



## *Nepenthes barcelonae* (Nepenthaceae), a new species from Luzon, Philippines

MARTIN CHEEK<sup>1</sup>, DANILO N. TANDANG<sup>2</sup> & PIETER B. PELSER<sup>3,\*</sup>

<sup>1</sup>Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, UK. E-mail: [m.cheek@kew.org](mailto:m.cheek@kew.org)

<sup>2</sup>Philippine National Herbarium (PNH), Botany Division, National Museum of the Philippines, P. Burgos St., Manila, Philippines.

E-mail: [sue93653@yahoo.com](mailto:sue93653@yahoo.com)

<sup>3</sup>School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand.

E-mail: [pieter.pelsers@canterbury.ac.nz](mailto:pieter.pelsers@canterbury.ac.nz)

\* author for correspondence

### Abstract

*Nepenthes barcelonae* is described as a new species in sect. *Insignes*, where it is unique in the inset mouth and the dichromic upper pitchers (first-produced pitchers red, later-produced pitchers green) which are also dimorphic. This is a newly recorded phenomenon in the genus: the first produced (primary upper pitchers) are red, larger, stouter, and have an uncoiled long tendril, while those later produced (secondary upper pitchers) are green, smaller, more slender, and have a coiled tendril. The only population of this species that is currently known grows in an area less than 10km<sup>2</sup> on a single mountain. Individual plants are at risk from collecting for the horticultural trade. Following the IUCN criteria, *N. barcelonae* is assessed as Critically Endangered.

**Key words:** Aurora Province, conservation, dimorphic pitchers, Sierra Madre range, taxonomy

### Introduction

*Nepenthes* Linnaeus (1753: 955) is a genus of c. 140 species of carnivorous pitcher plants. Although its center of diversity is in tropical Southeast Asia, several species are known from Madagascar, the Seychelles, Sri Lanka, northern India, Indochina, and New Caledonia (Jebb & Cheek 1997).

In February 2014, the second two authors, with Julie F. Barcelona, encountered a new species of *Nepenthes* in stunted submontane forest in the Sierra Madre range in Aurora Province, Luzon, Philippines. This species is here described as *Nepenthes barcelonae*. Placement in *Nepenthes* sect. *Insignes* Danser (1928: 314), characterised in Cheek & Jebb (2013), is indicated by the oblong, ligulate, sessile, glabrous, decurrent leaf-blades and the cylindrical upper pitchers with length:breadth ratio usually in the range of 2 to 4:1, the broad peristome, semi-circular in section, the inner edge of which is toothed, the outer attenuating in thickness until it is membranous, and becoming partly appressed to the outer surface of the pitcher, and not becoming revolute. Additionally sect. *Insignes* is characterised by the lower surface of the pitcher lid lacking an appendage, the lid nectar glands are usually transversely elliptic, non-perithecoidal and are absent from the midline, being generally restricted to two incurved lateral bands.

This section is confined to the Philippines apart from one species, *N. insignis* Danser (1928: 314), in New Guinea and, more ambiguously, *N. northiana* Hooker (1881: 717) in Borneo (Cheek & Jebb 2001). Only four species have been described from Luzon and the northern Visayas of the Philippines (up to the present), of which two are found in Luzon. Of these, *N. alzapan* Jebb & Cheek (2013: 59) is the most recently described. It is distinguished by its subglobose upper pitchers with fringed wings and leaf-blades 1.5–2.5(–3.4) cm wide. It is known from a single location, also in the Sierra Madre range. The second species, *N. ventricosa* Blanco (1837: 807), is widespread in the mountains of Luzon, and numerous collections have been made. This species is distinguished by the upper pitchers being tightly constricted at their midpoint, the upper part then flaring dramatically to the dilated mouth, clearly very different from *N. barcelonae*. Other differences between the two species are set out in Table 1.

*Nepenthes barcelonae* is also similar to *N. burkei* Masters (1889: 492) of Mindoro and Panay and *N. sibuyanensis* Nerz (Nerz *et al.* 1998: 18) of Sibuyan. However, the apex of the pitcher tube below the peristome is straight and not

constricted in *N. burkei* and *N. sibuyanensis*, whereas it is abruptly constricted in *N. barcelonae* so that the mouth is inset. In addition, the peristome of *N. burkei* and *N. sibuyanensis* has coarse teeth that are conspicuous around the entire inner perimeter. In contrast, the teeth on the inner edge of the peristome of *N. barcelonae* are only visible near the lid column. Neither of these two species has dimorphic and dichromic upper pitchers as does *N. barcelonae*. *Nepenthes burkei* further differs from *N. barcelonae* in having a narrowly ovate pitcher mouth instead of it being orbicular. *Nepenthes sibuyanensis* has larger nectar glands (0.8–2.1 mm long) than *N. barcelonae* (0.4–0.95 mm long) and a larger stem diameter (8.0–9.0 vs. 4.5–7.0 mm). It also has different upper pitcher dimensions: up to 20(–25) by 12(–15) cm (*N. sibuyanensis*) vs. up to 18 by 6.8 cm (*N. barcelonae*). In addition, *N. sibuyanensis* is restricted to ultramafic thicket and has strongly angular stems.

This paper forms part of studies towards a World Monograph of *Nepenthes* building on a Skeletal Revision of *Nepenthes* (Jebb & Cheek 1997) and the Flora Malesiana account (Cheek & Jebb 2001). It also contributes to the Co's Digital Flora of the Philippines project (Pelser *et al.* 2011 onwards).

**TABLE 1.** Morphological comparison of *Nepenthes ventricosa* and *N. barcelonae*.

	<i>Nepenthes ventricosa</i>	<i>Nepenthes barcelonae</i>
<b>Primary upper pitcher shape</b>	Hour-glass shaped (constricted at midpitcher to <0.5 the maximal width) and not constricted at mouth	Cylindrical or slightly constricted above midpoint (<0.05 the maximal pitcher width) and constricted at mouth
<b>Pitcher mouth orientation</b>	Horizontal or slightly oblique	Oblique at 45–50° from horizontal
<b>Lid length: breadth ratio</b>	2.25–3:1	1.15–1.5:1
<b>Spur length</b>	9 mm	3–5 mm
<b>Fruits</b>	25–32 mm long, sessile	10–16 mm long, stipitate

## Taxonomy

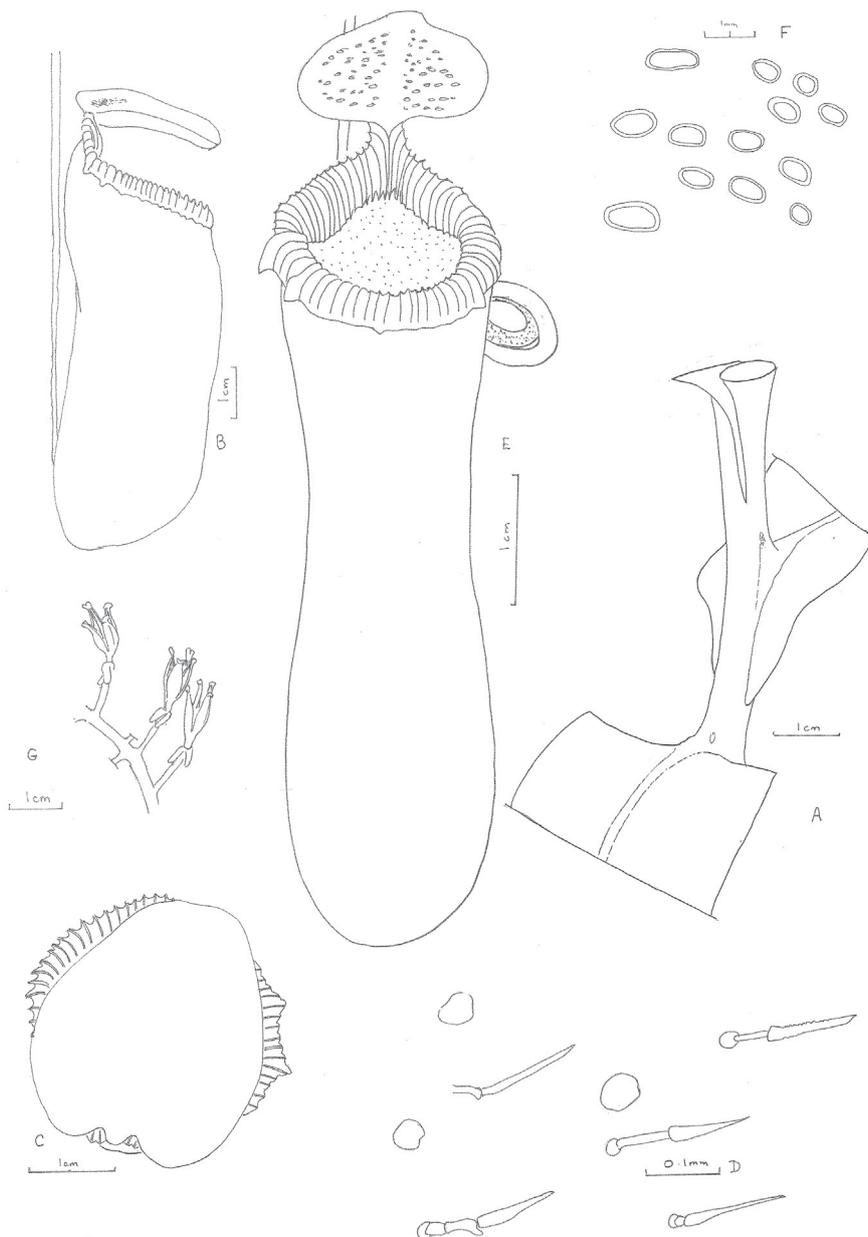
*Nepenthes barcelonae* Tandang & Cheek, *sp. nov.*

**Type:**—PHILIPPINES: Luzon, Sierra Madre Mountain range, Aurora Province, fr. 22 Feb. 2014, Tandang 1727 with Pelsers & Barcelona (holotype PNH!, isotype K!) (Figs. 1–2).

**Diagnosis:**—*Nepenthes barcelonae* a ceteris speciebus *Nepenthium* in sect. *Insignes* Danser ponendis ascidiis superioribus ore diametro minore ascidio ipso, ascidiis dimorphis eis terra proximis robustis rubrisque, eis apice caulium proximis gracilibus viridibusque distincta.

**Description:**—*Terrestrial climber* to 2 or 3 m tall, glabrous apart from the pitcher and inflorescence. Rosette and short stems unknown. Climbing stems terete, 4.5–7.0 mm, mainly 2-winged, internodes 1.5–3.0(–4.5) cm long, winged for 0.5–2.5 cm of their length, wings decurrent from leaf, 0.6–0.7 cm wide at midlength, leaf-base clasping stem for half its circumference. *Leaves* sessile, ligulate-oblong, (13.2–)19.5–23.0(–24.5) × (1.9–)2.5–4.0(–4.5) cm, apex obtuse-acute, tendril not arising peltately, leaf base not tapering towards the stem. *Upper pitchers* (mouth facing away from tendril, fringed wings absent) dimorphic and dichromic, slightly curved, cylindrical or slightly laterally compressed, constriction slight, gradual, inconspicuous, 0–1/4 the diameter, about two-thirds the length from the base, or constriction absent; apex of pitcher tube abruptly constricted, so that the mouth is inset, and only the tips of the lobes of the broad peristome extend beyond the circumference of the top of the pitcher tube; fringed wings reduced to inconspicuous ridges 1.10–1.25 cm apart, or absent; indumentum of expanding, immature pitchers dense, 100% cover, hairs matt, medium brown, appressed, simple hairs 0.4–0.6(–0.9) mm long; indumentum of mature pitchers sparse, cover <5%, hairs patent, simple, (1–)2–3(–4)-celled, mostly 0.15–0.25 mm long, suberect or appressed, mixed with depressed-globose red glands 0.05 mm in diameter. Inner surface of pitcher with crescent-shaped pits, waxy surface absent. Mouth orbicular, 2.70–3.75 cm interior diameter, oriented at 45–50 degrees from the horizontal, straight, not curved until the dorsal 1/10 which is abruptly concave, forming a short but distinct column 3–4 × 4–5 mm. Peristome glossy dark red, subcylindrical in section, outer edge gradually attenuate until membranous, mostly appressed to outer pitcher surface, undulate, with 1–2(–4) shallow lobes on each side, inner edge with slender teeth c. 1 mm long, conspicuous only near the column, elsewhere inconspicuous due to the slight reflexing of the edge under the main peristome body. Lid ovate, length: breadth ratio 1.15–1.5:1, held more or less horizontally, apex rounded, base cordate, basal appendage absent, upper surface sparsely puberulous, indumentum as outer pitcher, with a pair of low, curved ridges each side of the slightly depressed midline,

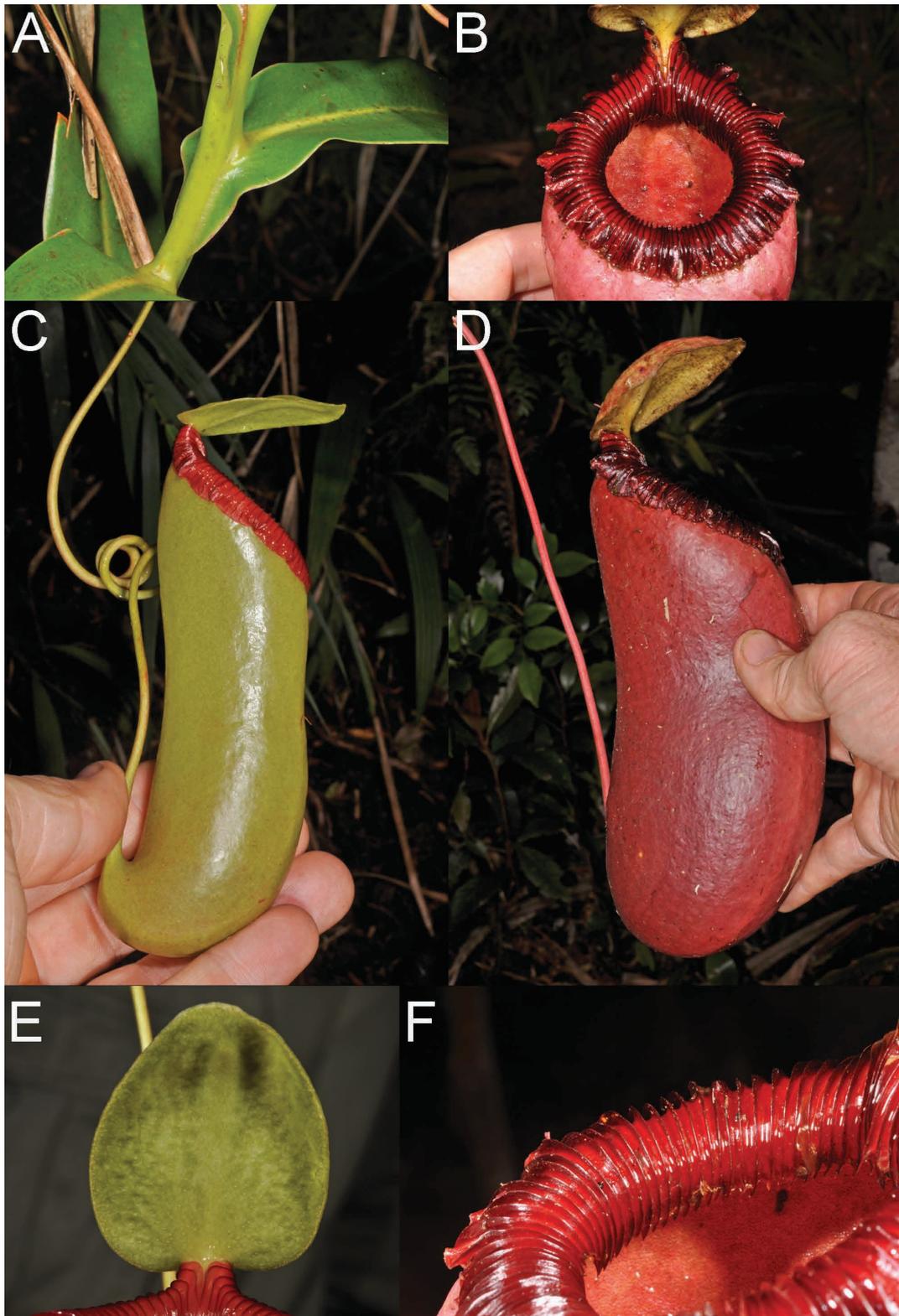
lower surface with 30–90 nectar glands scattered over the surface on each side of a midline band 4–5(–7) mm wide which lacks nectar glands, nectar glands thinly bordered, transversely elliptic,  $(0.4\text{--}0.5\text{--}0.8\text{--}0.95) \times 0.35\text{--}0.50$  mm. Spur erect, cylindrical,  $3\text{--}5 \times 0.9\text{--}1$  mm, apex acute, puberulous with hairs  $0.2\text{--}0.3$  mm long. *Primary upper pitchers* produced on the lower part of the stem, up to c. 1.5m from the ground, tendrils (30–)73–79 cm long, not coiled, pitchers sometimes resting on ground, outer pitcher surface uniformly bright red, lid green flushed red, pitcher length:breadth ratio 2–3:1,  $5.7\text{--}18 \times 2.7\text{--}6.8$  cm, peristome (4–)6–10.5(–20) mm broad, ridges  $(0.9\text{--})1.5\text{--}2.0$  mm apart,  $(0.5\text{--})1.5$  mm high; lid  $(3.6\text{--})8.0 \times (2.7\text{--})6.0$  cm. *Secondary upper pitchers* produced from stems more than 1.5m tall, tendrils 20–21 cm long, coiled, pitchers all aerial, outer pitcher surface glossy pale green, pitcher length:breadth ratio 4–5:1,  $10\text{--}12 \times 2.6\text{--}2.7$  cm; peristome 6–7 mm across, ridges less pronounced than in primary upper pitchers; lid c.  $3.85 \times 1.75$  cm. *Infructescence* racemose, c.  $35 \times 6$  cm, peduncle c. 19 cm long, 0.6 cm diam. at base, rhachis c. 15.7 cm long with at least 78 1-flowered partial-peduncles; bracts absent; pedicels  $8.5\text{--}9.0\text{--}(11.0)$  mm long, sepals elliptic-oblongate, c.  $3.5\text{--}4.0 \times 1.175$  mm. Fruit stipitate, 4-valved, fusiform, 10–16 mm long, stipe 1.25 mm long. Seed fusiform, pale brown, 4.5 mm long, seedbody oblong, 1.75 mm long.



**FIGURE 1.** *Nepenthes barcelonae* **A)** habit of stem, showing sessile leaf-blade bases; **B)** primary upper pitcher (side view); **C)** plan view of B, showing the orbicular pitcher mouth and ovate lid; **D)** indumentum of outer pitcher surface; **E)** secondary upper pitcher, frontal view; **F)** transversely elliptic nectar glands from lower surface of lid (from E); **G)** portion of inflorescence. All drawn from *Tandang 1727* by Cheek.

**Etymology:**—The specific epithet is chosen in honour of Julie F. Barcelona, Philippine botanist, specialist in Philippine ferns and *Rafflesia* Brown (1821: 207) and co-discoverer of this new *Nepenthes* species.

**Distribution & ecology:**—Philippines, Luzon, Sierra Madre Mts, submontane forest, sometimes stunted, 1500–1700 m a.s.l.



**FIGURE 2.** *Nepenthes barcelonae*. **A)** climbing stem, terete-winged, showing sessile leaves; **B)** primary upper pitcher showing inset mouth, and lid column; **C)** secondary upper pitcher, note green colouration and coiled tendril; **D)** primary upper pitcher, note red colouration and non-coiled tendril; **E)** lower surface of lid, secondary upper pitcher, note absence of nectar glands from midline; **F)** Side view of peristome of primary upper pitcher. Photos of *Tandang* 1727 by Pelsler.

**Conservation:**—The exact location is here withheld to reduce the risk of the plants being stripped from the wild for sale to hobbyists as has happened with other species of *Nepenthes*. We believe that seed has already entered the trade, and hope that this will allow production of plants through tissue culture or by other means that will reduce the demand on wild collection. No census has been taken of the numbers of individuals.

Although the type location is not immediately threatened, the wider area is in need of formal protected status. Slash and burn agriculture and illegal logging were observed at lower elevation in nearby areas (Tandang and Pelsner, pers. obs. 2014). We here assess *N. barcelonae* as Critically Endangered under Criterion B2ab(iii) of IUCN (2014) since it is known from a single location, with an area of occupancy and extent of occurrence of < 10km<sup>2</sup> (using the currently IUCN-favoured 4km<sup>2</sup> grid cell size), where it is threatened by collecting of mature individuals and where habitat degradation is encroaching.

**Notes:**—*Nepenthes barcelonae* is a poorly known species, since rosette and short stem phases (if produced), and flowers, remain undocumented. However, these features are also unknown in other species of the genus and are not a barrier to description and naming.

**Paratypes:**—PHILIPPINES: Luzon, Sierra Madre Mountain range, Aurora Province, fr. 22 Feb. 2014, *Tandang* (with Pelsner & Barcelona) 1718 (K!, PNH!); *ibidem* 1717 (PNH!).

### Dimorphism in upper pitchers of *Nepenthes*

Most *Nepenthes* species bear two types of pitchers (Cheek & Jebb 2001). Lower pitchers bear two fringed wings on the ventral surface. These pitchers face the tendril and main axis and the tendril is not coiled. Lower pitchers are generally ovoid-cylindric and are positioned on the ground. They are produced from rosette and short stems, and so appear to trap predominantly terrestrial insects. Upper pitchers lack entirely or have reduced fringed wings, the pitcher faces away from both the main axis, and the tendril, which is coiled. The shape of upper pitchers is more cylindrical or infundibular than the lower pitcher. They are produced from climbing stems, are suspended in the air, and appear to trap mainly flying insects.

Intermediate pitchers occur at the switch from production from lower to upper. They usually have the tendril at the side of the pitcher and are otherwise intermediate in shape between the lower and upper. In most species for which they are documented, only 1–2 intermediate pitchers are produced per stem, but in some species the intermediate stage is extended, with several pitchers of this type produced per stem, or even with the majority of pitchers produced per stem.

In the species of sect. *Insignes* present in the Philippines (*N. alzapan*, *N. burkei*, *N. sibuyanensis*, and *N. ventricosa*) lower pitchers appear to be either not produced, or to be produced only briefly, and are not reliably recorded. The upper pitchers seen in *N. barcelonae* are clearly dimorphic and are here named as primary upper pitchers which are first-produced, and secondary upper pitchers produced later, further up the stems from the ground.

The primary upper pitchers of *N. barcelonae* are red, stout, with a length:breadth ratio of 2–3:1 (Fig. 2D). They face away from the tendril, which, unusually in an upper pitcher, lacks coils, and are quite long [(30–)73–79 cm], resembling in these last two respects the tendrils of the lower pitchers seen elsewhere in the genus.

Secondary upper pitchers, compared with the primary upper pitchers, are less massive, green, and more slender, with a length:breadth ratio of 4–5:1 (Fig. 2C). They face away from the coiled tendril, which is shorter than in the primary upper pitchers, being only 20–21 cm long. The peristome is narrower, and the mouth less inset than in the primary upper pitchers.

Dimorphic upper pitchers have not been documented before within the genus. It is, however, likely that this character has been overlooked. In fact, upon further inspection, dimorphic upper pitchers were also observed in *N. ventricosa* (Cheek, pers. obs. April 2015). Here the secondary upper pitchers are less than half the size of the primary upper pitchers, show the same tendril transition from uncoiled to coiled as in *N. barcelonae*, have a less conspicuous pitcher constriction and a much more narrowly cylindrical peristome. However there is no colour difference between primary and secondary upper pitchers in *N. ventricosa*.

It is postulated that upper pitcher dimorphism has a functional basis, and that the primary upper pitchers, being held at or near the ground, fulfil the function of lower pitchers in other species (trapping ground dwelling insects), and the secondary upper pitchers those of conventional upper pitchers (catching flying insects). It can be suggested that dimorphism arose after the earlier loss of lower pitchers in this supposed evolutionary lineage.

## Acknowledgements

We would like to thank P. A. C. Buenavente (National Museum of the Philippines, NMP) for assisting Tandang in the use of the Scanning Electron Microscope (SEM) and directors J. Barns and A. M. T. P. Labrador (NMP) for supporting the collaboration that resulted in this paper. We thank V. Dacumos, F. D. Dacumos, and R. S. Bue for their hospitality. Director M. S. Lim, J. de Leon and C. G. Francisco (Biodiversity Management Bureau, BMB), J. G. Aberim, and M. Milan (DENR Aurora) helped facilitate the issuance of collecting and transport permits. We thank our guides the Tabliga cousins Marlon, Nestor, Randy, and Rudy for their company and assistance during our fieldwork. M. Coode translated the diagnosis into Latin. W. Suarez provided feedback on an earlier draft of this paper. Plants of *Nepenthes barcelonae* were collected during *Rafflesia* fieldwork supported by the Marsden Fund Council from Government funding, administered by the Royal Society of New Zealand.

## References

- Blanco, M. (1837) *Flora de Filipinas*. D. Miguel Sanchez, Manila, 887 pp.
- Brown, R. (1821) An account of a new genus of plants, named *Rafflesia*. *Transactions of the Linnean Society of London* 13: 201–234.  
<http://dx.doi.org/10.1111/j.1095-8339.1821.tb00062.x>
- Cheek, M. & Jebb, M. (2001) Nepenthaceae. *Flora Malesiana* 15: 1–161.
- Cheek, M. & Jebb, M. (2013) *Nepenthes alzapan* (Nepenthaceae), a new species from Luzon, Philippines. *Phytotaxa* 100 (1): 57–60.  
<http://dx.doi.org/10.11646/phytotaxa.100.1.6>
- Danser, B.H. (1928) The Nepenthaceae of the Netherlands Indies. *Bulletin du Jardin Botanique de Buitenzorg III* 9: 249–438.
- Hooker, J.D. (1881) *Nepenthes northiana* sp. nov. *Gardeners' Chronicle* II. 717 pp.
- IUCN (2014) *Guidelines for Using the IUCN Red List Categories and Criteria*. Version 11. Prepared by the Standards and Petitions Subcommittee. Available from <http://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed 16 June 2015)
- Jebb, M. & Cheek, M. (1997) A skeletal revision of *Nepenthes*. *Blumea* 42: 1–106.
- Linnaeus, C. (1753) *Species Plantarum*, vol. 2. Laurentii Salvii, Holmiae, 899 pp.
- Masters, M.T. (1889) *Nepenthes burkei*. *The Gardeners' Chronicle, Third Series* 6: 492–493.
- Nerz, J., Alt, T., Mann, P. & Smith, T. (1998) *Nepenthes sibuyanensis*, a new species from Sibuyan, a remote island of the Philippines. *Carnivorous Plant Newsletter* 27: 18–23.
- Pelser, P.B., Barcelona, J.F. & Nickrent, D.L. (Eds.) (2011 onwards) *Co's Digital Flora of the Philippines*. Available from: <http://www.philippineplants.org> (accessed 20 July 2015)