

Notes on the Flora of Taiwan (28) — The Genus *Cotoneaster* Medik (Rosaceae)

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ABSTRACT : The genus *Cotoneaster* in Taiwan is revised. By comparing fresh flowering specimens and published literature, four species, i.e. *C. horizontalis* Dcne., *C. konishii* Hayata, *C. morrisonensis* Hayata and *C. rokujodaisanensis* Hayata are recognized in Taiwan. *C. horizontalis* is a new record. Color photographs of *C. horizontalis* and *C. morrisonensis* are provided for the flower color of the former is reddish purple, but the latter is white. SEM micrographs of leaf hairs and pollen grains, a key to species, and taxonomic description are provided.

KEY WORDS : *Cotoneaster*, Pollen morphology, Taxonomy, Taiwan.

INTRODUCTION

The genus *Cotoneaster* contains about 90 species mainly in temperate regions of Asia, Europe, and North Africa (Yü and Lu, 1974). Hayata described three species in Taiwan, i. e. *C. konishii* in 1913 and, *C. morrisonensis* and *C. rokujodaisanensis* separately in 1915. Masamune (1932) treated *C. rokujodaisanensis* as a synonym of *C. morrisonensis*. This opinion was accepted by Kanehira (1936), Li (1963), Yü and Lu (1974), Liu and Su (1977), and Ohashi (1993). But we consider it as a distinct species.

Recently, some specimens collected from Nanhutashan (Huang & Hsieh, 1995), Taichung County, when compared with specimens deposited in TAI and TAIF herbaria and with published literature, were recognized by us to be *C. horizontalis* Dcne (Fig. 1), because *C. horizontalis* can easily be distinguished from *C. morrisonensis* (Fig. 2) by its upright reddish purple petals and white anthers. Thus four species are recognized in Taiwan. In addition to morphological study, the pollen features are also presented.

MATERIALS AND METHODS

The plants were studied in fields. Specimens deposited in TAI-, TAIF- and TI-herbaria were also carefully examined and compared with the published literature (Hayata, 1913,

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Figs. 1, 2. Color photographs of *Cotoneaster horizontalis* Dcne. (Fig 1) x 2, and *C. morrisonensis* Hayata (Fig 2) x 0.8.

1915, 1917). Three species of pollen grains were acetolyzed according to the method of Erdtman (1952). The acetolyzed grains were examined with Leica light microscope. Some acetolyzed grains were dehydrated in an ethanol series and dried in critical point drying. Dried grains were coated with gold and examined with SEM, Hitachi S520. Micrographs of pollen grains were also taken.

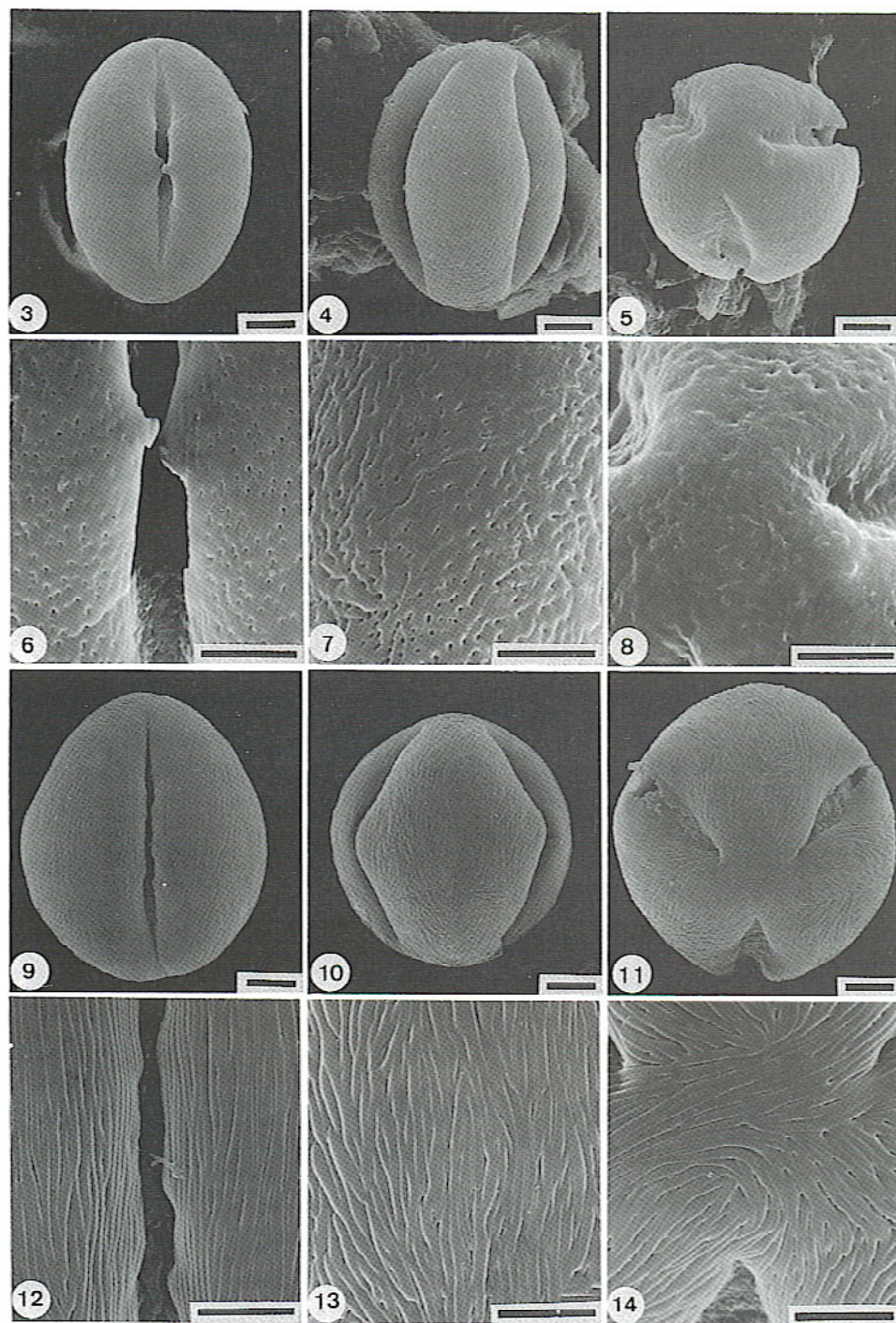
RESULTS

Pollen morphology

The pollen grains of *Cotoneaster* (Figs. 3-20, Table 1) are characteristically 3-colporate, spheroidal to subprolate, 23-29.5 μm (31-44 μm in SEM) long in P value and 19-25.5 μm (25-41 μm in SEM) broad in E value in equatorial view; amb from circular to semi-circular; colpus long, the margin bulged and elevated at os in *C. horizontalis* and *C. konishii* but not prominently elevated in *C. morrisonensis*; exine 1.1-1.8 μm thick, with striate ornamentation (Table 1) in *C. morrisonensis* but rugulate and perforate ornamentation in *C. horizontalis* and *C. konishii*, characters that were not reported by previous workers in Taiwan (Huang, 1972).

Table 1. Pollen morphology of *Cotoneaster* in Taiwan. The numbers in brackets are from LM measurements).

Taxa	<i>C. horizontalis</i>	<i>C. konishii</i>	<i>C. morrisonensis</i>
Character			
P (μm)	23.0-26.5	24.5-29.5 (31.0-41.0)	25.5-29.0 (33.0-44.0)
E (μm)	19.0-20.5	24.5-25.5 (25.0-38.0)	24.0 (27.0-41.0)
P/E	1.12-1.39	1.16-1.00 (1.00-1.36)	1.06-1.21 (1.00-1.36)
Shape	prolate-spheroidal to subprolate	spheroidal to subprolate	spheroidal to subprolate
Ornamentation	rugulate prominently and perforate	rugulate obscurely and perforate	striate
Colpus	margin bulged at os	margin bulged at os	margin not bulged at os
Locality	Taichung: Nanhutashan	Nantou: Patungkuan	Chiayi: Paiyunshan to Tungpu; Monrou Cliff to Tungpu
Collector	Hsieh 1539	Yang et al. s.n.	Huang 14309, Hsu 5465



Figs. 3-20. SEM micrographs of pollen grains. Figs. 3-8: *Cotoneaster horizontalis* Dcne.; Figs. 9-14: *C. morrisonensis* Hayata; and Figs. 15-20: *C. konishii* Hayata. Figs. 3, 9 and 15 showing 3-colporate grains at aperture area in equatorial view; Figs. 4, 10, and 16 showing mesocolpi area in equatorial view; Figs. 5, 11 and 17 showing circular to semi-circular amb in polar view; Figs. 6, 12 and 18 showing the magnification of aperture area; Figs. 7, 13 and 19 showing the magnification of mesocolpi area in equatorial view; Figs. 8, 14 and 20 showing the magnification of polar area in polar view; Figs. 3-8 and 15-20 showing the rugulate and perforate ornamentation and Figs. 9-14 showing the striate ornamentation. Scale bar= 5 μ m in Figs. 3-5, 9-11 and 15-17; and 3 μ m in Figs. 6-8, 12-14 and 18-20.

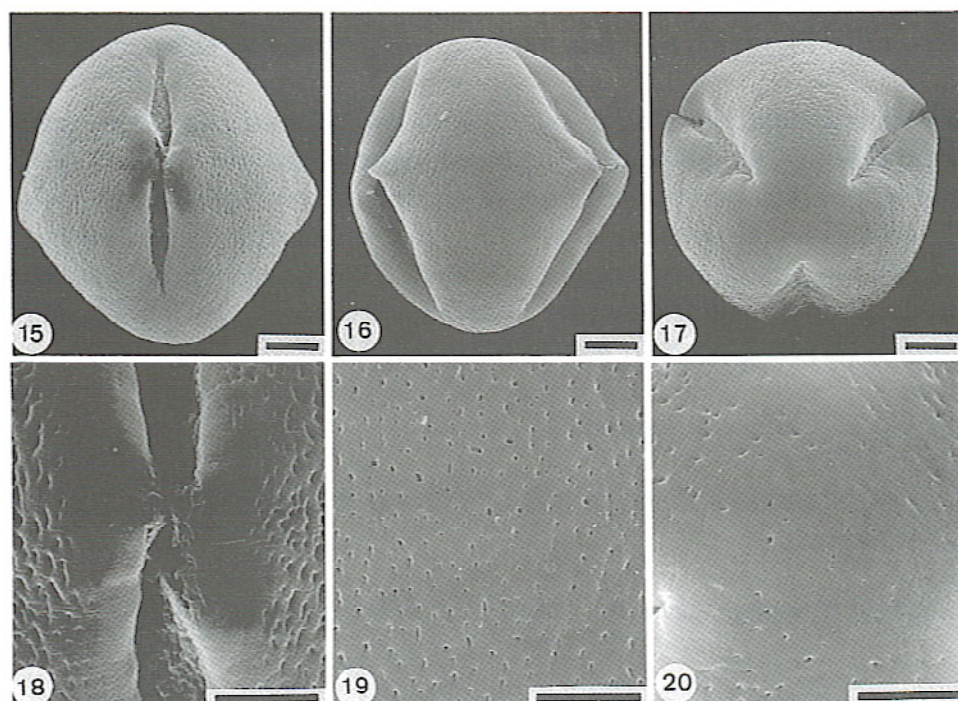


Fig. 3-20. continued

Taxonomic treatment

Cotoneaster Medik. Gesch. Bot. 85. 1793; Liu & Su in Fl. Taiwan 3: 60. 1977; Ohashi in Fl. Taiwan 2nd ed. 3:71. 1993. (Type: *C. vulgaris* Lindl.)

Evergreen or deciduous shrubs or small trees, erect or decumbent. Leaves simple, alternate, entire, usually with densely recurved hair on lower surface, petiolate; stipules caducous. Flowers small, white, pink or reddish purple, axillary or in terminal cymes or corymbs, rarely solitary; calyx tube adnate to the ovary, 4-5 lobed; petals 4-5, imbricate in bud, upright or spreading; stamens 5-25; carpels 2-5, inferior; styles 2-5, free; ovules 2 in each cell, anatropous, collateral. Fruit a red or black drupaceous pome.

About 90 species, mainly in temperate regions of Asia, Europe, and North Africa. at least four in Taiwan.

Key to species in Taiwan

1. Shrubs or small trees erect; leaves densely hairs on both surfaces at maturity; flowers white, in terminal corymbs 2. *C. konishii*
1. Shrubs prostrate; leaves glabrous on upper surface, few hairs on lower surface at maturity; flower(s) 1 or 2
 2. Styles 3; leaves usually broadly elliptic and mucronate at apex, few hairs on lower surface of young leaves, but glabrous at maturity 4. *C. rokujodaisanensis*
 2. Styles 2
 3. Petals white, spreading; leaves thick and recurved on margins, dense hairs on lower surface of young leaves, but few hairs at maturity 3. *C. morrisonensis*
 3. Petals reddish purple, upright; leaves thin and not recurved on margins, few hairs on lower surface of both young and mature leaves 1. *C. horizontalis*

1. **Cotoneaster horizontalis** Dcne. in Fl. Serr. 22: 168. 1877; Yü and Lu in Fl. Reip. Pop. Sinicae 36: 170-173. *pl.* 22, figs. 4-9. 1974. 平枝鋪地蜈蚣 Figs. 1, 3-8, 21-22.

Prostrate shrubs; branches hirsute, caducous. Leaves chartaceous, thin; blades ovate or broadly ovate, 5-14 mm long, 4-9 mm long broad, acute or abruptly acute at apex, obtuse to cuneate at base, glabrous on upper surface, few recurved hairs on lower surface (Figs. 21-22); margin not recurved; petiole ca. 3.5 mm long, pubescent. Flower solitary, terminal; pedicels 1-2 mm long; calyx campanulate, 4-5 lobed, lobes triangular, apex acute, pubescent outside; petals 4 or 5, reddish purple, upright; stamens 10, 2-whorled, anthers white, filaments purple; carpels 2; styles 2, free. Fruits ovoid, 4-6 mm in diam.

Distribution: Nepal, China and Taiwan.

Altitude: above 3000 m.

Habitat: margin of *Abies kawakamii* (Hayata) Ito forests or on exposed rock cliffs.

Flowering: May, June.

Specimens examined: Taichung: Nanhutashan, Hsu 5932, Tateishi et al. 18692, J. C. Wang 3651, T. H. Hsieh 1539.

Note: This species is a new record for the Flora of Taiwan. It (Fig. 1) can be distinguished easily from *C. morrisonensis* (Fig. 2) by its upright reddish purple petals and white anthers during flowering. The significant floral color is hardly observed in dry specimens or found in the field collections. However, the leaves can be used to distinguish them; the former has chartaceous leaves and the margins are not recurved, the latter has coriaceous leaves and the margins are recurved. The lower surface of young leaves in the former has few hairs, but the latter has dense hairs.

2. **Cotoneaster konishii** Hayata, Icon. Pl. Form. 3: 100. 1913; Liu & Su in Fl. Taiwan 3: 60. 1977; Ohashi in Fl. Taiwan 2nd. ed. 3: 73. 1993. (Hualien: Btaliankei, *Konishi s. n.* 1902. Holotype, TI!; isotype, TAI!) 臺灣鋪地蜈蚣 Figs. 15-20, 25-26.

Photinia kudoii Masamune in Trans. Nat. Hist. Soc. Form. 23: 206. 1933. (Nantou: Nengkaoshan, Kudo & Mori 89. Holotype, TAI!)

Deciduous shrubs or small trees. Leaves chartaceous, rhombic-ovate or elliptic, 2-9 cm long, 1.5-4 cm broad, acute to acuminate at apex, obtuse to cuneate at base, the upper surface with recurved hairs, the lower surface with densely recurved hairs (Figs. 25-26), yellowish; petioles 2-5 mm long. Flowers white, in terminal corymbs; pedicels 3-5 mm long, pubescent; calyx campanulate, 5-lobed, lobes triangular, outside pubescent; petals 5, white, carpels 3-5; styles 3-5, free. Fruits ellipsoid, 5-8 mm in diam.

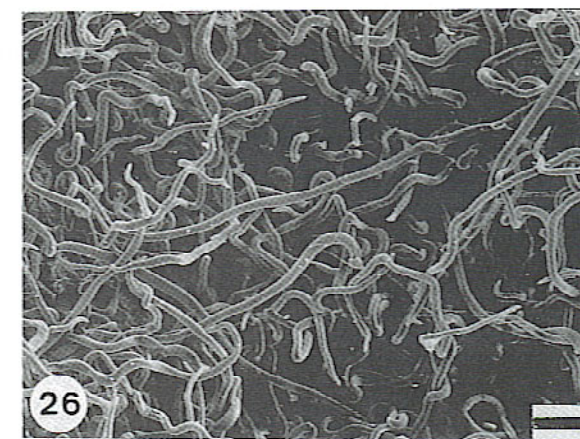
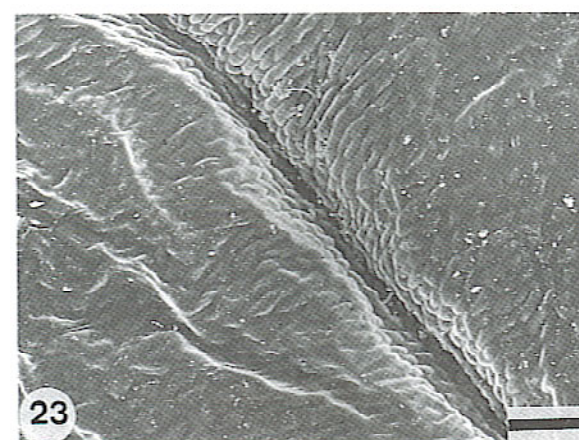
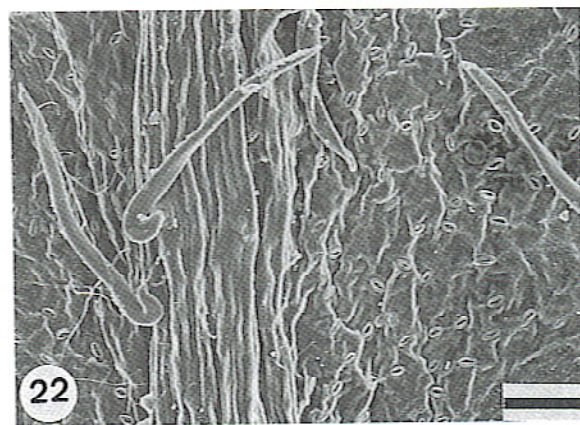
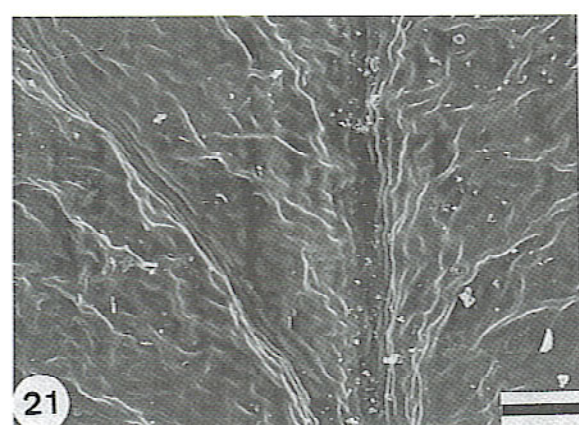
Distribution: Endemic.

Altitude: 1800-3000 m.

Habitat: exposed grasslands.

Flowering: May, June.

Specimens examined: Taichung: Nánhutashan, T. Suzuki 17749, Tateishi et al. 18690, 18697, Hsu 5935, 6055, J. C. Wang 3795; Chiliting Ridge, T. C. Huang 7760. Hsinchu: Sasaki s. n. 1932. Hualien: Hohuanshan, Kuo 2645, Kuo et al. 7042. Nantou: Patungkuan, K. C. Yang et al. s. n. Jul. 1993.



Figs. 21-26. SEM micrographs of leaf surface. Figs. 21 and 22: *Cotoneaster horizontalis* Dcne.; Figs. 23 and 24: *C. morrisonensis* Hayata; Figs. 25 and 26: *C. konishii* Hayata; Figs. 21, 23 and 25: upper surface; and Figs. 22, 24 and 26: lower surface. Scale bars=100 μ m.

Note: Although the leaves are variable in this species which confused some botanists such as Yü and Lu (1974), the densely recurved hairs are good diagnostic character (Figs. 25-26) and can also be used to distinguish it from other species (Figs. 21-24) in Taiwan.

3. **Cotoneaster morrisonensis** Hayata, Icon. Pl. Form. 5: 62. 1915; 6: 17. 1917; Liu & Su in Fl. Taiwan 3: 61. *pl.* 478. 1977; Ohashi in Fl. Taiwan 2nd. ed. 3: 73. *pl.* 39. 1993 (Chiayi: Yushan, Kawakamii & Mori *s. n.* 1906. Holotype, TI!; isotype, TAIF!)
玉山鋪地蜈蚣 Figs. 2, 9-14, 23-24.

Prostrate shrubs, copiously branched, young branches and buds pubescent. Leaves coriaceous, thick, obovate, ovate to elliptic, 0.7-1.8 cm long, 0.4-1.2 cm broad; acute, rounded, to emarginate at apex, obtuse to cuneate at base, upper surface glabrous, lower surface with densely recurved hairs when young (Figs. 23-24), scabrous hair when mature; margins recurved; petioles 2-4.5 mm long, pubescent. Flower solitary, sometimes 2 or 3, terminal; pedicel 3 mm long; calyx 5-lobed, lobes triangular-ovate; petals 5, white, spreading, stamens 10-15, the anthers whitish-pink, filaments purple; carpels 2; styles 2, free. Fruits ellipsoid, 5-8 mm long, 3 mm wide.

Distribution: Endemic.

Altitude: 2500-3500 m.

Habitat: in sunny grasslands or on rock cliffs.

Flowering: May, June, July.

Specimens examined: Chiayi: Paiyunshan to Tungpu, T. C. Huang 4589, 14309; Yushanchiense, C. Hsu 9174; Tataka, Hsu & Kuoh 7396; Monroe cliff to Tunpu, Hsu 5364; Arisan, T. C. Huang *s. n.* Feb. 1956.

4. **Cotoneaster rokujodaisanensis** Hayata, Icon. Pl. Form. 5: 63. 1915. (Miaoli: Rokujo-daishan, U. Mori *s. n.* Oct. 1908. Holotype, TI!; isotype, TAIF!)
樂山鋪地蜈蚣

Prostrate shrubs, up to 2 m tall, copiously branched, young branches and buds reddish brown, pubescent, with circular or transversally elliptic lenticels. Leaves coriaceous, thick, broadly elliptic, rarely obovate, up to 2.7 cm long, 1.5 cm broad, acute or mucronate, rarely obtuse or emarginate at apex, obtuse at base, upper surface shining glabrous, dark green or reddish brown, lateral veins impressed, lower surface with few hairs when young, glabrous at maturity, lateral veins elevated, red; margins entire, recurved; petioles 3-5 mm long. Fruits obovate, 6-7 mm long, 6-6.5 mm wide, red; seeds 3, trigonal obovate, dark brown, 4 mm long, 2.5 mm wide and 1.5 mm thick; pedicels 3-4 mm long.

Distribution: Endemic.

Altitude: c. 2500 m.

Habitat: open sunny slopes along mountain path.

Fruiting: from October to following March.

Specimens examined: Miaoli, Mt. Leshan (Rokujodaisan), T. C. Huang, M.J. Wu, J.L. Hsiao & C.W. Chang 166971-3 (Topotypes, TAI).

Note: In addition to 3 carpals against 2 carpels, *Cotoneaster rokujodaisanensis* differs from *C. morrisonensis* by its broadly elliptic leaves with usually mucronate apex against elliptic leaves with usually emarginate apex; few hairs against dense hairs on the lower surface of young branches and trigonal obovate against concave and convex seed shape.

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臺灣植物誌之觀察 (28) — 臺灣產鋪地蜈蚣屬之訂正

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摘 要

本文訂正臺灣產鋪地蜈蚣屬為4種，分別為平枝鋪地蜈蚣 (*Cotoneaster horizontalis* Dcne.)，臺灣鋪地蜈蚣 (*C. konishii* Hayata)，玉山鋪地蜈蚣 (*C. morrisonensis* Hayata) 和樂山鋪地蜈蚣 (*C. rokujodaisanensis* Hayata)。平枝鋪地蜈蚣為新記錄種，目前僅發現於南湖大山地區，其與玉山鋪地蜈蚣相似，但前者花瓣暗紅色，花瓣直立，及花粉具散條紋 (rugulate ornamentation) 和穿孔 (perforation)；而後者花瓣白色，花瓣平展，及花粉具平行條紋 (striate ornamentation) 足資區別。

關鍵字：鋪地蜈蚣屬，花粉形態，分類，臺灣。

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