Phytotaxa 151 (1): 25–34 (2013)
www.mapress.com/phytotaxa/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

http://dx.doi.org/10.11646/phytotaxa.151.1.2

The *Nepenthes micramphora* (Nepenthaceae) group, with two new species from Mindanao, Philippines

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Abstract

The *N. micramphora* group is erected to accommodate the species *N. micramphora*, *N. abgracilis sp. nov.* and *N. cid sp. nov.* from submontane habitats in Mindanao, Philippines. An overview of the genus in the Philippines is presented in the context of recent discoveries. The greater taxonomic importance of pitcher characters over those of the flowers in the genus is reviewed and hypotheses are provided to account for this phenomenon.

Key words: conservation, Critically Endangered**,** IUCN, Surigao Province, taxonomy, ultramafic

Introduction

This paper is part of the research towards a World Monograph of *Nepenthes* Linnaeus (1753: 955), building on a Skeletal Revision of *Nepenthes* (Jebb & Cheek 1997) and the Flora Malesiana account (Cheek & Jebb 2001).

Nepenthes is the only genus of Nepenthaceae Dumort. and includes taxa mainly distributed in Malesia (ca. 125 species), while ca. 12 species occur in Madagascar, Seychelles, Sri Lanka, NE India, Indochina, Solomon Islands, New Caledonia and Australia. Cheek & Jebb (2001) recorded 87 species of *Nepenthes*, but since 2001, 54 new specific names have been published in the genus (see IPNI 2013 continuously updated) and others have been resurrected from synonymy. The number of species currently accepted is 140 and is set to rise further.

Cheek & Jebb (2001) recorded 12 species in the Philippines. New field surveys and herbaria examinations allowed discovery of 16 new species that have been published in the last twelve years (see IPNI 2013 continuously updated, e.g. Heinrich *et al.* 2009, Cheek 2011, Cheek & Jebb 2013a, 2013b, 2013c, 2013d). Some taxa [e.g. *Nepenthes alzapan* Jebb & Cheek (2013b: 59)] are considered possibly extinct since the destruction of forest habitat in the Philippines over the last 100 years has been so extensive. Although the Philippines is thought to have remained two-thirds forested as recently as 1925 according to Sohmer & Davis (2007), 75 years after that date Myers *et al.* (2000) estimated that remaining primary vegetation in the Philippines amounted to only 3%. Lowland primary forest has now all but gone from the Philippines (Sohmer & Davis 2007). They define lowland forest as occurring below 500 m a.s.l. Sohmer & Davis (2007) estimate species extinction levels due to habitat destruction as 9−28% in one representative, mainly forest genus, *Psychotria* Linnaeus (1759: 929) (Rubiaceae). Since habitat destruction continues in the Philippines, it is a race against time to discover, publish, assess and draw attention to the conservation needs of species before they become extinct, if they have not already been lost.

Accepted by Duilio Iamonico: 6 Nov. 2013; published: 6 Dec. 2013

About 50% of the *Nepenthes* species in the Philippines occur or occurred in scrub or stunted forest habitats on ultramafic substrates (both lowland and submontane), while the remaining 50% occur mainly in submontane forest (500–2000 m a.s.l) on non-ultramafic, mainly volcanic substrates. Species diversity is highest on Mindanao island, the southernmost and second largest island, followed by Palawan island.

All Philippine *Nepenthes* species are endemic, except for *N. mirabilis* (Loureiro 1790: 606) Druce (1916: 637) which is known from Tawi Tawi island (near Borneo), and from the northern coast of Mindanao and its associated islands. Concerning *Nepenthes*, and from the phytogeographical point of view, Palawan has closer affinities with Borneo rather than with the rest of the Philippines (Cheek & Jebb 1999).

Most of the endemic species can be assigned to one of three main groups:

1) The *Nepenthes villosa* group (sensu Cheek & Jebb 1999), including taxa with petiolate leaves, well-developed lid columns, peristomes with blade-like teeth, and lids which lack a basal appendage. These taxa are restricted to higher altitude ultramafic habitats and are most diverse in Palawan, but extend to NE Borneo (Cheek & Jebb 1999).
2) The *N. ventricosa* group (sensu Cheek & Jebb 2013b). Its species lack a petiole, have broadly subcylindrical pitchers with a broad peristome which is conspicuously toothed on its inner edge, lids which lack appendages, and transversely elliptic nectar glands except along the midline band. They occur in both ultramafic and non-ultramafic, mainly submontane forest habitats and are most diverse in the Philippines (but absent from Palawan), extending to New Guinea and to Borneo (Cheek & Jebb 2013b).
3) The *Nepenthes alata* group (sensu Cheek & Jebb 2013d). Its species have winged petioles, lids with basal ridges, usually producing appendages, and upper pitchers usually broadest at the base, and occurs in the same range of habitats as the *N. ventricosa* group. It is most diverse in Mindanao, and is endemic to and extends throughout the Philippines except Palawan, (Cheek & Jebb 2013d).

Nepenthes philippinensis Macfarlane (1908: 43) (endemic to Palawan), part of the *N. hirsuta* Hooker f. (1873: 99) group (restricted to Borneo; sensu Cheek & Jebb 1999: 890–891) and *N. abalata* Jebb & Cheek (2013: 153) (that occurs in the small low-lying, drier islands between Palawan and Panay Islands) are separate from the morphological point of view and they cannot be included in the groups above presented. Finally, *N. micramphora* V.Heinrich, S.McPherson, Gronemeyer & Amoroso (2009: 1315) (from the extreme SE of Mindanao) which has been of uncertain placement is discussed in the present paper.

Many of the Philippine *Nepenthes* species are only known from a single, sometimes sterile, specimen. However, there are few doubts that they are distinct taxa since the most important species-diagnostic characters in the genus are the morphology, anatomy and the size of the pitchers (especially the uppers and the intermediates), while the flowers and the fruit features have less taxonomic value. In many other plant groups, evolution of character diversity in floral characters appears to be correlated with assisting pollination, often by a single or few insect species. In *Nepenthes*, cross-pollination appears from initial studies to be performed by a broad range of generalist *Diptera* and *Hymenoptera* (Lian 1995, Adam 1998). Perhaps for this reason there is comparatively little species-level differentiation florally in the family. In contrast, evidence has been steadily accumulating in recent years that the pitchers of different *Nepenthes* species are specialised at gathering nutrients from one of a variety of animal sources. They are not always pitfall trappers of any prey item that happens to fall in, as had previously been assumed. *N. mirabilis* studied by Jebb (1991) in New Guinea predominantly trapped ants, but also a spectrum of other insects, while *N. albomarginata* T.Lobb ex Lindley (1849: 580) traps almost exclusively a species of termite (Clarke, 1997). *N. hemsleyana* Macfarlane (1908: 61), the pitchers of which, providing day roosts for a species of bat, benefit from the resulting faecal deposits produced (Grafe *et al.* 2011). No doubt in future, the morphological and micromorphological character states seen in the pitchers of other *Nepenthes* species or species groups, will also be shown to be important to targeting hitherto unsuspected specialised animal nutrient sources.

In the last few cases, the morphological modifications of the pitcher each appear to target only one or two species of animal. However, it is possible that future studies will show that some or most species of *Nepenthes* trap a wider range of insect species available in their environment. Since the range of e.g. arthropod species can be expected to vary from one mountain (or other geographic location) to another, it is possible that speciation in *Nepenthes* might be driven by modifications of the pitcher caused by selection for efficiency in trapping, or otherwise targeting, the spectra of animal species present at each. This might explain the common pattern seen in several *Nepenthes* groups to have different species, as recognised by pitcher morphology and micromorphology, on different mountains or islands.

An alternative hypothesis to explain this speciation pattern is genetic drift (Stace 1991). In this hypothesis, the progeny of the few founding individuals at a new location might accumulate morphological changes over time, that are not related to selection pressures. This scenario assumes that animal targeting is not strongly selected for in *Nepenthes*. This might be the case if the threshold for the need for nutrients derived from animals in *Nepenthes* is very low, or if there is no threshold at all, for example if *Nepenthes* can survive without capturing animal nutrients through their pitchers.

The shape and dimensions of the upper and intermediate pitchers and their structures are taxonomically highly useful characters, including those of the body, mouth and lid of the pitcher, and of the fringed wings when present. The nectar glands on the lower surface (size, shape, orientation, position, number per area unit, presence/absence of the nectar gland perimeter wall) of the lid are especially important as species characters. Trichome complements on the pitchers, leaves and stems are often important for species delimitation especially in the *Nepenthes alata* group. Here the trichome classification of Cheek & Jebb (2001: 7–8) is maintained.

Materials and Methods

Herbarium specimens (codes for herbaria are according to Thiers 2011 continuously updated) and living plants were examined. In several cases the mouth and the lid surface are not well visible in herbarium specimens, so it was necessary to soak the mouth area and lid, or sometimes the entire pitchers, in warm soapy water.

The following characters were measured: stem, and leaf and pitcher (using a graduated rule), hair sizes, and peristome and lower lid details (using a binocular microscope with an eyepiece graticule graduated in units of 0.025 mm at X40 magnification).

Results and discussion

The two species here described, *N. abgracilis* and *N. cid*, do not fit in any of the species-groups known from the Philippines (see introduction). Although they appear similar to the *N. alata* group, they lack the basal ridge and appendage of the lower surface of the lid. On the other hand, there is a clear morphological affinity with *N. micramphora* (described from Mindanao). Therefore, we here propose a new and informal species group named the "*N. micramphora* group", the diagnostic characters of which are:

1. submontane habitat;
2. stems terete;
3. peristome slender, cylindrical, 0.8–2 mm wide;
4. peristome ridges low, about 0.1 mm high, inconspicuous;
5. inner edge of peristome without visible teeth (in natural position);
6. lower surface of lid lacking a basal ridge and appendage;
7. lid nectar glands >100, monomorphic, large (ca.0.5 mm diam.) with a narrow border,± evenly spread over the lid

McPherson & Gronemeyer (2008: 36, 38) and McPherson (2009: 638 & fig. 343) published detailed photographs of a range of variants of *N. alata*. One of these images was indicated as "*A spectacular variant of N. alata growing on Mt Legaspi in the north of Mindanao. Note the lack of an appendage on the underside of the lid*". The lack of a lid appendage, and the lack of the leaf petiole (viewed in image), indicates that the plant represented by these photographs cannot be included in the *N. alata* group (*sensu* Cheek & Jebb 2013d). Moreover, the taxon cannot be identified as any of the known *Nepenthes* species. Concerning the pitcher features, the lids appear elliptic with base rounded, not cordate, and the lid nectar glands are large, dense and uniform over the entire lower surface including the midline; the short column has holes, not teeth, on the inner edge of the uniform cylindrical peristome; the slightly swollen, ellipsoid pitcher base narrows very slightly to a waist above, then dilates towards the peristome.

We found a specimen at K matching the photographs by McPherson & Gronemeyer (2008) and McPherson (2009). The label includes Merrill's annotation "*seems only to answer to a large form of N. gracilis. With sheet no. 34501 of N. merrilliana alt. 670m, Surigao, Mindanao, April 1919, Ramos & Pascasio*". Merrill's observation that this specimen is a form of *N. gracilis* was logical. It evidently refers to the apetiolate, subamplexicaul leaf-blade and subglabrous state of the material which, together with the subcylindrical pitcher, with its narrowly cylindrical peristome and ovate-elliptic, unappendaged lid, are characters seen in *N. gracilis* Korthals (1840: 22). Until recently this combination of characters was unknown in the Philippines. However, recently a species has been described from Mindanao with these *N. gracilis* characters, this being *N. micramphora*. Our material, described below as *N. abgracilis*, can be distinguished from *N. micramphora* and *N. gracilis* as shown in table 1 below.

TABLE 1. Diagnostic features separating *Nepenthes micramphora*, *N. abgracilis*, *N. gracilis* and *N. cid*.

	Nepenthes micramphora	***Nepenthes abgracilis***	***Nepenthes gracilis***	***Nepenthes cid***
Geographic distribution	Philippines, SE Mindanao (Mt Hamiguitan, Davaos Oriental Province)	Philippines, NE Mindanao (Mt Legaspi, Surigao Province)	Borneo, Sulawesi, Sumatra & Malay Peninsula	Philippines, N-Central Mindanao (Bukidnon Province)
Habitat	Undisturbed submontane ultramafic scrub	Undisturbed submontane forest, probably ultramafic	Disturbed lowland forest	Undisturbed lower submontane forest
Stem in cross-section	Terete	Terete	Triangular	Terete
Stem diameter	3.5 mm	6.0–7.0 mm	(1.5–)2.8(–5.0) mm	3–4 mm
Width of decurrent leaf wings at node	Nil	3–4 mm	6–13 mm	Nil
Leaf blade shape	Widest in distal half	Widest in distal half	Widest in proximal half	Widest in middle
Leaf blade size	4.0–8.0 x 0.7–1.0 cm	23.2–29.0 x 2.6–3.1 cm	(6.5–)12–19 x (1.0–)1.5–2.8(–3.7) cm	(9.0–)11.5–13.0(–14.0) × (1.2–)2.2–3.0 cm
Upper pitcher shape and dimensions	Upper pitchers broadest at either centre or at apex 4.0 (–6.7) cm long.	Upper pitchers slightly broadest at base about 16 cm long.	Upper pitchers slightly broadest at base (4.5–)7.0–15.5cm long.	Upper pitchers broadest at base & apex (4.5–)6.0–11.0 cm long
Peristome width	0.8 mm	2.5 mm	0.5 mm	1–1.5(–2) mm
Peristome inner edge (natural state)	Teeth not visible	Teeth not visible	Teeth visible	Teeth not visible
Number of lid nectar glands	>100	>100	(6–)20–30	>100
Lid nectar gland type	Not recorded	Thinly bordered	Thickly bordered, dome shaped	Thinly bordered
Spur	Branched	Entire	Entire	Entire

Nepenthes abgracilis Jebb & Cheek, *sp. nov.*

Type:—PHILIPPINES. Mindanao, Surigao Province (not further localised), 670 m a.s.l., April 1919, *Ramos & Pascasio in BS 34501B*, (holotype UC!, photo K!) (Fig. 1).

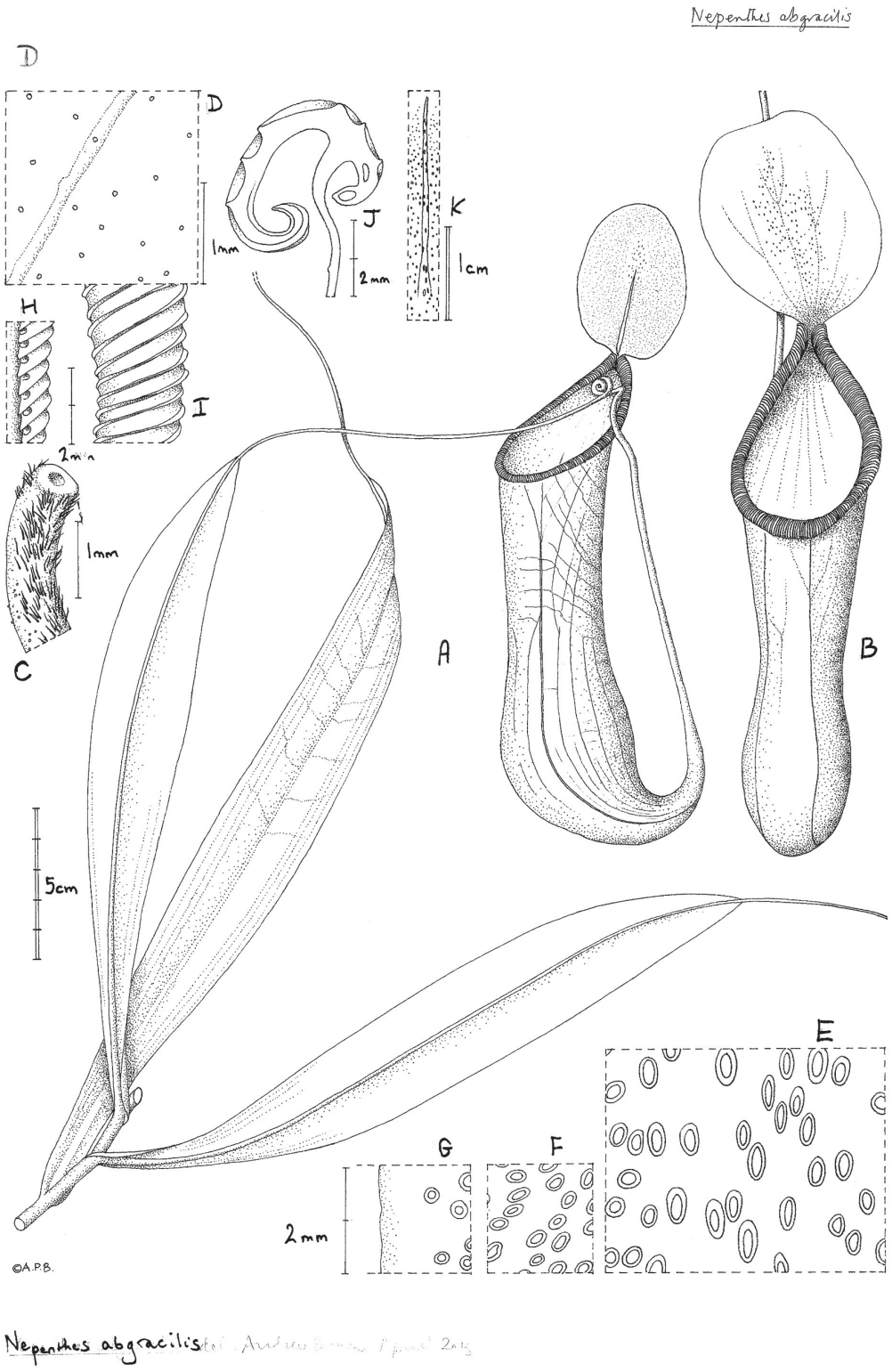

FIGURE 1. *Nepenthes abgracilis* **A** habit, stem with upper pitcher; **B** upper pitcher (from McPherson 2009); **C** tendril apex (pitcher not developed), indumentum; **D** outer surface of pitcher, with sessile glands; **E** nectar glands, lower surface of lid, midline (elongated); **F** nectar glands of lateral areas; **G** nectar glands, lid margin; **H** peristome, inner edge dissected (non-natural state); **I** peristome view from above; **J** peristome transverse section (inner surface on right); **K** lid, lower surface, midline ridge (probably artefact of drying). Scale-bars: single = 1 mm; graduated single = 2 mm; double = 1 cm; graduated double = 5 cm (drawn by A. Brown from the type specimen).

Diagnosis:—*Nepenthes gracilis* similis sed caulibus teretis (non triangularibus), peristomio 2–2.5 mm diametro ad marginem interiorem edentato (non ca. 0.5 mm diametro margine dentato) glandulis nectariferis in facie operculi inferiore >100 numero (non <30) distincta.

Description:—*Terrestrial climber* to several metres tall. Rosette and short stems unknown. *Climbing stems* terete, lacking wings, 6–7 mm diam., internodes 15–18 mm long, indumentum absent, apart from moderately dense minute sessile depressed-globose red glands 0.05 mm diam; stem apex unknown. *Leaves* spirally inserted, coriaceous, apetiolate, narrowly oblanceolate-oblong, 23.2–29 × 2.6–3.1 cm, apex attenuate, base gradually attenuate to ca. 1.3 cm wide at base, clasping the stem for 3/4 to 4/5 its circumference, at an acute angle from the vertical, forming wings 0.3–0.4 cm wide and extending 0.9–1.2 cm below the leaf axil; longitudinal nerves 3–4 pairs on each side of the midrib in the outer ¾ of the blade, arising from the leaf base and along the midrib, visible only on adaxial surface; pennate nerves not visible, upper surface dark green, lower surface drying brown, moderately densely scattered with sessile glands as the stem, hairs absent. *Lower and intermediate pitcher* unknown. *Upper pitchers* (tendrils coiled) subcylindric ca. 16.4 cm × 5.5 cm, broadest at the slightly ellipsoid base, gradually and slightly constricting to 4.1 cm wide at the centre, before dilating to 5 cm wide below the peristome, outer surface yellow-green, with sessile glands as the stem, 3–4 per mm², hairs absent except a few inconspicuous simple hairs 0.05–0.10 mm long near peristome; fringed wings reduced to ridges running the length of the pitcher. Mouth ovate, ca. 6 × 4 cm, oblique; peristome cylindric, ca. 2.5 mm wide, red, faintly lobed, to 4 mm wide, 2 ridges per mm, ridges 0.1 mm high, inner and outer edges tightly in-rolled, teeth not visible; column short, not strongly developed, with holes visible at the inner edge; lid ovate-elliptic, ca. 5.2 × 4 cm, apex rounded to truncate, base rounded at base; lower surface suffused or blotched red, lacking an appendage, but with a basal ridge (probably an artefact of drying), ca. 10 mm long, 1 mm, flat-topped; nectar glands more than 100, 95% or more monomorphic and relatively uniform in size, orbicular or slightly elliptic, 0.6–0.75(–0.9) × 0.4–0.5 mm, including a narrow rim ca. 0.05 mm wide; the basal ridge upper surface with circa 20 narrowly elliptic-oblong glands 0.75 × 0.25 mm; glands at the junction of blade with peristome, deeply sunken, lacking a rim, ca. 0.25 mm diam.; sessile glands as on stem evident only at the edge of the lid, few and inconspicuous; spur entire. *Inflorescence and fruit* unknown.

Distribution & habitat:—Philippines, Mindanao, Surigao Province. Forested submontane ridges, probably ultramafic, 670 m a.s.l.

Etymology:—The epithet *abgracilis* means "*from gracilis*" referring to the type specimen that was early identified by Merrill (see above) as a form of the species of that name.

Conservation status:—*Nepenthes abgracilis* is here assessed as Critically Endangered, under Criterion D of IUCN (2012). A single location is currently known (NE Mindanao). Although mining for metal ore occurs at the Mt Legaspi location, this is so far at lower altitudes than the species is known to occur (McPherson 2009). However, recent logging in Mindanao may have resulted in the extinction in the wild of one species recently (Cheek 2011). It is hoped that further observations will show that *N. abgracilis* is more common and widespread than present data suggest.

Nepenthes cid Jebb & Cheek, *sp. nov.* Type:—PHILIPPINES. Mindanao, Bukidnon, Dalvangan, 26 Dec. 1952, *Cid 8* (holotype L!; photo.K, isotype PNH) (Fig. 2).

Diagnosis:—*A* N. micramphora *caulibus foliis ascidiisque indumentosis (non glabris), ascidiis subcylindricis plerumque in medio constrictis (non infundibuliformibus) supremis alis conspicuis fimbriatis obsitis (non carentibus).*

Description:—*Epiphytic shrublet* high in trees, 0.1–0.5 m tall. Stems several from a woody rootstock ca. 2 × 5 × 2 cm, roots numerous, stout, 2 mm diam. *Rosette shoots* and *climbing stems* not seen, short stems terete, 3–4 mm in diameter, internodes 1.5–2.5 cm long, axillary buds not seen, moderately densely and persistent hairy in distal internodes, hairs white, covering ca. 50% of the surface, hairs 0.2–1.0 mm long, mainly simple, some with 2–6 erect branches from the base, either all equal or with a bristle hair longer than the others, intermixed with dark red depressed globose sessile glands 0.05 mm in diameter. *Leaf blades* chartaceous, drying brown on both sides, oblong-elliptic, (9.0–)11.5–13.0(–14.0) × (1.2–)2.2–3.0 cm, apex

acute, not peltate, base decurrent, longitudinal nerves 2(–3) pairs in the outer half of the blade, arising from the base of the midrib, conspicuous on the upper surface; pennate nerves moderately numerous and conspicuous on the upper surface, more or less patent; midrib on both surfaces moderately densely hairy (ca. 20% cover) with white, simple, mostly appressed hairs 0.2–0.4(–0.5) mm long, on lower surface, 0.3–1.0 mm long, on upper surface, the leaf-blade otherwise with sparse simple hairs and moderately dense depressed globose red-black glands 0.05 mm diam. Petiole 2.5–4.0 × 0.4–0.5 cm, wings held flat or slightly u-shaped, clasping the stem for ½ its circumference, not, or very slightly decurrent, indumentum as leaf-blade. Tendril >50% covered in appressed hairs 0.25–1 mm long, hairs simple or basally branched, arms equal or with one long and bristle-like (Fig. 2E). *Lower pitchers* not seen. *Intermediate* and *Upper pitchers* (tendrils not fully coiled) subcylindrical in outline (4.5–)6.0–11.0 × 1.9–2.8 cm, often with the basal 1/2–3/5 ellipsoid, narrowing gradually and slightly about the middle to ca. 1.6 cm wide before widening slightly to the peristome, outer surface 10–30% covered in minute, 4–5-armed, stellate hairs 0.1 mm diam., mixed with sparse minute simple hairs and larger basally branched hairs 0.4 mm long, together with depressed globose glands 0.05 mm in diameter; fringed wings running from the peristome to within 1–2 cm of the base of the pitcher, 1.8–2.0 mm wide, fringed elements (0.5–)1.0(–1.5) mm long, 3–4 mm apart, held close to the pitcher surface; mouth ovate 1.1–2.1 × 1.8–2.8 cm, moderately oblique, straight to slightly concave. *Peristome* cylindrical 1–1.5(–2) mm wide, even in width from front to lid, 3 ridges per mm, ridges 0.10–0.15 mm high, inner edge in life inconspicuous, incurved, (Fig. 2J), when dissected and unrolled, with a line of holes, teeth absent (Fig.2 L&K), outer edge not lobed; column not developed. *Lid* orbicular 1.9–2.2(–2.8) × 1.8–2.0 cm, apex emarginate or rounded, base rounded or weakly cordate, lower surface lacking a basal ridge or appendage, drying brown; nectar glands more or less monomorphic and evenly and moderately distributed over the lower surface of the lid, 1.5–3 nectar glands per mm^2, glands large, orbicular or slightly longitudinally elliptic, borders low, rounded, (0.3–)0.4–0.6 mm long, lacunae drying black, glossy; glands slightly denser along the midline and more diffuse at the margin; red sessile peltate or depressed-globose glands 0.05 mm diam., scattered evenly; marginal areas with minute inconspicuous branched hairs. Spur simple, tapering from base to apex, acute, 4–5 mm long, moderately to densely hairy. 10–20% covered in simple hairs 0.2 mm long. *Inflorescence* and *Infrutescence* unknown.

Etymology:—The specific epithet is dedicated to the collector of the type specimen, F. Cid (fl. 1952) of the Herbarium of the Department of Botany, University of the Philippines.

Distribution & ecology:—Philippines, Mindanao, Bukidnon; lower submontane forest, on tall trees. Elevation 770 m.

Conservation:—*Nepenthes cid* is currently known from one location in a country where most of the original forest habitat has been cleared for timber and agricultural land (Myers *et al.* 2000) and where forest degradation and clearance are ongoing. Intensive industrial pineapple plantations extending SE along the valley from Cagayan de Oro appear to be the main pressure on natural habitat at the type locality, as viewed on GoogleEarth (viewed 2 Oct. 2013). The population found include less than ten individuals (two), so *N. cid* is here assessed as Critically Endangered under Criterion D of IUCN (2012). It is hoped that additional locations for this species will be found and that one or more can be protected to ensure the survival of this species. However it is a concern that despite much searching by many enthusiasts in the last 10 years, including in the Bukidnon area (e.g. McPherson 2009), this species has not been collected in the last 60 years. This span corresponds with the peak period of forest destruction in the Philippines (Sohmer & Davis 2007). It is possible that *N. cid* is already globally extinct.

Notes:—Excepting for *Nepenthes cid*, and *N. truncata* Macfarlane (1911: 209), all other species of *Nepenthes* known from Mindanao are mainly terrestrial, although a few can sometimes root on the base of trunks of stunted trees in mossy forest on mountain peaks. However, examples of high epiphytes such as *N. cid,* on tall trees in lower submontane forest (700 m a.s.l) are rarer. Potentially *N. cid* could be more common than the sparsity of the existing material indicates, but due to its inaccessibility on tall trees is rarely seen. *Nepenthes cid* remains incompletely known to science. Botanists in Mindanao are urged to search for this species to establish whether or not it survives, to reveal its full range and to obtain collections with inflorescences, thus far unknown.

FIGURE 2. *Nepenthes cid* **A** habit, showing the whole plant, with woody rootstock; **B** lower surface of leaf-blade showing simple hairs and sessile globose glands; **C** stem, showing hairs; **D** tendril, showing hairs; **E** detail of D showing individual 'dagger hairs'; **F** outer surface of pitcher showing minute stellate hairs; **G** lower surface of pitcher lid; **H** nectar glands from midline of lid; **I** nectar glands from near periphery of lid; **J** peristome, viewed from above; **L** & **K** peristome, after dissection, rolled back to expose inner edge with holes (normally concealed); **M** peristome, transverse section, outer edge to right; **N** junction of lid and peristome, with spur. Scale-bars: single = 1 mm; graduated single = 2 mm; double = 1 cm; graduated double = 5 cm (drawn by A Brown from the type specimen).

Key to the species of the *N. micramphora* group

1. Epiphyte of tall trees; stems, leaves and pitcher hairy; leaves with distinct petiole 2.5–4 cm long..... *N.cid*
- Terrestrial shrub or climber; stems, leaves and pitchers (except under peristome) glabrous; leaves without a distinct petiole (sessile).....2
2. Upper pitchers subcylindric, widest at base, about 16 cm long..... *N. abgracilis*
- Upper pitchers infundibuliform, narrowest at base, widest in upper half, 4(–6.7) cm long.....*N.micramphora*

Acknowledgements

Tim Utteridge (London) advised studying the UC specimens which resulted in the discovery of *N. abgracilis*. Janis Shillito typed the manuscript (London). Mark Coode (Edinburgh) translated the Latin and gave advice on historic collection data. Duilio Iamonico (Rome) gave advice on structuring the paper. Two unknown reviewers made valuable suggestions on an earlier draft of this manuscript. Eimear Nic Lughadha (London) made helpful comments on the introductory pages.

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