

Contribution to a Revised Orchid Flora of Taiwan (IV)

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ABSTRACT: A new species of Orchidaceae, *Listera meifongensis* is described from Taiwan. The native species of *Galeola* in Taiwan are also revised. Illustrations and taxonomic notes are given for these species.

KEY WORDS: Orchidaceae, Flora of Taiwan, *Listera meifongensis*, *Galeola* spp.

INTRODUCTION

This paper is a preliminary report for a revised orchid flora of Taiwan. As stated in Su (1999), an attempt has been made to reappraise the orchid species not yet recorded or described by previous authors, and to revise their taxonomy and nomenclature. The work aims to consolidate the native orchids of Taiwan based on current knowledge and materials.

When Miss Chia-ying Hu and I were revising the Taiwan species of *Listera*, we collected many new specimens and examined all relevant materials in Taiwan herbaria. We found that some specimens had been misidentified or determined with uncertainty. *Listera* is a rather difficult group in Taiwan. With few exceptions, all species of *Listera* look alike vegetatively. This is perhaps why many Taiwan species have long been neglected when not flowering, and new species have been published episodically throughout the twentieth century. So far 8 species, including the recently described *L. kuanshanensis* (Su, 1999), have been recognized in Taiwan. After extensive collections and careful observations, we wish to describe another new species from Taiwan.

Galeola is a genus of leafless saprophytic plants in tropical and subtropical areas. We listed two species in the Flora of Taiwan, *G. altissima* (Bl.) Reichb. f. and *G. kuhlii* (Reichb. f.) Reichb. f. (Liu and Su, 1978). The former, a climbing plant with glabrous slender stems, peduncles and rachises, and filiform fruits, has been transferred to *Erythrorchis* (Garay, 1986). The latter, an erect species with peduncle and rachis densely covered by rusty woolly hairs, was originally published by Hayata as *G. matsudai*. However, it was incorrectly lumped with *Galeola kuhlii* (see below) in the Flora. Later, Leou and Chung (1995) recorded another species, *Galeola javanica* (Bl.) Benth. & Hook. f., from Taiwan. This is a small plant with fleshy tuberous roots and indehiscent fruits, and is currently accepted by most authors as a species of the related genus *Cyrtosia* (Garay, 1986; Seidenfaden, 1992). Thus we have only one species remaining in *Galeola* in Taiwan. Since the treatment of this species in the Flora was incorrect, and the specimens of it in herbaria are highly variable, the Taiwan species of *Galeola* (*sensu str.*) is revised in this paper.

The morphological observations made in this study were largely based on fresh materials. Specimens are preserved in the Herbarium of Academia Sinica, Taipei (HAST) and the Herbarium of the Department of Forestry, National Taiwan University (NTUF).

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A new species of *Listera*

Listera meifongensis Su H. J. et C. Y. Hu, *sp. nov.*

梅峰雙葉蘭 plate 1

Listera macranthae Fukuyama similis, sed sepalis extus ecarinatis, labello minore c. 6-10 mm longo, margine crispato albo-ciliato et pagina carina unico incrassato longitudinaliter instructo distinctissima.

Terrestrial herbs 12-25 cm tall; rhizome short; roots filiform, clustered. Stems erect, pale green, ridged below leaves, puberulous, bearing 1-3 bract-like scales above leaves, scales ovate-lanceolate, 3-5 mm long. Leaves 2, opposite, near middle or upper part of stem, sessile, broadly ovate or ovate-deltoid, 1.5-2.5 cm long, 1.8-3.2 cm wide, apex acute, base truncate-cordate, both surfaces glabrous, membranaceous, veinlets reticulate. Raceme terminal, 3-6 cm long, laxly 3-7-flowered; bracts ovate-lanceolate, 3-4.5 mm long, 2 mm wide, acute; pedicel 4-5 mm long; ovary 2.5-3.5 mm long, usually bent down from pedicel, glabrous or sometimes sparsely puberulous. Flowers spreading, greenish; dorsal sepal lanceolate, 3-4.5 mm long, 1-1.3 mm wide, apex acute, slightly contracted at base; lateral sepals falcate-lanceolate, 3.5-5 mm long, 1.5 mm wide, apex acute, base broadly cuneate; petals linear-lanceolate, 3-3.5 mm long, 0.7-1 mm wide, acuminate; lip spreading, cuneate-rectangular or oblong, 6-10 mm long, 3-7 mm wide, white-ciliate and wavy crisped along the margin, 2-lobed, lobes ovate-oblong, 2 mm long, 2-2.5 mm wide, apex obtuse-rounded, disc short papillose, bearing a median thickened keel running longitudinally from sinus toward base and ending ca. 1/3 distance from lip base, base with a lengthwise groove bordered by 2 lateral low ridges; column elongate, incurved from ovary, 4 mm long, consisting of a dilated and incurved apex, a slender neck and a dilated base; anther terminal, nearly erect or inclined at apex of column, oblong, 1 mm long; pollinia 2, clavate, unequally cleft, soft and mealy; stigma entire, semiorbicular; rostellum rectangular, 0.8 mm long, apex truncate-mucronate.

Distribution: endemic, forests of *Abies kawakamii* (Hayata) Ito and *Tsuga chinensis* var. *formosana* (Hayata) Li & Keng, 2700-3000 m, central Taiwan.

Specimens examined: Nantou County: Meifong, ca. 2700 m in elevation, June 27, 1999. C. Y. Hu 226 (holotype, HAST); Hualien County: Mt. Hohuan, ca. 3000 m in elevation, July 25, 1999. H. J. Su. & C. Y. Hu. 9592 (NTUF).

Notes: Vegetatively, *Listera meifongensis* resembles *L. macrantha* Fukuyama, *L. taizanensis* Fukuyama, *L. nankomontana* Fukuyama and the newly discovered *L. kuanshanensis* Su. It is also similar to *L. pinetorum* Lindl. (Himalaya) and *L. longicaulis* King & Pantl. (India and Tibet) in size and appearance of the leaves. The flowers are most similar to those of *L. macrantha*. They are both characterized by the elongate column about 4-5 mm long, and the distinctly 2-lobed, short ciliate lips. In *L. macrantha*, the flowers are larger, the sepals are distinctly keeled outside, the lip has a flat margin, ranging from 12 to 20 mm long or more, and the microscopically ciliate margins mostly appear on the terminal lobes of the lip. The new species has smaller flowers, the sepals are not keeled, the lip is only 6-10 mm long, often wavy crisped along the margin. Its ciliate margins are more obvious and uniform over the whole lip. The most important difference between these two species is in the disc of the lip whose characteristics are better observed in fresh flowers. The disc of *L. macrantha* is glabrous, its midrib is longitudinally grooved and bordered by 2 low lateral ridges. The groove is deeper near the base, and contains the nectary usually found on the lip of species of *Listera*. In contrast, *L. meifongensis* is remarkable for its short papillose disc, thickened

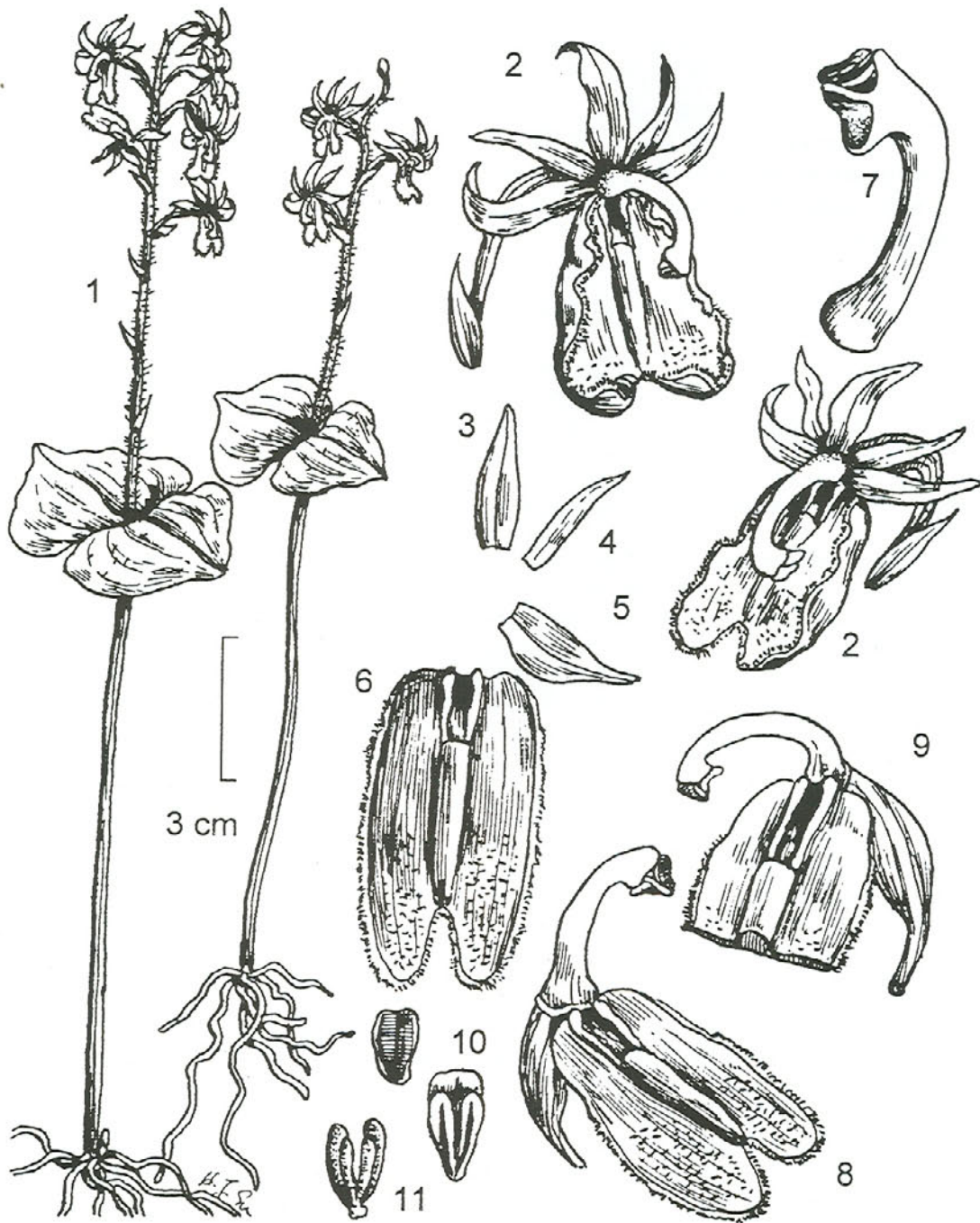


Plate 1. *Listera meifongensis* Su H. J. et C. Y. Hu. 1. habit; 2. flowers from different views; 3. dorsal sepal; 4. petal; 5. lateral sepal; 6. lip; 7. column and anther; 8. column and lip showing basal nectary groove and keel; 9. column and transversely cut lip; 10. anther; 11. pollinia.

midrib and longitudinal keel running from the sinus of the lobes toward the base of the lip and ending about 1/3 the distance from the lip base (Plate 1. Fig. 6). The base of the lip is characterized by a lengthwise groove bordered by 2 small lateral ridges. The nectary is contiguous with the median keel, but can be clearly defined (Plate 1. Figs. 8 and 9).

Listera meifongensis is most closely related to *L. longicaulis* King & Pantl. from India and Tibet (King and Pantling, 1898). Both species have a papillose lip with ciliate margins. Their sepals and petals are similar in size and shape. The lips of these two species are more or less similar in shape. However, *L. meifongensis* can be distinguished from *L. longicaulis* by the smaller, crisped lip which is only twice as long as the sepals. In comparison the flat lip of the latter is 3 times as long as the sepals. It also differs from the latter by the median keel on the disc of the lip accompanied by the peculiar basal nectary groove.

This new plant brings the number of species in Taiwan to 9, as summarized in the following analytical key.

Key to the species of *Listera* in Taiwan

1. Lip with 2 small lateral lobes ca. 0.7 mm from base; base narrowly clawed. *L. pseudonipponica* Fukuyama
1. Lip without distinct lateral lobes near base; base cuneate or truncate, sometimes with small or large auricles.
 2. Column nearly consisting of anther and stigma, without a distinct dilated stalk.
 3. Basal auricles of lip embracing apex of column; disc with a Y-shaped fleshy keel; leaves cuspidate-cordate or ovate-rhombic. *L. japonica* Bl.
 3. Basal auricles of lip not embracing column; disc with a simple longitudinal fleshy keel; leaves deltoid or deltoid-ovate. *L. suzukii* Masamune
 2. Column clearly differentiated into a dilated apex, a slender middle neck and a dilated stalk at base.
 4. Lip cordate-emarginate or shallowly 2-lobed at apex, lobes less than 1/10 length of the lip.
 5. Leaves orbicular-ovate; lip elongate-obtriangular or obovate, 8-10 mm long. *L. morrisonicola* Hayata
 5. Leaves ovate-semiorbicular; lip spatulate, less than 5 mm long. *L. taizanensis* Fukuyama
 4. Lip distinctly 2-lobed at apex, lobes more than 1/5 length of the lip.
 6. Lip short ciliate at least along apical margins (more obvious microscopically); column 4-5 mm long.
 7. Lip with wavy crisped margins; midrib thickened into a longitudinal keel; sepals not keeled outside. *L. meifongensis* H. J. Su & C. Y. Hu
 7. Lip with flat margins; midrib longitudinally grooved and bordered by 2 low lateral ridges; sepals distinctly keeled outside. *L. macrantha* Fukuyama
 6. Lip not ciliate; column 2-3 mm long.
 8. Lip short stipitate at base, lanceolate, ca. 5 times longer than wide, with 2 divergent linear lobes near middle of lip. *L. kuanshanensis* H. J. Su
 8. Lip not stipitate at base, rectangular, 2-3 times longer than wide, with 2 rectangular or elongate triangular, parallel lobes near apex. *L. nankomontana* Fukuyama

A revision of the genus *Galeola* in Taiwan

Two species of *Galeola* occur in Taiwan. Lin (1987) treated and illustrated *G. matsudai* Hayata, a species previously reported and illustrated in Flora of Taiwan (as *G. kuhlii*). In revising the genus *Galeola* of Taiwan, I examined many living plants and herbarium specimens formerly identified as *G. matsudai*. The variation in the flowers is remarkable, and I was able to differentiate two species. They are quite similar at first glance; they have tall, erect stem, tomentose inflorescences and bright yellow flowers, but they can be distinguished by the detailed structure of the flowers. The plant reported in Flora of Taiwan (*G. kuhlii*) and by Lin (1987) as *G. matsudai* is *Galeola falconeri*. Hayata's *G. matsudai* is conspecific with *Galeola lindleyana*.

Key to the species of *Galeola* in Taiwan

1. Sepals less than 2 cm long, with a distinct wavy keel on outer surface; lip with a semispherical callus near the base, without a constriction or fold between callus and blade of the lip; anther strongly papillose outside. 1. *G. lindleyana*
1. Sepals 2.5-3 cm long, without a distinct keel on outer surface; lip with a small fold forming a sac at base, distinctly constricted between the sac and blade of the lip; anther short papillose or nearly glabrous outside. 2. *G. falconeri*

1. *Galeola lindleyana* (Hook. f. & Thoms.) Reichb. f., Xen. Orch. 2: 78. 1874; King and Pantl. in Ann. Roy. Bot. Gard. Calcutta. 8: 264. T. 352. 1898; S. C. Chen *et al.* in Fl. Reipubl. Popularis Sin. 18: 9. 1999. 山珊瑚 plate 2A

Cyrtosia lindleyana Hook. f. & Thoms. in Hook. f., Ill. Himal. Pl. t. 22. 1855

Erythrorchis lindleyana (Hook. f. & Thoms.) Reichb. f., Bonplandia 5: 37. 1857.

Galeola matsudai Hayata, Icon. Pl. Formosan. 9: 114. 1920.

Galeola kwangsiensis Hand.-Mazz., Sinensia 7: 620. 1936.

Saprophytic plants more than 1 m tall. Rhizomes 2-3 cm thick, with triangular scales. Stems erect, straight, rigid, brownish yellow, sometimes with dark purple stripes, ca. 1-2 cm thick at base, rusty hairy above, nearly glabrous and bearing several scales below; scales ovate-lanceolate, 1.5-2.5 cm long. Racemes terminal and lateral, pendulous, 10 cm long; peduncle and rachis densely woolly tomentose; floral bracts ovate to oblong, 7-10 mm long; pedicel and ovary terete, 1-2.5 cm long, woolly tomentose. Flowers bright yellow, ca. 2-3.5 cm in diam., spongy in texture; sepals similar, elliptic, 1-2 cm long, 4-8 mm wide, inner surface glabrous, outer surface densely rusty tomentose, distinctly keeled, the keel sometimes wavy; petals similar to sepals in shape and size, glabrous on both surfaces; lip cup-shaped, orbicular or ovate, ca. 1.5 cm in diam., papillose on upper surface, especially near the base, margins ciliate, incurved near the base, loosely embracing column, base with a glabrous semispherical callus forming a chamber; column 5-7 mm long, slightly dilated at apex, with 2 papillose processes at base; anther ovoid-conical, 3 mm long, strongly papillose outside; pollinia 2, compressed ovoid, 1 mm long, cleft; stigma slit-like, under short rostellum. Capsule oblong, 10 cm long, subtrigonal, short tomentose. Seeds ca. 1-1.5 mm long including wing.

Distribution: India, the Himalaya, southern China. Taiwan, in mountainous regions, 1800-2700 m.

Specimens examined: Taichung County: Shihyuen, *H. J. Su* 9090; 710 logging road, *H. J. Su* 7176. Nantou County: Salishien, *H. J. Su* 8360. Pingtung County: Mt. North Tawushan, *H. J. Su* 9362; *H. J. Su* 9409.

Note: In the original description of *G. matsudai*, Hayata (1920) considered it to be closely related to *G. lindleyana*, differing from it only by the more hirsute lip. He described the lip as sessile with narrowed base, but did not mention the small fold (sac-like pseudo-nectary) near the base of the lip, as found in the lip of *G. falconeri*. In the specimens examined, plants without a basal sac on the lip have many characteristics of *G. lindleyana*, such as the distinct wavy keel on the sepals and the strongly papillose anther. I believe that *G. matsudai* is conspecific with *G. lindleyana*.

Galeola lindleyana is characterized by the structure of the base of lip. There is a glabrous semispherical callus forming a chamber, with an opening towards the base of the column. There is no constriction between the chamber and the blade of the lip. Although the chamber resembles a sac inside the lip, a sac-like structure cannot be seen from outside. This character distinguishes it from *G. falconeri*. The inner wall of the callus is glabrous, but the chamber is also filled with papillae on the processes at the base of the column (Plate 2A. Figs. 9, 10).

2. *Galeola falconeri* Hook. f., Fl. Brit. Ind. 6:88. 1890; King and Pantl. in Ann. Roy. Bot. Gard. Calcutta. 8: 265. t. 353. 1898. 小囊山珊瑚 plate 2B

Galeola kuhlii auct. non (Reichb. f.) Reichb. f.: T. S. Liu et H. S. Su in Fl. Taiwan 5: 996. Pl. 1596. 1978.

Galeola matsudai auct. non Hayata: T. P. Lin, Native Orch. Taiwan 3: 91-92 (f). 1987.

Saprophytic plants 1-3 m tall. Rhizomes 3-5 cm thick, branching, covered by large triangular scales. Stems erect, straight, rigid, brownish, ca. 2-4 cm thick at base, short rusty hairy or nearly glabrous, with several scales; scales ovate-lanceolate, 2-4 cm long. Racemes several, terminal and lateral, 10-20 cm long; peduncle and rachis more or less short tomentose; floral bracts ovate to oblong, 1-2 cm long; pedicel and ovary terete, 2-3 cm long, without ribs, woolly tomentose. Flowers bright yellow, ca. 4-5 cm in diam., spongy in texture; sepals similar, elliptic, 2.5-3 cm long, 1-1.5 cm wide, short rusty tomentose or nearly glabrous outside, glabrous inside; petals similar to sepals in shape and size, glabrous on both surfaces; lip deeply concave, orbicular, ca. 2 cm in diameter, papillose on upper surface, especially near margins, margins undulate, fimbriate, incurved near base, loosely embracing column, base with small fold forming a small sac-like pseudo-nectary, sac rounded, 2-lobed; column ca. 7 mm long, curved forward, apex slightly dilated; anther fleshy, conical, 2.5 mm long, short papillose or nearly glabrous outside; pollinia 2, compressed ellipsoid, 1 mm long, cleft; stigma slit-like, under short rostellum. Capsule oblong, subfalcate, more than 10 cm long. Seeds surrounded by irregularly wing, about 2 mm long including the wing.

Distribution: India and the Himalayas. Taiwan, in mountainous regions at 1000-2500 m altitudes.

Specimens examined: Nantou County: Chitou, *H. J. Su* 676; Hoshe, *H. J. Su* 9440; Meifong, *H. J. Su* & *S. H. Wu* 9545. Ilan County: Chileiting, *H. J. Su* 8333. Hualien County: Mt. Chingshuishan, *H. J. Su* 8344; Aaohua, *H. J. Su* 7889.

Note: *G. falconeri* is also remarkable for the structure of its lip. The lip is deeply concave, with a small folded sac near the base just under the column. King and Pantling (1898) termed it a pseudo-nectary. The sac is rounded and often shallowly 2-lobed at the apex. It is separated from the blade of the lip by a narrow constriction and can be seen clearly from outside. The sac is glabrous on the inner wall, but is filled with papillae arising from the processes at the base of the column (Plate 2B. Figs. 6, 9).

In general morphology, *Galeola falconeri* is so similar to *G. lindleyana* that many authors felt it difficult to distinguish them. Hooker (1890) described *G. falconeri* as "habit and status of *G. lindleyana*, but differing in the larger flowers with broadly ovate sepals being nearly glabrous dorsally, and glabrous anther". He provided no detailed structure of the flowers since he did not find the plant himself. He pointed out that the plant may be a form of *G. lindleyana*, although he described it as a new species. However, as he noted, all collectors in Sikkim recognized these two plants as distinct.

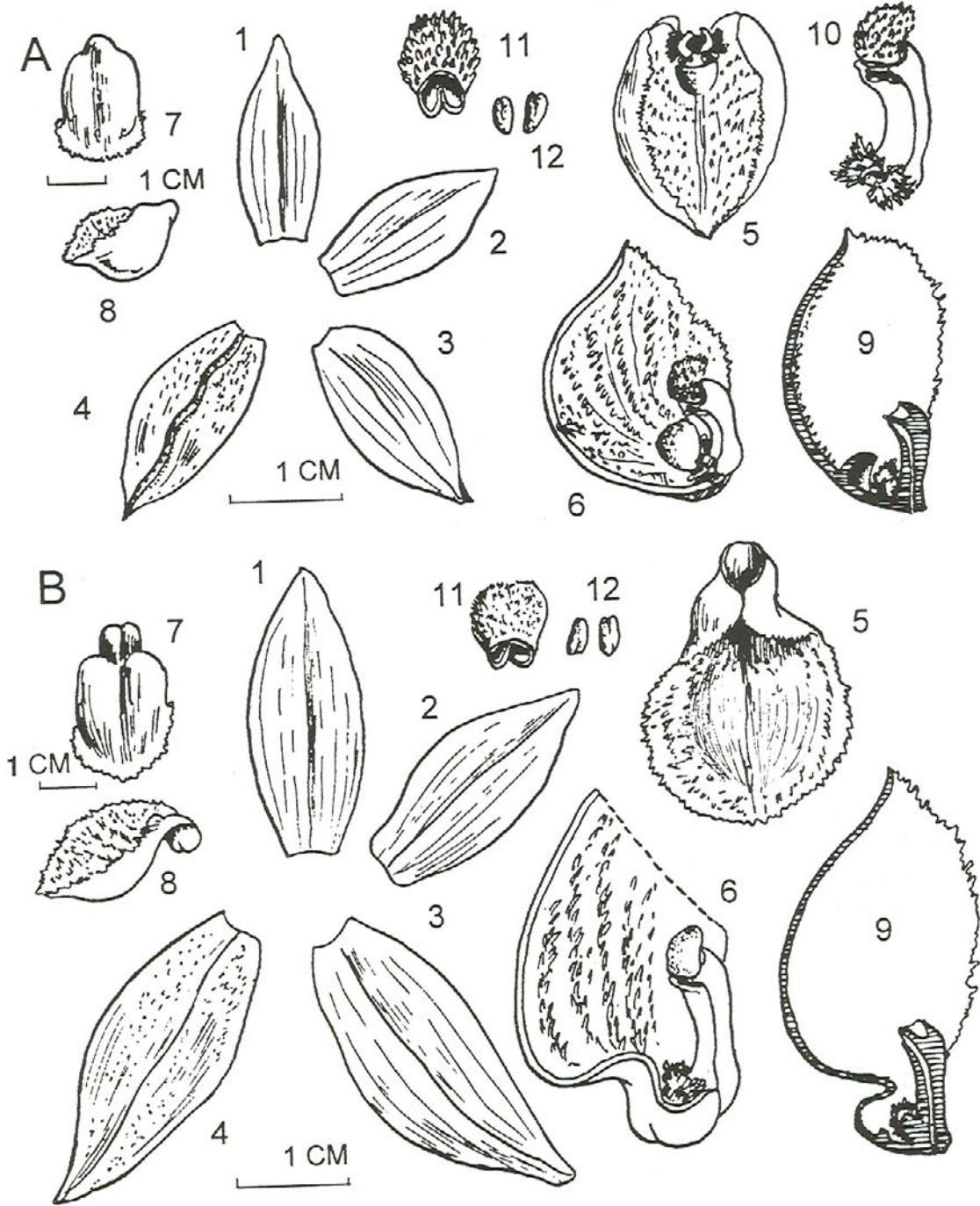


Plate 2. Dissected flowers of *Galeola lindleyana* (A) and *G. falconeri* (B). 1. dorsal sepal; 2. petal; 3. lateral sepal (inner view); 4. lateral sepal (outer view); 5. lip; 6. column and the longitudinally cut lip showing the basal structure; 7. lower view of lip; 8. side view of lip; 9. longitudinal section through median lip and column; 10. column and anther; 11. anther; 12. pollinia. Scales between 7 and 8 are for these two figures. The scales below lateral sepals applies to all numbers except 10-12, and B6 (variously magnified). Figure 10 is lacking in B (column and anther can be seen in figure 6).

These two related species appeared in the orchids of Sikkim Himalaya by King and Pantling (1898), with detailed structure of flowers and rather fine illustrations. Differences in the structure of the lip can be seen in the illustrations. The authors suggested that *G. falconeri* may be a variety of *G. lindleyana*, although they treated them as two species and separate them in the key by the size of rhizomes, flowers and fruits. Such treatment was later followed by a few Indian authors (Pradhan, 1976; Bose and Bhattacharjee, 1980). *G. falconeri* has been distinguished from *G. lindleyana* in northwest Himalaya by Deva and Naithani (1986) who stressed that the latter has smaller flowers with keeled sepals and strongly papillose anther.

According to my observation, plants with different lip structures as in Figs. 2A and 2B occur in discrete populations, although their altitudinal ranges largely overlap. This may be due to the fact that specimens in one locality are actually produced from the same underground rhizome. Nevertheless, as in Sikkim, orchid collectors in Taiwan have long recognized two species of *Galeola*. These two species have been distinguished based on the size of flowers and rhizomes by Chow (1986), an orchid collector and grower in Taiwan. The smaller-flowered plant is listed as *G. lindleyana* in Chow's book. The robust one with larger flowers (incorrectly identified as *G. altissima*) is presumably *G. falconeri*. Chow (1986) noted that the rhizomes of *Galeola* are rather long, may be branching and extending horizontally to more than 30 meters long in the ground, as in the case of *G. falconeri*. Rhizomes of *G. lindleyana* are erect, simple, only about 1 meter long.

Whether these two entities should represent distinct species, subspecies or varieties are open to debate. Here I tentatively treat them as two species, aiming to add more information on flower structure and general habit for future study. The final resolution must depend upon more observations from the whole range with respect to their geographical and ecological variations.

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LITERATURE CITED

- Bose, T. T. and S. K. Bhattacharjee. 1980. Orchids of India. Naya Prokash, India. 538 pp.
- Chen, S.-C., Z.-H. Tsi, K. Lang and G. Zhu. 1999. Flora Reipublicae Popularis Sinicae. Vol. 18. Science Press, Beijing.
- Chow, C. 1986. Formosan Orchids: Terrestrials. Author's Press.
- Deva, S and H. B. Naithani. 1986. The Orchid Flora of North West Himalaya. Print and Media Associates, New Delhi. 459 pp.
- Garay, L. A. 1986. Olim Vanillaceae. Bot. Mus. Leaflet. Harvard Univ. 30: 223-237.
- Hayata, B. 1920. Icones Plantarum Formosanarum. Vol. IX. Bureau of Forestry, Industries, Government of Formosa, Taihoku.
- Hooker, J. D. 1890. The Flora of British India Vol. 6. Ashford, Kent.

- King, G. and R. Pantling. 1898. The Orchids of Sikkim Himalaya. Ann. Roy. Bot. Gard. Calcutta **8**: 1-342.
- Leou, C.-S. and N.-J. Chung. 1995. *Galeola javanica* (Bl.) Benth. & Hook. f., A new addition to the orchid flora of Taiwan. Quart. J. Exp. For. Natl. Taiwan Univ. **9**: 19-23.
- Lin, T.-P. 1987. Native Orchids of Taiwan. Vol. 3. Southern Materials Center, Taipei.
- Liu, T.-S. and H.-J. Su. 1978. Orchidaceae. In: Li, H.-L., T.-S. Liu, T.-C. Huang, T. Koyama, and C. E. DeVol (eds.). Flora of Taiwan, vol. 5. Epoch Pub. Co., Taipei.
- Pradhan, U. C. 1976. Indian Orchids: Guide to Identification & Culture. Vol. I. Bharat Lithographing Co., India.
- Seidenfaden, G. 1992. The Orchids of Indochina. Opera Bot. **114**: 1-502.
- Su, H.-J. 1999. Contribution to the revised orchid flora of Taiwan (III). Quart. J. Exp. For. Natl. Taiwan Univ. **13**: 203-209.

台灣蘭科植物之訂正研究(IV)

蘇鴻傑

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摘 要

本文為台灣蘭科植物誌訂正工作系列報告之四，文中發表一台灣蘭科植物新種，即梅峰雙葉蘭，此外，台灣所產之山珊瑚屬植物亦在本文中加以訂正，各附以植物形態之解析圖，並探討其特徵及判別問題。

關鍵詞：蘭科，台灣植物誌，梅峰雙葉蘭，山珊瑚屬。