

NEPENTHES LIMIANA (NEPENTHACEAE), A NEW PITCHER PLANT FROM THE
NORTHERN TITIWANGSA RANGE OF PENINSULAR MALAYSIA

MICHAL R. GOLOS • School of Biological Sciences • University of Bristol • 24 Tyndall Avenue
• Bristol BS8 1TQ • UK • michal.golos@bristol.ac.uk

FRANÇOIS SOCKHOM MEY • 9 rue René Lothon • 27110 Epéard • France • meyfr@yahoo.fr

ANDREAS WISTUBA • Friedhofweg 4 • 88437 Maselheim • Germany • andreas@wistuba.com

GIDEON LIM • B-07-03 • Tower B • Epic Residence • Jalan BP 7/12 Bandar Bukit Puchong 2 • 47120
Puchong • Selangor • Malaysia • malaysiacarnivorousplants@gmail.com

STEWART R. MCPHERSON • Redfern Natural History Productions • 61 Lake Drive • Hamworthy
• Poole • Dorset BH15 4LR • UK • stewart@mcpherson.net

ALASTAIR S. ROBINSON • National Herbarium of Victoria • Royal Botanic Gardens Victoria
• Melbourne • VIC 3004 • Australia • alastair.robinson@rbg.vic.gov.au

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Abstract: *Nepenthes limiana*, a pitcher plant from the northern Titiwangsa Range of Peninsular Malaysia, is described as new. It is the northernmost known species of the recently defined *N. macfarlanei* group, whose members are characterised by the presence of conspicuous hairs on the lower surface of the lid. It differs from other members of this group in exhibiting adaptations to seasonal drought in the form of thickened roots and narrow laminae that are reminiscent of those produced by the pyrophytic *Nepenthes* of Indochina and northernmost Malaysia. Coupled with the presence of decurrent leaf bases, which are not present in any other *N. macfarlanei* group species but which are present in the pyrophytic *Nepenthes*, these characters could indicate either morphological convergence or an as yet uncharacterised relationship between *N. limiana* and the *Nepenthes* species of Indochina.

Introduction

The last few years have seen renewed interest in the *Nepenthes* of Peninsular Malaysia, with several new species described from previously poorly botanised regions and also as a direct outcome of improved understanding of the endemic species complexes. The latter has largely resulted from extensive herbarium studies critically supported by targeted expeditions intended both to document in the living state the full range of species variation across the peninsula and to relocate poorly known species at their infrequently visited type localities (Ghazalli *et al.* 2019, 2020, 2021, 2022, 2023; Nikong 2020; Tamizi *et al.* 2020a, b; Lim *et al.* 2023; Tan *et al.* 2023).

Lim *et al.* (2023) introduced the *Nepenthes macfarlanei* group, an informal aggregate comprising *N. alba*, *N. berbulu*, *N. gracillima*, *N. macfarlanei*, *N. sericea*, and *N. ulukaliana*. These six species are united by the presence of: (1) conspicuous hairs or bristles on the underside of the lid; (2) round to ovate crateriform nectar glands more or less evenly distributed across the lower lid;

(3) a finely but distinctly toothed sub-cylindric peristome that flattens and widens into a short column towards the rear; and (4) sessile, lanceolate to oblong laminae. Inflorescences consist predominantly of bracteate, two-flowered partial peduncles. During field studies undertaken in August 2022, a seventh species of the *N. macfarlanei* group was identified in the northern Titiwangsa Range, close to the border with Thailand. While showing clear affinities to the other members of the *N. macfarlanei* group, it is divergent in exhibiting characteristics associated with the pyrophytic *Nepenthes* of Indochina. The species is described herein as *N. limiana*.

Botanical history

Nepenthes limiana has been the source of considerable taxonomic confusion over the years. Due to its somewhat intermediate appearance, herbarium material belonging to this species has at various times been identified as *N. gracillima*, *N. macfarlanei*, *N. sanguinea*, *N. gracillima* × *N. macfarlanei*, and *N. macfarlanei* × *N. sanguinea*.

The earliest collection of *Nepenthes limiana* known to the authors was made on 06 March 1924 from Gunung Stong (sometimes spelled ‘Sitong’ or ‘Setong’; 1422 m) by Mohamed Nur bin Mohamed Ghous (commonly known as Mohamed Nur, also spelled ‘Noor’; 1898–1958). Nur, who was employed by the Singapore Botanic Gardens, was accompanying fellow botanist Frederick William Foxworthy (1877–1950) on an expedition from Kuala Lipis in Pahang to Kelantan (see I.H. Burkill 1927:152; H.M. Burkill 1959; van Steenis-Kruseman 2017). The specimen in question (Nur 12221, SING!) was seen by *Nepenthes* monographer Benedictus Hubertus Danser (1891–1943), who tentatively treated it as a natural hybrid between *N. macfarlanei* and *N. sanguinea* in his influential 1928 revision of the genus, together with specimens of *N. gracillima*, *N. sericea*, and *N. ulukaliana* (Danser 1928; see Lim *et al.* 2023). Another specimen collected from Gunung Stong on the same day, Nur 12219, may also represent *N. limiana*, but we were unable to locate it at the Singapore herbarium in August 2022. This specimen was treated as *N. gracillima* by Danser (1928) and as *N. ramispina* by both Jebb & Cheek (1997) and Clarke (2001:133).

Danser had a very broad concept of *Nepenthes macfarlanei* that encompassed what are now recognised as *N. gracillima*, *N. macfarlanei* s.str., *N. sericea*, and *N. ulukaliana*; similarly, his *N. gracillima* included *N. alba*, *N. gracillima* s.str., and *N. ramispina* (Lim *et al.* 2023). Working solely from herbarium material, which was often incomplete or poorly preserved, Danser struggled to adequately delimit the montane *Nepenthes* of Peninsular Malaysia. He wrote: “*N. sanguinea*, from the Malay Peninsula, is very well characterized in its typical forms, but it is vaguely limited against *N. gracillima* and still more vaguely against *N. Macfarlanei*, often growing along with it. The very striking hairs on the lower side of the lid of *N. Macfarlanei* are very different in length and in number in different specimens, and short hairs on the underside of the lid occur also often in *N. gracillima* and *N. sanguinea*.” (Danser 1928:410). Danser treated specimens that he considered to deviate from “typical” *N. sanguinea* only in the presence of lid hairs as true representatives of that species, while those that exhibited further affinities with *N. macfarlanei* were treated as hybrids between the two.

Nepenthes limiana was collected for a second time by Colin Fraser Symington (1905–1943), a botanist with the Malayan Forestry Service, on 10 October 1934, also from Gunung Stong (*Symington* 37699, KEP!), and two days later on what he called “Gunung Sagi” (*Symington* 37772, KEP!). The latter material, recorded as being from an elevation of 4600 ft (ca. 1400 m), is likely to also be

from Gunung Stong (1422 m), rather than from the true Gunung Saji (1284 m) nearby (see Chew *et al.* 2009:72 for detailed rationale).

The species was again collected from Gunung Stong by Ruth Kiew on 17 May 1988 (Kiew RK 2735, SING!). It was identified as *Nepenthes gracillima* and mentioned as such by Kiew (1990), who wrote that the pitchers were “deep red-purple with white flecks”.

In their “skeletal revision” of the genus, Jebb & Cheek (1997) included herbarium material of *Nepenthes limiana* from Gunung Stong (Symington 37699, KEP!) under their broad concept of *N. macfarlanei*, which also encompassed *N. berbulu*, *N. gracillima*, *N. macfarlanei s.str.*, *N. sericea*, and *N. ulukaliana*. This circumscription *sensu lato* was maintained in their later works concerning the *Nepenthes* of Peninsular Malaysia (Cheek & Jebb 2001, 2012). In addition to *N. macfarlanei*, Cheek & Jebb (2012) also recognised *N. gracillima* as occurring on Gunung Stong; this record is likely based on material of *N. limiana*, though in the absence of specimen references it is impossible to confirm this.

Similarly, Chua (2001) cited Gunung Stong as the northernmost known locality of *Nepenthes macfarlanei s.lat.* (see also Clarke 2001:304, map 6A)—not Gunung Korbu (2183 m) as in previous works (e.g., her comprehensive doctoral thesis, Chua 1995), highlighting knowledge that was accruing on the distribution of the *N. macfarlanei* group during this time. Notably, *N. macfarlanei s.lat.* was not found by Chua (1995) on Gunung Kabut (1317 m) in the northern Titiwangsa Range, where *N. limiana* might be expected to occur; it was suggested that its absence might be due to the relatively low summit elevation of that mountain (Chua 1995:37, 39, 49), though this falls well within the known range of *N. limiana*.

There remained uncertainty over the delimitation of *Nepenthes macfarlanei s.lat.* and *N. sanguinea*, with Clarke (2001:213) writing: “The boundaries between *N. sanguinea* and *N. macfarlanei* can be particularly difficult to determine.”, echoing Danser’s position more than 70 years earlier.

Even on Gunung Stong, its best-known locality due to its relative accessibility and popularity among tourists (Hilimi 2012:71; Muhamad 2021), *Nepenthes limiana* was often overlooked. Barely a mention of pitcher plants is made in the substantial work of Shaharuddin *et al.* (2005), based on a major multi-disciplinary scientific expedition to Gunung Stong carried out in 23–29 May 2003, and *Nepenthes* are entirely absent from the two lists of plants included therein (Chee *et al.* 2005; Shamsul *et al.* 2005)—only a passing reference is made to the presence of “some species of *Nepenthes*” in Gunung Stong State Park (Latiff & Faridah-Hanum 2005:44).

Material likely representing *Nepenthes limiana* was collected during the preparation of the management plan of Maseri *et al.* (2006) and identified as *N. gracillima*, and the species was subsequently reported from the mountain in a number of related publications (e.g., Maseri 2009).

A significant series of collections were made during a nine-day expedition to Gunung Stong State Park in February 2007, by a team that included Ruth Kiew, A. Angan, M.Y. Chew, S. Kamarudin, H. Pauzi, and T.L. Yao. Their findings were summarised in Chew *et al.* (2009) and Yao *et al.* (2009). Based on this new material, Yao *et al.* (2009) reported *Nepenthes gracillima* from Gunung Kob (1266 m), a mountain close to Gunung Stong in Kelantan. To these specimens from Gunung Kob, Chew *et al.* (2009:108) added new records for *N. macfarlanei s.lat.* from Gunung Ayam (1504 m), Gunung Tera (1556 m), and their surroundings. Additionally, a putative natural hybrid between *N. gracillima* and *N. macfarlanei* was identified from an extensive *Sphagnum* bog habitat, unique in the region and known locally as Padang Ragut (1371 m), which is thought to have been created through elephant activity (Chew *et al.* 2009:108; see also Yao *et al.* 2009). These

specimens have been examined by the present authors and determined to all represent *N. limiana* (see “Additional specimens examined”).

The first collections of *Nepenthes limiana* from Gunung Chamah (2171 m), the fifth highest mountain in the Malay Peninsula, appear to have been made in July–August 2010 (*Imin FRI 71759*, L!; *Imin FRI 71803*, KEP!, L!). The subsequent book-length treatment of the biology of Gunung Chamah by Karim *et al.* (2013) made only passing mention of “pitcher plants” on this mountain and listed the presence of *N. gracilis* in the surrounding area, though it also included photographs of what appears to be *N. sanguinea* and possibly a hybrid with *N. limiana* (Karim *et al.* 2013:156, 294, 298).

In early 2011, Radio Televisyen Malaysia (RTM) aired a series of short documentary films titled *Eksplorasi Gunung* (“Mountain Exploration”). In episodes 8 and 9, where the crew explored Gunung Stong and Gunung Beirut (1380 m; part of the Gunung Stong complex) respectively, several clips of *Nepenthes* plants were shown; however, these more likely represented individuals of *N. benstonei* or *N. domei* rather than *N. limiana* (Q-PLEX 2011a, b; see Anon. 2010).

In a 2021 conservation assessment for the *Malaysia Red List*, both *Nepenthes gracillima* and *N. macfarlanei* were said to occur in Gunung Stong State Park (Chua 2021). Finally, in the 2022 book *Kepelbagaian dan Panduan Pengecaman Nepenthes Semenanjung Malaysia* (“Diversity and Identification Guide for Peninsular Malaysian *Nepenthes*”; Ghazalli *et al.* 2022), no mention of *N. limiana* was made; however, it was recorded that *N. benstonei* occurred on Gunung Stong, suggesting that at least preliminary observations had been made on that mountain. This remained the current state of knowledge prior to our field studies.

Materials and methods

Field observations were made in August 2022 of *Nepenthes limiana* on Gunung Basor (Titiwangsa Range) as well as four other species of the *N. macfarlanei* complex: *N. berbulu* on two undisclosed peaks of the Titiwangsa Range, *N. macfarlanei* on Gunung Bubu (Bintang Range), *N. sericea* on Gunung Brinchang and Gunung Warpu in the Cameron Highlands (Titiwangsa Range), and *N. ulukaliana* on Gunung Ulu Kali in the Genting Highlands (Titiwangsa Range). While preparing the manuscript, the authors reviewed all relevant material pertaining to the *N. macfarlanei* group that is deposited at KEP, KYO, L, SAN, SING, TI, and TNS herbaria, with further specimens studied at BO, K, and P (acronyms follow Thiers 2023). Additionally, online scans were consulted of material at A, MO, MPU, NLU, NY, RSA, TEX, US, and WIS.

New herbarium material of *Nepenthes limiana* was collected by G. Lim under permit ref. JH/100 Jld. 33(35) issued by the Forest Department of Peninsular Malaysia, and subsequently deposited at KEP. Fine measurements of live material were made using Vernier callipers and a tape measure. Measurements from herbarium material of small-scale structures such as hairs were made using a stereomicroscope. Locality data for the distribution map was taken from herbarium records and information gathered from field observations, and plotted using SimpleMappr (Shorthouse 2010).

Results

Comprehensive field and herbarium studies have revealed the presence of a seventh member of the *Nepenthes macfarlanei* group in the northern Titiwangsa Range of Peninsular Malaysia. This species, the northernmost known representative of its group, is herein described as *N. limiana* and delimited from its closest congeners.

Nepenthes limiana Wistuba, Mey, Golos, S. McPherson & A.S. Rob., *spec. nov.* (Figs. 1–12, Front Cover, Back Cover)

Type: — MALAYSIA. **Kelantan:** G. Basor, 1840 m, 13 August 2022, *Lim 1* (holotype KEP!, isotypes KEP! [2 sheets]) [sterile rosette with two lower pitchers (holo-); sterile offshoot from subterranean runner with single lower pitcher, including fragment of runner with roots (iso- sheet 1); climbing stem with single upper pitcher and male inflorescence (iso- sheet 2)].

– *N. macfarlanei* × *N. sanguinea* Danser (1928:324), *quae pro parte* = *N. gracillima*, *N. limiana*, *N. sericea* & *N. ulukaliana*

– *N. macfarlanei* auct. non Hemsl.: sensu Jebb & Cheek (1997:57), Cheek & Jebb (2001:91) & Cheek & Jebb (2012:263), *quae pro parte* = *N. berbulu*, *N. gracillima*, *N. limiana*, *N. macfarlanei*, *N. sericea* & *N. ulukaliana*

Diagnosis: *Nepenthes limiana* differs from *N. sericea* in having (differences in parentheses) narrowly cylindrical upper pitchers with an infundibular base and hip in the lower part (vs. wholly infundibular with hip immediately below mouth or infundibular in basal part and cylindrical to slightly infundibular above with medial hip); slightly decurrent, narrowly oblanceolate to almost linear laminae (vs. sessile and oblanceolate to obovate-oblong); and lower pitchers with a proportionally wider, bulbous peristome, often slightly flared and crenellated (vs. proportionally thinner peristome, expanded near column only and not crenellated). *Nepenthes limiana* differs from *N. sanguinea* in having dense indumentum of filamentous lid hairs ≤ 2 mm long on lower lid surface (vs. glabrous); slightly decurrent, narrowly oblanceolate to almost linear laminae (vs. sessile and oblong); and lower pitchers with a proportionally wider, bulbous peristome, often slightly flared and crenellated (vs. proportionally thinner peristome and rarely crenellated). *Nepenthes limiana* also differs from both species by its thickened, tuber-like rootstock.

Description: Terrestrial or epiphytic, erect, subscaudent or climbing shrub, up to several metres tall. *Roots* swollen, tuber-like, up to 18 mm thick. *Stems* slightly angular, 8–14 mm in diameter. Internodal length 25–40 mm in rosettes, 24–130 mm in climbing stems. *Leaves* sessile and coriaceous. Lamina of rosette leaves generally oblanceolate, sometimes lanceolate, becoming much narrower, almost narrowly linear, in larger rosettes, lamina shape similar but usually less narrow in climbing stems, 29.5–44 cm long and 5–6.7 cm wide in rosette leaves, 20.5–25 cm long and 3–3.5 cm wide in climbing stems, apex acute to obtuse, base clasping stem for at least 3/4 of its circumference, slightly decurrent in rosettes and in climbing stems for 5–10 mm, four longitudinal veins on either side of midrib. Tendrils of rosette and lower pitchers uncoiled, those supporting upper pitchers coiled several times, length of tendril of all types of pitchers once to less than twice the length of the pitcher. *Rosette pitchers* variable in shape, ovoid or infundibular in basal half, forming a slightly bulbous base with hip at midsection or just below the mid-section and cylindrical above, contracted slightly below mouth, or broadly cylindrical with a discernible hip at midsection or just below, wings extending length of ventral surface with widely spaced fringe elements, mouth ovate. Peristome uniform, lid with fine hairs on lower surface. *Lower to intermediate pitchers* similar to the rosette pitchers in shape, ovoid to broadly infundibular in basal half and cylindrical above, the two parts demarcated by a usually distinct hip, and contracted slightly below mouth, 26–31 cm tall, 3.3–7 cm wide, with wings extending length of ventral surface, 4–8 mm wide, with 6–8 mm long, widely spaced fringe elements, mouth ovate. Peristome bulbous, often slightly flared and slightly crenellated, 5–6 mm wide at front, broadening and flattening towards rear, forming a prominent column 18–39 mm wide, opposing parts often diverging beneath lid,



Figure 1: *Nepenthes limiana* Wistuba, Mey, Golos, S.McPherson & A.S.Rob. (a) Short-stemmed plant with lower pitchers, showing thickened roots. (b) Close-up of lower pitcher showing lid underside and mouth. (c) Detail of lid underside showing hair density and interspersed glands. (d) Peristome of lower pitcher in lateral aspect, showing broad column and diminution of ribs towards outer margin. (e) Lower surface (right) and upper surface of lower pitcher lid. (f) Detail of lower pitcher lid glands. (g) Spur. (h) Climbing stem with upper pitcher. (i) Male inflorescence. (j) Male flowers. (k) Dehiscent fruit and unpollinated female flower. (l) Seed. Based on the type material, additional voucher specimens, as well as photographs and measurements made *in situ* on Gunung Basor (density of lid hairs reduced for clarity). Illustration by F.S. Mey.

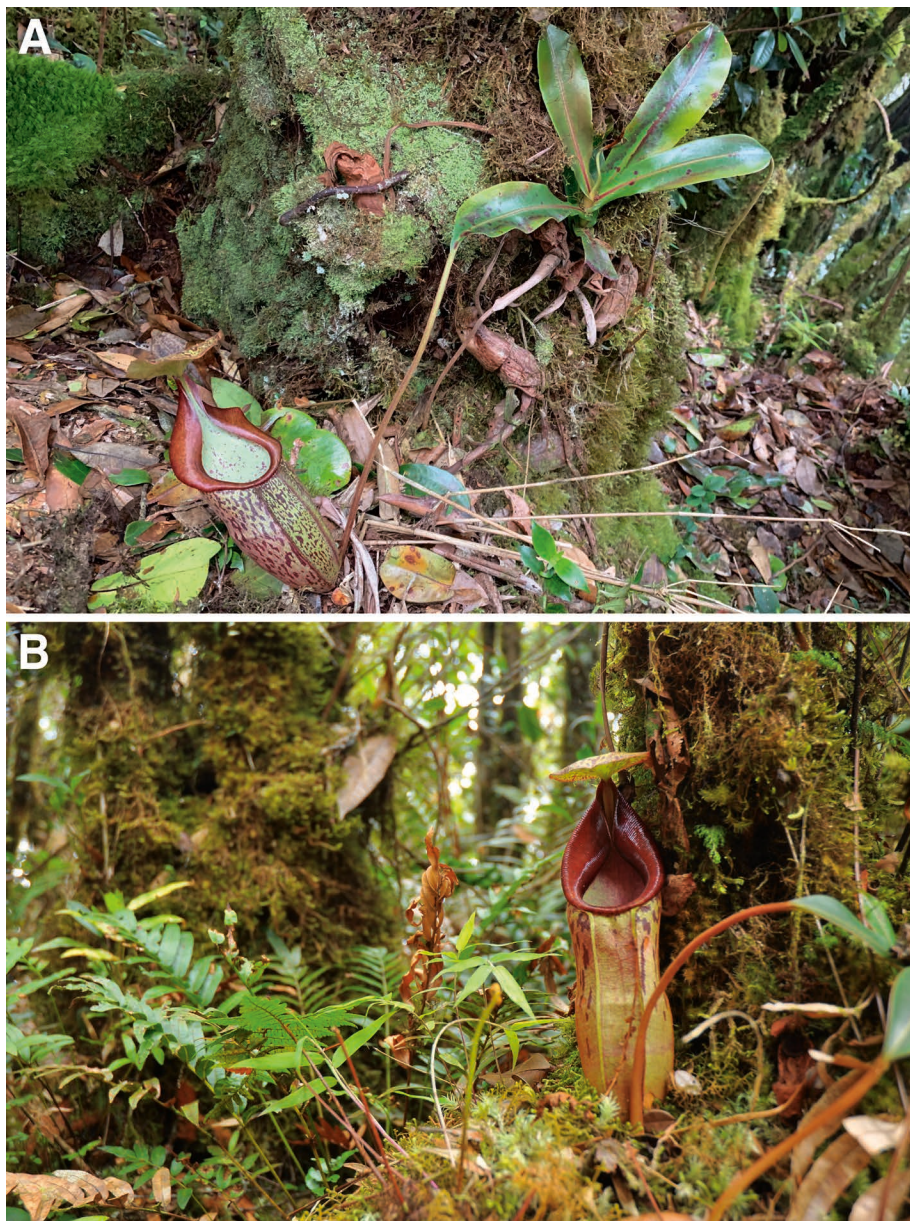


Figure 2: *Nepenthes limiana*. (A) Rosette plant bearing a lower pitcher growing on a moss cushion at the type locality on Gunung Basor. (B) Lower pitcher of a plant observed in the Temengor region. Photographs by F.S. Mey (A) & Shariff Mohamad/WWF-Malaysia (B).

leaving conspicuous gap, fine but conspicuous ribs, becoming noticeably shorter and sometimes lost entirely towards sides and rear and thereby often giving peristome a distinctly shiny and fleshy appearance, teeth distinct. Lid generally ovate, rarely sub-orbicular, 77–105 mm long, 72–86 mm

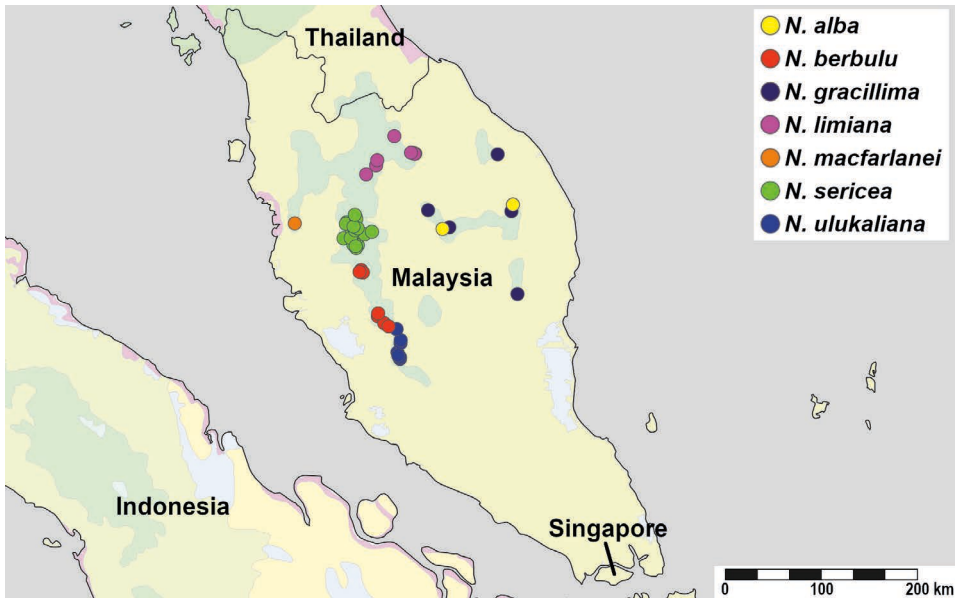


Figure 3: Known distribution of *Nepenthes limiana* and closely related species of the *N. macfarlanei* group, based on field observations and voucher specimens. The coloured areas show ecoregions defined by the World Wide Fund for Nature (WWF); note that all known species of this group are confined to the 'Peninsular Malaysian montane rain forests' ecoregion, which roughly corresponds to areas above 1000 m in elevation. Drawn by M.R. Golos.

wide, usually held horizontally, lower surface lacking appendages or prominent medial ridge, with fine filamentous white, yellow to orange hairs up to *ca.* 2 mm long, distributed throughout, except near margins where becoming minute, denser medially and especially near peristome attachment, crateriform glands up to 1 mm in diameter densely but $\pm$ evenly distributed across entire lower surface with exception of margins, spur simple, rarely slightly branched at base, apex acute, *ca.* 12–20 mm long. *Upper pitchers* with conspicuous venation, narrowly infundibular in basal 2/5 to 1/2, narrowing slightly just above the pronounced hip, cylindrical above, with flattened ventral surface between wing vestiges, 24–30 cm tall by 4.2–4.6 cm wide, wings reduced to prominent ridges except just below mouth where ridges often inconspicuous, mouth ovate. Peristome bulbous, sometimes flared but not crenellated, broadening and flattening towards rear of pitcher, *ca.* 2–5 mm wide at front, *ca.* 9–12 mm wide at column which is significantly less pronounced than in lower pitchers, ribs conspicuous, striate, teeth distinct. Lid sub-orbicular to ovate, 60–75 mm long, 55–67 mm wide, apex rounded to slightly truncated, base cordate, held at *ca.* 45° degrees from horizontal, lower surface lacking appendages or prominent medial ridge, with fine hairs and crateriform glands as in lower pitchers, spur filiform, simple, *ca.* 11–13 mm long, apex acute. *Inflorescence* a racemose panicle. Male inflorescence *ca.* 55 cm long, peduncle 15 cm long, *ca.* 3–8 mm wide, rachis 40 cm long, *ca.* 140 flowers borne on 2-flowered partial peduncles, bracts prominent, mostly basal, sometimes situated close to ramification of partial peduncle, simple, filiform, tepals *ca.* 2–3 mm long, 1–1.5 mm wide. Female inflorescence two-flowered, *ca.* 30 flowers in total, *ca.* 25 cm long, peduncle *ca.* 17.5 cm long, *ca.* 2 mm in diameter, rachis *ca.* 7.5 cm long,

bracts variably expressed, simple, filiform, basal pedicel with a longer bract, tepals ovate-elliptic, *ca.* 2 mm long, 1 mm wide, with minute nectar glands. *Seeds* fusiform, *ca.* 10 mm long, with well-developed wings. *Indumentum* conspicuous, 1–2 mm long, orange, on midribs, tendrils of lower pitchers, and lower pitchers; upper pitchers and their tendrils glabrous. Colour of stem red to dark red, leaves light to dark green with paler midrib on the adaxial side often red near the stem forming a very narrow red triangle, midrib often red to dark red in the abaxial side as for stem, lower pitcher light yellow to green, often suffused lightly or heavily with red, brown or purple, or entirely brown, brown-red to chocolate, this background colour being moderately to heavily mottled with dark red, brown, or purple, sometimes much lighter between wings. Peristome uniformly red, brown, or purple, sometimes yellow to green even in aged pitchers, rarely with red banding, interior waxy zone off-white to light green, sometimes suffused with red or purple, sometimes with some red to purple blotches, colour of adaxial side of lid lightly or heavily red to purple speckled on yellowish green background, abaxial side being yellowish green with some red or purple speckles on the margins. Upper pitchers entirely yellow or green or with similar coloration to lower pitchers, peristome yellow and striped with red bands, or simply yellow or reddish, lower lid entirely yellow on both sides or similar to the lower pitchers, sometimes with red speckles even on the abaxial side, colour of flowers and fruits unknown.

Etymology: The specific epithet *limiana* honours Gideon Lim Li Qian, a Malaysian *Nepenthes* conservationist, who organised the series of expeditions that led to the revision of the *N. macfarlanei* group and the descriptions of *N. berbulu*, *N. sericea*, *N. ulukaliana*, and this eponymous species. While descending from the type locality of *N. limiana* at night during a thunderstorm on 13 August 2022, Lim survived a near-direct lightning strike that passed through his metal walking stick, as witnessed by several nearby guides and porters (see Lim 2023).

Phenology: A dried male inflorescence was observed on Gunung Basor in August 2022, and infructescences and a male inflorescence are known from herbarium material collected in the same month on Gunung Chamah (*Imin FRI 71803*, KEP!, L!). A specimen from the summit of Gunung Kob taken in February (*Yao FRI 55873*, KEP!) also bears an infructescence, but this was already dry when collected. The timing and periodicity of flowering in this species are otherwise completely unknown.

Distribution and ecology: *Nepenthes limiana* is known with certainty only from the northern Titiwangsa Range of Peninsular Malaysia, where it has thus far been documented from some ten peaks across the Malaysian states of Kelantan and Perak (Fig. 3). It is possible that the species' range extends into southernmost Thailand; a photograph seen by the authors shows a plant resembling *N. limiana* from the Hala-Bala Wildlife Sanctuary, but the species' presence there cannot be confirmed at present. *Nepenthes limiana* has a wide elevational range, from *ca.* 800 m to the summit of Gunung Chamah at 2171 m (see *Imin FRI 71803*, KEP!, L!).

At its type locality on Gunung Basor, *Nepenthes limiana* grows predominantly as a terrestrial, though occasionally also as an epiphyte (Fig. 12A), in mossy forest and summit scrub at and slightly below the summit, where it occurs in open habitat with high light exposure. A small number of plants were also observed on a false peak at *ca.* 1500 m, which was the lowest recorded elevation of this species on Gunung Basor. These plants grew mostly in shade and were consequently etiolated and generally lacked pitchers, in stark contrast to those found in the summit area. As seen in other members of the *N. macfarlanei* group, the lower pitchers of *N. limiana* sometimes develop deeply embedded in moss, leaving only their mouths and lids exposed (Fig. 6C).

During our visit to the type locality, more than 200 specimens of *Nepenthes limiana* were observed; however, a significant proportion of pitchers were dry, and only five live upper pitchers

were found, possibly indicative of seasonality or a sensitivity to a dry spell prior to our visit. No other species of *Nepenthes* is known to grow at the type locality of *N. limiana*.

Gunung Basor appears to be subject to a high level of elephant activity (as is the case in certain parts of the Gunung Stong complex; see Yao *et al.* 2009). The authors frequently observed elephant droppings during their field studies on the mountain, even in the summit area. The movement of these animals creates and maintains clearings in the forest and this open habitat appears to support colonisation by species such as *Nepenthes limiana* which, like many *Nepenthes*, thrives in ruderal vegetation.

On Gunung Basor, minute golden ants were observed congregating on the underside of the lid of a lower pitcher, apparently traversing the hairy surface largely unimpeded (G. Lim, pers. observ.).

Natural hybrids: No natural hybrids involving *Nepenthes limiana* have been observed with certainty, though citizen science photos seen by the authors show plants that might represent crosses with *N. sanguinea* (see also Karim *et al.* 2013:298, fig. 6a).

Conservation status: *Nepenthes limiana* occurs in at least three protected areas (Gunung Basor Forest Reserve, Gunung Stong State Park, and Royal Belum State Park), but concerns remain about the long-term sustainability of this habitat (see Anon. 2009). Gunung Chamah, another location where this species is known to occur, has yet to be gazetted as a Permanent Forest Reserve. Direct observations of this species across the breadth of its range are lacking, thus the taxon is designated DD (Data Deficient) for the purposes of assessment of its risk of extinction based on its distribution and population status (IUCN 2012).

Additional specimens examined:

Nepenthes limiana — along ridge of G. Sitong [=G. Stong], 2600 ft [≈790 m], 6 March 1924, Nur 12221 (SING!) [stem with lower pitcher; originally identified as *N. macfarlanei*, later (tentatively) as *N. macfarlanei* × *N. sanguinea* by B.H. Danser, August 1927, and as *N. macfarlanei* by R. Kiew, 23 November 2007]; G. Stong summit, no elevation data [G. Stong is 1422 m high], 10 October 1934, Symington 37699 (KEP!) [stem with lower pitchers; originally identified as *N. sanguinea*, later as *N. macfarlanei* by both L. Chua, May 1993, and M. Jebb, January 1995]; “G. Sagi” [likely G. Stong rather than true G. Saji; see Chew *et al.* 2009:72, 73], open forest, 4600 ft [≈1400 m], 12 October 1934, Symington 37772 (KEP!) [stem with lower pitchers; originally identified as *N. sanguinea*, later as *N. macfarlanei* by M. Jebb, January 1995]; G. Setong [=G. Stong], top of sheer rockface on ridge, climbing over low trees, 1000 m, 17 May 1988, Kiew RK 2735 (SING!) [stem with intermediate pitchers; originally identified as *N. gracillima*; “only pitcher plant species seen on G. Setong”]; ridge top near Padang Ragut, lower montane forest, on peaty soil along ridge, growing appressed among mosses or climbing, 5°19.32'N 101°54.54'E, 1316 m, 9 February 2007, Chew FRI 53544 (KEP!, SAN!) [stem with intermediate pitcher (KEP); stem with upper pitchers (SAN); originally identified as *N. macfarlanei*]; FRIM Swamp [Padang Ragut], lower montane forest, growing on tree hummock in *Sphagnum* bog, 5°20.36'N 101°54.45'E, 1248 m, 10 February 2007, Chew FRI 53575 (KEP!) & 53576 (KEP!) [stem with upper pitchers (53575); rosette with pitchers and roots (53576); originally identified as *N. gracillima* × *N. macfarlanei* (53575) and *N. macfarlanei* (53576)]; G. Tera summit, montane forest, 5°20.52'N 101°54.15'E, 1556 m, 11 February 2007, Chew FRI 53580 (KEP!, SING!) [stem with lower pitchers and roots (KEP); poorly preserved stem with lower pitcher (SING); originally identified as *N. macfarlanei* (both sheets)]; near G. Ayam summit, montane forest, growing on tree hummock, 5°20.36'N 101°55.49'E, 1510 m, 12 February 2007, Chew FRI 53607 (KEP!) [stem with lower pitchers; originally identified as *N. macfarlanei*]; G. Kob summit, lower montane forest, growing on tree hummock, 5°20.18'N 101°56.40'E,

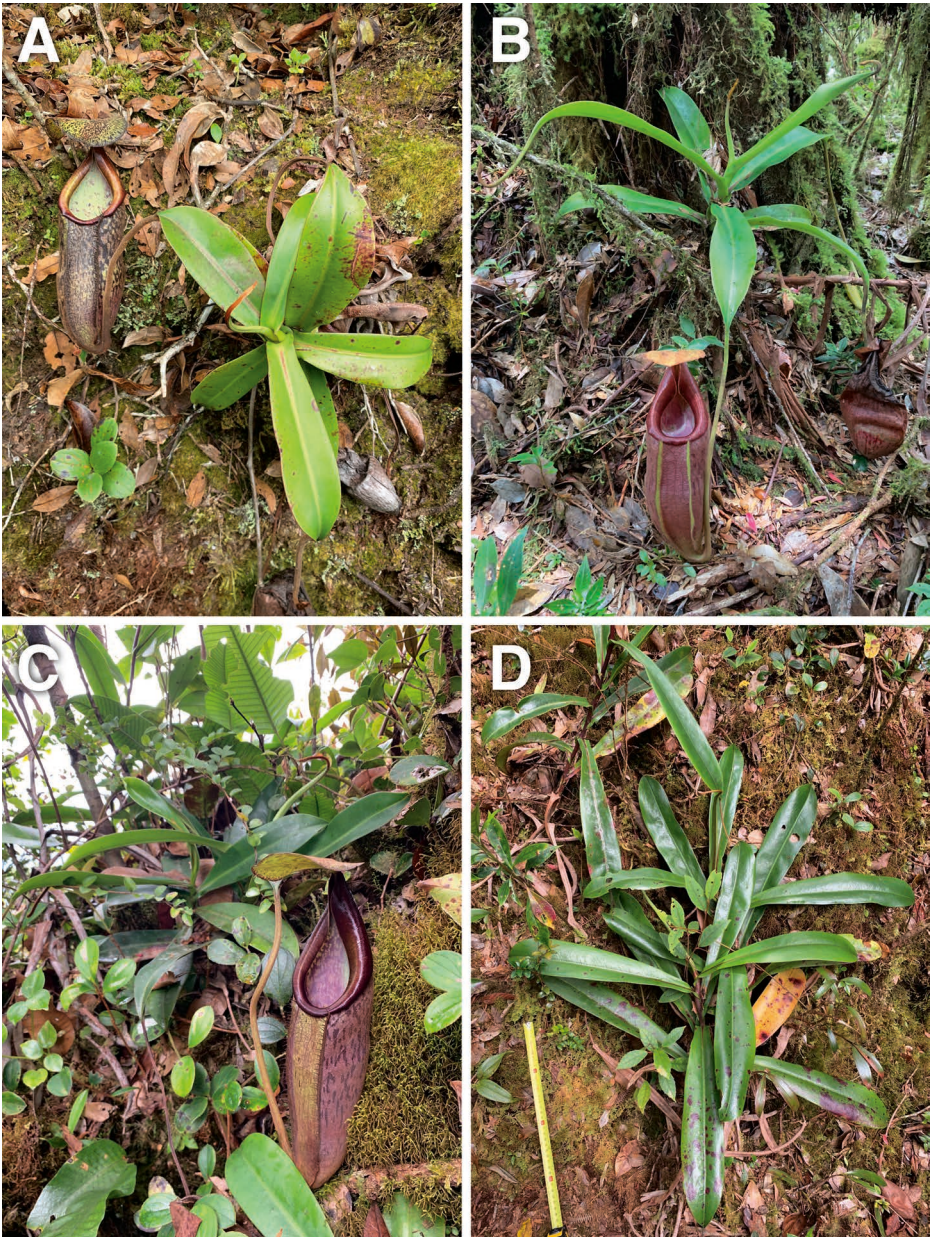


Figure 4: *Nepenthes limiana* (G. Basor). Rosette and short-stemmed plants growing terrestrially. Note the elongated laminae of the plants shown in D, with a tape measure extended to 38 cm provided for scale. Photographs by F.S. Mey.

1266 m, 13 February 2007, *Chew FRI 53617* (KEP!) & *53618* (KEP!) [stem with lower pitcher (*53617*); stem with upper pitchers (*53618*); originally identified as *N. gracillima* (both sheets)]; G. Kob summit, lightly shaded, 5°20.18'N 101°56.40'E, 1266 m, 13 February 2007, *Yao FRI 55873*

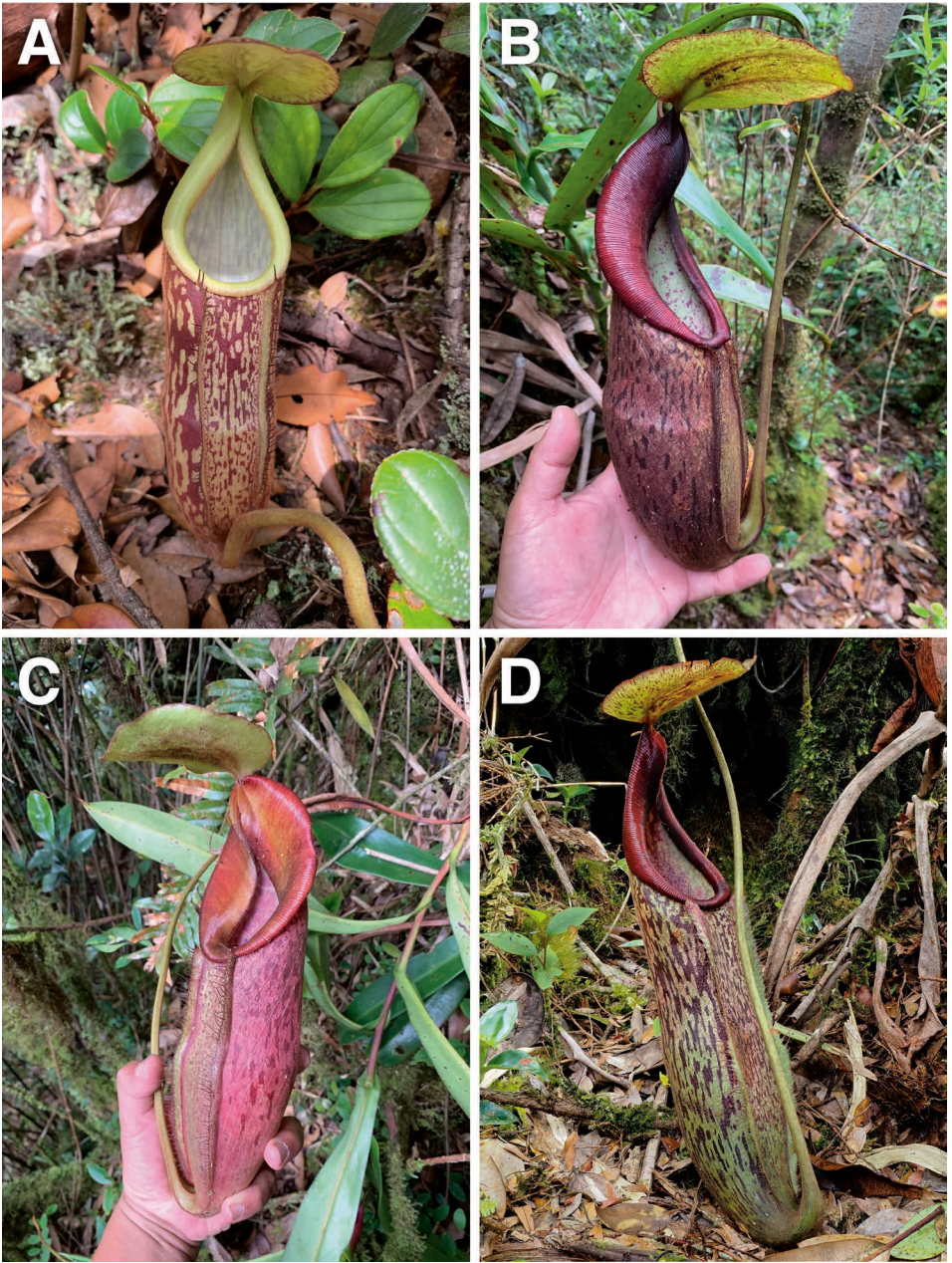


Figure 5: *Nepenthes limiana* (G. Basor). Variation in morphology and colouration of rosette and lower pitchers. Photographs by F.S. Mey (A–C) & A. Wistuba (D).

(KEP!) [pitcherless stem with infructescence (already dry when collected); originally identified as *N. gracillima*]; G. Chamah, Anak Camah, lower montane forest, slope exposed to sun, 5°12.12'N 101°33.87'E, 1713 m, 31 July 2010, *Imin FRI 71759* (L!) [rosette with pitchers and roots]; G. Chamah



Figure 6: *Nepenthes limiana*. Lower pitchers from Gunung Basor (A, C–D) and Gunung Chamah (B). Photographs by A. Wistuba (A), Mat Dee (B) & G. Lim (C–D).

summit area, lower montane forest, 5°13.65'N 101°34.53'E, 2171 m, 2 August 2010, *Imin FRI 71803* (KEP!, L! [2 sheets]) [stem with upper pitchers and infructescence, separate male inflorescence (KEP); stem with upper pitchers and infructescence (L sheet 1); stem with upper pitcher (L sheet 2)].



Figure 7: *Nepenthes limiana* (G. Basor). A particularly large intermediate pitcher measuring over 30 cm in length excluding the lid. Photographs by Rentas Buana.



Figure 8: *Nepenthes limiana* (G. Basor). Large intermediate pitchers alongside a white-flowered *Coelogyne* sp. orchid. Photograph by F.S. Mey.

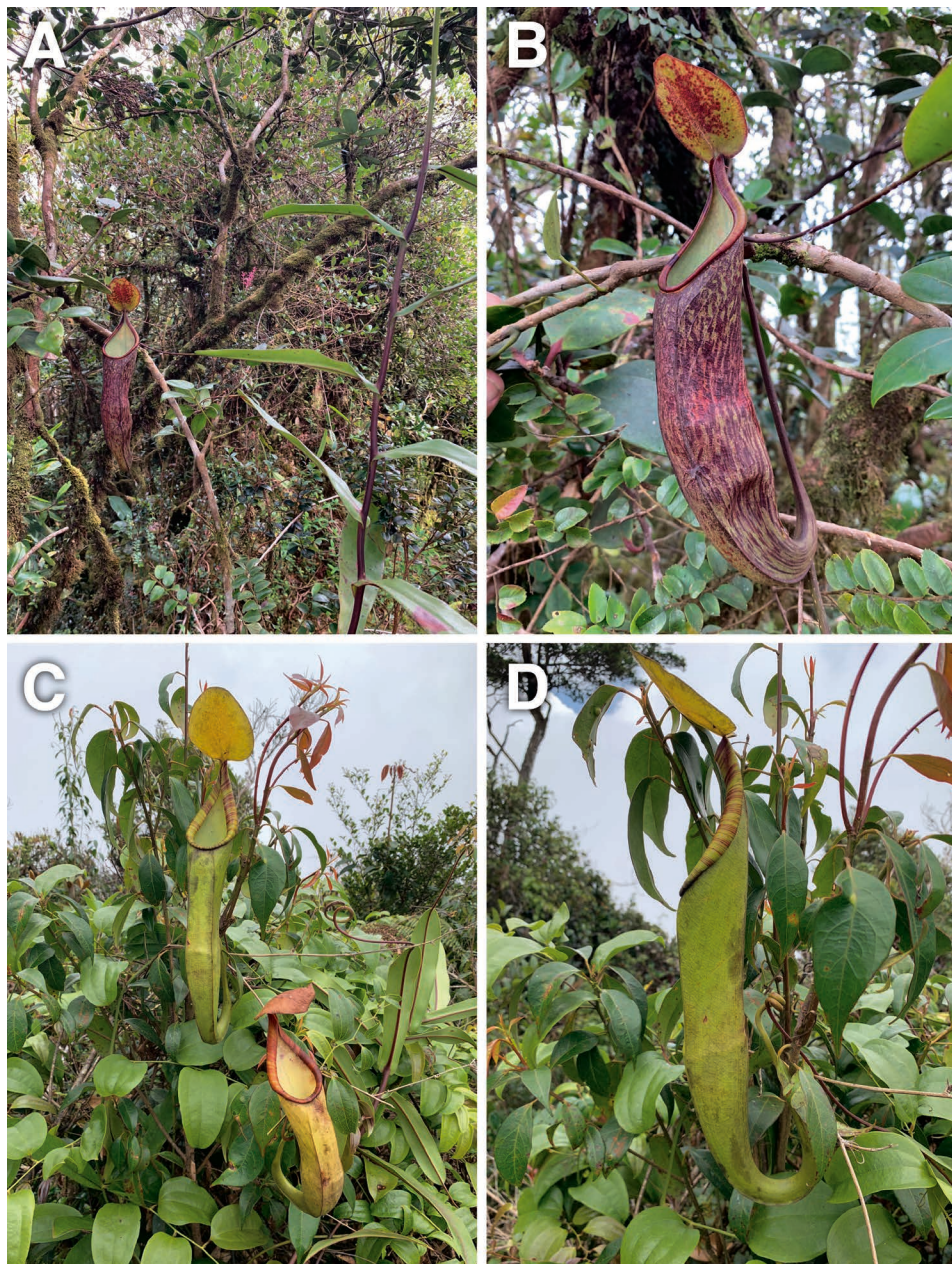


Figure 9: *Nepenthes limiana* (G. Basor). Upper pitchers from two different plants at the type locality, showing variation in trap colouration and form. Photographs by F.S. Mey.

Nepenthes sanguinea (selected specimens) — G. Ledang [per Jebb & Cheek 1997:79], no elevation data, no date [distributed to Kew in 1863–1864], *Griffith 4441* (**lectotype** K! [designated by Jebb & Cheek 1997:79], islecto- K! [2 sheets]) [stem with upper pitcher and female inflorescence,

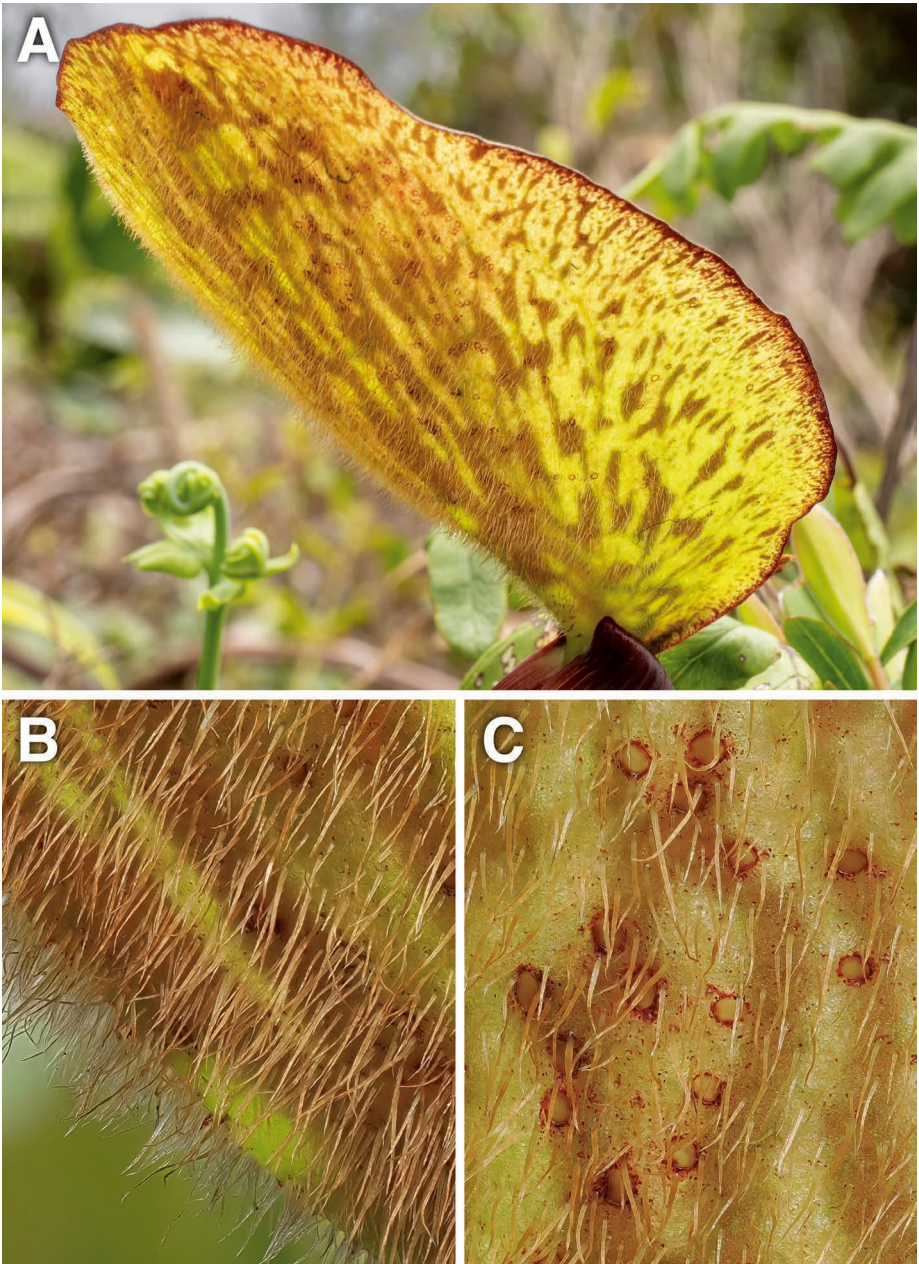


Figure 10: *Nepenthes limiana* (G. Basor). Lower surface of lid (A) and details of medial hairs (B) and nectar glands (C). Photographs by A. Wistuba.

pitcherless stem with infructescence, separate female inflorescence (lecto-); pitcherless stem, separate intermediate pitchers (isolecto- sheet 1); pitcherless stem with two male inflorescences, separate pitcherless stem with developing inflorescence (isolecto- sheet 2)]; Larut [district in Perak], ca.

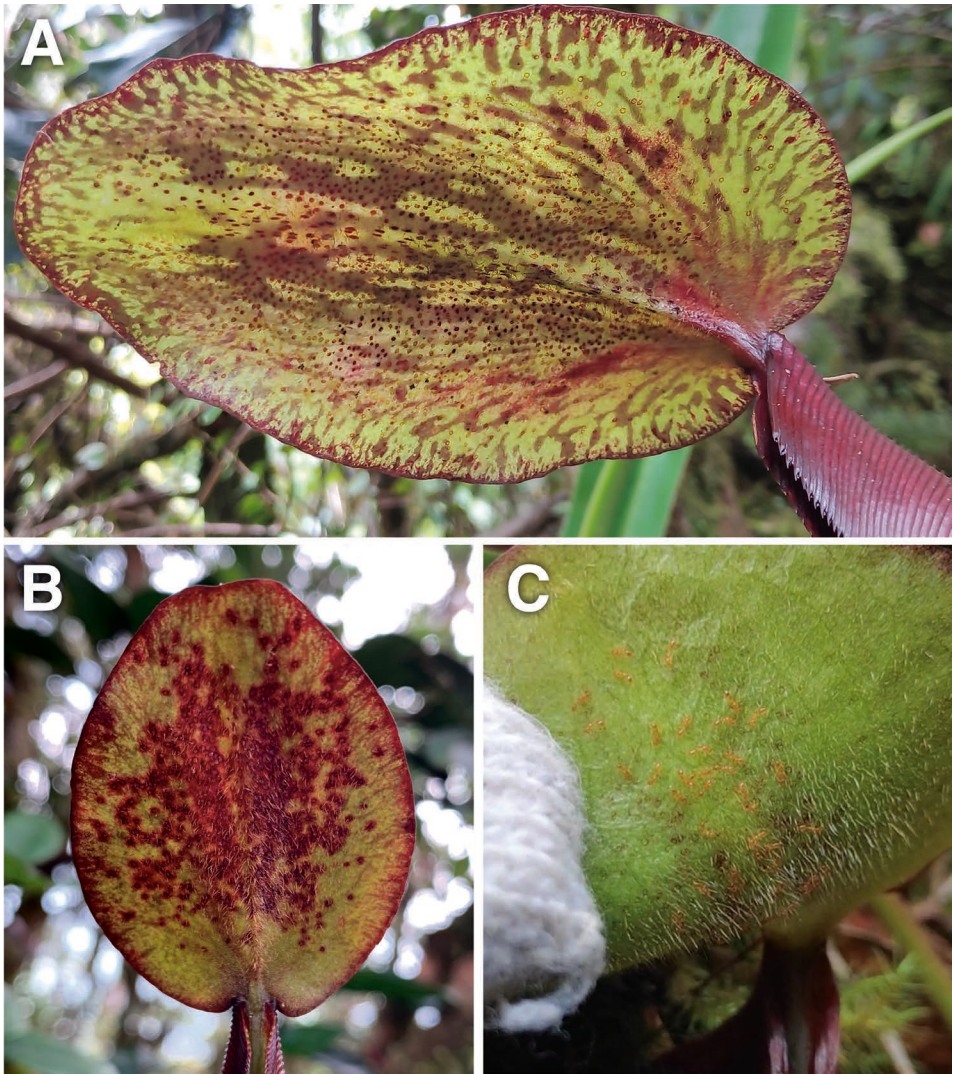


Figure 11: *Nepenthes limiana* (G. Basor). Details of lid: nectar gland distribution (A), abaxial lid surface of an upper pitcher showing presence of hairs (B), and minute golden ants congregating at the lower lid surface (C). Photographs by G. Lim (A, C) & F.S. Mey (B).

1400 m [“4600 ft”], September 1882, *Dr. King’s Collector 3316* (SING!) [stem with lower pitcher]; G. Hijau, *ca.* 1280 m [“4200 ft”], December 1887, *Curtis 1314* (SING!) [leaf with lower pitcher]; G. Hijau, *ca.* 1830 m [“6000 ft”; *sic!*], September 1889, *Curtis 2044* (SING! [2 sheets]) [leaf with lower pitcher (both sheets)]; G. Hijau, no elevation data, no date [likely *ca.* 1890], *Wray s.n.* (SING! [2 sheets]) [stem with infructescence, separate leaf with lower pitcher (sheet 1); stem with upper pitcher and infructescence (sheet 2)]; Bukit Etam, *ca.* 1370 m [“4500 ft”], January 1891, *Kelsall s.n.* (SING!) [stems with lower pitchers]; G. Hijau, no elevation data, March 1892, *Ridley s.n.* (SING!)

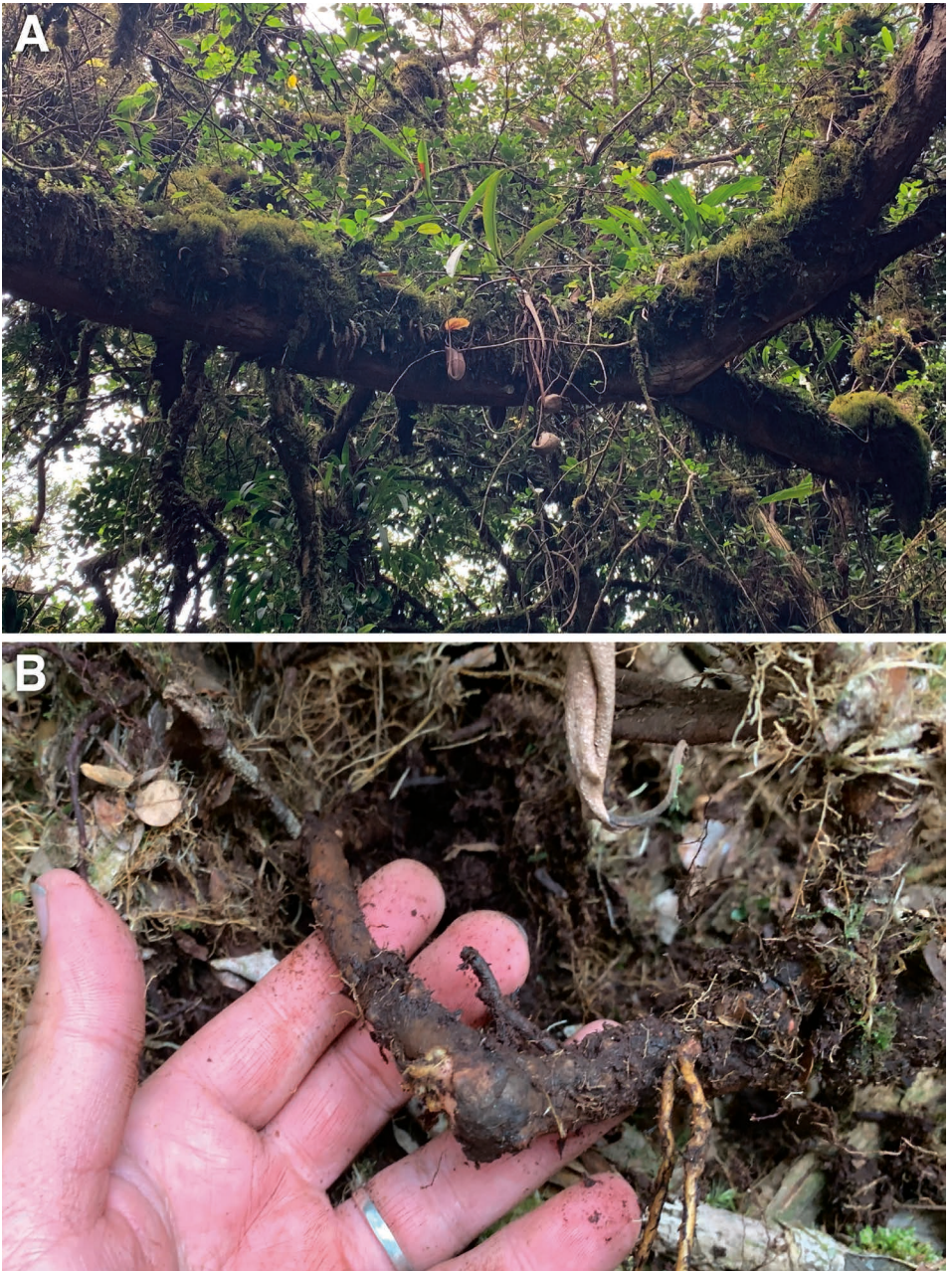


Figure 12: *Nepenthes limiana* (G. Basor). (A) Short-stemmed plant with lower pitchers growing epiphytically on the bough of a tree some 5 metres off the ground. (B) Thickened root system resembling that seen in the pyrophytic species of Indochina. Photographs by F.S. Mey.

[leaves with lower pitchers]; Bukit Hitam, no elevation data, May 1896, *Ridley s.n.* (SING!) [pitcherless stem with inflorescence, separate leaf with upper pitcher]; Bujong Malacca [=G. Bujang Melaka], ca. 1220 m ["4000 ft"], August 1898, *Curtis 3362* (SING! [2 sheets]) [stem with upper pitchers (sheet 1); leaf with upper pitcher, separate infructescence (sheet 2)]; Bujong Malacca [=G. Bujang Melaka], no elevation data, September 1898, *Ridley 9790* (SING!) [pitcherless stem with male inflorescence, separate leaves with upper pitchers]; Maxwell's Hill [=Bukit Larut], ca. 1340 m ["4400 ft"], October 1899, *Fox 182* (SING! [2 sheets]) [stem with upper pitcher (sheet 1); stem with upper pitcher and infructescence (sheet 2)]; Bukit Birch [=Birch Hill; subsidiary peak of Bukit Larut], ca. 1340 m ["4400 ft"], October 1899, *Fox 184* (SING! [2 sheets]) [stem with upper pitchers and infructescence (sheet 1); stem with upper pitchers (sheet 2)]; [G.] Kluang Terbang, no elevation data, 1900 [precise date not given], *Barnes 10912* (SING!) [stem with upper pitchers]; [G.] Kluang Terbang, no elevation data, 1900 [precise date not given], Barnes s.n. (SING!) [rosette with pitchers]; G. Hijau, no elevation data, 14 September 1911, *Anderson 62* (SING!) [separate leaves with lower pitchers]; Maxwell['s] Hill [=Bukit Larut], ca. 1040 m ["3400 ft"], 5 February 1917, *Yeob 1467* (KEP!) [stem with upper pitchers]; Bukit Fraser [=Fraser's Hill], no elevation data, July 1919, *Hose 65* (SING!) [stems with upper pitchers and female inflorescence]; Fraser['s] Hill, upon the Selangor border, ca. 1220–1332 m ["4000–4370 ft"], 16–30 September 1922, *Burkill & Holttum 8630* (SING! [2 sheets]) [stems with upper pitchers and male inflorescence (sheet 1); stems with upper pitcher and infructescence (sheet 2)]; upper Tras valley under Fraser['s] Hill, mined area, ca. 1070 m ["3500 ft"], 27 September 1922, *Burkill 7878* (SING!) [stem with lower pitcher, rosette with pitchers]; Fraser's Hill, ca. 1220 m ["4000 ft"], 28 August 1923, *Henderson 11217* (SING!) [rosette with pitchers]; G. Benom, no elevation data, 26 July 1925, *F.M.S. Mus. Coll. s.n.* (SING!) [pitcherless stem fragment, separate male inflorescence]; Cameron Highlands, Robinson Falls, ca. 1460 m ["4800 ft"], 18 November 1925, *Henderson 17752* (SING!) [stem with upper pitchers]; Cameron Highlands, below Foster's Hill, open swampy patch, ca. 1460 m ["4800 ft"], 19 November 1925, *Henderson 17841* (SING!) [stem with intermediate pitchers]; Fraser's Hill, Gap, no elevation data, 14 July 1929, *Symington 20175* (KEP!) [rosette with pitchers and roots]; Cameron Highlands, Taman Sedia, ca. 1460 m ["ca. 4800 ft"], 14 October 1929, *Symington 20966* (SING!) [stem with upper pitchers]; Cameron Highlands, swamp, ca. 1460 m ["ca. 4800 ft"], 31 March 1930, *Henderson s.n.* (L!) [stem with lower pitcher, stem with upper pitchers]; Cameron Highlands, swamp, ca. 1460 m ["ca. 4800 ft"], 1 April 1930, *Henderson 23282* (SING!) [stems with upper pitchers and infructescence, separate male inflorescence]; G. Benom, ca. 1680 m ["5500 ft"], 21 May 1930, *Strugnell 22311* (SING!) [leaf with giant upper pitcher]; Cameron Highlands, Taman Sedia, ca. 1430 m ["±4700 ft"], 11 September 1931, *Holttum 24987* (SING!) [stems with upper pitchers, infructescence, and male inflorescence]; Cameron Highlands, tree tops, no elevation data, 14 May 1936, *Holttum s.n.* (SING!) [stems with upper pitchers]; Fraser's Hill, Gap Road, roadside cutting, ca. 1160 m ["3800 ft"], 17 April 1955, *Purseglove P.4121* (L!, SING!) [rosette with pitchers, seedling with pitchers (L); rosette with pitchers, seedlings with pitchers, separate leaf with intermediate pitcher (SING)]; Cameron Highlands, Tanah Rata, near Rest House, scrub, ca. 1450 m ["4750 ft"], 29 August 1956, *Burkill HMB 731* (SING!) [stem with mass of lower pitchers and roots]; Cameron Highlands, Break Pressure Tank Hill, open roadside waste, ca. 1490 m ["4900 ft"], 31 August 1956, *Burkill HMB 762* (L!, SING!) & *763* (L!, SING!) [stem with lower pitchers (both 762 sheets); stem with upper pitchers and male inflorescence (both 763 sheets); 762 and 763 are from the same plant]; G. Bunga Buah, ca. 1280 m ["4200 ft"], 5 October 1958, *Wyatt-Smith KEP 77684* (KEP!) [mass of rosettes with lower pitchers]; Fraser['s] Hill, Richmond, hill slope, forest, ca. 1220 m ["4000 ft"], 25 September 1959, *Shah & Noor MS 655* (L!, SING!) [stem with upper pitcher (L); stem with upper pitchers and male

inflorescence (SING!); Bukit Tunggul, primary forest, hill side, *ca.* 1620 m [“5300 ft”], 15 May 1960, *Wyatt-Smith KEP 94569* (L!) [pitcherless stem]; Bukit Kamunting, hill top ridge, stunted scrub, *ca.* 1620 m [“5300 ft”], 9 October 1961, *Burkill HMB 2847* (L!, SING!) [stem with upper pitchers and infructescence (both sheets)]; Cameron Highlands, Break Pressure Tank Hill, exposed hilltop scrub, *ca.* 1520 m [“5000 ft”], 12 October 1961, *Burkill HMB 2886* (L!, SING!) & *2887* (SAN!, SING!) [stem with upper pitcher(s) (all sheets)]; Fraser[']s Hill, path to Pine Hill, ridge top, primary forest, *ca.* 1220 m [“4000 ft”], 4 June 1965, *Kochummen KEP 93132* (L!) [rosette with lower pitcher and roots]; Fraser[']s Hill, road side, secondary forest, no elevation data, 11 June 1965, *Kochummen KEP 93136* (L!) [stem with upper pitchers and female inflorescences]; path to Fraser's Hill, primary forest on hill side, *ca.* 910 m [“3000 ft”], 11 June 1965, *Kochummen KEP 93137* (L! [2 sheets]) [pitcherless stems with female inflorescence (sheet 1); stem with upper pitchers (sheet 2)]; above Speedy's House [=Speedy's Chalet; a bungalow now known as Rumah Rehat Gunung Hijau], Maxwell's Hill [=Bukit Larut], *ca.* 1070–1220 m [“3500–4000 ft”], 3 December 1965, *Shah & Sidek MS 1060* (L!, SING!) [rosette with pitcher(s) (both sheets)]; G. Hijau summit, *ca.* 1370 m [“4500 ft”], 4 December 1965, *Shah & Sidek MS 1101* (L!, SING!) [stem with upper pitcher (L); stem with upper pitchers and male inflorescence (SING)]; Fraser's Hill, no elevation data, 3 August 1966, *Keng & Keng s.n.* (SING!) [stem with lower pitcher]; G. Benom, lower summit, open *Leptospermum* forest, *ca.* 2055 m [“6740 ft”], 19 March 1967, *Whitmore FRI 3295* (SING!) [stem with upper pitcher and male inflorescence]; G. Benom, near Kampong Ulu Cheka, trail up broad NE ridge, lower montane rainforest, leaf litter and peat over coarse sandy yellow soil, suspended on supporting vegetation in a clearing near the ridge, *ca.* 1370 m [“*ca.* 4500 ft”], 19 April 1970, *Davidson 1435* (L!) [leaf with lower pitcher, separate infructescence]; Fraser's Hill, Methodist mission, jungle path, *ca.* 1220 m [“4000 ft”], 1 September 1972, *Shah MS 2811* (SING!) [stem with upper pitcher]; Fraser's Hill, *ca.* 1070 m [“3500 ft”], 1 July 1973, *Kusnan 1682* (L!) [small rosette with pitchers]; Fraser's Hill, Gap Road, 54th mile, valley, no elevation data, 18 August 1976, *Kochummen FRI 18395a* (KEP!) [stem with upper pitcher, stem with female inflorescence]; Fraser's Hill, along road, no elevation data, 11 November 1976, *Keng, Chow & Hons. Students 57* (SING!) [rosette with pitchers]; Fraser's Hill Resort, cut bank, 3°43'N 101°42'E, *ca.* 1250–1280 m [“4100–4200 ft”], 7–8 March 1987, *Worthington 12532* (L!) [stem with upper pitcher]; G. Bubu, scrambling on ground, 700 m, 20 April 1995, *Chua FRI 33009* (L!, SAN!, SING!) [stem with lower pitchers (L); stem with upper pitchers (SAN & SING)]; G. Bubu summit trail, 1600 m, 20 April 1995, *Chua FRI 40413* (SAN!) [stem with lower pitcher]; G. Hijau summit, [along] trail, primary lower montane forest, 4°51.33'N 100°48.55'E, 1448 m, 14 July 2006, *Kamarul Hisham FRI 52053* (SAN!, SING!) [stem with upper pitchers (SAN); stem with lower pitcher (SING)]; G. Hijau summit, primary lower montane forest, 4°51.40'N 100°48.40'E, 1448 m, 19 March 2007, *Julius FRI 53303* (L!) [stem with upper pitchers]; G. Benom, trail to peak, stream, primary montane forest, creeping on tree, 3°49.83'N 102°6.41'E, 2065 m, 13 November 2009, *Mohd Hairul FRI 69881* (SING!) [stem with lower pitcher]; Cameron Highlands, 2000 m, 26 April [year not given], *Asakura s.n.* (SING! [2 sheets]) [rosette with pitchers (sheet 1); stem with lower pitchers (sheet 2)].

Only type material is enumerated for the following species. For an exhaustive list of examined specimens refer to Lim *et al.* (2023).

Nepenthes alba — MALAYSIA. **Pahang:** G. Tahan, *ca.* 1520 m [“5000 ft”], 3 June 1905, *Wray & Robinson 5411* (**lectotype** SING! [designated by Jebb & Cheek 1997:44], isolecto- BO n.v.) [stem with upper pitchers and male inflorescence (SING)].

Nepenthes perbulu — MALAYSIA. **Perak:** Titiwangsa Range, above 1900 m (exact location withheld for conservation reasons), 23 August 2022, *Lim 4* (**holotype** KEP!, isotypes KEP! [7 sheets] &

KLU! [2 sheets]) [stem with three upper pitchers, female inflorescence, and infructescence (holo-); stem with two lower pitchers (iso- KEP sheet 1); stem with two upper pitchers (iso- KEP sheets 2 & 3); stem with two lower to intermediate pitchers (iso- KEP sheet 4); stem with intermediate pitcher (iso- KEP sheet 5); stem with two infructescences (iso- KEP sheet 6); stem with male inflorescence (iso- KEP sheet 7); stem with upper pitcher and infructescence (iso- KLU sheet 1); stem with two lower pitchers (iso- KLU sheet 2)].

Nepenthes gracillima — MALAYSIA. **Pahang:** G. Tahan, *ca.* 1010 m [“3300 ft”], 29 May 1905, *Wray & Robinson 5309* (**lectotype** SING! [designated by Jebb & Cheek 1997:43], isolecto- BO n.v.) [stem with upper pitchers].

Nepenthes macfarlanei — MALAYSIA. **Perak:** G. Bubu, *ca.* 1460–1620 m [“4800–5300 ft”], March 1885, *Dr. King’s Collector 7421* (**lectotype** K! [designated by Jebb & Cheek 1997:57], isolecto- K! [3 sheets]) [separate lower, intermediate, and upper pitchers (lecto-); stem with upper pitcher and male inflorescences (isolecto- sheet 1); stem with upper pitchers (isolecto- sheet 2); separate lower and intermediate pitchers (isolecto- sheet 3)].

Nepenthes sericea — MALAYSIA. **Kelantan:** G. Warpu, 1745 m, 19 August 2022, *Lim 3* (**holotype** KEP!, isotypes KEP! [3 sheets]) [stem with upper pitchers and male inflorescences (holo-); stem with lower pitcher (iso- sheet 1); stem with upper pitchers and infructescences (iso- sheet 2); stem with upper pitchers (iso- sheet 3)].

Nepenthes ulukaliana — MALAYSIA. **Pahang:** G. Ulu Kali, 3°26.21’N 101°47.11’E, 1707 m, 16 February 2007, *Julius FRI 54894* (**holotype** KEP!) [stem with upper pitchers and male inflorescences].

Key to the species of the *Nepenthes macfarlanei* group (adapted from Lim *et al.* 2023)

- 1a. Pitchers with thickened lid hairs ≥ 5 mm long2
- 1b. Pitchers with filamentous lid hairs ≤ 3 mm long3
- 2a. Upper pitchers wholly infundibular, typically white, base green—Bintang Range
.....*N. macfarlanei*
- 2b. Upper pitchers broadly cylindrical, white with dark speckling, base green—Titiwangsa Range
.....*N. berbulu*
- 3a. Lower pitchers wholly ovoid, amphora-shaped—Titiwangsa Range*N. ulukaliana*
- 3b. Lower pitchers infundibular to ovoid in the lower part, cylindrical or slightly infundibular above the hip.....4
- 4a. Upper pitchers of $\pm$ uniform size and form with respect to individual plants 5
- 4b. Upper pitchers of two distinct forms, being up to 26 cm tall on shorter climbing stems, but reduced to ≤ 10 cm tall on established climbing stems, distinctly slender, very narrowly infundibular below hip, cylindrical above, predominantly mottled with black or red speckling, hip at or more typically below the midsection; pitcher lids ovate, not strongly cordate at the base; spur up to 12 mm long on mature plants; peristome teeth distinct, 0.5–5.0 mm—Timur Range *N. gracillima*
- 5a. Upper pitchers small, < 13 cm tall, usually conspicuously white and often with red speckling, hip at or above the midsection; pitcher lids circular, strongly cordate at the base; spur < 5 mm long on mature plants; peristome teeth indistinct or very short, < 0.2 mm—Timur Range*N. alba*
- 5b. Upper pitchers large, often > 20 cm tall, broadly infundibular or cylindrical—Titiwangsa Range6
- 6a. Leaves sessile with lamina oblanceolate to obovate-oblong, upper pitchers large broadly infundibular or broadly cylindrical, white, base green, hip at midsection to immediately below the peristome—Titiwangsa Range *N. sericea*

6b. Leaves slightly decurrent with lamina narrowly oblanceolate to narrowly oblong, upper pitchers narrowly cylindrical with infundibular base, yellow or brown, hip below the midsection, roots thickened, tuber-like—Titawangsa Range..... *N. limiana*

Discussion

Nepenthes liminana bears a close resemblance to *N. sanguinea*, though it can be reliably distinguished from that species by the conspicuous hairs on the lower lid surface. The observation of enlarged, fleshy roots reminiscent of those found in the pyrophytic *Nepenthes* of Indochina and northernmost Malaysia (Fig. 12B) is the first such record in a *N. macfarlanei* complex species and may reflect the seasonality of rainfall within this region, which experiences a pronounced dry spell between February and April (CCKP 2023) that may result in drought stress, particularly in exposed summit locations that are more prone to desiccation than closed canopy forest. Further characters shared with the Indochinese *Nepenthes* include the long, narrow laminae and slightly decurrent leaf bases, however, further investigation is required to determine whether these common features are the product of physiological convergence induced by seasonal drought stress or homologous structures reflecting a close phylogenetic relationship with the pyrophytic species to the north.

Nepenthes limiana produces notably large foliage. Individuals growing at the type locality are likely to include some of the largest plants of the *N. macfarlanei* complex, with rosette diameters approaching 1 m and each lamina measuring almost 50 cm in length. The pitchers also appear to be the largest in this species group, occasionally exceeding 30 cm (Fig. 7).

That this impressive species has remained unrecognised until now can be explained both by its somewhat intermediate appearance (showing particularly close affinities to *Nepenthes gracillima*, *N. sanguinea*, and *N. sericea*, the latter itself unrecognised until very recently) and the fact that it occurs in a region of the northern Titawangsa Range that is comparatively poorly botanised. Most of the existing herbarium material originates from the Gunung Stong complex, but even this mountainous region was very incompletely known until recently. This poor state of knowledge is reflected in the following quote from WWF-Malaysia (1998): “Information about the flora and fauna of Gunung Stong is scarce. There are two small, pretty endemic herbs found only on this mountain, and sphagnum moss, sedges, pitcher plants and conifers grow near the peaks.” Stong Waterfall, described by the same source as “possibly the highest and certainly the most spectacular in Peninsular Malaysia”, was “unheard of” until the end of the 20th century, when the opening of the road between Jeli and Dabong made it accessible for the first time (WWF-Malaysia 1998). Continued exploration of the northern Titawangsa Range will likely reveal further localities of *N. limiana* and perhaps other *Nepenthes* species.

Acknowledgements: We express our gratitude to the Director-General of the Forest Department of Peninsular Malaysia, Dato’ Indera Mohd Ridza Bin Awang, who allowed our studies to be carried out (permit ref. JH/100 Jld. 33(35)); the Deputy Director (Development) of the Kelantan Forestry Department, En. Haji Abdul Wahab Bin Deraman for permission to conduct research at the *Nepenthes limiana* type locality (permit ref. PHN.KN.130/1/9.J9 (27)); and the officers at the Forest Department of Peninsular Malaysia, Forest Planning & Economics Division, including Mohd Hafiz Bin Mohd Noor, Najihah binti Aderis and their team, who assisted us throughout the permit application process.

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We thank Mohammad Mustaqim Bin Ahmad Nordin (Taqim) of Rentas Buana Adventures for photographs of the largest *Nepenthes limiana* pitcher recorded at the type locality; WWF-Malaysia and Shariff Mohamad for providing photographs of *N. limiana* in the Belum-Temengor forest complex; Mat Dee for permission to use his photograph of *N. limiana* from Gunung Chamah; once again our co-author on the *N. berbulu* paper, Tan Hong Liang, and Tan Ji of Universiti Tunku Abdul Rahman (UTAR), for their contribution towards furthering our understanding of the *N. macfarlanei* complex through that species; Robert Ziemer and the International Carnivorous Plant Society (ICPS) for overseeing the publication of *N. berbulu* in the March 2023 issue of the Carnivorous Plant Newsletter; and Charles Clarke for fruitful discussions with author F. Mey relating to the taxonomy of Peninsular Malaysian *Nepenthes*.

We thank Taqim of Rentas Buana Adventures again for his professionalism in arranging comfortable accommodations and logistics throughout the early planning stages of our expedition, our kind hostess at Dalila Homestay who provided to our every need despite our late night arrival at Jelawang; inkeepers of Stong Heritage Eco Resort for providing a wonderful place to perform our botanical works upon return, our dedicated crew of porters and chefs during our three-day trek to Gunung Basor; Basri, Jaki, Amran, Jamri, Nazril, and team, whose combined survival skills and mountaineering knowledge contributed richly to the success of our expedition; and special mention to Ayie and Amorei, who bravely stayed behind in a thunderstorm to assist G. Lim after he was struck by lightning.

Final thanks go to Malaysia Carnivorous Plants for initiating this venture of expeditions to expand our understanding of the carnivorous plants of Peninsular Malaysia.

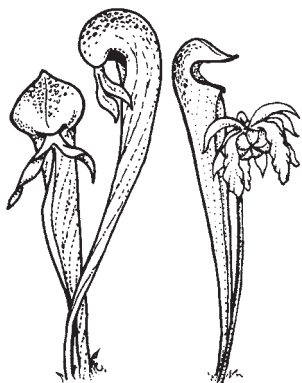
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Front Cover: Rosette plant of *Nepenthes limiana* growing near the summit of Gunung Basor in the northern Titiwangsa Range of Peninsular Malaysia, August 2022. Photo by F.S. Mey. Article on page 128.

Back Cover: Yellowish-green upper pitcher of *Nepenthes limiana* on Gunung Basor. Photo by F.S. Mey. Article on page 128.

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International Carnivorous Plant Society, Inc.
2121 N. California Blvd., Suite 290
Walnut Creek, CA 94596-7351, USA
icps@carnivorousplants.org

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Bob Ziemer, bob@carnivorousplants.org

Cindy Slezak, cindy@carnivorousplants.org
John Brittnacher, john@carnivorousplants.org
Mark Anderson, mark@carnivorousplants.org
Marcel van den Broek, marcel@carnivorousplants.org

Science Editor Andreas Fleischmann
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