A new species *Cotoneaster chingshuiensis* (Rosaceae) from Taiwan

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ABSTRACT: *Cotoneaster chingshuiensis* Kun C. Chang & Chih C. Wang, a new species from Taiwan is described. A taxonomic treatment, line drawings, color photos, and SEM micrographs of pollen are also provided in the paper. *Cotoneaster chingshuiensis* is found at Mt. Chingshui of Taroko National Park, at 2,100 m altitude in Northern Taiwan. It is similar to *C. konishii* Hayata, but can be distinguished by the 1-3-flowered inflorescence, shorter pedicels (0.5-1.5 mm), smaller leaves (6-28 × 4-15 mm) and the lower surface of leaf with densely yellowish villus.

KEY WORDS: *Cotoneaster chingshuiensis*, *Cotoneaster konishii*, Maloideae, Rosaceae, Spiraeoideae, Taiwan.

INTRODUCTION

The genus *Cotoneaster* Medik. (Maloideae: Rosaceae), with about 90 species, is widespread in temperate regions of Asia (except Japan), Europe, and North Africa (Yü and Lu 1974, Lu and Brach 2003). In former time, Hayata described three species in Taiwan, *i.e. C. konishii* Hayata in 1913, *C. morrisonensis* Hayata and *C. rokujodaisanensis* Hayata in 1915. Later, Masamune (1932) treated *C. rokujodaisanensis* as a synonym of *C. morrisonensis*. But Hsieh and Huang (1997) considered them as two distinct species, and enumerated four species of the genus in Taiwan including a new record *C. horizontalis* Decne. Lai and Hsieh in 2001 and 2003 described two new record species to the flora of Taiwan, *i.e. C. subadpressus* Yü and *C. apiculatus* Rehd. & Wils.. Moreover, Fryer and Hylmö describes a new species *C. hualiensis* Fryer & Hylmö from Taiwan in 2001. Lu et al. described a new record species *C. dammeri* Schneid. to the flora of Taiwan in 2005. Recently, Fryer and Hylmö (2009) described two new species *C. nantouensis* Fryer & Hylmö and *C. taiwanensis* Fryer & Hylmö from Taiwan. Later, we clarify the identity of *C. bullatus* Bois in the flora of Taiwan (Chang et al., 2009). In the past, *C. bullatus* was treated as two new species, *Photinia kudoi* Masamune (Masamune, 1933) and *C. taiwanensis*, and was identified as *C. konishii*. Moreover, this species *C. nantouensis* was considered to treated as a synonym of *C. subadpressus* in our other report (Chang et al., 2011).

We have some specimens collections from recent expeditions to Mt. Chingshui area. After the overall investigation on type specimens in herbaria and with published literatures, a new species *C. chingshuiensis* Kun C. Chang & Chih C. Wang is proposed in the paper.

The number of species of *Cotoneaster* of Taiwan increased rapidly from late 1997 to 2009. About 9 species have been recorded so far. Among them, *C. konishii*, *C. apiculatus*, *C. hualiensis*, *C. bullatus*, and *C. chingshuiensis* which were reported as new species by us were erect, and the others were creeping. *C. hualiensis* was reported as a new species by Fryer and Hylmö in 2001. It was collected on Mt. Shihmen in Hualien County, Taiwan. This species was different from *C. konishii* mainly in its 18-20 stamens and 2-4 pyrenes. *C. konishii* was described that it had 10 stamens and 3-5 pyrenes by Hayata. We compared the type specimen of *C. konishii* and the specimen of *C. hualiensis* we collected in the type location, Mt. Shihmen. It was found that the morphologies of specimens were similar. After dissecting, we found that the population had 2-4 pyrenes mostly, and seldom 5. The numbers of stamens were not stable; they were often 18-20, and sometimes 13-15. Therefore, we thought that *C. hualiensis* and *C. konishii* should be classified in the same species. The descriptions of Hayata and Fryer and Hylmö (2001) were some population variations. They could not record all detailed characteristics. We suggested treating *C. hualiensis* as a synonym of *C. konishii*. The main morphological characteristics of these four erect species of Taiwan are listed in Table 1. Meanwhile, we supply a key to help with identification.

POLLEN OBSERVATION

The anthers of fresh flowers of *Cotoneaster chingshuiensis* Kun C. Chang & Chih C. Wang

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Table 1. Comparisons of four erect species of *Cotoneaster* in Taiwan.

	C. apiculatus	*C. bullatus*	*C. chingshuiensis*	*C. konishii*
Leaf				
Shape	Ovate	Oblongovate to elliptical, rhombic, oval	Ovate or rotund	Rhombic-oval, ovate, rhombic
Size (mm)	6-15 × 4-15	50-130 × 15-55	6-28 × 4-15	13-50 × 10-35
Lower surface	Sparse hair or glabrous	Densely pilose	Complete villose	Pilose
Veins (pairs)	2-3	7-12	3-5	4-6
Flower				
Inflorescence	1 (-3)	7-21	1 (-4)	3-8
Pedicel length (mm)	0.4-1.3	5-8	0.5-1.5	1-5
Styles	3 (rarely 2)	4 or 5	3 or 4	3 or 4 (rarely 5)
Fruit				
Shape	Subglobose or ellipsoid	Obovoid or globose	Campanulate or ovoid	Ellipsoid, ovoid to subglobose
Color at maturity	Ruby	Ruby to maroon	Reddish-orange to red	Ruby
Pyrenes				
Number	3 (rarely 2)	4 or 5	3 or 4	2-4 (rarely 5)
Style scar	2/3 from base	1/2 from base	3/4 from base	2/3 from base
Pollen				
Shape	Subspheroidal (Lai and Hsieh, 2003: Figs. A-F)		Ellipsoidal (Fig. 1)	Subspheroidal (Hsieh and Huang, 1997: Figs. 15-20)
Ornamentation	Crowded perforate, (Lai and Hsieh, 2003: Figs. A-F)		Perforate, glossy on near polar view (Fig. 1)	Rugulate and crowded perforate (Hsieh and Huang, 1997: Figs. 15-20)

(collected from the *Chang et al. 3925*, holotype at TCF) were carefully removed with tweezers, and then sequentially dehydrated with alcohol (30%, 5 min; 40%, 5 min; 50%, 5 min; 60%, 5 min; 70%, 5 min; 80%, 5 min; 95%. 5 min). The anthers were then broken with a dissection needle under the stereomicroscope to scatter the pollen. Pollens were kept in a desiccator with silica gel over night. Finally, the pollen was observed under the scanning electron microscope (HITACHI S-3000N) and photographs were taken after gilt.

Key to four erect species of *Cotoneaster* in Taiwan

1a. Leaves less than 3 cm long; inflorescence 1(-4)-flowered ……..… 2
1b. Leaves usually over than 3 cm long; inflorescence 3-20-flowered ……...…….3
2a. Leaves lower surface sparse hairy or glabrous; pyrenes 3, rarely 2 ..... *C. apiculatus*
2b. Leaves lower surface densely yellowish-villous; pyrenes 3 or 4 ……..……... *C. chingshuiensis*
3a. Leaves upper surface is not bullate; inflorescence 3-5-flowered (rarely -7) ……..…….. *C. konishii*
3b. Leaves upper surface is conspicuously bullate; inflorescence 7-21-flowered ……..……..……... *C. bullatus*

TAXONOMIC TREATMENTS

Cotoneaster chingshuiensis Kun C. Chang & Chih C. Wang *sp. nov.* – TYPE: TAIWAN. Hualien County, Mt. Chingshui, 2,100 m altitude. 9 May 2007, *K. C. Chang et al. 3925* (holotype: TCF; isotypes: HAST and MO). Figs. 1, 2 A-D, 3, 4.

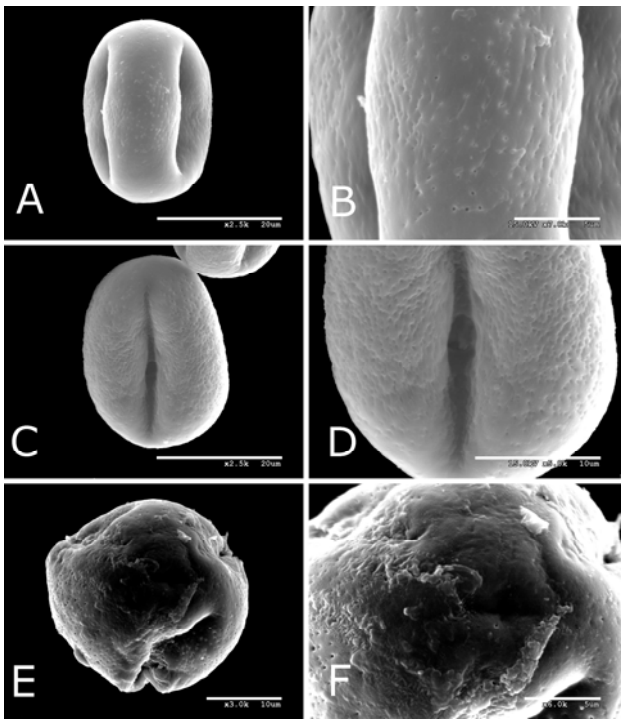


Fig. 1. SEM-micrographs of pollen grain of *Cotoneaster chingshuiensis* Kun C. Chang & Chih C. Wang. A: Equatorial view. B: Ornamentation on the equatorial view. C: Colporate view. D: Ornamentation on the colporate view. E: Polar view; F: Ornamentation on the polar view.

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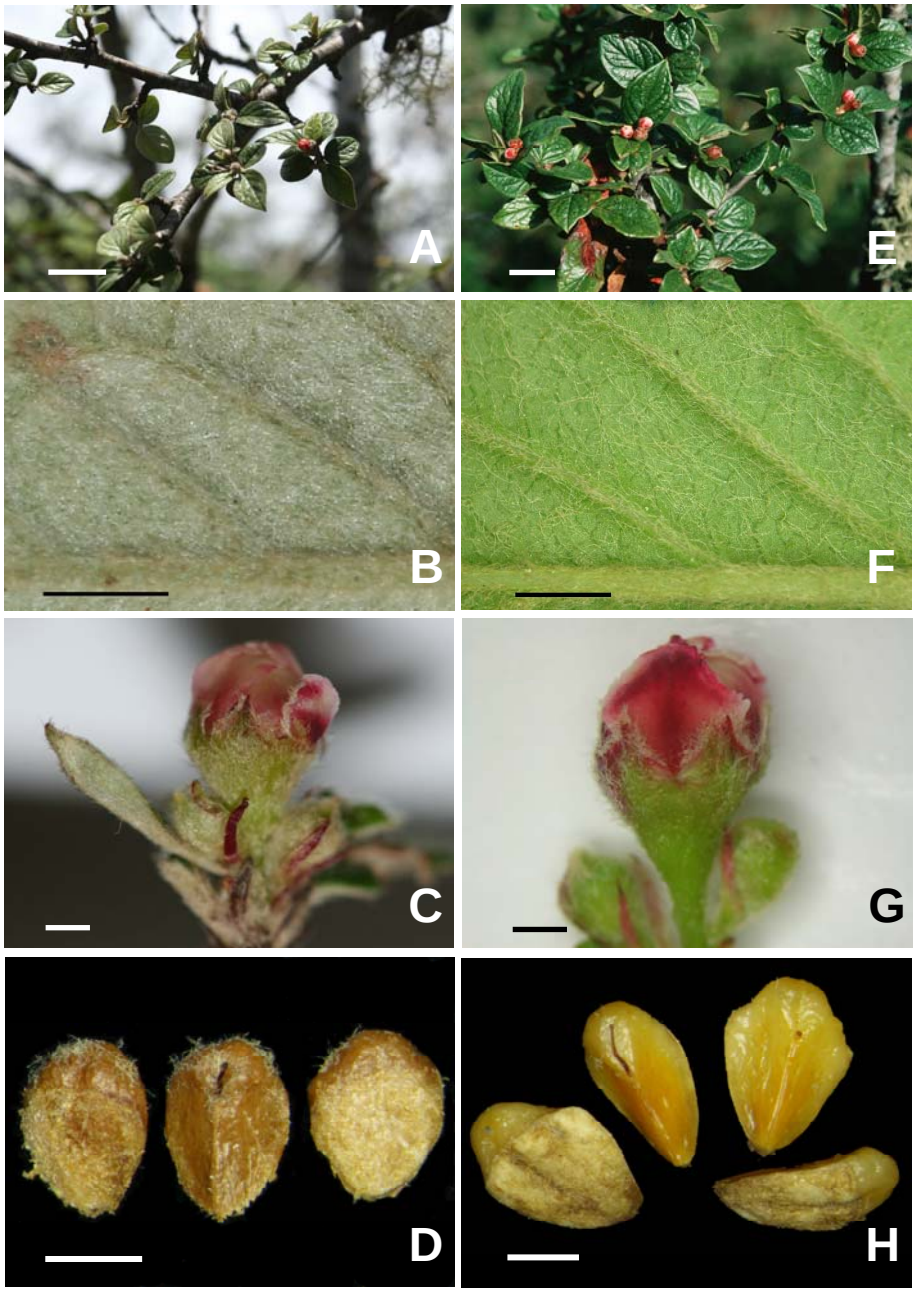


Fig. 2. Morphological comparisons between *Cotoneaster chingshuiensis* Kun C. Chang & Chih C. Wang (A-D) and its similar species *C. konishii* Hayata (E-H). A, E: Flowering branch. B, F: Lower surface of leaf. C, G: Inflorescence and flowers. D, H: Pyrenes. (Scale: A, E = 3 cm; B - D, F - H = 2 mm).

Haec species affinis Cotoneastro konishii Hayata, *sed flores solitarii vel 2 ad 3, pedicellis 0.5-1.5 mm. longis; folia 6-28 mm. longis, 4-15 mm. lata, subtus omnino dense flavidus villi differt.*

清水山枸子 Figs. 1, 2 A-D, 3, 4.

Deciduous shrub or small tree to 2-3 m high. Branches erect, branchlets spiraled or distichous, columnar, grayish-black to blackish-brown, with prominent lenticels, initially densely strigose-pilose, glabrous when old. Leaves chartaceous, ovate, ovate-round, long-ovate or rhombic-ovate, 6-28 mm long, 4-15 mm wide; apex acute, acuminate, apiculate, or rounded-blunt, base rounded to cuneate; upper surface initially densely yellowish pilose, subglabrous when old; lower surface complete densely

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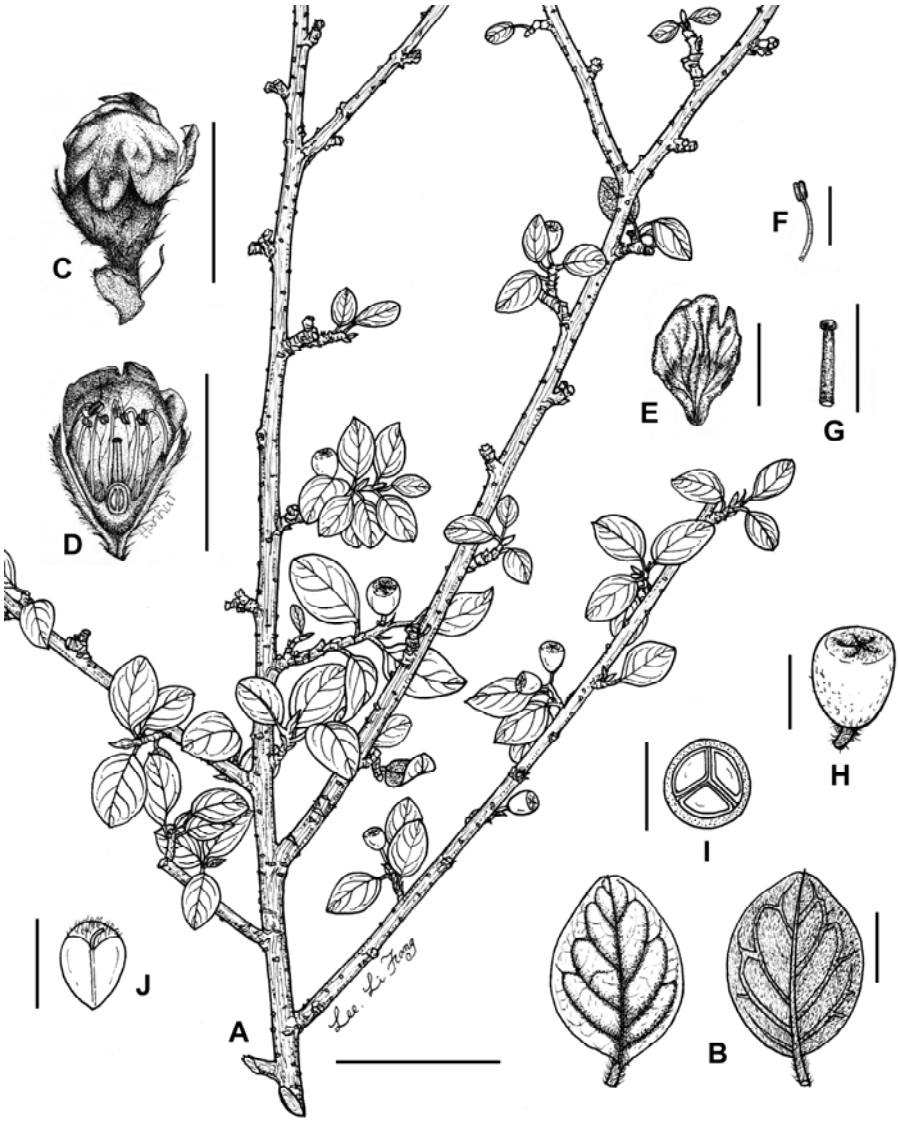


Fig. 3. ***Cotoneaster chingshuiensis*** **Kun C. Chang & Chih C. Wang. A: Habit. B: Leaves. C: Flower. D: Vertical-section of flower. E: Petal. F: Stamen. G: Styles. H: Pome. I: Cross-section of pome. J: Pyrene. (Scale: A = 3 cm. B-D = 5 mm. E-G = 2 mm. H-J = 4 mm).**

yellowish-villous or yellow-white-villous; veins in 3-5 pairs, indented on upper surface and raised on lower surface; petiole 0.5-3.5 mm, pilose; stipules lanceolate, 4-6 mm long. Fertile shoots 4-20 mm long, including 3-4 leaves and an inflorescence. Inflorescence usually 1-flowered or 2-4-flowered corymb, ca. 1 cm across; rachis and pedicels pilose; pedicels 0.5-1.5 mm long, bract narrow-lanceolate, 2-5 mm long; corolla 4-7 mm across. Hypanthium campanulate, exterior puberulent; sepals 5, triangular, exterior and margin puberulent, ca. 4.5 mm long, ca. 4 mm wide. Petals 5, erect with the tip incurving, red, pinkish, or off-white border and red base, obovate to broadly obovate or fan-shaped, apex rounded or erose, 2.5-4.5 mm long, 1.6-3.5 mm wide, glabrous. Stamens 18-20, 2-3.5 mm long, aduncous, filaments pinkish or reddish, glabrous, anthers ellipsoidal, yellow-white; ovary 3-4 cells, pubescent apically; styles 3 or 4, ca. 2.5 mm long, free, glabrous. Fruits obovoid, initially pilose, glabrous when old, reddish-orange to red, 3.8-6.5 mm long, 3.6-6 mm across; pedicel 0.5-1.8 mm long; sepal persistent; pyrenes 3 or 4**,** style remains at 3/4 from base. Flowering during April to August, with fruit ripening from July to November.

Distribution and habitat: Endemic species of Taiwan, in Mt. Chingshui of northeastern parts at

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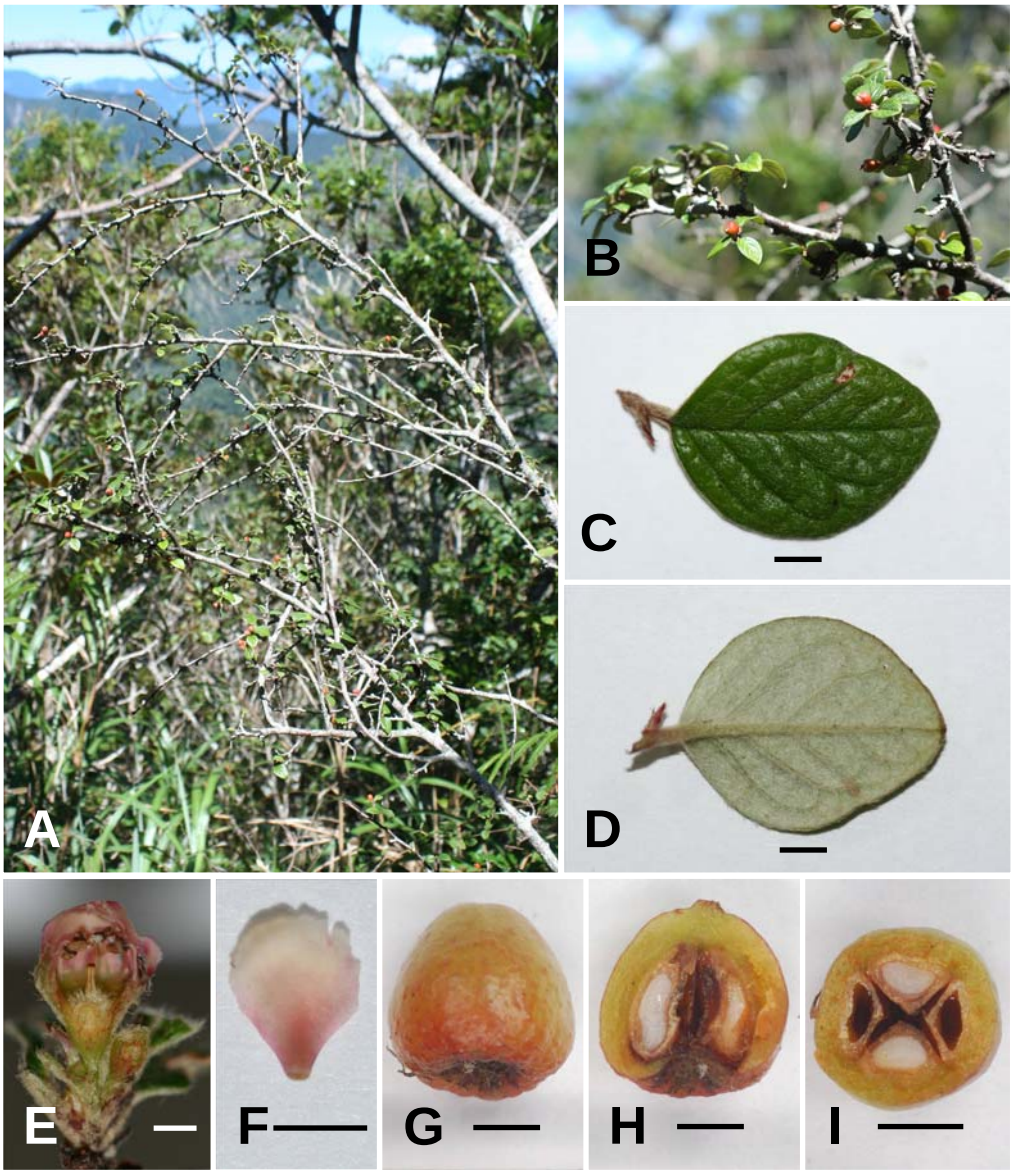


Fig. 4. Photographs of *Cotoneaster chingshuiensis* Kun C. Chang & Chih C. Wang. A: Habit. B: Fruiting branch. C: Upper surface of leaf. D: Lower surface of leaf. E: Vertical section of flower. F: Petal. G: Pome. H: Vertical section of pome. I: Cross-section of pome. (Scale: C - E = 3 mm, F - I = 2 mm).

elevations of 2,100 m. At forest margins, on exposed limestone gravelly slopes.

Specimens examined: Mt. Chingshui, Hualien, Taiwan. 28 August 2006, *K. C. Chang et al. 3661* Fr. (TCF); 9 May 2007, *K. C. Chang et al. 3925* Fl. (holotype: TCF; isotype: HAST, MO).

IUCN Red List category: *Cotoneaster chingshuiensis* known only distribution in the Mt. Chingshui, Taroko National Park, Northeast Taiwan at present. Our field observations suggest that this species is uncommon, but there are no data regarding estimates of population numbers or sizes. Therefore, we recommend a conservation status of Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Pollen morphology: The shape of pollen grains of *Cotoneaster chingshuiensis* is ellipsoidal with three colpoids, polar surface is 3-lobed circular, and its size is 20-28 × 29-36 μm (P×E). The ornamentation on polar surface and equatorial surface of the grain is only perforate (Fig. 1). By the morphologies of pollen, *C. chingshuiensis* could be distinguished from relative species *C. konishii* as well. The pollen of *C. chingshuiensis* is ellipsoidal and with perforate ornamentation but smooth and not perforate near the

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polar side. According to Hsieh and Huang (1997), the pollen of *C. konishii* was subspheroidal, with striped, rugulate and crowded perforate ornamentation.

Note: *Cotoneaster chingshuiensis* is similar to *C. konishii*, but can be distinguished by the flower number of the inflorescence, length of pedicel, size and haired lower surface of leaves. The former, its inflorescence is 1-3-flowered, shorter pedicel (0.5-1.5 mm), smaller leaves (6-28 × 4-15 mm), with densely yellowish-villous on lower surface. The latter, its inflorescence is 3-8-flowered, longer pedicel (1-5 mm), biggish leaves (13-50 × 10-35 mm), with green and pilose on lower surface. A comparison of salient morphological features of the two species is showed in Fig. 2.

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臺灣產枸子屬(薔薇科)一新種：清水山枸子

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摘 要：本文報導臺灣產枸子屬（*Cotoneaster*）一新種：清水山枸子（*C. chingshuiensis* Kun C. Chang & Chih C. Wang），並提供形態描述、手繪圖、花果照片及花粉的掃瞄式電子顯微鏡照片以供辨識。本種主要分布於臺灣北部太魯閣國家公園清水山海拔 2,100 公尺之山區。本種形態近似小西氏枸子（*C. konishii* Hayata），但本種的花序 10-3 朵花，花梗較短（0.5-1.5 mm）、葉較小（6-28 × 4-15 mm）及葉背密被淡黃色長柔毛可與之區分。

關鍵詞：清水山枸子、小西氏枸子、蘋果亞科、薔薇科、繡線菊亞科、臺灣。

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