Supplements to the Orchid Flora of Taiwan (VI)

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ABSTRACT: New data for the orchid flora of Taiwan is provided. Three new species, *Gastrodia clausa*, *G. confusoides* and *Nervilia arisanensis*, and one newly recorded species, *Flickingeria xantholeuca*, are described and illustrated.

KEY WORDS: *Flickingeria xantholeuca*, *Gastrodia clausa*, *Gastrodia confusoides*, *Nervilia alishanensis*, Orchidaceae, Taiwan, taxonomy.

INTRODUCTION

In this article, we continue our previous works (Hsu and Chung, 2009; Chung and Hsu, 2009; Hsu et al., 2009; Hsu and Kuo, 2010; Hsu and Chung, 2010) providing new insights to the biodiversity of Orchidaceae in Taiwan. *Gastrodia clausa* sp. nov., *G. confusoides* sp. nov. and *Nervilia arisanensis* sp. nov. are herein described, and *Flickingeria xantholeuca*, a new record of Taiwan is reported. Illustrations and notes on taxonomy and ecology are also provided.

TAXONOMIC TREATMENTS

Gastrodia clausa T. C. Hsu, S. W. Chung & C. M. Kuo, ***sp. nov.*** 閉花赤箭 Figs. 1A-D & 2

Type: TAIWAN. New Taipei City, Sanchih District, Peihsinchuang (北新莊), ca. 400 m alt., 24 Mar 2008, *T. C. Hsu 1299* (holotype: TAI; isotype: TAIF), here designated.

Roots few, slender, often germinating from the junction between rhizome and inflorescence after flowering season. Rhizome tuberous, fusiform or cylindrical, 2-5(-7) cm × 3-10(-13) mm, yellowish brown, covered with root-hair-like unicellular hairs and verticillate scales. Scales lanceolate, pale yellowish brown, 1-3 mm. Inflorescence erect, 2-4 cm × 2-3 mm, pale brown underground, dark brown over ground, 3-4 noded, with tubular, membranous sheaths; rachis often less than 5 mm; floral bracts membranous, broad ovate to ovate, brownish, 5-9 × 4-6 mm; pedicel and ovary 5-15 mm. Flowers 1-3(-6), erect, tubular; all tepals connate and forming a 6-lobed perianth tube; perianth tube enclosed or rarely hardly opening, 4-5 mm in diam. Sepals similar, 9-13 mm, connate 3/5-2/3 their lengths with petals and lip; outer surfaces dark brown, densely verrucoulose; inner surfaces dark greenish brown, smooth, slightly concave at apex; margins entire; free lobe of dorsal sepal broad ovate, retuse, 3-4 × 4.5-6 mm; free lobes of lateral sepals deltoid, 4-5 × 4-5 mm. Petals light brown, obliquely ovate, concave, free lobes 3-3.5 × 2-3 mm; base contracted; margin slightly incurved, entire or scabrous. Lip adnate to perianth tube, light yellowish brown, ovate-deltoid, 3.5-4.5 × 3-4 mm, base contracted, petiole-like, margin entire or scabrous. Column straight, clavate, 5-6.5 × 2.5-3 mm, white tinged with grayish brown at base, with a pair of lateral wings (stelidia) and a prominent ventral appendage; column foot obscure; lateral wings reddish, incurved, edges parallel to column, tips inferior to anther; rostellum absent; stigma located near middle; ventral appendage reddish, arising just below stigma, apex parallel to column, rhombic-ovate, ca. 3 × 2.5 mm, bilobed at apex. Anther hemispheric, 1.1-1.3 × 0.8-1 mm; pollinia 2. Capsule cylindrical, 2-3.3 cm; pedicel elongate to 14-43 cm in fruit. Seeds fusiform, 1.5-2.2 mm.

Distribution: Taiwan (Taipei City, New Taipei City and Pingtung County).

Habitat and ecology: Secondary forests dominated by *Acasia confusa* Merr., primary broadleaved forests and artificial *Cryptomeria japonica* D. Don. forests at 200-700 m alt. Flowering from early to middle March and fruiting from March to April.

Additional specimens examined (paratypes): TAIWAN. New Taipei City: Peihsinchuang, *S. W. Chung & T. C. Hsu 7697* (TAIF); same loc., *C. M. Wang et al. 9692* (TNM); same loc., *T. C. Hsu 1253* (TAIF); Monghu (夢湖), *T. C. Hsu 457* (TAI); Hongludi (烘爐地), *T. C. Hsu 1251* (TAIF); Neliao (內寮), *T. C. Hsu 2539* (TAIF); Yun Hsien Holiday Resort (雲仙樂園), *T. C. Hsu 1272* (TAIF); Tunghou (桶後), *T. C. Hsu 1284* (TAIF). Taipei City: Mt. Chihsing (七星山), *T. C. Hsu 1259* (TAIF); Neikou Neighborhood (內溝里), *T. C. Hsu 5483* (TAIF). Pingtung County: Mt. Chikupalin (耆古巴林山), *T. C. Hsu 2544* (TAIF).

Notes: This entity was first described in the thesis of Hsu (2008) and is validated here. *Gastrodia clausa* is remarkable in having a peloric flower with a small,

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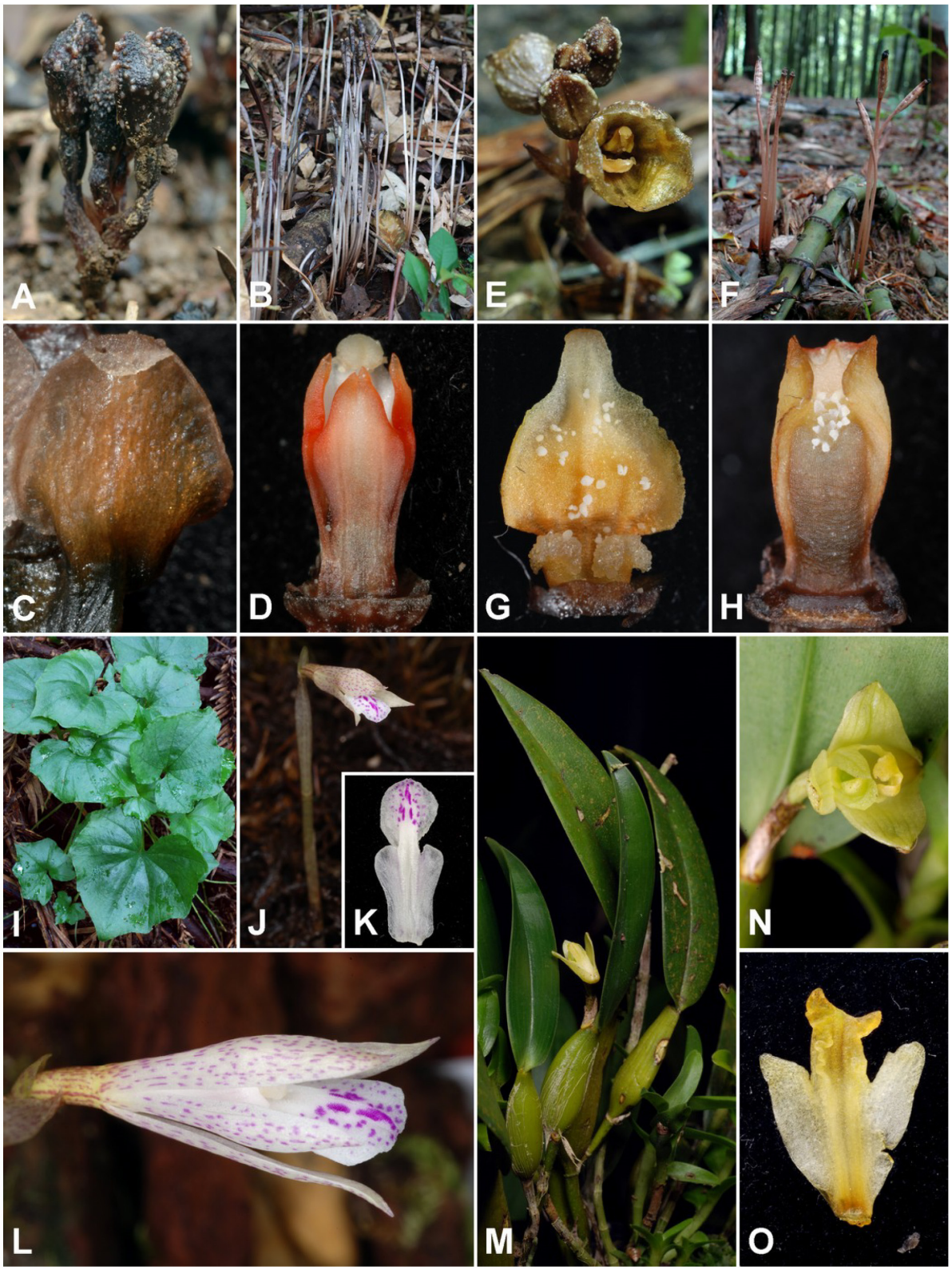


Fig. 1. Newly discovered orchids in Taiwan. A-D: *Gastrodia clausa*; A: flowering habit. B: fruiting habits. C: lip. D: column, ventral view. E-H: *Gastrodia confusoides*; E: flowering habit. F: fruiting habits. G: lip. H: column, ventral view. I-L: *Nervilia alishanensis*; I: leafing habits. J: flowering habit. K: lip, flattened. L: flower, side view. M-O: *Flickingeria xantholeuca*; M: flowering habit. N: flower, front view. O: Lip.

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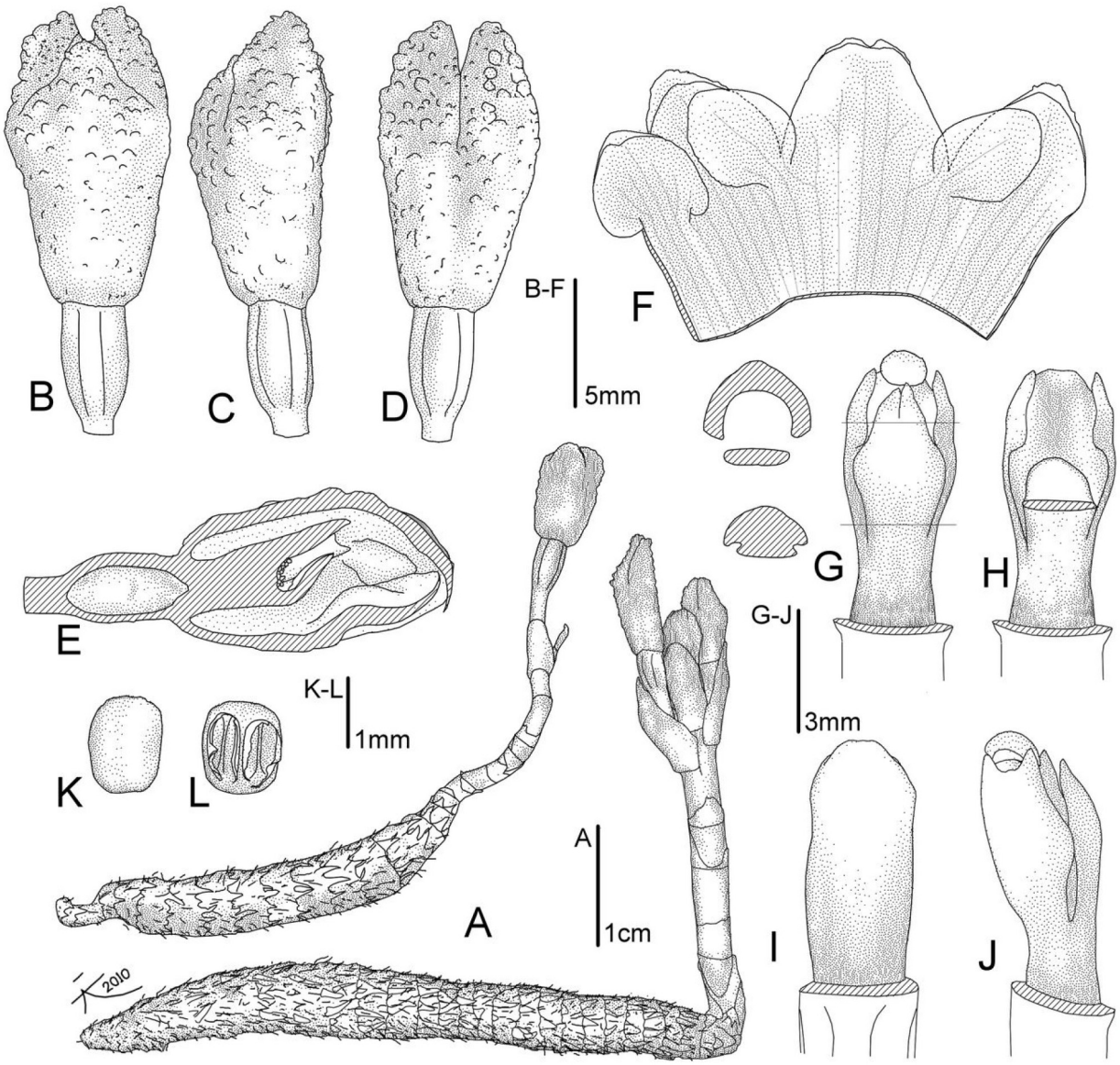


Fig. 2. ***Gastrodia clausa*** **T. C. Hsu, S. W. Chung & C. M. Kuo. A: Flowering habits. B-E: Flower; B: top view. C: side view. D: bottom view. E: longitudinal section. F: Perianth tube, expended and flattened. G-J: Column; G: bottom view. H: bottom view with ventral appendage removed. I: top view. J: side view. K-L: Anther cap; K: top view. L: bottom view. Drawn by T. C. Hsu from holotype.**

petaloid lip conjoint with the perianth tube. It is also characterized by having an enclosed or hardly opening perianth tube and a prominent ventral appendage of column. The peculiar floral morphology implies a strategy of self-pollination. By dissecting flowers in different growing stages, we found that the pollinia of *G. clausa* rapidly fragmented into small massulae before the flowers were fully mature, and the massulae then directly dropped onto stigma simply by gravity due to the lack of a projecting rostellum between anther and stigma. Such selfing mechanism is also seen in another *Gastrodia* species, *G. albida*, from Taiwan (Hsu and Kuo, 2011).

Gastrodia confusoides T. C. Hsu, S. W. Chung & C. M. Kuo, ***sp. nov.*** 擬八代赤箭 Figs. 1E-H & 3

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Type: TAIWAN. Taichung City, Hoping District, Tahsuehshan Forest Road (大雪山林道), 15-16k, ca. 1000 m alt., 14 Sep 2007, *T. C. Hsu 966* (holotype: TAI; isotype: TAIF), here designated.

Roots few, slender, often germinating from the junction between rhizome and inflorescence after flowering season. Rhizome tuberous, fusiform or cylindrical, 2-6 cm × 8-14 mm, yellowish brown, covered with numerous scales and root-hair-like unicellular hairs and verticillate scales. Scales lanceolate, pale yellowish brown, 2-4 mm. Inflorescence erect, 2-5 cm × 2-4 mm, pale brown under ground and dark brown over ground, 3-5 noded, with tubular, membranous sheaths; rachis often less than 2 cm; floral bracts broad ovate to ovate, brownish, 5-10 × 4-6 mm; pedicel and ovary 10-15 mm. Flowers 2-10, bell-shaped, suberect, resupinate, ca. 12-14 mm wide, sepals and petals connate and forming a 5-lobed perianth tube; perianth tube slightly irregularly thickened inside. Sepals similar, fleshy, 10-15 mm long, connate ca. 1/2 their length with petals and ca. 1/2 with each other, outer surface yellowish brown to dark brown, verruculose, inner surface green-yellowish brown, margins entire; free lobe of dorsal sepal broad ovate, apex retuse, 4-5 × 8-10 mm; free lobes of lateral sepals semiorbicular, 4-5 × 8-10 mm, apex obtuse. Free lobes of petals yellowish brown, ovate orbicular, 4.5-5 × 3.5-4.5 mm, base contracted and thickened, margin entire or slightly scabrous. Lip adnate to column foot, yellowish white or orange yellow, 3-parted, 6-7 mm × 4-5 mm; hypochile with 2 crest-like calli; mesochile ovate, base contracted, margin slightly scabrous or undulate, disc slightly thickened, with two longitudinal keels extending toward epichile; epichile ligulate, ca. 1.5 × 1 mm, slightly reflexed. Column straight, clavate, 4-5 × 2.5-3 mm wide, white tinged with yellowish brown; column foot well developed; lateral wings (stelidia) yellowish brown, edges oblique to column, tips inferior to anther; rostellum absent; stigma located slightly above middle. Anther hemispheric, ca. 1 mm in diam., pollinia 2. Capsule cylindrical, 2-3.5 cm, pedicel elongate to 16-40 cm in fruit. Seeds fusiform, 1.7-2.6 mm.

Distribution: Taiwan (New Taipei City, Taipei City and Taichung City).

Habitat and ecology: *Phyllostachys pubescens* Mazel ex J. Houz. plantations and broad-leaved forests at 600-1200 m alt. Flowering mainly in September and fruiting from middle September to October.

Additional specimens examined (paratypes): TAIWAN. Taipei City: Mt. Chungcheng (中正山), *T. C. Hsu 645*; *4800* (TAIF). New Taipei City: Mt. Pataoerh (拔刀爾山), *T. C. Hsu 675*; *1015* (TAIF). Taichung City: Tahsuehshan Forest Road, 15-16k, *T. C. Hsu 583*; *584* (TAIF).

Notes: This entity was first described in the thesis of Hsu (2008) and is validated here. It is very close to *Gastrodia confusa* Honda & Tuyama from Japan and Taiwan and only distinguished by column morphology. In *G. confusoides*, the rostellum is lacking and the stigma locates above the middle of column. While in *G. confusa*, there is a well-developed rostellum projecting stigma and anther, and the stigma locates below the middle of column. According to our detailed observation and dissection, *G. confusoides* is predicted to be obligate self-pollinated by pollen massulae directly falling onto stigma, the same mechanism of *G. albida* (Hsu and Kuo, 2011) and *G. clausa*. Since the morphological dissimilarities are clear and stable, and the self-pollination strategy would block possible gene flow with true *G. confusa*, we thus treat this entity as an independent species rather than an infraspecific taxon of *G. confusa*.

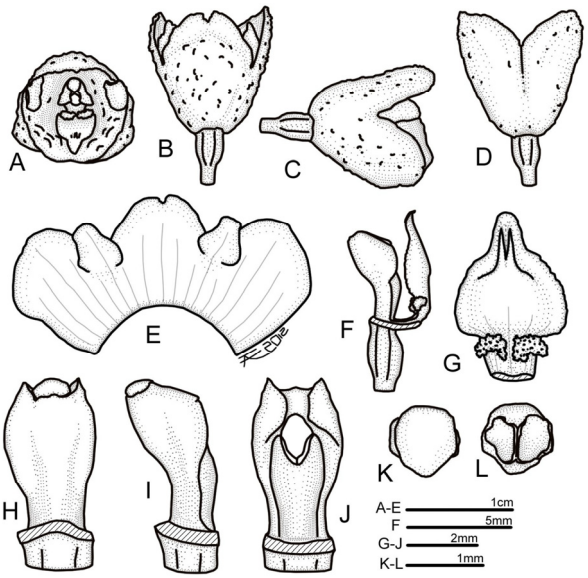


Fig. 3. *Gastrodia confusoides* T. C. Hsu, S. W. Chung & C. M. Kuo. A-D: Flower; A: front view. B: top view. C: side view. D: bottom view. E: Perianth tube, expanded and flattened. F: Lip and column, side view. G: Lip. H-J: Column; H: top view. I: side view. J: bottom view. K-L: Anther cap; K: top view. L: bottom view. Drawn by T. C. Hsu from holotype.

Nervilia alishanensis T. C. Hsu, S. W. Chung & C. M. Kuo, ***sp. nov.*** 阿里山脈葉蘭 Figs. 1I-L & 4

Type: TAIWAN. Chiayi County, Alishan Township, Fushan Tribe (福山部落), 1200-1400 m alt., 21 Mar 2012, *T. C. Hsu 5497* (holotype: TAIF), here designated.

Tuber whitish, subglobose, 5-15 mm in diam. Rhizomes slender, pilose. Leaf green on both surfaces, polygonal, 2.5-6 × 3-6.5 cm, with 5-7(-9) main veins,

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membranous, glabrous, base deeply cordate, apex acute, margin often cornute at tips of main veins and ± crisped; petiole-like stalk erect, 2-8 cm, with 1 or 2 short tubular sheaths near base. Inflorescence 5-8 cm, 1-flowered; peduncle pale greenish brown with purple flecks, with 2 or 3 tubular sheaths, elongating in fruit; sheaths pale brownish green with purple flecks, 1-2 cm, apex acute or acuminate; floral bract ovate-lanceolate, 4-7 × 1-2 mm, apex acute. Flower nodding, resupinate, not opening widely; pedicel and ovary pale brown with purple flecks, 5-7 mm. Sepals similar, pale beige-white with purple flecks, oblong -lanceolate, 16-18 × 3-3.5 mm, apex acuminate. Petals pale beige-white with purple flecks, linear-oblanceolate, 15-16 × ca. 2.5 mm, apex acuminate. Lip white with purplish flecks, oblong, 14-15 × 6-7 mm, spurless, 3-lobed near middle; lateral lobes erect and embracing column, semiorbicular, ca. 2 mm, apices rounded; mid-lobe suborbicular, ca. 6 × 5 mm, lateral margins revolute, apex obtuse or rounded, with a slightly elevated central ridge; disk with two longitudinal ridges connecting with the ridge of mid-lobe; disc ridges very low at base, gradually higher and more densely papillose toward the base of mid-lobe. Column white with sparse purple spots, 8-9 mm, apex dilated, slightly pilose beneath; stigma shield-shaped; pollinia enclosed within clinandrium, ca. 2 mm.

Distribution: Taiwan (Chiayi County).

Habitat and ecology: Primary forests or artificial *Cryptomeria japonica* forests at 1200-1600 m alt. Flowering from late March to April and leafing from April to November.

Additional specimens examined (paratypes) : TAIWAN. Chiayi County: Fushan Tribe, *T. C. Hsu 4629* (TAIF); Shihtzulu (十字路), *T. C. Hsu 4838*; *5567* (TAIF).

Notes: This entity was first pointed out as an unplaced taxon by Gale et al. (2010, as "*Nervilia* cf. *nipponica*") based on the result of AFLP analysis. However, they did not make a taxonomic treatment since its flowers had not been observed. Among the *Nervilia* species recorded from Taiwan (Chung, 2009; Chen and Gale, 2009; Yeh et al., 2010), *N. alishanensis* is most close with *N. lanyuensis* S. S. Ying in sharing membranous and uniformly green leaves, crisped leaf margin, and relatively shorter mid-lobes of lips. However, this new species is clearly distinguishable from *N. lanyuensis* by having often cornute (vs. subrounded) leaf margin, whitish (vs. brownish green) sepals and petals, semiorbicular (vs. triangular) lateral lobes of lip, obtuse or rounded (vs. retuse) lip apices, and longer columns (8-9 vs. 4.5-6 mm). The leaf morphology of *N. alishanensis* is also similar with *N. mackinnonii* from the Himalayas, but their lip shape is clear different comparing with available descriptions and illustrations (Seidenfaden, 1978; Chen and Cribb, 2009; Xu et al., 2010).

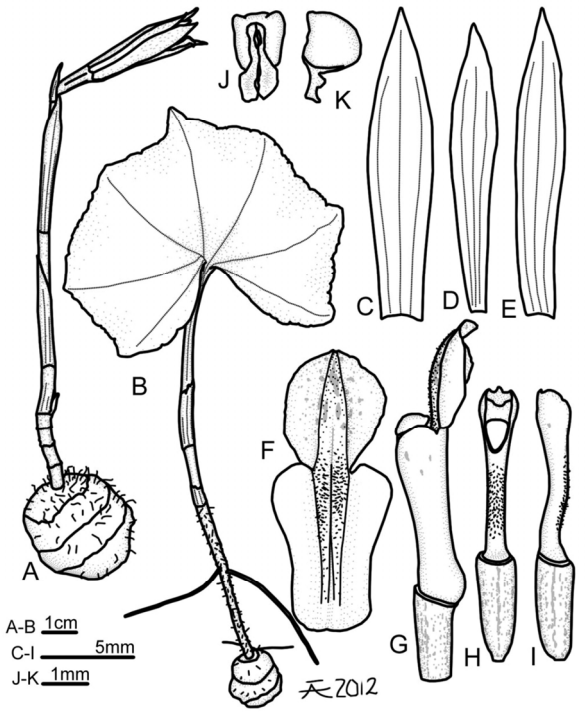


Fig. 4. *Nervilia alishanensis* T. C. Hsu, S. W. Chung & C. M. Kuo. A: Flowering habit. B: Leafing habit. C: Dorsal sepal. D: Petal. E: Lateral sepal. F: Lip, expanded and flattened. G: Lip and column, side view. H-I: Column; H: bottom view. I: side view. J-K: Anther cap; J: bottom view. K: side view. Drawn by T. C. Hsu from holotype and paratype (*T. C. Hsu 4838*).

Flickingeria xantholeuca (Rchb.f.) A. D. Hawkes, Orch. Weekly 2: 460. 1961.

淺黃暫花蘭 Fig. 1M-O

Basionym: *Dendrobium xantholeucum* Rchb. f., Xenia Orchid. 2: 73. 1865.

Type: INDONESIA. Java, Hariang, *Kuhl & Van Hasselt s.n.* (holotype: L, not seen.).

Rhizome short creeping, 2-3 mm in diam. Stems tufted, erect, ascending or pendulous, frequently branching, internodes terete, 1-4 cm × 2-4 mm, terminal internode enlarged into a pseudobulb. Psudobulbs yellowish green, flattened, elongate fusiform, 3-5 × 1-2 cm. Leaves ovate- or oblong-lanceolate, 4-10 × 1.5-3 cm, leathery, base obtuse, apex acute. Inflorescence emerging from top of pseudobulb just under abaxial side of leaf, 1 flower open at a time, subtended by bracts; floral bracts scarious, 3-5 mm, acute. Flowers ca. 1 cm wide, pale greenish yellow. Dorsal sepal ovate-elliptic, 5-6 × 3-3.5 mm, acute; lateral sepals obliquely ovate-triangular, 5-6 × 5-6 mm. Petals rhombic-ovate, 4-5 × ca. 2 mm, acute; lip rhombic, 8-10 × 6-7 mm, 3-lobed; lateral lobes erect, obliquely triangular, 2-3 mm,

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apex acute or obtuse, entire or slightly toothed; mid-lobe Y-shaped, 4-5 × 3-4 mm, entire, apex 2-lobulate; lobules ovate-oblong; disk with 2 lamellae extending from base to the clawed portion of mid-lobe, slightly crisped near top. Column 2.5-3 mm, stout, with triangular, acutely toothed stelidia; column foot ca. 4 mm; anther ovoid, ca. 1 mm.

Distribution: Indonesia, Malaysia, Philippines, Taiwan (Pingtung County) and Thailand.

Habitat and ecology: Epiphytic on taller branches in primary broadleaved forests and on rock cliffs along streams at 300-500 m alt. Flowering intermittently between April and November and fruiting all over the year.

Specimens examined: TAIWAN. Pingtung: Shuangliu (雙流), *T. C. Hsu 3190* (TAIF).

Notes: This newly recorded species is characterized by the 3-lobed lip which's mid-lobe is nearly entire in margin and bilobulate at apex. Details of its synonymy and morphological variation could be seen in the study of Seidenfaden (1980).

The record of *Dendrobium pallens* Ridl. (=*Flickingeria pallens* (Ridl.) A. D. Hawkes) in southern Taiwan (Hsieh, 1955) is possibly referable to this species since they are somewhat similar in morphology. True *F. pallens*, clearly distinguishable from *F. xantholeuca* in having an obtriangular mid-lobe with strongly plicate lateral margins, is so far not explicitly found in Taiwan.

Flickingeria tairukounia (S. S. Ying) T. P. Lin, described from eastern Taiwan, is also very close to *F. xantholeuca*. According to the protologue (Ying, 1978), the former resembles the later in vegetative part but differs in having longer sepals (8-9 vs. 5-6 mm) and lip (10-15 vs. 8-10 mm) and a much larger mid-lobe (7-9 × 6-8 vs. 4-5 × 3-4 mm) with dentate (vs. entire) margin. As indicated by Su (2000), the actual floral morphology *F. tairukounia* is still controversial, and more studies, especially the re-examination of type material, are thus necessary to clarify its relationship with *F. xantholeuca*.

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臺灣蘭科植物補註（六）

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摘要：本文報導臺灣蘭科植物誌之新訊，共描述三新種：閉花赤箭(*Gastrodia clausa*)、擬八代赤箭(*Gastrodia confusoides*)、阿里山脈葉蘭(*Nervilia alishanensis*)；以及報導一新紀錄種淺黃暫花蘭(*Flickingeria xantholeuca*)。

關鍵詞：閉花赤箭、擬八代赤箭、阿里山脈葉蘭、淺黃暫花蘭、蘭科、臺灣、分類學。

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