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Nepenthes alfredoi (Caryophyllales, Nepenthaceae), A New Species of Pitcher Plant from Mindanao, Philippines

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ABSTRACT

KEY WORDS :

Carnivorous pitcher plants
Nepenthes
Mt. Hamiguitan Wildlife
Sanctuary
Mindanao, Philippines

The Philippines having the highest rates of endemism of this family is considered a center of diversity of the genus *Nepenthes* along with Sumatra and Borneo. Recent explorations in Mindanao and Luzon has raised the Philippine number of *Nepenthes* species to 52. This study reports the discovery of a new *Nepenthes* species from Mt. Hamiguitan. It is distinguished in having ground and upper pitchers with fringed wings on the tendril. The new species described herein was only observed at Gov. Generoso and has not been recorded elsewhere in the Philippines. Known only from the type locality and it faces severe threat from habitat destruction.

INTRODUCTION

Nepenthes is the sole genus of the family Nepenthaceae and is among the largest carnivorous plants. They can lure and catch arthropods, and more rarely frogs, rodents and small birds, due to their highly specialized foliage, which takes the form of hollow, water-filled vessels, or pitchers (Cheek & Jebb 2013; McPherson 2009).

Since the first encounter of *Nepenthes* in the mid 17th century, interest in the genus has profoundly altered knowledge on its taxonomy, diversity and distribution, particularly with respect to understanding the *Nepenthes* of Indochina and the Philippines (McPherson 2009; McPherson 2012). In the Philippines *Nepenthes* exhibit the highest rate of endemism of all, with many highland species occurring only on a single peak (McPherson, 2012). Mount Hamiguitan Range Wildlife Sanctuary (MHRWS) currently harbors four endemic species (*N. peltata*, *N. micramphora* V.B. Heinrich, S. McPherson, Gronem. & V.B. Amoroso, *N. hamiguitanensis* Gronem., Wistuba, V.B. Heinrich, S. McPherson, Mey & V.B. Amoroso and *N. justinae* Gronem., Wistuba, Mey, V.B. Amoroso (Gronemeyer *et al.* 2016).

MHRWS was designated as a World Heritage Site on the 23rd June of 2014 and is also a Mindanao Long Term Ecological and Research Site (Amoroso *et al.* 2016). For the latter, extensive data collection has provided baseline information on the floral and faunal diversity in the area (Amoroso *et al.* 2016).

In this work, we describe a new *Nepenthes* species from the MHRWS expansion site. Mt. Hamiguitan is now home to five endemic *Nepenthes* species.

MATERIALS AND METHODS

Field research was conducted by V.B.A, F.P.C., N.E.L and other researchers from the Central Mindanao University (CMU) at MHRWS expansion site in the Municipality of Governor Generoso, Davao Oriental. All the data and dimensions were either collected in the field from live plants or from the respective herbarium type cited above. Herbarium specimens were prepared and deposited in the Central Mindanao University Herbarium (CMUH).

The MHRWS expansion sites in the area of Sitio Oregon, Tibanban, and Brgy. Luzon, Gov. Generoso, Davao Oriental was explored after a Wildlife Gratuitous Permit was secured from the Department of Environment and Natural Resources and in accordance with the DENR streamlining/procedural guidelines (DAO No. 2004-55) in order to collect herbarium specimens for identification and taxonomic purpose.

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Collected plant materials were placed between paper sheets *in situ* and processed subsequently using standard methods at the CMUH.

Photographs were made from suitable representative plant specimens. Stereomicroscopy was conducted to examine the microstructures such as nectar glands, digestive glands and other sectors. Light microscopy was also employed to examine the pollen and indumentum of the species described herein.

RESULTS AND DISCUSSION

Taxonomic Description of *Nepenthes alfreDOI*

Nepenthes alfreDOI V.B. Amoroso and Lagunday *sp. nov.*

Diagnosis: Differs from *N. zygon* Jebb & Cheek in having both lower and upper pitchers with well-expressed fringed wings extending for some distance along the tendril (in all other *N. alata* group species the wings rarely extend along the tendrils, or do so for a very short distance). The male and female inflorescence is two flowered and rarely one flowered.

Type: Philippines, Mindanao, Mt. Hamiguitan Range Wildlife Sanctuary Expansion Site, Barangay Luzon, Gov. Generoso, Davao Oriental (345 m a.s.l.), N 06° 32.420' E 126° 08.601', 12.10. 2016, V.B. Amoroso, N.E. Lagunday and F.P. Coritico, holotype CMUH10856, Central Mindanao University Herbarium (CMUH), Musuan, Bukidnon, Philippines.

Description:

Terrestrial climber 8-12 m tall, scrambling in tall trees 12-30 m tall or on neighboring vegetation, glabrous, terete to triangular in transection, up to 7 mm in diameter; climbing stems with internodes up to 6 cm in length. *Hydathodes* evenly distributed in the stem, upper and lower leaf surface, midveins, tendrils and pitcher exterior.

Leaf blade broadly linear to ovate up to 27 cm long and 4.3 cm wide, obtuse to rounded leaf apex, base decurrent to petiole, with 2 veins running on either side of the midrib. Midvein and leaf margin pubescent, leaf upper surface dark green and light green in the lower surface. *Petioles* ca. 3 mm wide, ca. 1 mm thick, 2 mm wings on both sides, broadly U-shaped in section, not inrolled, tapering towards the wings. Rolls abaxially upon maturity.

Lower pitchers up to 12 cm tall and 4.5 cm wide in the inflated zone, inflated in the bottom thirds with a distinct hip then becoming cylindrical in the mid-region becoming cylindrical to slightly funnel-shaped towards the opening. *Wings* up to 0.8 cm wide with entire to sinuate margins and run down the

entire trap anterior extending for some distance along the tendril. *Wing filamentous fringes* are up to 8 mm long filiform ca. 0.5 mm in diameter, triangular base ca. 2 mm long, widest at base ca. 1 mm. The wings and fringes are pubescent. *Pitcher opening* ovate acuminate towards the lid forming the neck. *Tendrils* not coiled, up to 16 cm long and 1.5 mm in diameter. *Exterior of lower pitchers* olive drab green with blotches of garnet/blood red or suffused with ruby red depending on sunlight exposure. *Interior of the pitcher* is olive drab green. Tendrils and the leaf midribs suffused red.

Peristome teeth are absent with nectar glands in the semilunar depressions between the ribs, with canals emptying into the inner pitcher wall. *Peristome* cylindrical, ca. 5 mm wide, ribs ca. 0.1 mm wide, 0.1 mm thick, ca. 0.2 mm spaces in between ribs, tapering posteriorly forming a slightly anteriorly inclined neck. *Lids* ovate, up to 5.3 cm long and 4.1 cm wide, suffused with blood red. The basal upper surface may be covered with wax, may have orbicular to elliptic dark gland-like spots ca. 1 mm in diameter. Triangular *lid appendage* is basal, up to 4 x 7 mm, tapering towards the apex, well-developed lid appendage rounded apex curve posteriorly toward the lid base. *Nectar glands* ca. 0.2 mm are evenly distributed in the lid's lower surface including the appendage, elliptic in the centre and orbicular elsewhere. Lid spur filiform, pubescent and mostly unbranched, may be covered with wax, up to 1.2 cm long and up to 1 mm in diameter.

Upper pitchers up to 19 cm tall and 8 cm wide, funnel-shaped and slightly inflated in the bottom third with a distinct hip and tapering posteriorly towards the tendril, cylindrical mid-region, slightly funnel-shaped towards the opening. *Wings* up to 0.8 cm wide with entire to sinuate margin and running down the entire trap anterior, extending for some distance along the tendril, filamentous fringes up to 0.7 cm long. *Tendril* coiling and terete in cross section. *Peristome* occasionally with slightly elevated anterior. Lid and peristome morphology consistent with lower pitchers, mostly olive drab.

Male inflorescence a raceme up to 41 cm long, pubescent, bracts filiform up to 3 mm long, ca. 0.2 mm in diameter, partial peduncles bearing two flowers up to 6 mm long and 1 mm in diameter, pedicels up to 10 mm and 0.2 in diameter. Occasionally one flowered towards apex of the inflorescence. Petals tetramerous, ovate, up to 3 x 2.5 mm with orbicular to elongated nectar glands ca. 0.1 x 0.2 mm in the upper surface. Androphore are 2 mm long and 0.5 mm in diameter, anther-head subglobose 1 mm in diameter. Pollen in tetrads.

Female inflorescence is a raceme up to 40 cm long. Bracts

absent, pubescent, partial peduncles up to 5-10 mm long, 1 mm in diameter, shortest at the apex, pedicels 4-10 mm long, 0.5 mm in diameter, shortest at the apex. Flowers without partial peduncles have pedicels that are 4-15 mm long ca. 0.2 mm in diameter, shortest at the apex. Bearing tetramerous narrow ovate petals 3 x 2 mm with orbicular to elongated nectar glands ca. 0.1 x 0.2 mm on the upper surface. Capsule bearing the seeds up to 2 cm long and 0.4 cm wide. Seeds filiform, appendages up to 1.2 cm long.

Indumenta ca. 0.2-1 mm long, with 4-8 basal pseudo branches ca. 0.2-0.5 mm long. It is ca. 20-30% dense on the leaf blades and lamina, ca.80-90 % dense in the stem, midvein and tendril, 100 % dense in the pitcher exterior and inflorescence.

The interior of the inflated bottom thirds of the pitchers composed of the digestive zone and the waxy zone towards the pitcher opening.

Wax observed in the posterior of the pitcher neck, peristome and in the pitcher exterior localized near the peristome.

Nepenthes alfreDOI habit and photomicrographs are shown in Figures 2 and 3.

The morphological features delineating *N. alfreDOI* and *N. mindanaoensis* are summarized in table 1.

Etymology: The specific epithet honors Alfredo Bolante Sr. "Pidoy", a forest guard and well-trained local researcher of MHRWS who first observed and collected the new species described herein.

Taxonomic Notes

Nepenthes alfreDOI falls morphologically, within the *Nepenthes alata* group of species (Cheek & Jebb 2013 & 2014). The well-expressed fringed wings extending along the tendril in the upper pitchers of the taxon are also observed in

the New Guinean *Nepenthes* species *N. neoguineensis* Macfarl. The latter was not recorded in the type locality or anywhere else in the Philippines and differ in pitcher and inflorescence morphology from the taxon newly described here.

Distribution and Ecology

The majority of the observed populations of *N. alfreDOI* were at a maximum altitude of ca. 345 m a.s.l. along the ultramafic ridges of Brgy. Luzon, Gov. Generoso, Davao Oriental in the Mt. Hamiguitan range (Fig. 1). Individuals were only observed at Gov. Generoso and have not been recorded elsewhere in the Philippines

The population was observed to be strictly terrestrial in their type habitat scrambling on neighboring plants up to 30 m (e.g. *Ochrosia glomerata*). No other *Nepenthes* species was observed in the type habitats. *Nepenthes mindanaoensis* was observed in San Isidro, Davao Oriental, an adjacent municipality.

The new species described was compared with *N. zYGON* Jebb & Cheek and *N. mindanaoensis* Sh. Kurata such that the species were observed in eastern Mindanao and are closely related (Table 1). None of the species compared with *N. alfreDOI* were observed or recorded in the type locality.

Nepenthes alfreDOI is found within the buffer zone/ expansion sites of MHRWS, which is characterized by a lowland mixed dipterocarp forest at 175-345 m a.s.l. with the coordinates N 08011.667'; E 124045.282 located in the south eastern and westerns part of Mt. Hamiguitan, Davao Oriental. There were ca. 30 individuals recorded along the established trail from 175-345 m a.s.l. The associated vegetation around these plant consists primarily of big trees 20-30 meters high, such as *Shorea polysperma* Merr., *Shorea astylosa* Foxw. (Dipterocarpaceae), *Lithocarpus* spp. (Fagaceae), *Ochrosia glomerata* (Blume) F. Muell.

Table 1. Major characteristics delineating *Nepenthes alfreDOI* from *N. zYGON* (Cheek & Jebb 2014) and *N. mindanaoensis*

Character	<i>Nepenthes mindanaoensis</i> Sh.Kurata	<i>Nepenthes zYGON</i> Jebb & Cheek	<i>Nepenthes alfreDOI</i> Amoroso & Lagunday <i>sp. nov.</i>
Habit	6 m long	2-3 m long	8- 12 m long
Altitudinal distribution	0-800 m a.s.l., occasionally at 1400 m a.s.l.	1500-1875 m a.s.l.	160- 345 m a.sl.
Lower pitcher	Fringed wings present from base to peristome	Fringed wings present from base to peristome,	Fringed wings extending for some distance along the tendril
Upper pitcher	Wings are reduced to ribs	Fringed wings present only immediately below the peristome continuing as a rib	Well-expressed fringed wings extending for some distance along the tendril

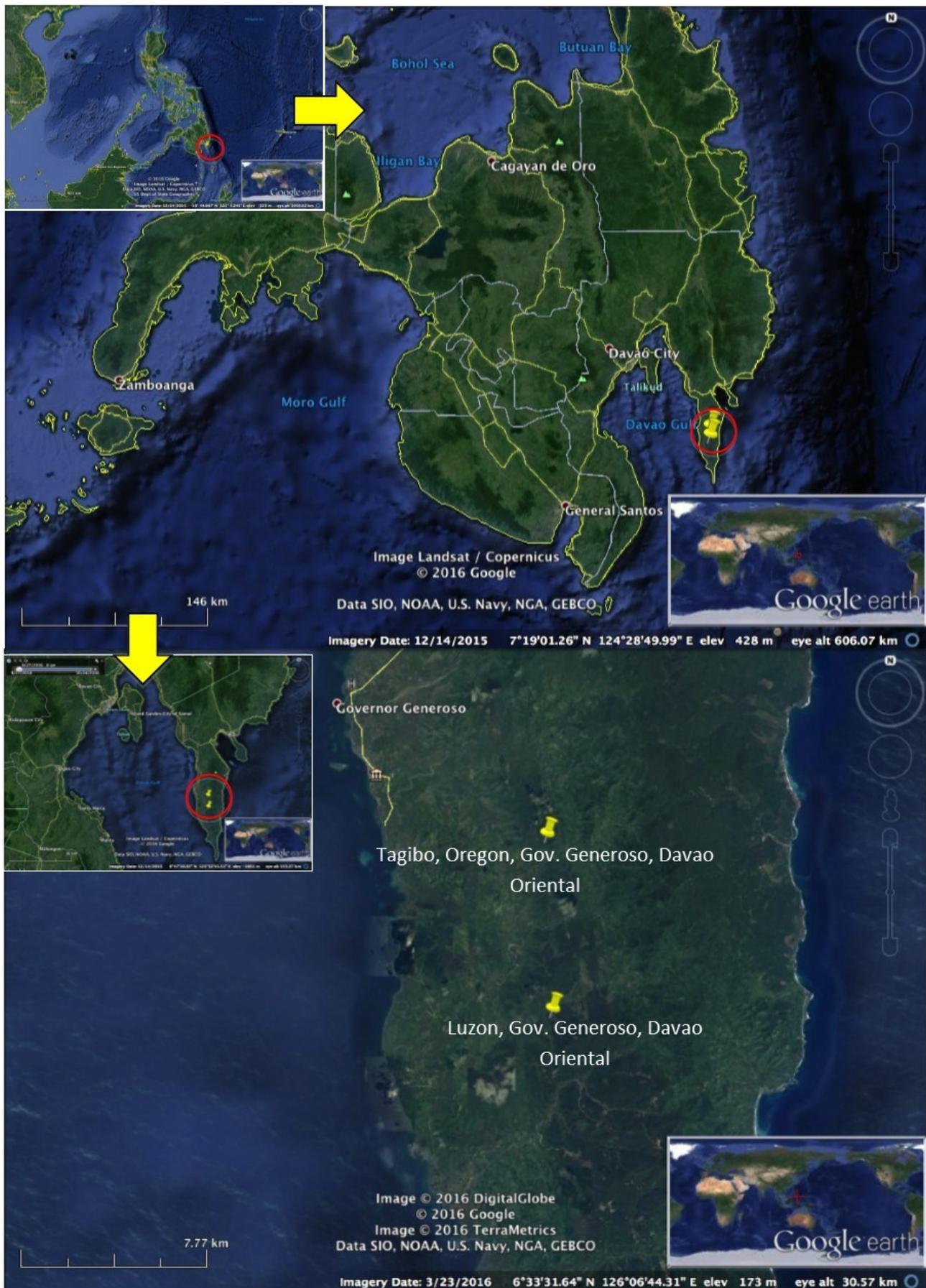


Figure 1. Map showing the distribution of *N. alfredoi* in Mt. Hamiguitan, Mindanao, Philippines (yellow pins)



Figure 2. *In situ* photographs of *N. alfredoi* (A) climbing stem with female inflorescence and upper pitchers; (B, C) upper pitchers; (D) rosette stem with ground pitchers; (E) ground pitchers, fw-fringed wing, wt-winged tendril.

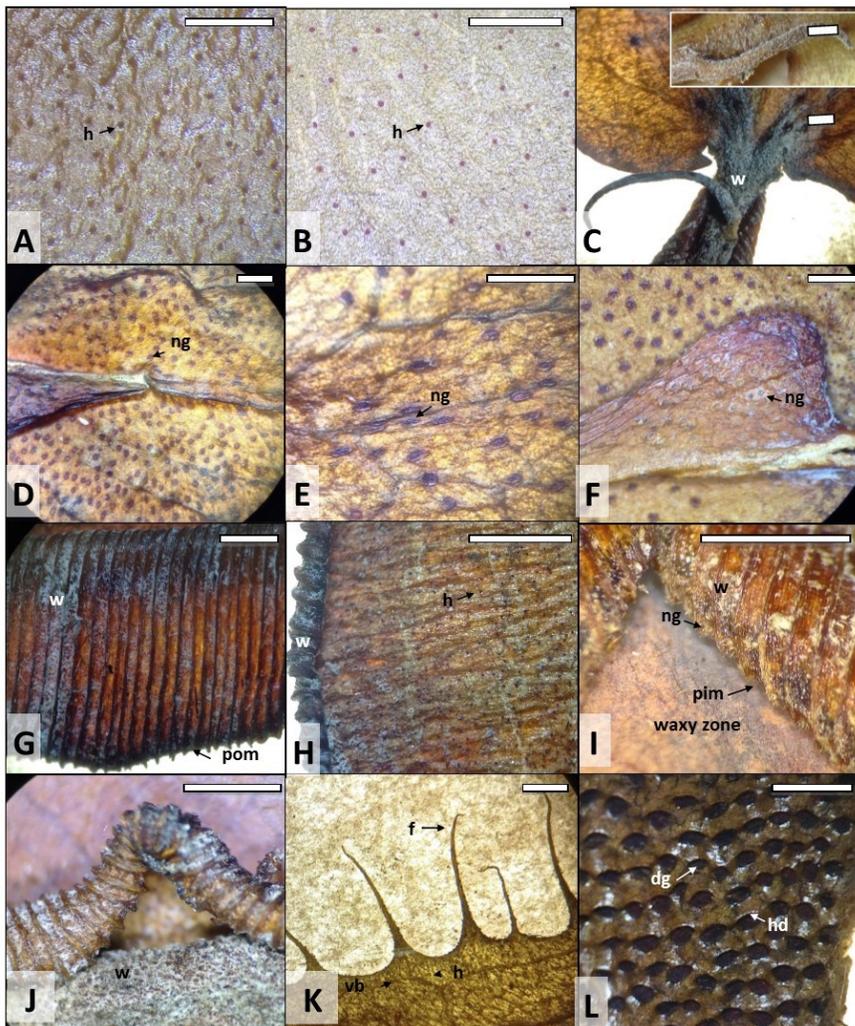


Figure 3. Photomicrographs of *Nepenthes alfredoi* (A) leaf adaxial with hydathodes evenly distributed, (B) leaf abaxial with hydathodes evenly distributed. (C) lid spur, (D-F) lid nectar glands, (F) lid appendage, (G) peristome upper surface, (H) peristome lower surface, (I) peristome inner margin, (J) slightly elevated peristome anterior, (K) pitcher wing with filamentous fringe, (L) digestive glands. dg-digestive gland, f-filamentous fringe, h-hydathodes, hd-hood, i-indumenta, ng-nectar gland, pom-peristome outer margin, pim-peristome inner margin, vb-vascular bundle, w-wax, bar-1mm.

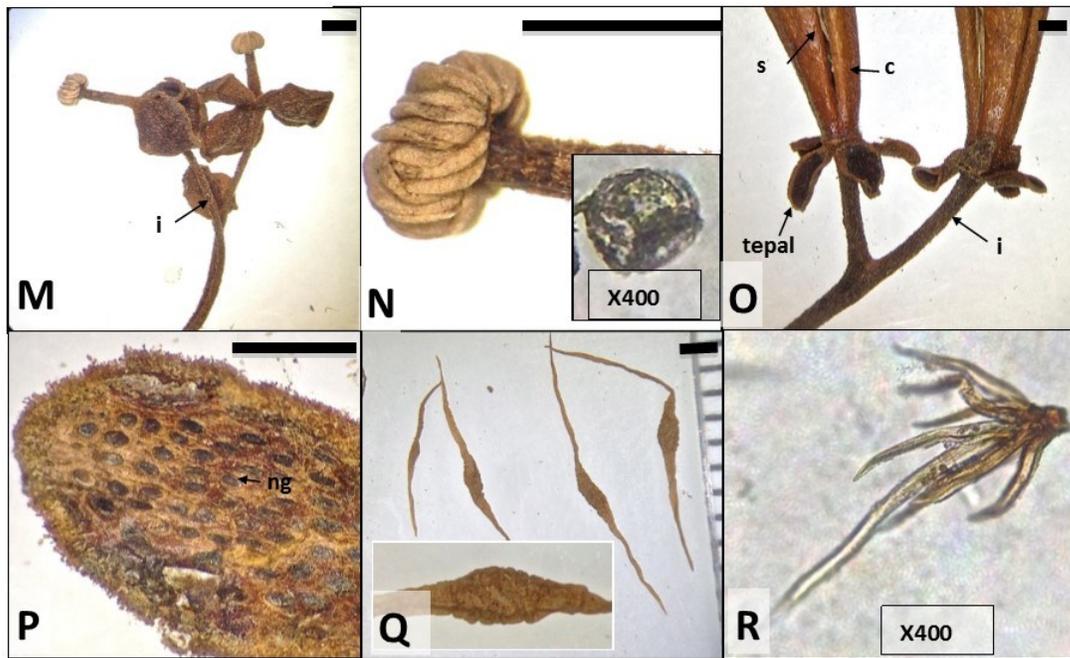


Figure 3 continued. Photomicrographs of *Nepenthes alfreDOI*. (M-N) male flower, (N) floret bearing the pollen (inset), (O) female flower, (P) tepal with nectar glands, (Q) seeds, (R) indumentum. c- capsule, i-indumenta, ng-nectar gland, sb- seed body, sw- seed filiform wing, bar-1mm.

(Apocynaceae), *Gymnostoma rumphianum* L.A.S. Johnson (Casuarinaceae), and the shrub *Melastoma malabathricum* L., and *Medinilla* spp. (Melastomataceae), as well as several species of ferns such as the common tree fern, *Sphaeropteris glauca* (Blume) R.M. Tryon *Lindsaea gueriniana* (Gaudich.) Desv., *Odontosoria retusa* (Cav.) J.Sm. (Lindsaeaceae), *Taenitis blechnoides* (Willd.) Sw. (Pteridaceae) and many other species of ferns and grasses.

Conservation Status

Critically Endangered [CR B1ab (i)] (IUCN 2016); extent of occurrence estimated to be less than 10 km². Occurring at lower elevations outside MHRWS with an estimated number of 150 mature individuals and it may likely suffer habitat destruction by human activities such as mineral mining, illegal logging, agriculture and slash and burn farming. Known only from the type locality and probably site endemic to Mt. Hamiguitan, where it faces severe threat from deforestation.

CONCLUSION

Botanical fieldwork in the MHRWS expansion sites has led to the discovery of a new taxon of carnivorous pitcher plant adding to the four described endemic species in the area. Previously identified other species in the site include *N. peltata*, *N. micramphora*, *N. hamiguitanensis* and *N. justinae*. and with the newly described species, a total of five endemic *Nepenthes* are now inhabiting this mountain range.

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