. nov. — TYPE: Taiwan, Hualien Hsien, Hsiulin Hsiang, Taroko National Park, terminus of the cable way at the beginning of Yenhai Forest Road. Windy, rocky ridges with dense herbaceous and scrub vegetation, such as *Photinia serratifolia, Rhamnus parvifolia, Sageretia tea, Ligustrum morrisonense, Rhaphiolepis indica, Spiraea tarokoensis, Aster hispidus, Dendranthema morii, Euphrasia tarokoana, Euphorbia tarokoensis, Galium tarokoense, Bletilla formosana, Ponerorchis taiwanensis*, ca. 1,150 m, 121°31'11" E, 24°09'51" N, 4 May 1993, *C.-I Peng 15456* (holotype: HAST; isotypes: A, CAS, E, F, HAST, K, KUN, KYO, MAK, MO, NY, PE, TAIF, TEX, TNM, TNS, TUS). / |» /d%¥e Figure 4

Species propria haec *S. fukienensis* affinis sed in cauli simplicibus, foliis triangulari-lanceolatibus (vs oblongo-ellipticis vel anguste oblongo-ellipticis), petiolis elongatibus (vs foliis auriculatis amplexicaulis), floribus radii pluribus (8–12 vs. 7–8), corollae longiore (15–17 mm vs. 7.5–9.5 mm), differt.

Perennial herbs with short rhizomes. Stems simple, ascending, striate, 15–75 cm tall, green, glabrous or nearly glabrous apically, purplish green to dark purple and increasingly densely villous toward base. Leaves dark green on upper surface, dark purple to greenish purple on lower surface, thick chartaceous to subcoriaceous, highly variable in shape, lateral veins 3–5-pairs. Lower and middle cauline leaves triangular-ovate or lanceolate, 3–9 cm long, 2–5 cm wide, lower surface villous, upper surface nearly glabrous, apex acute-mucronate, base obtuse, truncate or cordate, margins mucronate-serrate, dentate, coarsely dentate or cleft, sometimes with 1 or 2 distinct, ovate or obovate basal appendages; petiole 3–8 cm long, villous. Upper cauline leaves lanceolate, linear-lanceolate to linear, (3–)4–8 cm long, (0.3–)1–2 cm wide, apex acute to acuminate, base obtuse to attenuate, margins mucronate, subentire, remotely dentate or irregularly lobed, petiole 1–2 cm long, or leaves near base of inflorescence subsessile, villous. Heads 3–3.5 cm across, bracteate, solitary, or to ca. 20 in loose corymbs; peduncle 2.5–6(–12) cm long, slender, nearly glabrous to sparingly puberulous, bracteate; bracteoles 2–5, remote, ascending, linear, 1–4.5 mm long. Involucre cylindrical, ca. 8 mm long, 5–6 mm across; bracts 2-seriate; outer bracts calyculate, 4 or 5, linear, 3–3.5 mm long, 0.3–0.5 mm wide; inner bracts green, tinged purple at apex, ca. 20, subequal, lance-linear, 6.5–8 mm long, 1.2–1.5 mm wide, apex acuminate, base obtuse, margins membranaceous, 1-nerved, glabrous to sparsely pubescent. Ray florets 8–12, corolla yellow, ca. 15–17 mm long, ligules 10–12 mm long, 4-veined, tube ca. 5 mm long; disc florets ca. 40, yellow, funnelform, ca. 6.5 mm long, apically papillose, otherwise glabrous, limb 3.3–3.5 mm long, tube 3–3.2 mm long, 5-lobed, lobes ca. 1.3–1.5 mm long, 0.7–0.8 mm wide, acute. Anthers 1.8–2.2 mm long, obtuse at base, filaments ca. 1.8 mm long; appendages ovate, apex obtuse, ca. 0.25 mm long; anther collars slightly dilated at base, 0.3 mm long. Style branches ca. 1.2 mm long, apex truncate, papillate. Achenes brownish, cylindrical, slightly narrowed at both ends, 3–4 mm long, 0.6–0.8 mm thick, minutely appressed hairy; pappus white, in 1 series, 4–5.5 mm long. Flowering Mar–Jun.

Additional specimens examined. **TAIWAN**. HUALIEN HSIEN: Hsiulin Hsiang, Taroko National Park, exposed windy, rocky mountain summit, facing a valley, at terminus of a cable way at the beginning of Yenhai Forest Road, abundant locally but not found elsewhere along the road, elev. ca. 1,050–1,200 m, 27 Jan 1989, *Peng 12410* (sterile, HAST; flowering specimen pressed from greenhouse grown plants, 31 Mar 1989, HAST), 2 Nov 1989, *Peng 13071* (sterile, HAST), 24 Jul 1990, *Peng 13303* (sterile, HAST); along Shakatang Forest Road from entrance of Chingshuishan to Tatung, in broadleaf forest, lower part of a steep cliff, 900–1,500 m alt., 3 Jun 1993, *Leu 1809* (flowering, HAST); Luanshan railway, near 3rd cableway, 1,900 m alt., by railway on rock cliff in bare limestone habitat, lithophytic with some dripping water, roots in mosses and soil, in mid-humid, open, sunny environment, 31 Mar 1995, *Moore 18012* (sterile, HAST).

Distribution and notes. Endemic and rare, known only from metamorphosed limestone mountains in Taroko National Park in eastern Taiwan (Figure 2), on semishaded to open rocky ridges with abundant herbaceous and dwarf scrub vegetation, ca. 1,000–2,000 m alt. Taroko National Park is noted for harboring many endemic species, some of which have become known to science only recently, such as *Buxus microphylla* subsp. *sinica* var. *tarokoensis* (Yang and Lu, 1993), *Elaeagnus tarokoensis* (Lu and Yang, 1993), *Berberis tarokoensis* (Lu and Yang, 1996), *Lysimachia chingshuiensis* (Peng and Hu, 1999), *Gentiana tarokoensis* (Chen and Wang, 1999). A thorough botanical inventory of the less accessible mountains within this limestone national park may add more species to the rich flora of Taiwan.

Senecio tarokoensis is a distinct member of sect. *Flexicaulis* C. Jeffrey & Y. L. Chen. It is somewhat similar to *S. fukienensis* Ling ex C. Jeffrey & Y. L. Chen of southern China, but differs in its simple stems, triangular-ovate to lanceolate lower and middle cauline leaves (vs. oblong-elliptic or narrowly so), long petiole (vs. auriculate and amplexicaul leaves) and ray florets more numerous (8–12 vs. 7–8) with much longer corollas (15–17 mm vs. 7.5–9.5 mm). It is also the largest flowered species of *Senecio* in Taiwan.

The following key is provided to aid in the identification of the eight taxa of *Senecio* indigenous to Taiwan. I have excluded *Senecio formosanus* Kitam., *S. integrifolius* (L.) Clairv. var. *spathulifolius* (Miq.) Hara ("*spathulatus*") and *S. taitoensis* Hayata, which were previously listed in Flora of Taiwan (Li, 1978) and are now recognized as *Nemosenecio formosanus* (Kitam.) B. Nord., *Tephroseris kirilowii* (Turcz. ex DC.) Holub, and *Tephroseris taitoensis* (Hayata) Holub, respectively (Jeffrey and Chen, 1984).

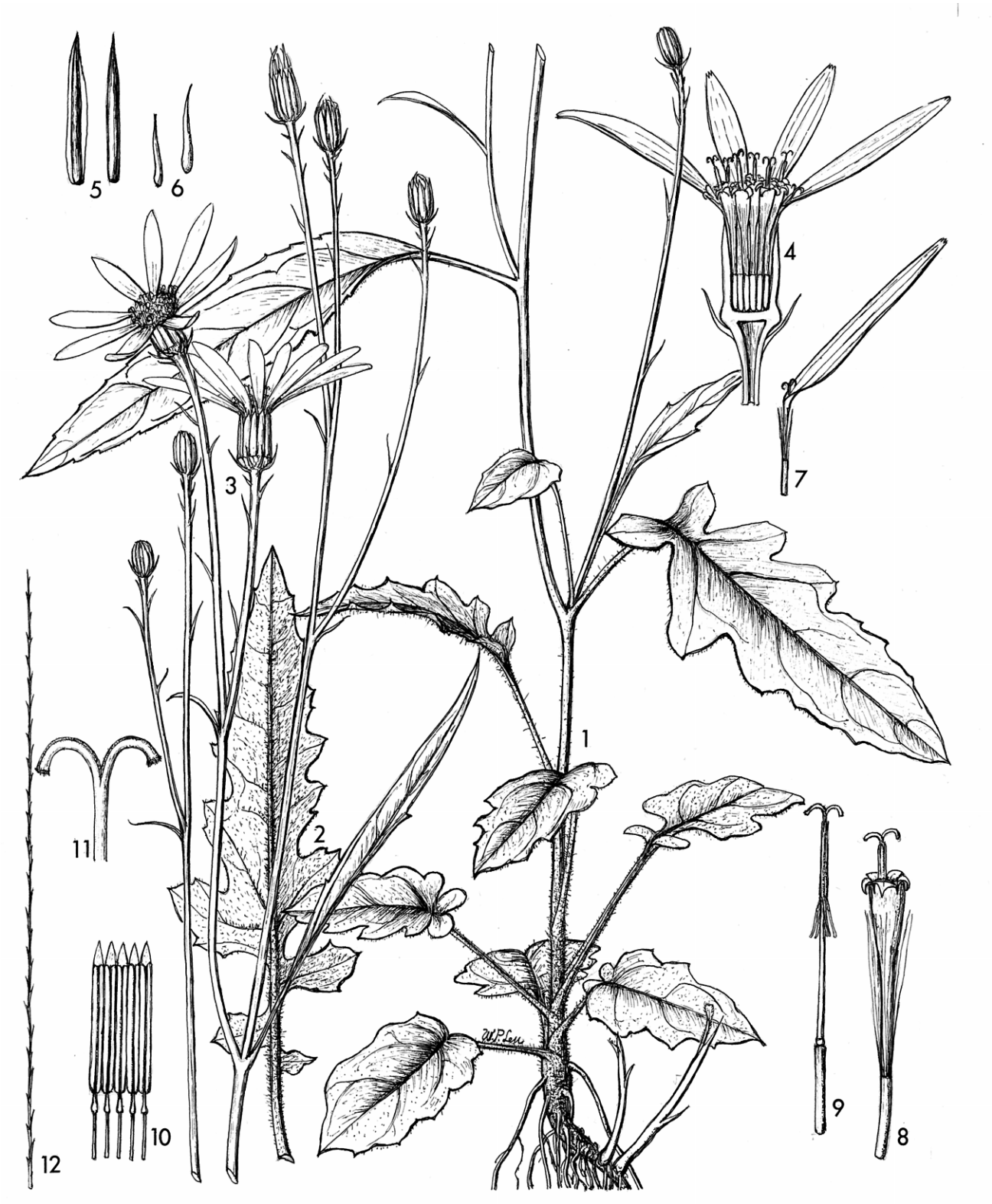

Figure 4. *Senecio tarokoensis*. 1, Lower stem; 2, Leaf; 3, Upper flowering stem and branches; 4, Head, longitudinal section; 5, Inner involucral bracts; 6, Outer bracteoles; 7, Ray floret; 8, Disc floret; 9, Disc floret, corolla and pappus removed; 10, Stamens; 11, Style branches; 12, Pappus bristle; 13, Achene.

Key to Taxa of *Senecio* in Taiwan

1. Plants annual with fibrous roots; heads discoid .... *S. vulgaris*
1. Plants perennial with rootstocks; heads radiate.
   2. Leaves mainly radical, rosulate, persistent at anthesis; flowering stems scape-like, with bracteate leaves *S. taitungensis*
   2. Leaves cauline, radical leaves usually withered at anthesis; flowering stems terminal and/or axillary; heads not on a scape-like flowering stem.
      3. Leaves thick chartaceous to subcoriaceous, petiole 3–8 cm long; peduncle 2.5–6(–12) cm long; ray florets 8–12 ..... *S. tarokoensis*
      3. Leaves chartaceous, petiole 0–2 cm long; peduncle 0.5–2(–3) cm long; ray florets 5–8.
         4. Stems erect; leaves linear, elliptic to oblong-lanceolate.
            5. Leaves bipinnately, pinnately, lyrately or runcinately lobed ..... *S. morrisonensis*
            5. Leaves dentate..*S. nemorensis* var. *dentatus*
         4. Stems weakly erect or scandent; leaves triangular or narrowly so.
            6. Stems weakly erect, ascending to nearly scandent, 10–60 cm tall; leaves 1–4 cm long; heads (1–)3–10 in lax corymbs at apex of stems and branches .... *S. crataegifolius*
            6. Stems scandent, 2–5 m tall; leaves 4–10 cm long; heads many, in large axillary paniculate corymbs.
               7. Leaves subentire to dentate, unlobed and without small lateral lobes at base .... *S. scandens* var. *scandens*
               7. Leaves pinnatifid, or with a large terminal lobe and several lateral lobes at base .. *S. scandens* var. *incisus*

Acknowledgments. We thank David E. Boufford and B. Bartholomew for useful comments on the manuscript; K. N. Gandhi, Peter F. Stevens and German Carnevali for assistance with the Latin diagnoses; Kuo-Fang Chung for technical assistance; and Taroko National Park, Taiwan for collect permit. This study was supported in part by research grants from the National Science Council and the Council of Agriculture, Taiwan to Ching-I Peng.

Literature Cited

Bremer, K. 1994. Asteraceae, Cladistics & Classification. Timber Press, Portland, 752 pp.

Chen, C.H. and J.C. Wang. 1999. Revision of the genus *Gentiana* L. (Gentianaceae) in Taiwan. Bot. Bull. Acad. Sin. **40:** 9–38.

Jeffrey, C. and Y. L. Chen. 1984. Taxonomic studies on the tribe Senecioneae (Compositae) of Eastern Asia. Kew Bull. **39:** 205–446.

Li, H.L. 1978. Compositae. *In* H.L. Li, T.S. Liu, T.C. Huang, T. Koyama, and C.E. DeVol (eds.), Flora of Taiwan, vol. 4. Epoch Publ. Co., Ltd., Taipei, pp. 768–965.

Lu, S.Y. and Y.P. Yang. 1993. Elaeagnaceae. *In* Editorial Committee of the Flora of Taiwan, Second Edition (eds.), Flora of Taiwan, 2nd edn., vol. 3. Editorial Committee of the Flora of Taiwan, Second Edition, Taipei, pp. 780–793.

Lu, S.Y. and Y.P. Yang. 1996. Berberidaceae. *In* Editorial Committee of the Flora of Taiwan, Second Edition (eds.), Flora of Taiwan, 2nd edn., vol. 2. Editorial Committee of the Flora of Taiwan, Second Edition, Taipei, pp. 575–585.

Peng, C.-I and C.M. Hu. 1999. *Lysimachia chingshuiensis* (Primulaceae), a new species from eastern Taiwan. Bot. Bull. Acad. Sin. **40:** 49–52.

Randeria, A. J. 1960. The Composite genus *Blumea*, a taxonomic revision. Blumea **10:** 176–309.

Yang, Y.P. and S.Y. Lu. 1993. Buxaceae. *In* Editorial Committee of the Flora of Taiwan, Second Edition (eds.), Flora of Taiwan, 2nd edn., vol. 3. Editorial Committee of the Flora of Taiwan, Second Edition, Taipei, pp. 666–673.