

# A spectacular new species of *Nepenthes* L. (Nepenthaceae) pitcher plant from central Palawan, Philippines

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A new species of *Nepenthes* L., *N. attenboroughii* (Nepenthaceae), from Palawan Island in the Philippines, is described and illustrated. It is restricted to rocky, ultramafic soils that comprise the summit region of Mount Victoria, Municipality of Narra, where it occurs in isolation from other members of the genus. On the basis of the morphological features, this new taxon appears to be related to both *N. mira* Jebb & Cheek of Palawan and *N. rajah* Hook.f. of Borneo. Its substantial size places it among the largest of known pitcher plants. The diagnostic morphological characters are discussed and an updated key is provided for a revised complex of *Nepenthes* species from the Palawan and North Borneo phytogeographical region. © 2009 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2009, 159, 195–202.

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## INTRODUCTION

*Nepenthes* is widespread within the Malesian biogeographical region, but the majority of species are known from recognized centres of diversity and endemism within this area (Clarke, 2001). The Philippine archipelago is home to 17 known species of *Nepenthes*, 16 of which are endemic, making it the third richest region for *Nepenthes* diversity after Sumatra and Borneo, each with approximately 30 endemic species. Here, as in Sumatra and Borneo (Cheek & Jebb, 2001; Lee, Hernawati & Akhriadi, 2006), the majority of newly described species are known from either one or just a few closely situated mountain tops; as with other

genera sympatric with *Nepenthes* (for example, *Ericaceae*; Heads, 2003), such endemism is most probably the result of allopatric speciation caused by vicariance within the principal territories occupied by *Nepenthes*.

Until 1998, only one species of *Nepenthes*, *N. philippinensis* Macfarl. (formerly synonymized with *N. alata* by Danser, 1928), was recognized from Palawan, with a second, *N. deaniana* (Macfarlane, 1908; Merrill, 1922), of indeterminate status owing to the destruction of the only known material, the type, at the Philippine National Herbarium during World War II (Jebb & Cheek, 1997). Subsequently, *N. mira* Jebb & Cheek was described from north central Palawan in 1998 (Cheek & Jebb, 1998), and *N. mantalingajanensis* Nerz & Wistuba, originally collected from Mount Mantalingahan in 1992 by Argent and

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Romero, was formally described in 2007 (Nerz & Wistuba, 2007).

A series of expeditions in the Philippines by three of the authors led to the observation of an unknown species of *Nepenthes* on Mount Victoria in central Palawan. The species was immediately distinguishable from other *Nepenthes* by its great dimensions and trumpet-shaped lower and upper pitchers. The characteristics of the population were stable and unique, indicating that the specimens were not a variety, mutation or aberrant ecotype of any known species. As the only member of the genus occurring at high elevation on the mountain (*N. philippinensis* was recorded below 300 m), it was possible to rule out immediate hybrid origins and to conclude that the species represented a new and undescribed taxon.

### SPECIES DESCRIPTION

***NEPENTHES ATTENBOROUGHII*** A.S.ROB.,  
S.MCPHERSON & V.HEINRICH **SP. NOV.**  
(FIGS 1, 2A, B)

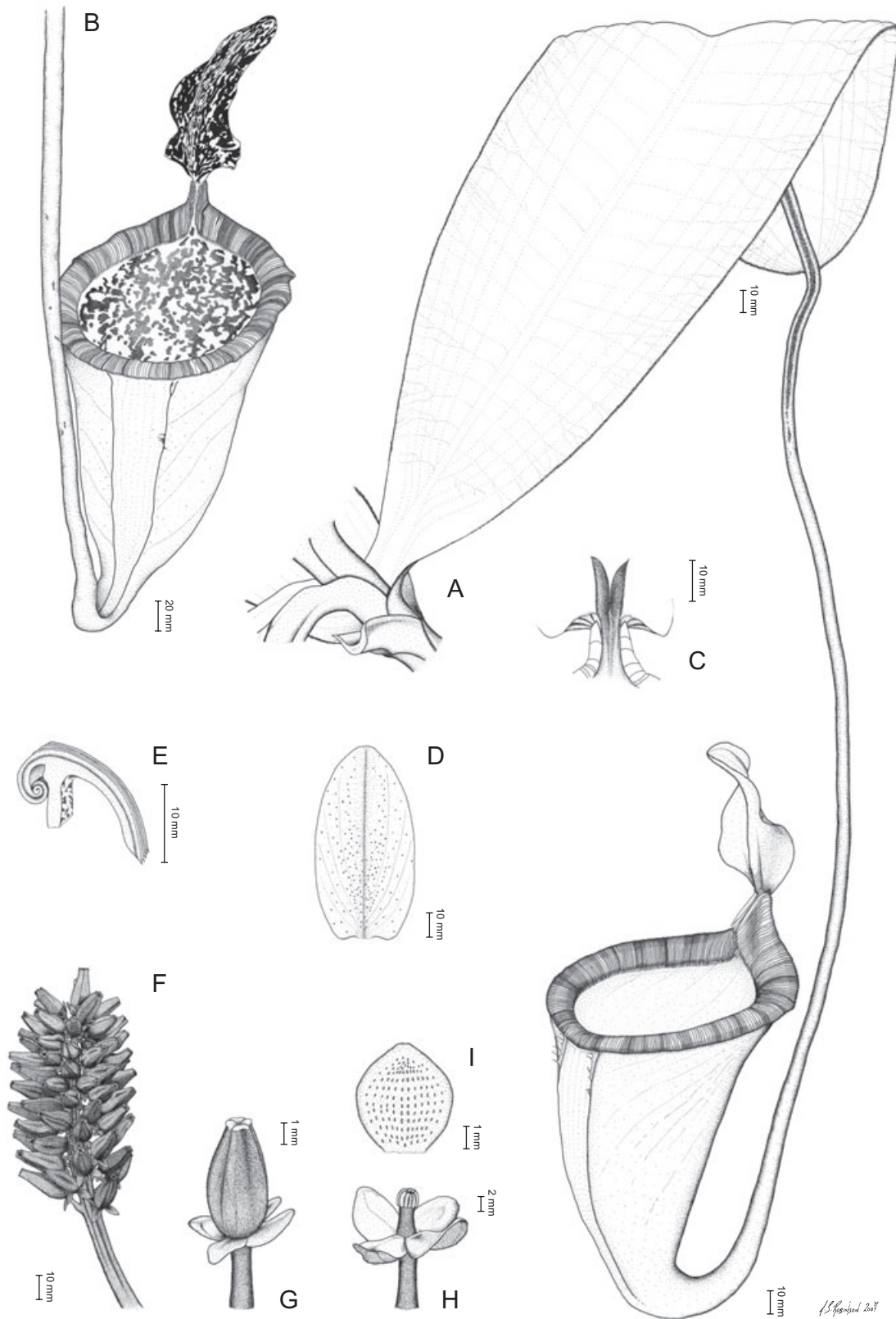
*Type:* Philippines, Palawan, Mount Victoria, 09°22.105'N, 118°18.484'E, 1650 m, on granular, largely inorganic, ultramafic soils towards the summit, 24.vi.2007, A. Robinson AR001 (holotype; PPC!); *ibid.*, AR002 (paratype!).

*Diagnosis:* Quoad habitum ad *N. rajah* Hook.f. accedit, sed ab ea differt essentialiter folia mediocria subpetiolata, lamina oblonga vel anguste elliptica, apice obtusa interdum retusa, basi breve angustatus et cirrho semitereti valde robusto nunquam spirali. Praeterea ad ea distat ascidia inferiora et superiora maxima, campanulata vel tubata, alis deminutis ad costas, ore maximo lato, operculo parvo elliptico complanato erecto, inflorescentia racemus magnus pedicellis 1-floris *c.* 1–1.5 cm longis, indumentum in partibus iuvenilibus densum velutino-pubescent, in partibus adultis tomentosum differt.

*Nepenthes attenboroughii* is easily distinguished by its large, campanulate or tubulate pitchers and narrow, upright lid. It is unlikely to be confused with any known species of *Nepenthes*.

*Description:* Terrestrial upright to scrambling unbranched shrub, to 1.5 m tall. STEM terete, 2.5–3.5 cm in diameter, internodes 3–4.5 cm long. Climbing stems unknown. ROSETTE LEAVES coriaceous; lamina oblong to narrowly elliptic, 25–30 cm long, 8–10 cm wide, apex obtuse or occasionally retuse, not peltate, base shortly attenuate, sessile or subpetiolate to 2 × 4 cm, amplexicaul, clasping the stem by two-thirds to four-fifths its circumference, decurrent along internode for 2–3 cm; longitudinal veins conspicuous,

arising from basal part of midrib, five to seven on each side in outer two-thirds of lamina, pennate veins numerous, almost perpendicular to midrib, finely reticulate towards margin; tendrils 30–40 cm long, broad, 4–9 mm in diameter, straight, sharply descending, flattened along adaxial surface in upper one-third. LEAVES OF SCRAMBLING STEM as those of rosettes, but larger, 30–40 cm long, 8–15 cm wide, base subpetiolate; tendrils to 50 cm long, uncoiled. LOWER PITCHERS brittle, campanulate to broadly tubulate, often dilating abruptly below the mouth, to 30 × 16 cm excluding lid, originating from tendril at front of pitcher; inner surface entirely glandular, *c.* 350–750 glands cm<sup>-2</sup>, ventral exterior surface rarely winged and usually marked by two pronounced ribs from tendril to mouth, infrequently ciliate in upper one-third; mouth oblique, orbicular to transversely elliptic, being the widest part of the pitcher, rising in the rear to a column 2–3 × 1.5–2 cm, in section an isosceles triangle with longest sides concave, formed by teeth of peristome held in apposition, to 2 cm long; peristome broad, 0.8–2 cm wide, striate with ribs to 0.5 mm high, flattened across middle at front of mouth, gently rounded at other parts, outer margin entire, occasionally sinuous on opposing sides, strongly revolute, inner margin flattened, curving sharply downwards, descending 3–8 mm, terminating in fine, conspicuously incised teeth to 2 mm long below mouth and 3 mm on the column. Lid held upright, usually 0°–20° from vertical, very slender relative to pitcher mouth, elliptic or slightly ovate, to 10 × 6.5 cm, apex rounded, base truncate to shallowly cordate, lower surface with flattened, rigid keel, up to 3 mm high at base, 3–5 mm broad, but no appendages, densely glandular except around upper one-third of keel where glands are most sparse, glands large, crateriform, conical, 0.1–0.3 mm across, with the smallest towards margin of lid, longitudinal veins conspicuous, four on each side, arising from base of midrib; spur substantial, 8–15 mm long, up to 6 mm wide at base, often bifurcated in distal one-third, each segment to 2 mm wide. UPPER PITCHERS similar to lower pitchers, but tubulate or infundibular, 25 × 12 cm, originating from tendril to side or from rear of pitcher, expanding gradually from base and abruptly flaring widely 2–4 cm below mouth; mouth orbicular to transversely elliptic, inner surface entirely glandular, ventral ribs prominent, without cilia, occasionally bifurcating towards the mouth; peristome flattened at front and sides, to 1.5 cm wide, rising in the rear to a column to 2.5 × 1.5 cm. Lid similar to those of lower pitchers but smaller, occasionally reflexed, elliptic, to 8 × 5 cm. INFLORESCENCE a raceme. Male inflorescence to 80 cm, 4 cm at widest point, with *c.* 100 flowers; peduncle 25–35 cm long, striate, 1 cm wide at base, rachis 30–45 cm,



**Figure 1.** *Nepenthes attenboroughii* A.S.Rob., S.McPherson & V.Heinrich: A, scrambling stem with leaf and upper pitcher; B, lower pitcher; C, rear elevation of spur; D, underside of lid; E, transverse section of peristome; F, rachis of female inflorescence; G, female flower; H, male flower; I, tepal. Drawing by A. S. Robinson.

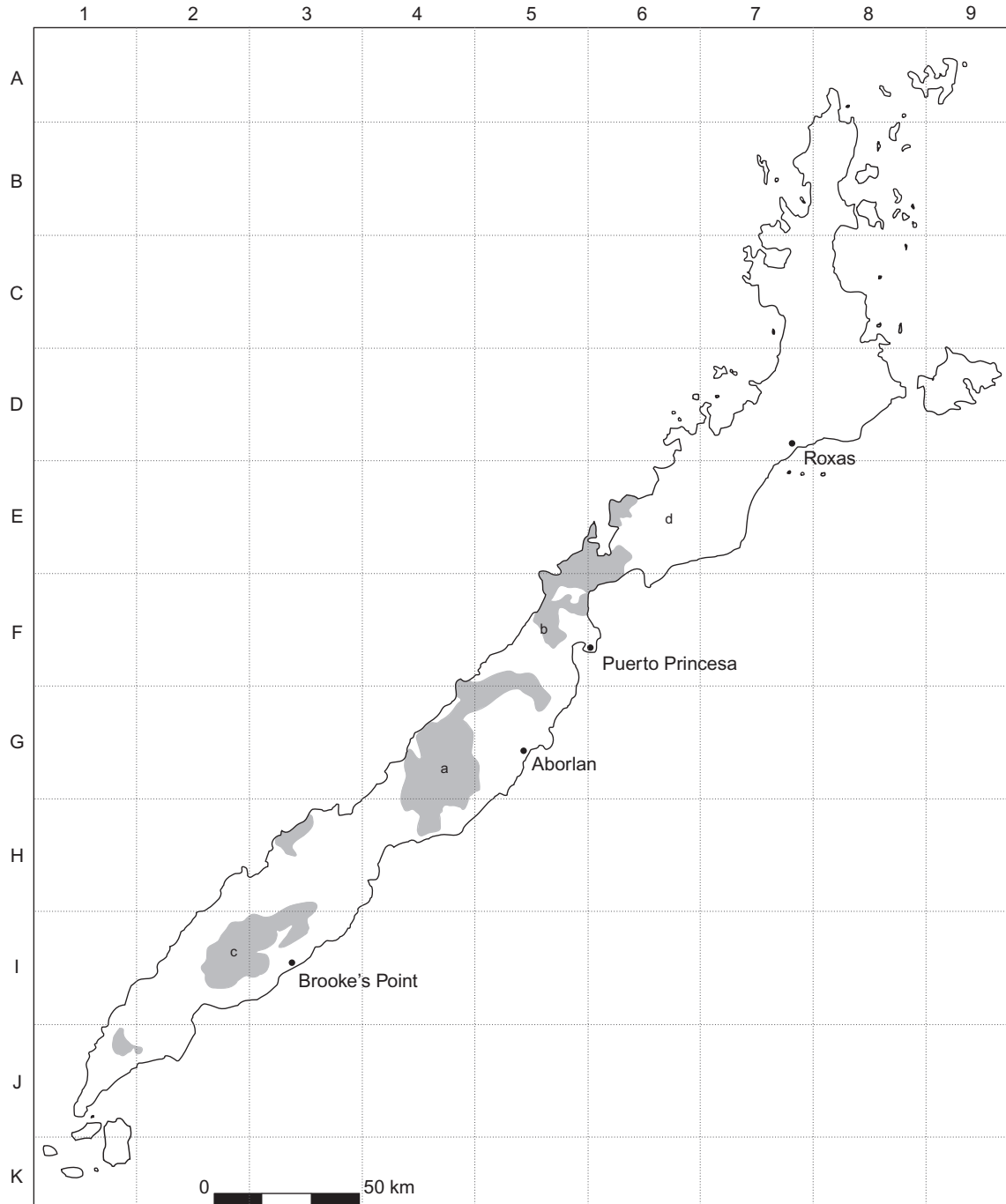


**Figure 2.** *Nepenthes attenboroughii*: A, upper pitcher; B, intermediate pitcher.

occasionally bifurcating; pedicels one-flowered, lacking bracts, to 2 mm in diameter, 1.2 cm long at base of rachis, 2 mm at tip; tepals red, broadly ovate, 4 × 5 mm, apex obtuse; staminal column 3–4 mm, anther head 2 × 3 mm of eight fused anthers. Female inflorescence to 65 cm, 5 cm at widest point, with c. 70 flowers; peduncle 45–52 cm long, to 1.5 cm at base, rachis to 20 cm, never bifurcating; pedicels one-flowered, tightly clustered in last one-third of rachis, lacking bracts, to 3 mm in diameter, 1.5 cm long at base of rachis, 1 mm at tip; tepals brown to purple, ovate, 5 × 3.5 mm, apex acute; ovary ovoid, 5 × 2.5 mm; fruit up to 20 × 8 mm, staminal surface drying black; seeds filiform, c. 7 mm long, pale brown. INDUMENTUM of reddish-brown sessile glands evenly distributed over surface of stem, increasing in density on abaxial leaf surfaces and accounting for a slightly scabrous texture, largely absent from adaxial leaf surfaces, occurring sparsely and irregularly on tendrils and pitchers; juvenile foliage including apex of stem, underside of midrib and floral organs pubescent, with simple, densely arranged, caducous reddish-copper hairs to 1 mm long, becoming velutinous along tendril and developing pitcher; adult leaf margin

ferruginous-tomentose or woolly, underside of midrib coarsely velutinous, dark golden-brown, especially in distal one-third, becoming lightly velutinous down upper one-third of tendril only; surface of pitcher and lower two-thirds of tendril largely glabrous, occasionally glaucous, a fine brown tomentum developing towards and encompassing spur; inflorescence covered with short, coppery hairs, more dense on pedicels, staminal columns and carpels and absent from adaxial surface of tepals. COLOUR of pitcher exterior pale yellow to light green, unmarked, reddish pigment highlighting external ribs, interior strongly flecked with maroon, in direct sunlight pitcher suffused entirely red, interior turning purple–black with quadrangular yellow–green flecks; lid green or red above, dark purple–mahogany beneath, flecked green; peristome green or yellow, boldly decorated with different shades of red, brown and purple; tendrils turning red with age; adaxial leaf surfaces dark green, abaxial surfaces light green but occasionally red or purple.

The holotype and paratype on which the description of *N. attenboroughii* is based were living specimens, subsequently pressed for herbarium storage at Palawan State University.



**Figure 3.** Geographical distribution of *Nepenthes attenboroughii* (a), *N. deaniana* (b), *N. mantalingajanensis* (c) and *N. mira* (d) on Palawan, with ultramafic regions coloured grey [based on Brooks (1987) and Okubo (1989)].

*Specimens examined:* *N. mira*: E6 (Fig. 3) Palawan, 1580 m, 22.i.1998, G. C. G. Argent *et al.* 25438 (holo K). *N. mantalingajanensis*: I2 Palawan, Mount Mantalingahan, 1700 m, 2.iii.1992, G. C. G. Argent & E. M. Romero 92114 (K). *N. rajah*: Borneo, Mt. Kinabalu, 1500 m, 1867, *Low s.n.* (holo K). *N. villosa*: Borneo, Mt. Kinabalu, 2300 m, 1867, *Low s.n.* (K). The follow-

ing were examined *in situ* at their type localities: *N. mantalingajanensis*: I2, *N. mira*: E6, *N. peltata* Kurata, *N. rajah*, *N. villosa* Hook.f.

*Conservation status:* This species is known from a single locality with an area of occupancy of less than 10 km<sup>2</sup> and a projected decline in the number of

mature individuals from poaching; it is assessed here as CR (Critically Endangered) according to the World Conservation Union (IUCN) Red List Criteria B2ab(v) (IUCN, 2001).

*Distribution and ecology:* The known population of *N. attenboroughii* consists of a few hundred individuals growing within a narrow altitudinal range, from 150 m below the summit of Mount Victoria to the 1726 m summit itself. Plants grow singly or in sparsely scattered groups amongst serpentine protrusions and stunted summit vegetation consisting of a continuous thicket of shrubs 0.8–1.8 m tall. The approximate population density was estimated by eye at less than one plant per 20 m<sup>2</sup>. Pitchers rest upon the substrate or within the surrounding vegetation, supporting the stem and open to the elements, thus often completely filled with fluid, forming two immiscible fractions: the lower one-third milky, transparent and viscous, and the upper two-thirds essentially water and frequently home to saddled mosquito larvae. Inflorescences sweetly perfumed, fruiting July to August. Plants exposed to intense sunlight but cooled by heavy cloud and nightly rains. June temperatures to 30 °C during the day, 16 °C at night (A. S. Robinson, pers. observ.). Associated species consist predominantly of a *Pleomele* sp. (Asparagaceae), as well as *Leptospermum* (Myrtaceae), *Vaccinium* (Ericaceae) and *Medinilla* spp. (Melastomataceae), a variety of grasses, and the pseudometallophytic orchid *Spathoglottis kimbaliiana* Hook.f. (Orchidaceae).

*Etymology:* The specific epithet, *attenboroughii*, is a commemorative, genitive noun in apposition taken from the patronym Attenborough.

We have chosen to name this species after broadcaster and naturalist, Sir David Attenborough, whose outstanding television documentaries have made the world's natural history accessible and understandable

to millions. As a keen enthusiast of the genus and a patron of Philippine conservation efforts, it is fitting that this spectacular new species be dedicated to him on the occasion of his 80th birthday.

## DISCUSSION

*Nepenthes attenboroughii* is closely related to the Palawan species, *N. mantalingajanensis* and *N. mira*, as well as to *N. rajah* from Borneo. Features common to the high-altitude *Nepenthes* of Palawan include the structure of the lid, which is keeled but lacks appendages, and the peristome which, although atypically shaped in *N. attenboroughii* on account of the wide pitcher mouth, has prominent, papery ribs that are noticeably enlarged on a characteristically stout column. With *N. rajah* it shares an entirely glandular inner pitcher wall, the same shape and distribution of crateriform glands beneath the pitcher lid, particularly coarse stems and leaves, a scrambling growth habit, habitat type, and exceptionally large pitchers (see Table 1). Although the stems and leaves of *N. attenboroughii* may be as robust as those of *N. rajah*, specimens are generally less massive, rarely attaining more than 1.5 m in length, and apparently never climbing.

The morphological similarities between *N. attenboroughii* and its Bornean counterpart are not surprising when studied in the context of previous observations. Palawan is known to have closer phylogeographical affinities to Borneo than to the rest of the Philippines, demonstrating floral and faunal elements from both the Sunda Shelf and Philippine ecoregions (Heaney, 1985; Wikramanayake *et al.*, 2001). Cheek & Jebb (1999, 2001) discussed the apparent relationship between the *Nepenthes* of Palawan and those of northern Borneo, placing *N. mira* within the *N. villosa* complex and *N. philippinensis* within the *N. hirsuta* Hook.f. complex on

**Table 1.** Comparison of *Nepenthes attenboroughii* with *N. rajah* and *N. mira* using selected characters

Character	<i>N. attenboroughii</i>	<i>N. rajah</i>	<i>N. mira</i>
Height (m)	1.5, scrambling	3, scrambling	3, climbing
Stem diameter (mm)	35	30	14
Leaf blade ( <i>l</i> × <i>w</i> , cm)	40 × 15	50 × 15	50 × 10.5
Pitcher ( <i>l</i> × <i>w</i> *, cm)	30 × 16	30 × 14	26 × 13
Peristome width (cm)	0.8–2	2–3	1.5–3
Spur ( <i>l</i> × <i>w</i> , mm)	8–15 × 6, bifurcated	10–20 × 2, unbranched	4 × 2, unbranched
Inflorescence (cm)	55–80	50–80	30–60
Pedicels	One-flowered	Predominantly two-flowered	Two-flowered
Digestive glands (cm <sup>-2</sup> )	350–750	300–800	300–600

\*As measured across the front of the pitcher.

account of shared characteristics. This relationship is also evident in *N. mantalingajanensis*, which is morphologically more similar to *N. villosa* than is *N. mira*, particularly in the structure and orientation of its lid on a broad, abruptly columnar peristome, its stout, one-flowered racemes, its defined petioles and its tendency to retain rosette form except under shaded growing conditions.

A plausible explanation for this apparent relatedness lies in a common ancestor posited to have existed in what is now modern-day northern Borneo. As Palawan was rifted from the Asian mainland and transported below water through seafloor spreading to its present location in the Philippine archipelago (Hall and Holloway 1998), it can only have been colonized by *Nepenthes* following its uplifting above water approximately 5–10 million years ago, during a set of geological episodes that also resulted in the formation of the Crocker Range, including Mount Kinabalu (Collenette, 1964; Hall, 2002). Palawan was never linked to the rest of the Philippine archipelago, and so this colonization is likely to have taken place via Borneo during the long period in which Palawan and Borneo were linked by a land bridge during the late Pleistocene (Voris, 2000; Sathiamurthy & Voris, 2006).

*Nepenthes peltata* Kurata, recently described from an ultramafic range in Davao Oriental, southern Mindanao, is described as having characteristics in common with *N. mira*, and was included by Kurata in the *N. villosa* complex (Kurata, 2008). The pitchers and peristome of this species are sufficiently similar to those of *N. mira* to cause confusion when viewed separately (L. Co, Herbarium at the University of the Philippines, Diliman, pers. comm.), but the species is pubescent in almost all parts and has petiolate leaves, like *N. villosa*, and possesses markedly peltate leaf tips reminiscent of young *N. rajah*.

A distant Bornean origin could account for the similarities between the largely ultramafic growing *N. mira* complex species and the ultramafic growing *Nepenthes* of northern Borneo. Moreover, *N. peltata* may be evidence that the radiative speciation of such a group originating on Borneo not only gave rise to a proportion of the *Nepenthes* species recognized from the island of Palawan, but also to at least one species on Mindanao.

With the descriptions of *N. attenboroughii*, *N. mantalingajanensis* and *N. peltata*, the key to the *N. villosa* complex of Cheek & Jebb (2001) should be modified as follows:

1a. Peristome ribs pronounced, like flattened plates, $\geq 3$ mm high.....	2
1b. Peristome ribs not like flattened plates, less than 5 mm high.....	4
2a. Largest pitchers up to twice as tall as broad.....	3
2b. Largest pitchers about three times as tall as broad, lower one-quarter globose, upper cylindrical; ultramafic substrates on Mt Kinabalu and Mt Tambuyukon (Borneo).....	<i>N. edwardsiana</i>
3a. Pitchers densely villose, upper pitchers rare; leaf tips emarginate; ultramafic substrates on Mt Kinabalu and Mt Tambuyukon (Borneo).....	<i>N. villosa</i>
3b. Pitchers about twice as tall as broad, constricted at midpoint; leaf tips acute to acuminate; sandstone on Mt Trus Madi (Borneo).....	<i>N. macrophylla</i>
4a. Largest pitchers up to twice as tall as broad.....	5
4b. Pitchers puberulent, generally as tall as broad, upper pitchers common, about half the size of the lower pitchers; sandstone substrates on Palawan.....	<i>N. mira</i>
5a. Leaf apex not peltate, tendril departing at leaf apex.....	6
5b. Leaf apex peltate, tendril departing up to 10 mm from leaf apex; pitchers obovoid to ellipsoid; all aerial parts except abaxial leaf surfaces and pitchers covered with coarse, dark hairs to 3 mm long; ultramafic substrates on Mindanao.....	<i>N. peltata</i>
6a. Pitchers glabrous, generally globose-obovoid but up to twice as tall as broad, lid round with cordate base, held horizontally, upper pitchers rare; ultramafic substrates on Palawan.....	<i>N. mantalingajanensis</i>
6b. Pitchers twice as tall as broad, bell or trumpet shaped with a narrow, upright lid; ultramafic substrates on Palawan.....	<i>N. attenboroughii</i>

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## REFERENCES

- Brooks RR 1987.** *Serpentine and its vegetation: a multidisciplinary approach*. Portland, OR: Dioscorides Press.
- Cheek M, Jebb M. 1998.** Two new Philippine *Nepenthes*. *Kew Bulletin* **53**: 966.
- Cheek M, Jebb M. 1999.** *Nepenthes* (Nepenthaceae) in Palawan, Philippines. *Kew Bulletin* **54**: 887–895.
- Cheek M, Jebb M. 2001.** *Nepenthaceae. Flora Malesiana*, Vol. 15. Leiden: Nationaal Herbarium Nederland – Universiteit Leiden Branch.
- Clarke C. 2001.** *Nepenthes of Sumatra and Peninsular Malaysia*. Kota Kinabalu: Natural History Publications (Borneo).
- Collenette P. 1964.** A short account of the geology and geological history of Mt Kinabalu. *Proceedings of the Royal Society of London. Series B, Biological Sciences* **161**: 56–63.
- Danser BH. 1928.** The Nepenthaceae of the Netherlands Indies. *Bulletin du Jardin de Botanique Buitenzorg* **3**: 249–438.
- Hall R. 2002.** Cenozoic geological and plate tectonic evolution of SE Asia and the SW Pacific: computer-based reconstructions, model and animations. *Journal of Asian Earth Sciences* **20**: 353–431.
- Hall R, Holloway JD. 1998.** *Biogeography and geological evolution of SE Asia*. Leiden: Backhuys Publishers.
- Heads M. 2003.** Ericaceae in Malesia: vicariance biogeography, terrane tectonics and ecology. *Telopea* **10**: 311–449.
- Heaney LR. 1985.** Zoogeographic evidence for middle and late Pleistocene land bridges to the Philippine Islands. *Modern Quaternary Research in Southeast Asia* **9**: 127–144.
- IUCN. 2001.** *IUCN red list categories and criteria: version 3.1*. Gland: IUCN Species Survival Commission.
- Jebb M, Cheek M. 1997.** A skeletal revision of *Nepenthes* (Nepenthaceae). *Blumea* **42**: 1–106.
- Kurata S. 2008.** *Nepenthes peltata* (Nepenthaceae), a new species of pitcher plant from the Philippines. *Journal of the Insectivorous Plant Society* **59**: 12–17.
- Lee CC, Hernawati, Akhriadi P. 2006.** Two new species of *Nepenthes* (Nepenthaceae) from North Sumatra. *Blumea* **51**: 561–568.
- Macfarlane JM. 1908.** Nepenthaceae. In Engler A, ed. *Saraceniales, das Pflanzenreich. Regni vegetabilis conspectus III*. Leipzig: Wilhelm Engelmann, 1–92.
- Merrill ED. 1922.** *An enumeration of Philippine plants*, Vol. 2. Manila: Govt. of PI Bureau of Science, 215–216.
- Nerz J, Wistuba A. 2007.** *Nepenthes mantalingajanensis* (Nepenthaceae), eine bemerkenswerte neue Spezies aus Palawan (Philippinen). *Das Taublatt* **55**: 17–25.
- Okubo Y 1989.** *The mineral exploration – mineral deposits and tectonics of two contrasting geologic environments in the Republic of the Philippines – consolidated report on Palawan area*. Tokyo: Japan International Cooperation Agency, Metal Mining Agency of Japan and Department of Environment and Natural Resources (Philippines) Joint Committee.
- Sathiamurthy E, Voris HK. 2006.** Maps of Holocene sea level transgression and submerged lakes on the Sunda Shelf. *The Natural History Journal of Chulalongkorn University* Suppl. **2**: 1–43.
- Voris HK. 2000.** Maps of Pleistocene sea levels in South East Asia: shorelines, river systems, time durations. *Journal of Biogeography* **27**: 1153–1167.
- Wikramanayake ED, Dinerstein E, Loucks CJ, Olson DM, Morisson J, Lamoreux J, McKnight M, Hedao P. 2001.** *Terrestrial ecoregions of the Indo-Pacific: a conservation assessment*. Washington: Island Press.