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New addition of *Neottia* in Taiwan

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ABSTRACT: A new orchid species, *Neottia trigona* T.P. Lin & Y.I. Lee, is described from Yushan in central Taiwan. This species resembles *Neottia nankomontana*, but can be readily distinguished by its shorter peduncle, stouter stem and larger floral dimensions, a broad triangular lip, and the ciliolate margin of the labellum. An illustration of the new species is provided, together with a dichotomous key to the species of *Neottia* in Taiwan.

KEY WORDS: *Listera*, *Neottia nankomontana*, *Neottia trigona*, new species, Orchidaceae, Taiwan.

INTRODUCTION

The genus *Neottia* Guett. (including *Listera* R.Br.), along with 5 other genera, belongs to the tribe *Neottieae*, which is the first diverging clade, and sister to the rest of the large subfamily Epidendroideae (Chase *et al*., 2015; Zhang *et al*., 2023). According to the Plants of the World Online database, this genus includes 86 accepted names (POWO, 2025). The native range of *Neottia* includes subarctic to temperate zones in the Northern Hemisphere in Eurasia and North America, with a few species in the northern extent of tropical latitudes in Asia and NW Africa. More than 50% of the species were recorded in China (Hsieh *et al*., 2025). Sixteen species have been reported in Taiwan (Lin, 2019; Hsieh *et al*., 2025). The diversity of this genus in Taiwan may be largely explained by altitudinal speciation in different mountain systems. Among our terrestrial orchid genera, the number of species of *Neottia* is only lower than that of *Calanthe*, *Goodyera*, and *Gastrodia* in Taiwan (Lin and Liu, 2025). However, most *Neottia* species in Taiwan are vegetatively very similar, and the characters of the sepals, petals, column, stigma and anther of the flower are often shared by many species. Only the shape of the lip of flower is most useful for identification. Yushan, also known as Mount Morrison, Mount Jade or Mount Niitaka, is the highest mountain in Taiwan at 3,952 m above sea level, the focal point of the Yushan National Park, and is one of the favorites among Taiwanese mountain climbers. *Neottia morrisonicola* (Hayata) Szlach. is the first species of *Neottia* reported in Taiwan (Hayata, 1912, as *Listera morrisonicola* Hayata; Lin and Liu, 2025). While it was named after the mountain where it was first found, *N. morrisonicola* has since then been discovered in other parts of Taiwan, and until now none of the several species of *Neottia* found in Yushan is endemic to the mountain. This study introduces *Neottia trigona*, a novel orchid species restricted to Yushan, uncovered through a biodiversity expedition.

MATERIALS AND METHODS

The morphological description was based on four individuals of *N. trigona* collected from Yushan, Alishan Township, Chiayi County, Taiwan at an elevation of approximately 2800 m during the summer of 2025. Morphological characteristics of flowers were examined under a stereoscopic zoom microscope (Greenough Stereomicroscope, Leica S8 APO, Germany) and measured with calipers. Ecology and phenological data of this new species were based on field observations. Voucher herbarium specimens were gathered by Mr. Shi-Dong Luo (羅世東) and were deposited at the herbarium of the National Taiwan University (TAI, https://tai2.ntu.edu.tw/). Specimens of *N. nankomontana* examined in this study were collected by Mr. Da-Ming Huang in July 2018 from Jinaji Shan (Mountain Jinaji), Hsinchu County, at an elevation of approximately 2400 m.

DISCUSSION

Neottia trigona T.P.Lin & Y.I Lee, ***sp. nov.***
羅氏雙葉蘭 Figs. 1–2 & S1

Type: Taiwan: Chiayi County, Alishan Township, Yushan, ca. 2800 m, Jun. 24, 2025, *Shi-Dong Luo s.n.* (holotype TAI289948).

Diagnosis: This new species resembles *N. nankomontana* (Fukuyama, 1935), from which the new species can be distinguished by a much shorter peduncle (1.0–1.5 cm) and a stout stem (vs. slender longer peduncle 3.5–6.8 cm), a larger flower measurement, and a broad triangular lip (vs. bell-like to triangular lip), and the presence of ciliolate margin of the labellum (vs. entire margin) (Fig. 1; Table 1).

Description: Terrestrial. **Stems** green, slender, glabrous, arising from horizontal or vertical short rhizome, ridged, 6–7 cm long, 2 mm in diameter, with a long membranous long sheath at base. Roots several,

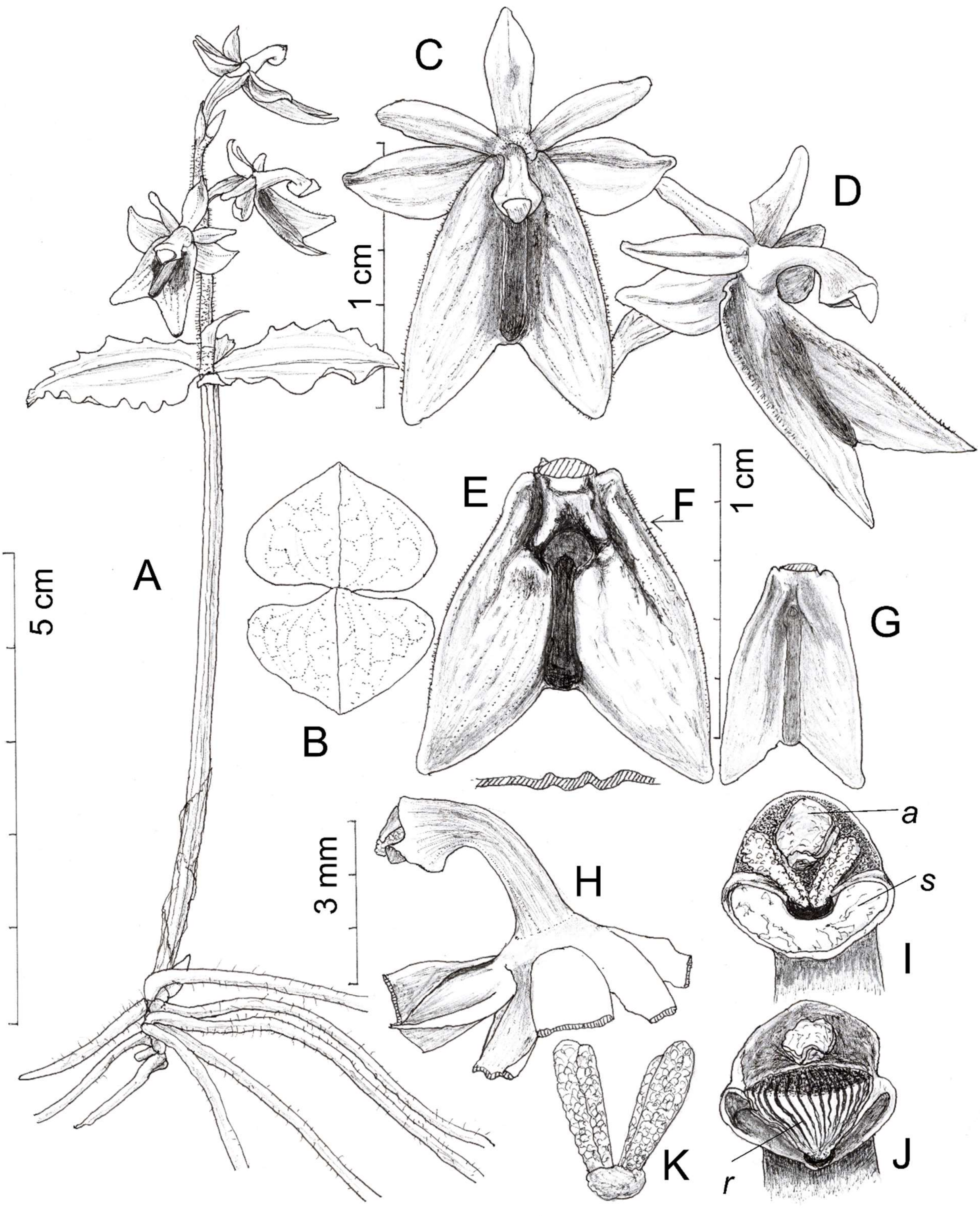

Fig. 1. Line drawing of ***Neottia trigona*** T.P.Lin & Y.I Lee. **A.** Flowering plant of ***N. trigona***. **B.** Leaf. **C.** Flower, frontal view. **D.** Flower, side view. **E.** Lip. **F.** Cross-section of lip. **G.** Lip of ***Neottia nankomontana***. **H.** Column with the anther attached, side view. **I.** Column with the anther attached, frontal view. **J.** Column with the anther removed showing the rostellum. **K.** Pollinia. **Notes**: letters a, s, and r denote the anther, stigma, and rostellum, respectively.

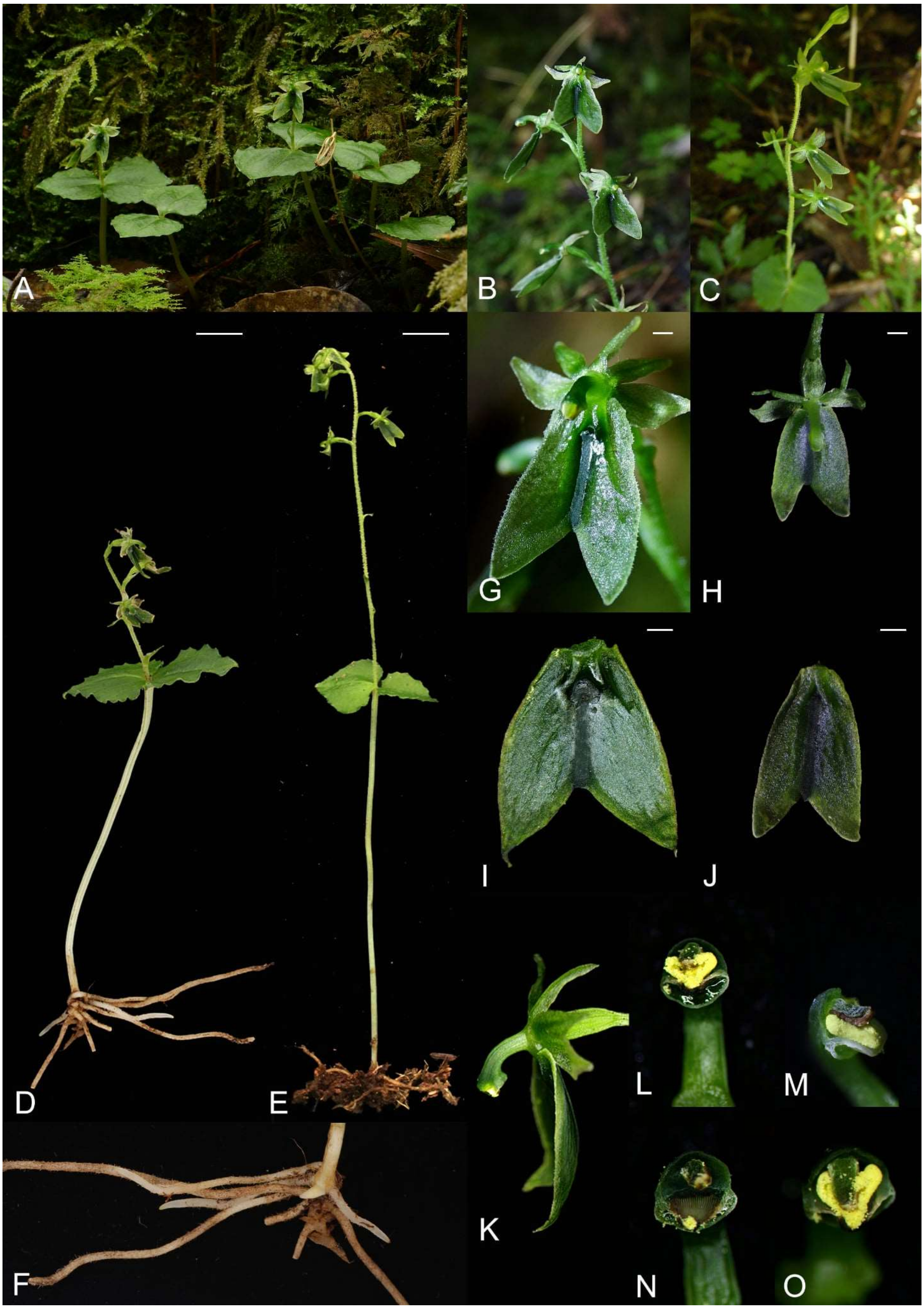

Fig. 2. Morphological details and general habits of ***Neottia trigona*** T.P.Lin & Y.I Lee. **A.** Native habitat. **B.** Inflorescence. **C.** Inflorescence of ***N. nankomontana***. **D.** Individual plant of ***Neottia trigona***. **E.** Individual plant of ***N. nankomontana***. **F.** Root system. **G.** Individual flower of ***N. trigona***. **H.** Individual flower of ***N. nankomontana***. **I.** Lip of ***N. trigona***. **J.** Lip of ***N. nankomontana***. **K.** Flower, side view. **L.** Column, view from below. **M.** Column of ***N. nankomontana***, side view. **N.** Column with pollinia removed showing clinandrium, view from below. **O.** Column with the anther attached, frontal view. Scale: D–E: 1 cm; G–J: 1 mm. Photographs. A, Taken by Po-Wen Shih; B, G, by Shi-Dong Luo; C, by Da-Ming Huang; D, F, I, K, L, N, O, by Yi-Tse Wang; E, H, J, M, by Tsan-Piao Lin.

Table 1. Comparison between ***Neottia trigona*** and ***N. nankomontana***.

Species	*N. trigona*	*N. nankomontana*
Length ratio of inflorescence/stem	0.4–0.6	0.9–1
Stem diameter	2 mm	1–1.2 mm
Inflorescence length	3–4.5 cm	5–11.5 cm
Peduncle length	1.0–1.5 cm	3.5–6.8 cm
Flower no/ Inflorescence	2–5	3–11
Lip size	7–10 × 5.5–10 mm	6–7 × 3–4 mm
Margins on lip	Ciliolate	Entire
Lip profile	Triangle	Bell-shape to triangular

filiform, spreading horizontally. **Leaves** 2, nearly opposite, ovate-triangular, about 1.7 × 2.5 cm, obtuse, green, with one prominent midvein, and several faint lateral veins, paler below. **Inflorescence** terminal, 3.0–4.5 cm long, with 2–5 flowers; scape green, minutely hairy, 1.0–1.5 cm long. Floral bracts ovate-lanceolate, ca. 4–6 mm long. Pedicel and ovary 5–6 mm long, glabrous. **Flowers** greenish, resupinate, ca. 11–15 mm long, 8–11 mm across, distichous, sepals and petals translucent, spreading; upper sepal lanceolate, about 4.2 × 1.0 mm, obtuse, with one prominent midvein; lateral sepals obliquely falcate, about 6 × 2.3 mm, obtuse, with one prominent midvein; petals narrowly lanceolate, ca. 4.2 × 1.4 mm, obtuse, with one prominent midvein. **Lip** green, flat, often with a light-greenish rim, mainly triangular in outline, cuneate at base, 7–10 mm × 5.5–10 mm, lateral margins ciliolate, apex deeply 2-lobed, without or slightly auriculate at base; lobes divergent, triangular, tapering to an obtuse apex, 3–4 mm long; disc lustrous except for a linear central stripe, which is dull-dark-green and slightly depressed, basal part of stripe circular and highly depressed. **Column** green, arcuate, ca. 2.5 mm long, semi-terete, apex slightly dilated. Rostellum protruding, nearly semicircular, whitish. Clinandrium large, decorated with parallel dark-brown marks. Stigma flat and wide. Anther-cap ovate, firmly attached to column; pollinia 2, large, each bipartite, mealy, granular, attached to a round viscidium.

Flowering time: June–July.

Distribution: Endemic to Taiwan.

***Etymology*:** The specific epithet "trigona" refers to the shape of lip.

Notes: The only known population of *Neottia trigona* has dozens of individuals growing in the moss cushion which covers big stones in a forest floor of *Tsuga chinensis* var. *formosana* (Fig. S1A). There are scattered mossy boulders in this location, and each boulder has a few individuals of *N. trigona* forming a small group. The understory location doesn't have creeks and receives good sunshine. Moisture is introduced by settling clouds that develop in this environment. No other species of *Neottia* was found nearby. *N. trigona* was first discovered by Mr. Po-Wen Shih (施博文), an employee in the Yushan National Park, on June 26, 2013, with a subsequent record documented in 2014. The specific location suffered from landslides, and the small population disappeared. The new location found by Shi-Dong Luo is nearby on the same mountain. This species is likely to be safe from disturbance because the site is neither close to the highway nor near to mountain trail. The closely related *N. nankomontana* is found in coniferous forests of northern Taiwan at an elevation of 2,200–2,600 m dominated by *Yushania niitakayamensis* (Hayata) Keng f. in the understory (Fig. S1B).

Neottia trigona has the shortest inflorescence among the species of *Neottia* in Taiwan, and the broad triangular lip are not shared by any other species there. *N. trigona* bears some resemblance to *N. nankomontana* in the lip shape but differs in the size of inflorescence, peduncle and flower. *N. trigona* has a much shorter inflorescence and peduncle (Fig. 2A, B, D, Table 1), and a broad triangular lip (Fig. 2B, G, I), whereas *N. nankomontana* has a much longer inflorescence and peduncle, and a bell-shaped to triangular lip (Fig. 2C, E, H, J). The lip of *N. trigona* is ciliolate at margin (Fig. 2G) while it is entire in *N. nankomontana*. The short peduncle is consistent across all observed individuals.

We have consulted flora works from Asian countries with temperate climates, China, India, Japan and Nepal (Chen *et al*., 2009; Nakajima, 2012; Iwatsuki *et al*., 2016; POWO, 2025) and papers available in recent years, but no identical species to *Neottia trigona* could be found. *N. chandrae* B. B. Raskoti, J. J. Wood & Rita from Nepal (Raskoti *et al*., 2012) is the only one resembling *N. trigona*, from which the Nepalese species can be distinguished by a hastate lip (vs. a bell-like to triangular lip) and a light-greenish middle stripe (vs. a dull-dark-green stripe). Further investigation is warranted to see the relationship between these two entities.

Based on phylogenetic analyses with limited sampling, *Neottia* has been divided to two informal clades (Clade 1 and Clade 2 in So and Lee, 2020; also see Peng *et al*., 2022), with the position of *Neottia ovalis* remaining uncertain. *N. trigona* is more likely to belong to Clade 1, which includes species without a column hood.

A dichotomous key for *Neottia* of Taiwan

1. Mycoheterotrophic plants, lacking green color .... ***N. acuminata***
   Autotrophic green plants ……………………..……..……………... 2
2. Column apex clearly differentiated into dilated hood; anther borne inside it. ………………………………………………………….... 3
   Column apex not forming a dilated hood; anther borne on apex of column. ……………………………………………………………. 5
3. Lip with no or only small auricles ……………………… ***N. suzukii***
   Lip with distinct basal auricles to embrace column. ………………… 4
4. Perianth not widely opening; lip lobes wide, 1–1.5 mm . ***N. atayalica***
   Perianth widely open; lip lobes narrow, to 1 mm ……..… ***N. japonica***
5. Lip with 2 small lateral lobes near base. ………. ***N. pseudonipponica***
   Lip without distinct lateral lobes near base ……………..………….. 6
6. Lip emarginate or shallowly 2-lobed at apex. ………….…………. 7
   Lip distinctly 2-lobed at apex ……………...………………………... 9

7. Leaves orbicular-ovate …………………………… ***N. morrisonicola***
Leaves deltoid or ovate-deltoid 8
8. Flowers greenish, lip tinged brown toward apical part, not ciliate. ……………………………………………….. ***N. taizanensis***
Flowers greenish, lip ciliate (more obvious microscopically) ……….
………………….………………………………….. ***N. meifongensis***
9. Lip shortly stipitate at base. ……………………………………… 10
Lip not stipitate at base …………………………………………… 12
10. Lobes of lip broad and truncate at apex …..……..… ***N. shenlengiana***
Lobes of lip linear and rounded at apex. ………………....………. 11
11. Lip with 2 divergent and linear lobes.…………. ***N. kuanshanensis***
Lip with 2 parallel and oblanceolate lobes. …. ***N. hohuanshanensis***
12. Flower larger, lip 1.1–2 cm long. ………………………….….. 13
Flower smaller, lip 6–9 mm long. ………………………………… 14
13. Lobes of the lip like a forked tail, sinus broad. …….. ***N. piluchiensis***
Lobes of the lip with a broad end, sinus narrow. ………… ***N. wardii***
14. Lobes of the lip rounded …………………………… ***N. cinsbuensis***
Lobes of the lip acute or obtuse. …………………………………. 15
15. Lip profile oblanceolate ……………………….…. ***N. ruisuiensis***
Lip profile more or less triangular…..…...………….…...…………16
16. Plant slender; Inflorescence 5–11.5 cm long; peduncle 3.5–6.8 cm long……………………………………..….….….... ***N. nankomontana***
Plant short and robust; Inflorescence 3–4.5 cm long; peduncle 1.0–1.5 cm long …..………………………………..……….... ***N. trigona***

Conservation status: During our fieldwork, only one population of *Neottia trigona*, with about 20 individuals were discovered in Yushan in an area of ca. five square meters. This location looks remote from any road. This taxon had not immediately been disturbed by human activities. From our preliminary assessment, this new species should be considered as Data Deficient (DD), an inadequate information to assess extinction risk or Near Threatened (NT) according to guidelines for the IUCN Red List Categories and Criteria (IUCN, 2024). It is important to re-evaluate this taxon at appropriate intervals.

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Supplementary materials are available from Journal Website