

Nepenthes group *Montanae* (Nepenthaceae) in Indo-China, with *N. thai* and *N. bokor* described as new

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Summary. A key is presented to the *Nepenthes* group *Montanae* in Peninsular Malaysia, Thailand and Cambodia. *Nepenthes bokor* Cheek is described from Cambodia and *Nepenthes thai* Cheek from peninsular Thailand. The affinities of both taxa are discussed and their conservation status assessed.

Key Words. Cambodia, Nepenthaceae, *Nepenthes*, new species, taxonomy, Thailand.

Introduction

The most recent infrageneric classification of *Nepenthes* is that proposed by Danser (1928) who distinguished six main informal species groups. Danser's characterisation of his *Montanae* group can be summarised as follows (Cheek & Jebb 2001):

“Ten ill-defined species drying black, fine stems showing $\frac{2}{5}$ phyllotaxy when climbing; sessile, but subpetiolate leaves; pitcher lids lacking appendages; inflorescence ‘racemose’ and indumentum fine and sparing. Peninsular Malaysia, Sumatra and Java.”

This description is still holds today, although with better specimen drying techniques, specimens no longer necessarily dry black, and species numbers have risen to c. 25 (Cheek & Jebb 2001; Clarke 2001). Most species of the genus in Java, Sumatra and Peninsular Malaysia belong to this group which presumably take their name from their exclusively mountainous habitat.

Hitherto *Montanae* have been represented north of Malaysia, that is, in Indo-China, by a single peninsular Malaysian species that extends to one location in Thailand: *N. sanguinea* Lindl. (Jebb & Cheek 1997; Cheek & Jebb 2001). In the course of identifying Indochinese material of *Nepenthes* in preparation for the *Flora of Thailand* and for a monograph of the genus, two additional species of *Montanae* came to light which are new to science. These can be identified

using the key below and are subsequently described as *N. bokor* and *N. thai*. The descriptions and terminology follow the usual format for *Nepenthes* as established by Danser (1928) and followed and developed by subsequent authors, e.g. Jebb & Cheek 1997; Cheek & Jebb 2001. All specimens cited have been seen unless otherwise indicated. All specimens of the genus present at BK, BKF, BM, K, P and PSU have been studied in connection with this paper.

It is conceivable that these new *Montanae* species, occurring as they do in Indo-China, may be confused with a group of pyrophytic species, e.g. *N. smilesii* Hemsl., also restricted to this area. These pyrophytic species are closely allied to the *Montanae*, sharing most of the characters given above by Danser (1928). They are found in seasonally dry savanna or semi-deciduous woodland habitats which are prone to dry-season fire. The species are characterised by underground tubers which give rise to successive shoots, the upper pitchers, if developed, usually lack coiling tendrils, and the peduncle usually greatly exceeds the length of the stem. The pyrophytic species, the subject of a separate paper (in prep.), are clearly capable of surviving frequent low-intensity fires, and frequently flower in the absence of upper pitchers. Species of the *Montanae* group and other *Nepenthes* species are found only in evergreen forest or other perennially humid habitats, lack underground tubers, bear upper pitchers in which the tendril is coiled, and usually commence flowering only after upper pitchers have been produced.

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Key to *Nepenthes* group *Montanae* in Peninsular Malaysia, Thailand and Cambodia

The key below is developed from that published in Cheek & Jebb (2001).

- 1a. Leaf base decurrent, running longitudinally down the stem as wings; stem always terete in transverse section 2
 1b. Leaf base amplexicaul, clasping the stem transversely; stem often angular in transverse section, rarely terete 4
 2a. Pitchers (16.5 –) 21 – 30 cm long; lip of peristome abruptly raised at front of mouth to form a triangular point; inflorescence with bracts at base of partial-peduncles. Cambodia **N. bokor**
 2b. Pitchers (7.5 –) 10 – 15 cm long; ventral lip of peristome level, not raised; inflorescence lacking bracts at base of partial-peduncles. Peninsular Thailand and Malaysia 3
 3a. Stem sparsely hairy; leaf-blade apices non-peltate, longitudinal nerves 3 – 5 per side; partial-peduncles 9 – 10 mm long; androphore 4 mm long. NE Peninsular Malaysia **N. benstonei**
 3b. Stem glabrous; leaf-blade apices usually peltate, longitudinal nerves 5 – 7 per side; partial-peduncles 2 – 5 mm long; androphore 2 mm long. SE peninsular Thailand **N. thai**
 4a. Lid orbicular, cordate at base; peristome narrow, rounded, stem rounded 5
 4b. Lid ovate, truncate at base; peristome broader, irregular, stem angular 6
 5a. Pitcher spur branched; lid glands numerous, small (0.2 – 0.3 mm) **N. ramispina**
 5b. Pitcher spur simple, lid glands few, large (0.4 – 0.5 mm) **N. gracillima**
 6a. Stem sharply 3-angled; peristome teeth inconspicuous; lower lid without hairs **N. sanguinea**
 6b. Stem rounded-angular; peristome teeth large near lid; lower lid with bristle-like hairs **N. macfarlanei**

Nepenthes bokor Cheek sp. nov. a *N. smilei* Hemsl. pedunculis partialibus 2-floris (non unifloris), foliorum superiorum cirrhis spiraliter tortis (nec flexuosis tantum) differt. Typus: Cambodia, Kampot, Mt Bokor, c. 1000 m, ♂ fl. upper pitchers, 20 Feb. 1960, *Smitinand* 6496 (holotypus BKF; isotypi BKF & K).

Climbing shrub 1.5 – 3 m high. Rosette and short stems unknown. *Climbing stems* terete, subglossy, 6 – 8 mm diam., internodes 1.5 – 6 cm long, axillary buds absent. Leaves pseudo-petiolate, coriaceous, lanceolate to narrowly oblong and subspatulate, 21 – 32 (– 37) × 3 – 5 (– 9) cm, blade apex broadly acute, not peltate, ± symmetrical, pseudopetiole 3.5 – 4 × 1.2 (– 1.7) cm, dilating at the node, decurrent down the stem for 9 – 17 (– 22) mm, clasping the stem for $\frac{3}{4}$ – $\frac{5}{6}$ of its circumference, projecting from the stem as wings c. 5 mm wide. Longitudinal nerves 3 – 4 (– 5) on each side of the midrib in the outer $\frac{1}{3}$, inconspicuous. Pennate nerves inconspicuous. *Lower pitchers* ovoid, c. 9 × 6 cm, with two fringed wings c. 11 mm wide extending the length of the pitcher, fringed elements 2 – 6 mm long, 6 – 8 per cm; mouth slightly concave in profile, rising steeply c. 5 cm from front to rear, column not distinct; peristome subcylindric, not flattened, 3 – 4 mm wide, expanding to 6 mm wide towards the lid, with outer edge entire, ridges 0.25 mm apart, c. 0.1 mm high, the inner edge with teeth 0.5 mm long; lid elliptic, c. 4.2 × 3 cm, apex rounded-truncate, base rounded, lower surface lacking distinct appendages or ridge when dried, nectar glands thin-walled, longitudinally elliptic along the midrib, c. 0.6 × 0.25 mm, otherwise scattered over the lower surface of the lid, directed towards base and midrib of lid,

circular, volcano-like, c. 0.25 mm diam., decreasing in size at the margin, absent from outer 5 mm; spur filiform, c. 6 mm. *Intermediate pitchers* not seen. *Upper pitchers* with tendrils coiled, pitchers narrowly infundibuliform to cylindrical (16.5 –) 21 – 30 cm tall, ‘hip’ c. $\frac{1}{3}$ the length from the base, 3.3 – 5 cm wide; waist, above the hip, slightly constricted, (1.8 –) c. 2.8 cm wide, dilating gradually towards the mouth, where (3.5 –) 4 – 5.7 cm wide, wings absent; mouth slightly concave in profile, occupying the upper (3.5 –) 4.5 – 7.6 cm of the pitcher, ovate-cordate; peristome flattened, 4 – 9 mm wide, ± even in width, column not well-defined; often raised at front into an acute, triangular lobe 4 – 10 mm high; ridges distinctly pronounced, 0.3 – 0.5 (– 1) mm apart, c. 0.1 – 0.2 mm high, the inner edge with teeth just visible near the column; teeth 0.1 mm long; lid suborbicular, wider than long, 4 – 6.5 (7.8) × 4.2 – 6.5 (– 7) cm; apex retuse, the notch 0 – 4 mm deep, with sides shallowly convex, rarely apex rounded; base shallowly cordate; lower surface lacking keel or appendages when dried; nectar glands angled towards the base and centre of the lid, scattered densely (c. 400 – 500 per cm²), circular, volcano-like, crater walls with radiating striations, glossy, 0.12 – 0.25 mm diam. midrib area with 10 – 20 sparse longitudinally elliptic glands c. 0.5 mm long absent from marginal 1 – 2 mm; spur inserted c. 4 mm from the lid, c. 7 mm long, unbranched, apex rounded. *Male inflorescences* c. 60 cm long; peduncle c. 42 cm long, c. 4 mm diam. at base, partial-peduncles c. 60, 2-flowered (the distal quarter of rhachis 1-flowered), c. 2.5 mm long; bracts inserted 0.5 – 1.5 mm from the base of the partial-peduncle, filiform, 0.5 – 1.5 mm long; pedicels (4 –)

5 – 6.5 mm long; tepals elliptic 3.25 – 4.5 mm; androphore 2 – 3 mm long; anther head 0.6 – 1 × 1 – 1.25 mm long, anthers c. 5. *Female inflorescences* 18 – 26 cm long; peduncle 9 – 10 cm long, partial-peduncles 20 – 30, 1-flowered; bracts inserted 3 mm from the base of the pedicel, filiform, 0.7 mm long; pedicel 9 – 12 mm long; tepals 4 – 5 × 2 mm; stipe 1.5 – 2 mm long; ovary obclavate, 8 – 12 mm long. *Infructescence* similar to female inflorescence, tepals persistent. Fruit valves 4, c. 18 mm long. Seeds not seen. *Indumentum* of stems, leaves and outer pitchers moderately dense, 0.25 – 0.5 mm long, patent, predominantly simple but often with a short branch, slightly crinkled, 7 – 8 hairs per mm²; stem hairs pale brown, soon lost by abrasion, but persisting in leaf axils; leaves completely concealed by dense red hairs when in bud, persisting in mature leaves, where not abraded, upper surface of leaves with grey-brown, shorter (0.1 – 0.25 mm) hairs, lower surface with brown hairs, pitchers' hairs shorter, 0.1 – 0.2 mm long, red brown; leaves with sessile red glands 8 – 10 per mm². Pitcher lid upper surface, lower margin 1 – 10 mm wide, and outer pitcher (adjacent to peristome) with 5 – 8-armed red, erect dendroid hairs, c. 0.25 mm long; spur densely brown puberulent. Inflorescence with appressed grey or red-brown simple hairs c. 0.25 mm long, sparser on peduncle, absent from adaxial tepal surface; androphore shortly puberulent to subglabrous. *Colour* of live pitchers green, purple-mottled, peristome reddish, purple-banded; inner pitcher greyish-reddish purple blotched; lid reddish purple on lower surface (*Smitinand* 6496). Dry specimens with subglossy, dark brown stems, leaves grey-green, pitchers red-brown, peristome glossy brown, inner pitcher mottled purple, lower lid glossy chestnut brown, flower colour not recorded. Fig. 1.

DISTRIBUTION. Cambodia, Kampot Province, Chaîne des Elephants.

CAMBODIA. Kampot Province: Popokwil, hautes sommets, c. 960 m alt., 14 Jan. 1904, upper pitchers, *Geoffray* 324 (P); *ibid.* lower pitchers 325 (P); *ibid.* upper pitcher, 326 (P); *ibid.* lower pitcher, 327 (P); *ibid.*, upper pitchers 328 (P); *ibid.*, lower pitchers, *Geoffray* 329 (P); Kamchay & Mt de l'Elephant, upper pitcher, ♂ fl., 15 – 17 Dec. 1917, *Chevalier* 36411 (P, 2 sheets); *ibid.* lower pitchers only, 36429 (P); Mt de l'Elephant, lower pitchers, 5 Aug. 1919, *Poilane* 206 (P, 2 sheets); Nord Kampot, upper pitchers, 6 Feb 1928, *Poilane* 14728 (P, 2 sheets); Mt Bokor c. 1000 m, ♂ fl., upper pitchers, 20 Feb. 1960, *Smitinand* 6496 (BKF holotype & isotype, K isotype) Kampot, 5 miles W near turn off for Bokor from route 3, lower pitcher, 19 Feb. 1960, *L. B. Abbe et al.* 9617 (BKF); Bokor, 1.5 miles N, c. 1000 m alt., ♂ fl., 20 Feb. 1960, *E. C. Abbe et al.* 9653 (BKF); Bokor, 1000 m alt., ♀ fl., fr. 18 March 1924, *Eryl Smith* s.n. (K); Bokor, upper pitchers, 20 Dec. 1965, *Vidal* 4780 (P).

HABITAT. Edge of submontane evergreen forest; c. 1000 m.

CONSERVATION STATUS. *Nepenthes bokor* is currently known from 14 specimens collected on eight occasions at four sites on the summits of the Monts des Elephants chain (also known as Chour Phnum Damnrei) that extends N for c. 120 km from the S China Sea coast of Cambodia, in the province of Kampot: Bokor, Popokwil, Kamchay and Mt de l'Elephant. It has been recorded as 'common' (*Smitinand* 6496), 'locally abundant' (*E. C. Abbe et al.* 9653) and 'very common' (*Eryl Smith* s.n.) at Bokor. Nevertheless its forest habitat is unprotected and threatened by degradation (*David Middleton* pers. comm. to M. Cheek 2000). Accordingly it is here assessed using IUCN (2001) as Endangered (EN B2ab (iii)).

ETYMOLOGY. Named (noun in apposition) for the type locality.

NOTES. *Nepenthes bokor* is remarkable for being the most isolated and the most northerly of the *Montanae* group and the only species of the group currently known from Cambodia. It lies c. 570 km NE of the nearest other species of *Montanae*, *N. thai*, separated by the Gulf of Thailand. The upper pitchers of *N. bokor* can exceed in length those of all other species of the group, including those of *N. spectabilis* Danser and *N. sanguinea* Lindl. These pitchers are unique in the *Montanae* group in showing an abruptly raised peristome lip, seen elsewhere in the genus in e.g. *N. sumatrana* Beck and *N. rafflesiana* Jack.

The morphological affinities of *Nepenthes bokor* are not obvious within the *Montanae*. The abruptly decurrent leaf-blades suggest possible affinity with *N. benstonei* C. Clarke and *N. thai*, which differ however from *N. bokor* in many other characters (see key above). While *N. bokor* is a forest species and shows no sign of any pyrophytic adaptations (referred to in the introduction, above), it does have two characters seen in the pyrophytic species such as *N. smilesii*. These are a) the abruptly raised peristome at the front of the mouth (see Fig. 1C) and b) some unusual features of the lid nectar glands, which are volcano-like, directed towards the base of the lid, and have striated sides. These facts suggest that, if the pyrophytic group originated from within the *Montanae*, it was perhaps from an ancestor of *N. bokor*.

***Nepenthes thai* Cheek sp. nov.** a *N. benstonei* C. Clarke pedunculo partiali 2 – 4 (– 5.5) mm (non 9 mm) longo, androphoro 2 mm (non 4 mm) longo, cauli glabro (non indumento sparso ornato) differt. Typus: Thailand, Narathiwat, Sukhirin, Khao Nakharach, c. 600 m alt., fl. 8 Aug. 1996, *Puudjaa* 260 (holotypus [annotated "holotype"] BKF; isotypus BKF, photos K).

Terrestrial climber 3 – 5 m tall. Rosette stems unknown. *Short stems* terete, matt, 5 – 7 mm diam.,

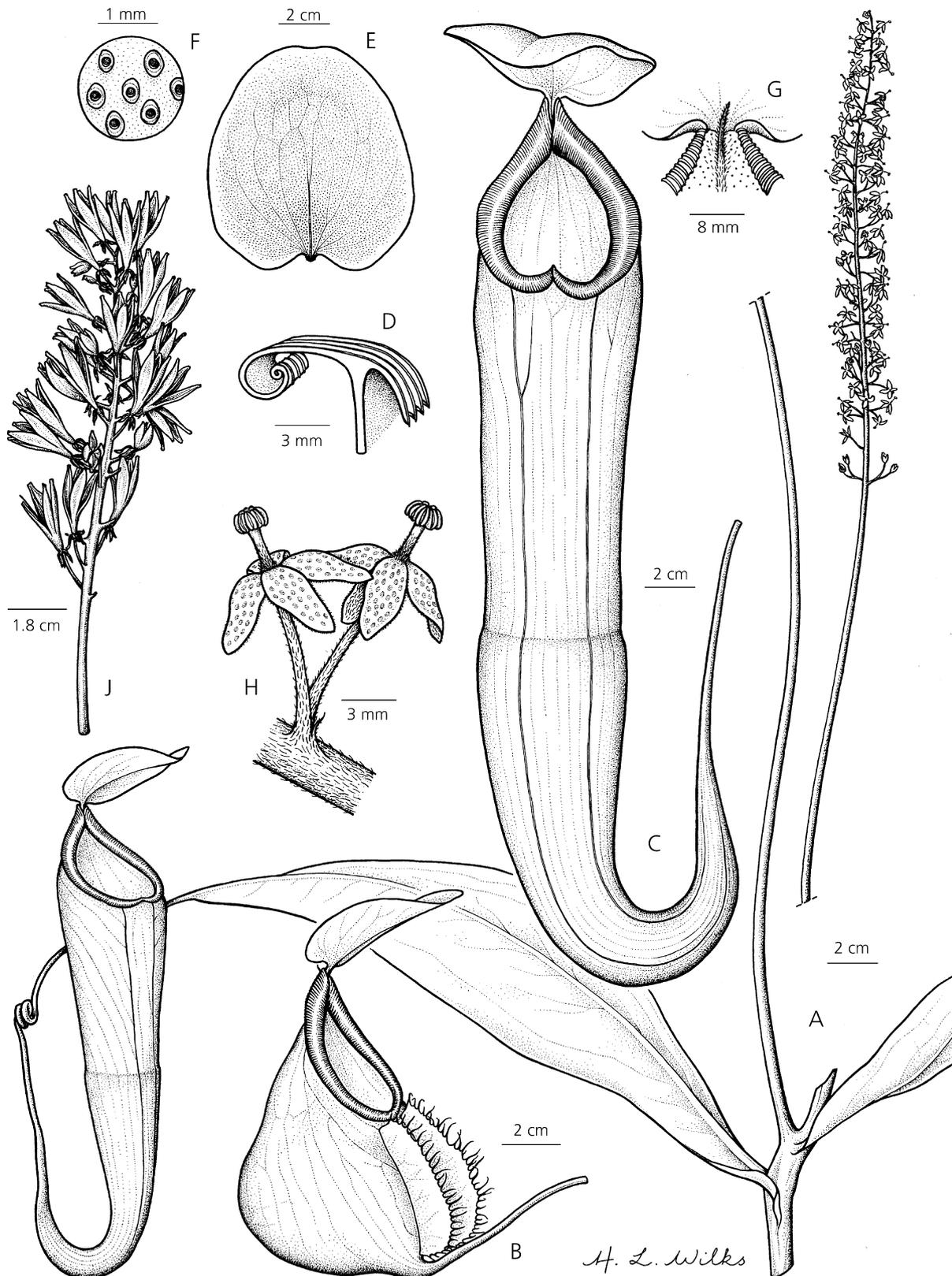


Fig. 1. *Nepenthes bokor*. A habit, with upper pitcher and male inflorescence; B lower pitcher; C upper pitcher, frontal view; D peristome of upper pitcher, transverse section; E lid of upper pitcher, lower surface; F nectar glands on lower lid surface; G spur of upper pitcher; H flowers; J inflorescence. A, C, E, F & H from *Smitinand* 6496; B & G, from *Abbe et al.* 9617; D & J, from *Smith* 18/03/1924. DRAWN BY HAZEL WILKS.

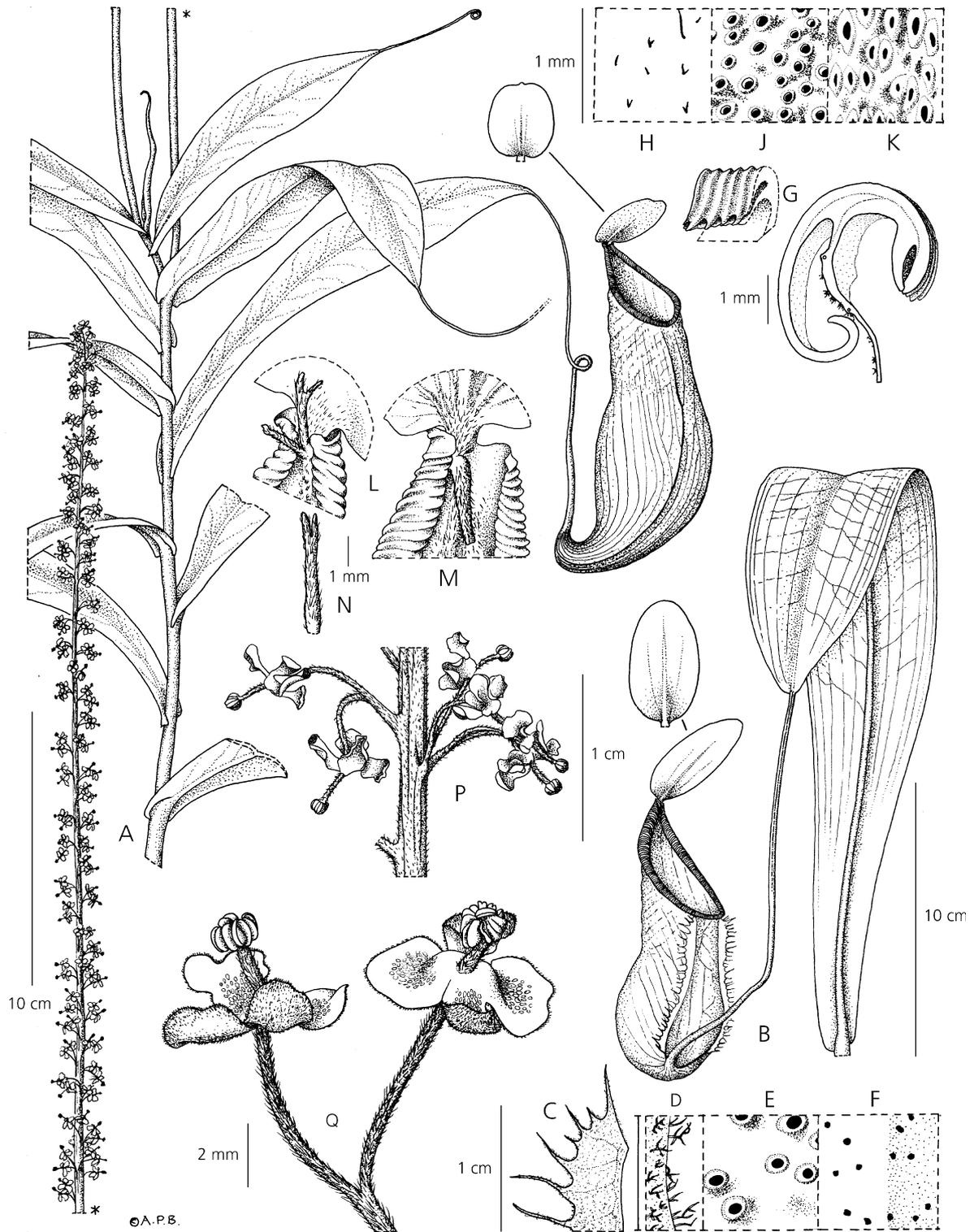


Fig. 2. *Nepenthes thai*. A habit, climbing stem with male inflorescence and upper pitcher; B lower pitcher and leaf-blade showing peltate apex; C part of fringed wing from lower pitcher; D detail of branched hairs on fringed wing; E lid nectar glands of lower pitcher; F sessile glands on lower lid of lower pitcher; G peristome in transverse section (right) and viewed from inside upper pitcher, with inconspicuous teeth; H detail of hairs on outer surface of pitcher; J detail of lid nectar glands from the upper pitcher; K detail of nectar glands from the midrib, upper pitcher; L basally branched spur, upper pitcher; M entire spur, upper pitcher; N distally forked spur, upper pitcher; P part of male inflorescence; Q 2-flowered partial-peduncle showing male flowers. A, H – K, P & Q from *Puudja* 260; B – F from *Puudja* 259; G & L from *Niyomdham & Puudja* 5554; M from *Niyomdham & Puudja* 4713; N from *Niyomdham* 4843. DRAWN BY ANDREW BROWN.

internodes 0.5 – 1.5 cm long, axillary buds absent. Leaves not petiolate, coriaceous, narrowly oblanceolate or narrowly oblong and subspatulate, pseudopetiolate, dilating at the node, 11.5 – 29 × 2.7 – 6 cm, the pseudopetiole, if present, 1.2 – 7 × c. 1.2 cm, blade apex broadly acute, peltate, the tendril departing 0.5 – 1 mm from the apex, base decurrent down the stem for 3 – 12 mm at an angle of c. 45° to the main axis, clasping the stem for $\frac{3}{4}$ – $\frac{5}{6}$ of its circumference, projecting from the stem as wings 3 – 7 mm wide. Longitudinal nerves 5 – 7 cm each side of the midrib in the outer $\frac{2}{3}$, conspicuous. Pennate nerves arising at c. 45° from the midrib, forming a reticulum with the longitudinal nerves, moderately conspicuous. *Lower pitchers* ovoid-cylindric, 8 – 11 × 3 – 4.4 cm, ovoid portion about $\frac{2}{3}$ of the total length, thick-textured, cylindric portion 1.8 – 3.75 cm wide membranous, strongly wrinkled when dry with two fringed wings extending the length of the pitcher 3 – 4 mm wide, fringed elements 2 – 5 mm long, 6 – 8 per cm; mouth concave in profile, gradually rising over 2 – 4.5 cm from front to rear, column not distinct; peristome with outer edge entire, rarely sinuate, front part of the mouth with peristome subcylindrical, 1.2 – 1.5 mm wide, side of mouth with peristome flattened 2.5 – 4 mm wide; rear of mouth with peristome abruptly dilated to 7 – 9 mm wide at junction with the lid; ridges weakly but distinctly pronounced, 0.25 – 0.35 mm apart, c. 0.1 mm high, the inner edge generally lacking visible teeth. Lid elliptic, 2.5 – 4.5 × 2.25 – 2.6 cm, apex rounded, base rounded, lower surface lacking distinct appendages, but with a low keel along the midline, nectar glands sparse, elliptic, c. 0.5 mm long, along the keel, otherwise densely scattered (c. 480 per cm²) over the lower surface of the lid, crater-like, circular, 0.2 – 0.3 mm diam, decreasing slightly in size towards the margin, all but absent from marginal 2 mm. Spur flattened, 4.5 – 6 mm long, divided to the base into two equal or unequal arms, apices of branches entire or bifurcate. Intermediate pitchers not seen. *Climbing stems* as the short stems, but 4 – 5 mm diam., internodes 1.5 – 3.0 cm long. Leaves narrowly oblong-elliptic and spatulate/pseudopetiolate, 12.5 – 18 × 2.5 – 4 cm, pseudopetiolar part 2.5 – 3 cm long, 1.0 – 1.6 cm wide, dilating at the node to c. 1.7 cm wide, blade apex either peltate or with the tendril attached to the apex, clasping the stem for $\frac{3}{4}$ of its circumference. *Upper pitchers* freely produced, resembling the lower pitchers but tendrils coiled, (7.5 –) 12 – 14 × (1.5 –) 3.8 – 4.2 cm, lower half narrowly infundibular, base curved upward 2 – 2.5 cm to meet the tendril, junction abrupt or gradual, upper half of pitcher cylindrical, (1.2 –) 2.2 – 2.6 cm wide, wings absent; peristome at front and side of mouth (0.5 –) 2 – 4 (–7) mm wide; teeth inconspicuous, obscured by curvature of inner peristome, when visible (0.1 –) 0.3 – 0.4 mm long,

peristome ridges (0.15 –) 0.3 – 0.5 mm apart, each ridge separated by c. 5 microscopic lines. Lid ovate-elliptic (1 –) 2.5 – 3.5 × (1.4 –) 2 – 2.4 cm, apex rounded or slightly emarginate, base rounded to slightly cordate, lower surface lacking a well developed keel or appendages, but sometimes with a slight keel (drying artefact?) terminating in a hairy area up to 2 mm long, raised up to 1 mm; nectar glands circular, scattered evenly over the lid, or with the midrib area bearing only a few sparse elliptic glands twice as long as the circular glands. Spur flattened 5 – 6 × 0.7 mm, apex rounded entire to 4-lacinate, inserted c. 4 mm below the peristome-lid junction. *Male inflorescences* often two per stem, borne at intervals of c. 5 internodes, 29 – 41 cm long; peduncle 7 – 10 (– 13) cm long, 3 mm diam. at base, often terminating with a variably shaped bract, sometimes foliose, to 9 × 4 mm; partial-peduncles (37 –) 60 – 100), 2-flowered, 2 – 4 mm long; bracts absent; pedicels 5 – 9 mm long; tepals elliptic 2 – 2.5 × 1.5 mm; androphore c. 2 mm long; anther head 0.75 × 1.2 mm, anthers 5 – 8. Female inflorescences, infructescences and seed not seen. *Indumentum* absent from stems, apart from sessile red glands c. 0.05 mm diam. which extend to the lower surface of the leaf-blades (c. 960 – 1600 per mm²) and exterior of pitchers. Leaf blades with 10 – 30 appressed white hairs, best viewed in the unfurled leaf, but persisting, highly inconspicuous; blade apex sometimes moderately densely hairy, hairs sometimes extending along tendril to the pitcher, hairs white or grey, simple, 0.25 – 0.5 mm long. Pitcher exterior with sparse red-brown and branched white simple hairs, c. 0.1 × 0.1 mm extending to the lid (rarely glabrous) and marginal 0.1 – 0.2 mm and apex of the lower lid. Spur with hairs as the inflorescence. Inflorescence with dense grey hairs, partly appressed hairs 0.12 – 0.25 mm long, sparse on peduncle, dense, concealing surface, on rhachis, partial-peduncles, pedicels and outer surface of tepals, extending to inner surface margin, and androphores (rarely absent from the androphores), tepal nectar glands elliptic,

Table 1 The more significant characters separating *Nepenthes thai* and *Nepenthes benstonei*.

	<i>N. thai</i>	<i>N. benstonei</i>
Substrate	Limestone	Sandstone
Geography	SE peninsular Thailand	NE peninsular Malaysia
Stem	Glabrous	Sparsely hairy
Partial-peduncle length	2 – 4 mm	c. 9 – 10 mm
Androphore length	2 mm	4 mm
Flower colour	Red or brown	Green

0.12 × 0.05 mm. *Colour* on drying of short stems matt mid brown, climbing stems purple-black; leaves and pitchers pale grey-brown; live flowers recorded as red to brown (*Puudjaa* 260). Fig. 2.

DISTRIBUTION. Peninsular Thailand.

THAILAND. Narathiwat: Sukhirin, Pha khuai Mai, lower pitchers, st. 17 April 1996, *Niyomdham* & *Puudjaa*, 4713 (BKF); *ibid.* Khao Nakharach, c. 600 m alt., lower pitchers, st., 8 Aug. 1996, *Puudjaa* 259 (BKF); *ibid.*, upper pitchers and ♂ fl. 8 Aug. 1996, *Puudjaa* 260 (BKF, holotype & isotype); Khao Nakarat, 665 m alt., upper pitchers ♂ fl. 20 Oct 1996, *Niyomdham* 4843 (BKF); Khao Ai Daang, Bala-Hala, Narathiwat, 500 m alt., upper pitchers, st. 21 Aug. 1998, *Niyomdham* & *Puudjaa* 5554 (BKF).

HABITAT. Limestone hills; 500 – 600 m.

CONSERVATION STATUS. *Nepenthes thai* is here assessed as Endangered (EN B2 ab(iii)) using the criteria of IUCN (2001) since it is known from only four sites (see above) within a small geographic area. Its limestone habitat in the Peninsula is threatened by mining for cement production, as such habitats are elsewhere in Malesia (Cheek & Jebb 2001).

ETYMOLOGY. Named (noun in apposition) for Thailand.

NOTES. Vegetative colour, rosette stems, female inflorescences, infructescences and seeds have still to be seen in *Nepenthes thai*. Moreover, although five collections were available, there has been little opportunity to study variation in some structures, such as the lower surface of the lid of the lower pitchers, for which only one lid was available. Therefore more collections and observations of this taxon would be welcome. In recent years access to specimen locations on the border with Malaysia has been hindered by security considerations.

Specimens of *Nepenthes thai* were first identified as *N. benstonei* of Peninsular Malaysia and for this reason *N. benstonei* is stated to occur in Thailand in the *Flora Malesiana* account (Cheek & Jebb 2001). The two species share leaf-bases which are abruptly decurrent as longitudinal wings along the stem, features not seen otherwise in Malay Peninsula *Montanae*. The upper pitchers and leaf-blades of the two taxa are also very similar. The two taxa can be separated using the features detailed in the key above and in Table 1 opposite.

The characters in Table 1 have been found to be useful in separating other taxa of *Nepenthes* and are considered likely to be reliable. However, it must be remembered that the known characteristics of *N. benstonei* are derived largely from the description by Clarke, based on a single population, that at Bukit Bakar (Clarke 1999, 2001). When specimens from other populations are available, more variation is likely

to be discovered, possibly affecting some of the continuous characters listed below that otherwise might appear diagnostic at present. *N. thai* also appears to differ from *N. benstonei* in having black-tinted, not yellow, stems; the leaf-blades of the short stems can be shorter and narrower in *N. thai*, starting as small as 11.5 × 2.7 cm, not 25 × 4 cm, and their bases sheath the stem more completely: by ¾ to ⅝, rather than by ½ to ¾, while the blade apices are peltate, versus non-peltate in *N. benstonei*. The longitudinal nerves are 5 – 7 per side in *N. thai*, against 3 – 5 in *N. benstonei*, while the lower pitchers of *N. thai* only reach 11 cm long, with lids to 2.6 cm wide, versus 15 cm and 3.5 cm in *N. benstonei*.

Nepenthes thai may well prove to be a limestone obligate species since the labels of two of the five specimens record this substrate. Further checking of all the remaining known sites is needed to verify that it is not merely a facultative limestone species. Currently obligate and facultative limestone *Nepenthes* species have been observed only in Borneo (Cheek & Jebb 2001).

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