Trappers in Nature:
The NEPENTHES of Peninsular Malaysia



'Trappers in Nature – The Nepenthes of Peninsular Malaysia' book aims to provide knowledge and awareness to the public about the diversity of pitcher plant species or better known by its scientific name *Nepenthes* (Nepenthaceae) in Peninsular Malaysia. Description of scientific information are presented with a collection of beautiful photographs of the species in their original habitat equipped with QR codes of additional information on MYBIS (Malaysia Biodiversity Information System) website which aims to be the Repository Centre for biological diversity information in Malaysia.

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Ministry of Natural Resources, Environment and Climate Change

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> “Peninsular Malaysia is among the **world’s biodiversity hotspots** for a wide variety of pitcher plants (*Nepenthes*) species with nine endemic species”

Preface



This book on the richness of pitcher plants or *Nepenthes* species in Peninsular Malaysia is a suitable read for all levels of local and foreign communities.

The unique *Nepenthes*, which mostly grow in nutrient-poor soils and environment, have inspired botanists since they were first discovered by Europeans in the 17th century.

However, not many Malaysians know about the actual functions and uses of this diverse species. Therefore, this book aims to raise public awareness on the beauty and importance of our pitcher plants species, with updated information on selected species of Malaysia’s pitcher plants and presented in an interesting way. In accordance with the title of this book, the best pictures have been selected to highlight the wondrous world of *Nepenthes*, complete with QR codes. Readers can get more detailed information for each species in the MyBIS database via this QR code on websites that can be accessed on-line for free.

The information contained in this book is the result of extensive research and photography efforts. Many people have helped in our efforts to conduct field studies and research and cannot be acknowledged enough.

However, for the publication of this book, we would like to thank the Honourable YB Tuan Nik Nazmi bin Nik Ahmad, Minister of Natural Resources, Environment and Climate Change; YBhg. Dato’ Haji Rosli bin Isa, Secretary-General, Ministry of Natural Resources, Environment and Climate Change; YBrs. Dr. Khairul Naim bin Adham, Under-Secretary, Biodiversity Management, Ministry of Natural Resources, Environment and Climate Change; YBhg. Dato’ Dr. Mohammad Zabawi bin Abdul Ghani, Director- General of the Malaysian Agricultural Research and Development Institute (MARDI); and YBrs. Dr. Mohd Shukri bin Mat Ali @ Ibrahim, Director of Agrobiodiversity and Environment Research Centre, MARDI. The printing of this book is funded by the Ministry of Natural Resources, Environment and Climate Change.



14205
Nepenthes ampullaria
Nepenthaceae
Periuk kera
©Dome Nikong

LC

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About MYBIS

Malaysia Biodiversity Information System (MyBIS) is a one-stop repository database system, which provides and facilitates access to information on biodiversity studies and management in Malaysia. In accordance with Article 18(3), it has evolved into a global network of websites with the CBD website (www.cbd.int) as its central node, and MyBIS as national nodes of the network.

Our Mission

1. To collate information related to Malaysia's biodiversity from a variety of sources.
2. To provide easy access to and make available for public circulation, information, databases and other relevant materials, provided by various stakeholders.
3. To create public awareness on biodiversity and environmental issues.
4. To provide updated statistical analysis on biodiversity data.

To date, four main modules with several sub-modules containing many different types of information have been developed and are available on-line. The four main modules consist of Discover, Explore, Analysis, and References. Meanwhile, the sub-modules are Species, Protected Areas, Experts, Specimen, Toxinology, Gallery, Relations, Structure, Glossary, Newsletters and Literature.

The website can be accessed via www.mybis.gov.my through three interfaces; desktop, tablet and mobile displays. With these interfaces, users can easily search for information about Malaysian biodiversity.

INTRODUCTION

The publication of 'Trappers in Nature – The *Nepenthes* of Peninsular Malaysia' Malaysia Biodiversity Information System' aimed to document information on diversity of carnivorous plant species in Malaysia and to promote national biodiversity database known as Malaysia Biodiversity Information System (MyBIS). MyBIS is the one-stop reference centre for biodiversity of Malaysia, established as part of Malaysia's commitment under the Convention on Biological Diversity. There are fifteen species of *Nepenthes* recorded in Peninsular Malaysia and mainly distributed in heath forests, lowland area, including montane species up to 1000 m altitude and above (Ghazalli et al. 2020; Tamizi et al. 2020). The primary centres of diversity of *Nepenthes* are in Borneo, the Philippines and Sumatra, with updated enumeration of 179 species already recorded. It is also important to includes their secondary centres of diversity that covers Peninsular Malaysia, Sulawesi and New Guinea (Cheek & Jebb 2001; Christenhusz 2016; Clarke 2002; McPherson 2009; Robinson 2019). Out of the fourteen *Nepenthes* species recorded in Peninsular Malaysia, ten are considered endemic, one - *N. gracillima* seems to need to be further study and confirmation, and the other four annotated species are noted as common species with wider distribution records. Global conservation statuses used in this book are based on International Union for the Conservation of Nature and Natural Resources (IUCN) Red List. Categories and Criteria used in the taxon assessments are based on IUCN Red List Categories and Criteria: Version 3.1. Second Edition. IUCN list should be reviewed from time to time. Latest information can be obtained on MyBIS website http://www.mybis.gov.my/ and MyBIS social media official facebook http://facebook.com/mybisgovmy and official twitter http://twitter.com/mybisgovmy.

The following are the conservation status categories of the IUCN Red List:

EXTINCT (EX): A taxon is extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW): A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range.

CRITICALLY ENDANGERED (CR): A taxon is critically endangered when the best available evidence indicates that it meets any of the criteria A to E for critically endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

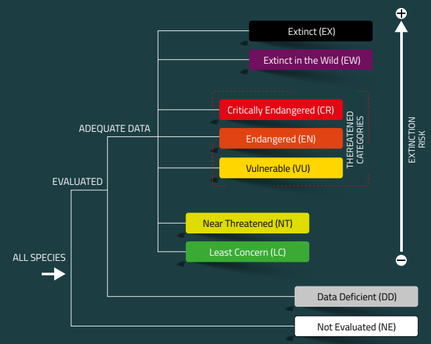
ENDANGERED (EN): A taxon is endangered when the best available evidence indicates that it meets any of the criteria A to E for endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU): A taxon is vulnerable when the best available evidence indicates that it meets any of the criteria A to E for vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT): A taxon is near threatened when it has been evaluated against the criteria but does not qualify for critically endangered, endangered or vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC): A taxon is least concern when it has been evaluated against the criteria and does not qualify for critically endangered, endangered, vulnerable or near threatened. Widespread and abundant taxa are included in this category.

NOT EVALUATED (NE): A taxon is not evaluated when it has not yet been evaluated against the criteria.



Guide To USING THE BOOK

1 QR CODE
By scanning the QR codes, users are enable to find more information related to the species of interest via MyBIS website. The QR code reader apps can be downloaded from Google Play Store (Android users) or Apple App Store (for iOS or iPhone users).

2 SPECIES SERIAL NUMBER (SSN)
Each species in MyBIS has its own unique identifying number. This species serial number enables users to search for a particular species quickly in MyBIS website without scanning the QR code.

To search on Web:
Go to the internet browser i.e. Google Chrome, Mozilla Firefox, Internet Explorer, etc. and insert the following URL
http://www.mybis.gov.my/sp/xxxxx
(replace xxxxx with the SSN)

Using Telegram apps:
1. Open Telegram apps
2. Search contact 'mybisgovmy'
3. Start searching using SSN

3 IUCN STATUS
Shows the conservation status of the species whether it's under Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC). (Available from the IUCN Red List website: http://www.iucnredlist.org)

4 SCIENTIFIC NAME
Scientific name of the species

5 ENGLISH NAME
English name of the species

6 LOCAL NAME
Local name of the species

7 COPYRIGHT OWNER OF THE PICTURE
Copyright owner of the picture





ACKNOWLEDGEMENTS

The main objective of this book is to share and document the carnivorous plants species that we have prepared an inventory for research interests. Each *Nepenthes* species is described thoroughly including the morphology description, species distribution and ecological preferences. In view of the future plan for utilisation and genetic enhancement, carnivorous plants species especially *Nepenthes* are unique and have shown great diversity, variation, and characteristics.

Whilst these species diversity should be protected as a valuable asset of our nation's biodiversity, we are confident that all information in this book could also benefit all those who are interested in biological diversity theme book, both for harmonising research and development of agricultural related species, creating awareness in protecting these species diversity from loss and eventual extinction as well as tapping their potential in research discovery.

Appreciation is also addressed to the Herbarium MARDI (MDI), Dr. Richard Chung Cheng Kong from the Forest Research Institute Malaysia (KEP, FRIM) Dr. Noraini Talip from the Herbarium of the Universiti Kebangsaan Malaysia, Bangi (UKMB), Forestry Department of Peninsular Malaysia, Langkawi Development Authority (LADA), and Mr. Fauzi Abu Bakar for helping us in the field and laboratory. Finally, special appreciation is also addressed to Mr. Yasser Mohamed Arifin (Ministry of Natural Resources, Environment and Climate Change) with MyBIS Teamwork for their helps and encouragement for the publication of this book.

NT

27966
Nepenthes mirabilis
Nepenthaceae
Periuk kera
©Dome Nikong





Chapter 1

INTRODUCTION



66610
Nepenthes latiffiana
Nepenthaceae
Periuk kera
©Mohamad Alias
NE

Introduction

Nepenthaceae family members ranges from Madagascar and the Seychelles in the west, through northern India, South-east Asia to China, Australia and New Caledonia in the East and majority of the species are endemic to Malesia.

It comprises about 179 species, mostly in Malaysia, Singapore, Brunei, Indonesia, the Philippines, Papua New Guinea, with Borneo and Sumatera become the areas where most species are discovered.

General name
pitcher plant, tropical pitcher plant, monkey cup (En.).

Malaysia
periuk kera, periuk monyet, periuk kerengga.

Pitcher Plants
of Peninsular Malaysia

There is a total of 14 species of pitcher plants (*Nepenthes*) or locally known as periuk kera has been recorded in Peninsular Malaysia (Table 1).

Ridley (1923) provided the first taxonomic account of said genus in Peninsular through the record of a total of 10 species, namely *N. ampullaria* Jack, *N. albomarginata* Lobb ex Lindl., *N. gracillima* Ridl., *N. alba* Ridl., *N. ramispina* Ridl., *N. sanguinea* Lindl., *N. macfarlanei* Hemsl., *N. gracilis* Korth., *N. rafflesiana* Jack and *N. mirabilis* (Lour.) Druce).

Borneo, the Philippines and Sumatera are known as the epicentres of the diversity of *Nepenthes*, with an updated enumeration of 170 species were already recorded and it is also important to include their secondary centres of diversity that comprise of Peninsular Malaysia, Sulawesi and New Guinea (Cheek & Jebb 2001; Christenhusz 2016; Clarke 2002; McPherson 2009; Robinson 2019).

Nepenthes are most commonly encountered in disturbed secondary forests, swamp forests, *kerangas* or heath forests from sea level to ca. 700 m altitude, although some are found higher, e.g. Gunung Tahan which peaks slightly above 2,000 m. Regardless of that, only certain species occur in the aforesaid habitats, although they can be locally common. *Nepenthes rafflesiana, N. ampullaria* and *N. gracilis* are possible to be discovered in these habitats in Peninsular Malaysia, Sumatera, and Borneo.

A few *Nepenthes* species are confined to montane habitats between 1,500-2,500 m altitude, prevalently in open mossy, stunted, ridge-top forests as climbers or epiphytes such as *N. alba* and *N. ramispina*.

Some species can grow in both lowland and montane habitats, for example *N. rafflesiana* although most species occur in one or the other.

Limestone and ultramafic substrates or woodland are also habitats for some *Nepenthes*. Obligate limestone species are known only from Borneo, namely *N. boschiana, N. campanulata, N. faizaliana, N. mapuluensis,* and *N. northiana*.





NE

49469
Nepenthes malayensis
Nepenthaceae
Periuk kera
©Mohamad Alias Shakri

Table 1. A summary of *Nepenthes* species of Peninsular Malaysia

SPECIES	DISTRIBUTION	HABITAT	ALTITUDE (M)
Nepenthes alba	Endemic to Peninsular Malaysia	Growing in upper montane forests.	1,600-2,187
N. albomarginata	Borneo, Peninsular Malaysia & Sumatera	Hill and montane forests	up to 1,100
N. ampullaria	Borneo, New Guinea, Maluku Islands, Peninsular Malaysia, Singapore, Sumatera and Thailand	Damp, shady forests, swamp forests and *kerangas*, *Araucaria* forests, as well as secondary forests, open microphyllous vegetation, or swamp grassland.	up to 2,100
N. benstonei	Endemic to Peninsular Malaysia	Growing terrestrially in open, lowland, hill and montane forests.	150-1,200
N. domei	Endemic to Peninsular Malaysia	Terrestrial in rich humus soil, rosette/ lower pitchers tend to burrow in the soil up to ½ of the pitcher body.	850-1,000
N. gracilis	Borneo, Peninsular Malaysia, Singapore, Sulawesi, Sumatera and Thailand	Lowland peat-swamp forests, *kerangas*, podsol heath scrub, swamp edges or disturbed areas, e.g. roadsides; on poor soils, sometimes on sandstone or ultramafic soils; can be found thriving along the roadside in Peninsular Malaysia and Borneo.	up to 800
N. gracillima	Endemic to Peninsular Malaysia	up to 2,187 m altitude, growing in upper montane forests.	1,400-2,200
N. latiffiana	Endemic to Peninsular Malaysia	Terrestrial climber in upper montane forests.	1,000-1,100
N. macfarlanei	Endemic to Peninsular Malaysia	Mountain ridges, usually in shady sites on mossy banks.	900-2,150
N. malayensis	Endemic to Peninsular Malaysia	Terrestrial climber in upper montane forest.	1,000-1,100
N. mirabilis	Distributed across Southeast Asia, Mainland China, and Northern Australia	Found in a remarkable range of habitats, but usually most abundant in disturbed, swampy or grassland situations. Usually at low altitude up to 200 m, but up to 1,000 m, and more rarely to 1,500 m.	up to 1,500
N. rafflesiana	Borneo, Peninsular Malaysia, Singapore, Sumatera	*Kerangas* or swamp forests, often with *N. ampullaria*, also in secondary forests and old clearings, often on sand, rarely on ultramafic.	up to 1,000
N. ramispina	Endemic to Peninsular Malaysia	Growing in upper montane forests.	900-2,000
N. sanguinea	Endemic to Peninsular Malaysia	Mountain ridges.	900-1,800





NE

49422
Nepenthes domei
Nepenthaceae
Periuk kera
©Dome Nikong

Pitcher Plants

from the Economic and Cultural Perspectives

Certain pitcher plants species which are mostly located in the highlands have become well-known in the horticultural trade sector and among plant collectors.

The stems of *Nepenthes ampullaria* are prevalent in rope making as that particular part of the species is known for its good quality and durable fibre source. Apart from that, its opened pitchers are synonymous with the process of cooking rice/glutinous rice, which imparts an interesting flavour to what is called lemang periuk kera. Other than that, a boiled root concoction is proved to be beneficial in treating stomach aches.

Moreover, the fresh fluid extracted from unopened pitchers of all species are known to be useful in curing eyes inflammation and indigestion problems. *Nepenthes reinwardtiana* is common in Borneo through its utilisation in skin healing procedure and as an astringent.



LC

15206
Nepenthes gracilis
Nepenthaceae
Periuk kera
©Mohamad Alias Shakri



LC

43552
Nepenthes sanguinea
Nepenthaceae
Periuk Kera
©Dome Nikong

Batik Art Inspired

by Pitcher Plants Motif

Batik has become one of the fascinating Malay art heritages to this day. The distinctive textile decorating skill that is commonly based on floral or geometric motifs defines the art of batik. Aside from that, the East Coast states of Malaysia, namely Kelantan, Terengganu and Pahang are synonymous and well-known for the art of batik canting. The art of Malaysian batik production can be distinguished from the Javanese batik in Indonesia through the larger and simpler pattern of the elements drawn on the textile.

The pitcher plants motif of the art of batik is one of the most idiosyncratic Malaysian arts to be highlighted. The morphological characteristics of this pitcher plant which is a climber and the presence of pitchers at the end of the leaf part makes it distinctive from other plants. In addition, the physical appearance of these pitchers in terms of colour and shapes are varied, hence enhancing the uniqueness of this batik motif.

In maintaining the cycle of creating and producing fascinating art by the batik textile art entrepreneurs, it is vital that this particular art that belongs to the Malaysian cultural heritage is highlighted and promoted continuously, apart from increasing the awareness of the Malaysian community about the biological diversity of this country, which is interesting to be promoted in the heritage art high quality textile production.

The Government of Malaysia also recognizes the Malaysian batik through various initiatives including wearing batik shirts every Thursday, providing market opportunities on both on-line and off-line channels and a platform for local batik entrepreneurs and designers to create new batik designs that reflect Malaysia's identity.





Batik art with periuk kera motifs by MyCrafts

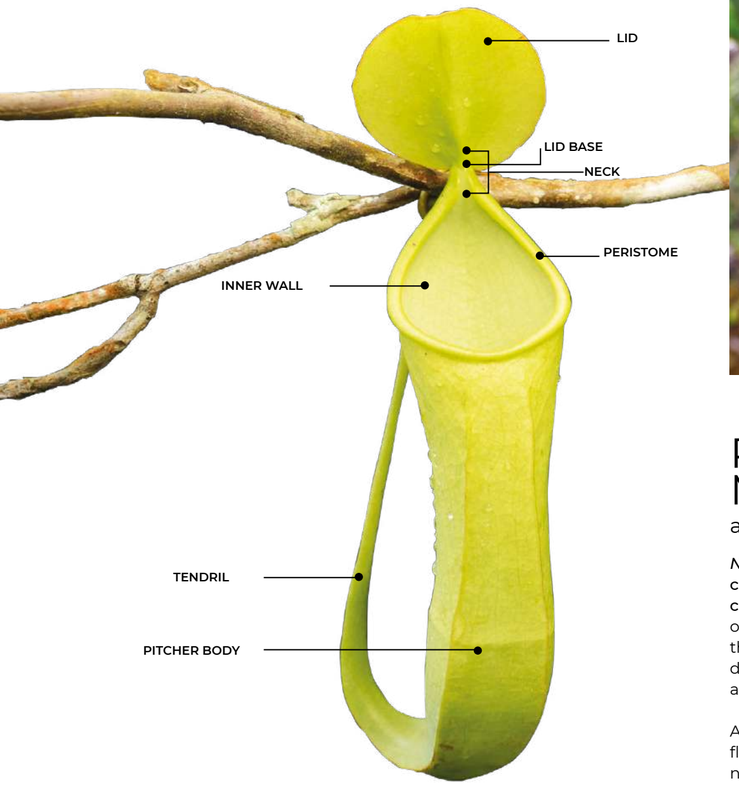


Figure 1: *Nepenthes* general morphology



Pitcher Plant Morphology

and How They Trap Their Prey

***Nepenthes* are part of rare and unique plants that consume insects, making it popular with the term carnivorous plants**. Unlike other plants that normally obtain nutrients from photosynthesis and water in the soil for their survival, carnivorous plants are often discovered thriving in nutrient-poor soil and get their additional nutrition from insects they preyed on.

A carnivorous plant commonly lures its preys such as flies, beetles, butterflies and other insects through the nectar on the underside of the plant's lid or decaying insects trapped inside. The waxy and slippery surface of its inner walls and the teeth and trichomes toward the top help the plant greatly in trapping preys. At the bottom of the pitcher structure is a pool of fluids, and any prey that is unable to escape the plant will drown. The plant's enzymes digest the meal, and the plant is then able to absorb the nutrients. Refer to Figure 1.





Chapter 2

SPECIES DIVERSITY

Nepenthes alba Ridl.
N. albomarginata T. Lobb ex Lindl.
N. ampullaria Jack
N. benstonei C. Clarke
N. domei M. N. Faizal, A. Amin et Latiff
N. gracilis Korth.
N. gracillima Ridl.
N. macfarlanei Hemsl.
N. rafflesiana Jack
N. mirabilis (Lour.) Druce.
N. ramispina Ridl.
N. sanguinea Lindl.
N. latiffiana M. N. Faizal, A. Amin et N. Dome
N. malayensis A. Amin, M. N. Faizal et N. Dome



Figure 2: *Nepenthes alba* upper pitchers.



Figure 3: *Nepenthes alba* lower pitcher

Species Diversity

Nepenthes alba Ridl.

(Figures 2 & 3)

Ridley, 1923. The Flora of the Malay Peninsula 3: 22. McPherson, Pitcher Plants of the Old World 1 (2009) 557, f. 300. Syn. *Nepenthes singalana* auct. non Becc., Macfarl. in Engl., Pflanzenr. 4, 3 (1908) 47, partim; Macfarl., J. As. Soc. Beng. 75, 3 (1914) 282. — *Nepenthes bongso* auct. non Korth.: Ridl., J. Linn. Soc., Bot. 38 (1908) 320. — *Nepenthes gracillima* auct. non Ridl.: Danser, Bull. Jard. Bot. Buitenz. III, 9 (1928) 296; Shivas, Pitcher Plants of Peninsular Malaysia and Singapore (1984) 31; Kiew, J. Wildlife and National Parks 10 (1990) 36; Jebb & Cheek, Blumea 42 (1997) 43; Cheek & Jebb, Fl. Malesiana 15 (2001) 69; Clarke, *Nepenthes* of Sumatra and Peninsular Malaysia (2001) 131.

08968
Nepenthes alba
Nepenthaceae
Periuk kera
©Muhamad Ikhwanuddin Mat-Esa

LC

Type
Wray & Robinson 5411 (Lecto. SING, isolecto. BO), Peninsular Malaysia, Pahang, Gunung Tahan, 1,500 m, 3 June 1905.

Nepenthes alba can be found specifically in the eastern peaks of Peninsular Malaysia - Gunung Tahan, Pahang and obviously the only *Nepenthes* species that is abundant in the short *padang* vegetation on the uppermost parts of the mountain. Colour of rosette/lower pitchers dark purple throughout, overlain with darker purple flecks; upper pitchers yellowish white throughout, sometimes with variable amounts of light red coloured flecks, sometimes with dark red pigment on the outer surfaces.

Distribution
Peninsular Malaysia, endemic.

Ecology and habitat
up to 1,600-2,187 m altitude, growing in upper montane forests.



Figure 4: *Nepenthes albomarginata* pitchers, with green pitcher body that can be found on Gunung Kerunai, Gerik, Perak.

09444
Nepenthes albomarginata
Nepenthaceae
Periuk kera
©Muhamad Ikhwanuddin Mat -Esa

LC



Figure 5: *Nepenthes albomarginata* lower pitcher with red-purplish pitcher body

Nepenthes albomarginata T. Lobb ex Lindl.

(Figures 4-8)

Lindley, 1849. The Gardeners' Chronicle 1849: 580.

Lobb ex Lindl., Gard. Chron. (1849) 580; Macfarl. in Engl., Pflanzenr. 4,3 (1908) 37, excl. syn. *Nepenthes teysmanniana*; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 262; Shivas, Pitcher Plants of Peninsular Malaysia & Singapore (1984) 25; Tamin & Hotta in Hotta, Diversity and Dynamics of Plant Life in Sumatra (1986) 80; Phillipps & Lamb, Pitcher Plants of Borneo (1996)65, f. 38; Jebb & Cheek, Blumea 42 (1997) 16; Clarke, *Nepenthes* of Borneo (1997) 62, f. 38 & 39.

Type
Gard. Chron. 1849, p. 580, t. 3 (lecto.).

This species can be confused with *Nepenthes gracilis* due to its pitcher morphological shape, but is distinguishable by a white band of densely packed silky hairs just below the peristome and long, dense coppery red indumentum on young stems and leaves. The white band consists of white hairy trichomes that serve to lure termites. Pitchers are green, red or green mottled with red, with a conspicuous glistening white band below the mouth. Two pitcher body colourations were recorded in Peninsular Malaysia, with the red variation found in Bukit Bendera, Pulau Pinang, Gunung Jerai in Kedah and Gunung Ledang in Johor, while the green variation was recorded in Gunung Kerunai, Perak.

Distribution
Sumatera, Peninsular Malaysia and Borneo.



Figure 6: *Nepenthes albomarginata* lower pitcher.



Figure 7: *Nepenthes albomarginata* upper pitcher.



Figure 8: *Nepenthes albomarginata*



Figure 9: *Nepenthes ampullaria* lower pitcher



Figure 10: *Nepenthes ampullaria* lower pitcher

14205
Nepenthes ampullaria
Nepenthaceae
Periuk kera
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Nepenthes ampullaria Jack
(Figures 9-12)

Jack, 1835. Companion to the Botanical Magazine 1: 271; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 265; Sh. Kurata, Gard. Bull. Sing. 26 (1973) 227; *Nepenthes* of Mt. Kinabalu, Sabah (1976) 34; Shivas, Pitcher Plants of Peninsular Malaysia & Singapore (1984) 27; Tamin & Hotta in Hotta. Diversity and Dynamics of Plant Life in Sumatra (1986)81; Jebb, Science in New Guinea 17 (1991) 21, f. 4 & 8; Phillipps & Lamb, Pitcher Plants of Borneo (1996)67, f. 40: Jebb & Cheek, Blumea 42 (1997) 18; Clarke, *Nepenthes* of Borneo (1997)65, f. 40-43.

Type
Jack s.n. (lecto. SING), Singapore.

Nepenthes ampullaria, famous for its flask-shaped rosette pitchers, comes with a variation in blotches pattern, colour and size. This species has an extensive distribution in South-east Asia, including Peninsular Malaysia, Sumatera, Borneo and New Guinea. The pitchers are ovoid with horizontal mouth and broad peristome, which can be found at ground level often in dense clusters.

Several variations of the pitcher were recorded in Peninsular Malaysia – green throughout, green with red peristome, green with red blotches and red-pitcher forms. This species is common in Johor, Pahang, Terengganu, Melaka, Negeri Sembilan, Selangor and Perak, often preferring heath forests, at the margins of open swamps or roadsides.

Distribution
Thailand, Sumatera, Peninsular Malaysia, Borneo and New Guinea.

Ecology and habitat
Damp, shady forests, in Borneo it is found in swamp and kerangas forests, also in secondary forests, open microphyllous vegetation, or swamp grassland; sea level to up to 2,100 m.



Figure 11: *Nepenthes ampullaria*.
Diversity of pitcher colorations and blotches.







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Nepenthes ampullaria
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Figure 12: *Nepenthes ampullaria*

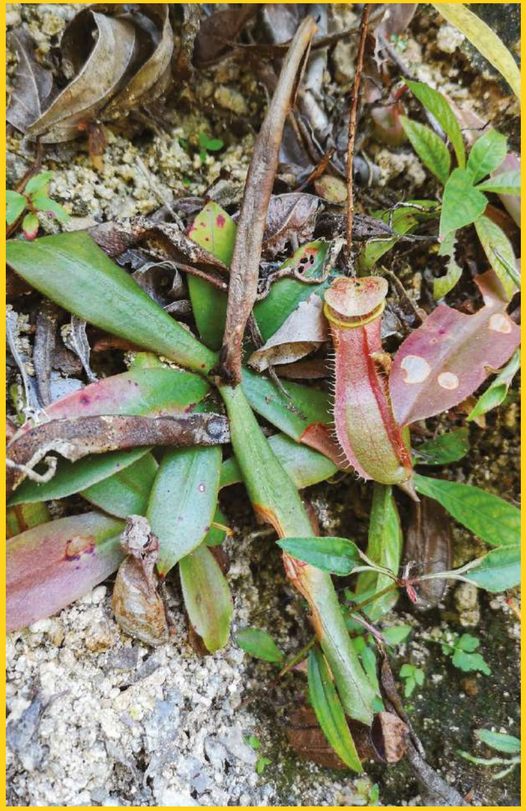


Figure 13: *Nepenthes benstonei* rosette pitchers

00680
Nepenthes benstonei
Nepenthaceae
Periuk kera
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NE



Figure 14: *Nepenthes benstonei* lower pitcher

Nepenthes benstonei C. Clarke
(Figures 13-14)

Clarke, 1999, Sandakania 13 : 79. TYPE: Clarke s.n. (holo. KEP n.v.; iso. BO n.v., K n.v., L n.v., SAN n.v., SING n.v.).

Type
Peninsular Malaysia, Kelantan, Machang, Bukit Bakar, 530 m, 24 July 1998.

Nepenthes benstonei was named after the British–American botanist, Dr. B. C. Stone. This species is closely related to *N. sanguinea* but can be differentiated by a number of morphological characteristics such as stems, leaf characteristics, and also pitcher morphology. This species is known from Gunung Tahan (Pahang), Bukit Bakar (Kelantan) and also other highland areas in Terengganu (Chemerong, Dungun) and Pahang (Bukit Tinggi).

Ecology and habitat
Growing terrestrially in open, lowland, hill and montane forests, sea level to 150-1,200 m.



Figure 15: *Nepenthes macfarlanei* upper pitchers



Figure 16: *Nepenthes macfarlanei* upper pitcher



27949
Nepenthes macfarlanei
Nepenthaceae
Periuk kera
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Nepenthes macfarlanei Hemsl.
(Figures 15-19)

Hemsley, 1905. Proceedings of the Linnean Society 117: 12. ; Hook.f., Icon. (1906) 29, t. 2814, 2815; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 323; Shivas, Pitcher Plants of Peninsular Malaysia & Singapore (1984) 35; Jebb & Cheek, Blumea 42 (1997) 57.

Type:
King's Collector 7421 (lecto. K; iso. K), Peninsular Malaysia, Perak, near top of Gunung Bubu, 4,800-5,300 ft, in 1885.

Nepenthes macfarlanei is one of the most interesting highland pitcher plant species in Peninsular Malaysia. It is immediately recognisable by the presence of bristles on the underside of the lid. The pitchers come in pale green, often with the upper half in white or cream, mottled with red, or sometimes wholly purplish red with darker blotches. The inner surface is waxy white with red blotches; lowers pale yellowish - green, red or waxy brown.

Ecology and habitat
Mountain ridges, usually in shady sites on mossy banks; 1,000-2,150 m.



Figure 17: *Nepenthes macfarlanei* upper pitcher



Figure 18: *Nepenthes macfarlanei* lower pitchers





Figure 19: *Nepenthes macfarlanei* lower pitchers variation in shape and size.

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Nepenthes macfarlanei
Nepenthaceae
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Figure 20: *Nepenthes gracilis* upper pitchers





Figure 21: *Nepenthes gracilis* lower pitcher



Figure 22: N*epenthes gracilis* upper pitchers, with unique coloration observed in Kuala Kubu Baharu, Selangor.

Nepenthes gracilis Korth.
(Figures 20-22)

Korthals, 1839, in *Verhandelingen over de Natuurlijke Geschiedenis der Nederlandsche Overzeesche Bezittingen, Kruidkunde 1839-1842* by *C.J. Temminck*. Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 290; Sh. Kurata, Gard. Bull. Sing. 26 (1973) 229; Shivas, Pitcher Plants of Peninsular Malaysia & Singapore (1984) 29; Tamin & Hotta in Hotta, Diversity and Dynamics of Plant Life in Sumatra (1986) 86; Phillipps & Lamb, Pitcher-Plants of Borneo (1996) 89, f. 49; Jebb & Cheek, Blumea42 (1997) 42; Clarke, *Nepenthes* of Borneo (1997) 90, f. 59 & 60; J.H. Adam & Wilcock, Sarawak Mus. J. 50 ('1996', 1998) 159.

Type:
Korthals s.n. (lecto. L; iso. K), Borneo, Kalimantan, Gunung Pamatton, 325 m.

Nepenthes gracilis is a widespread, common and weedy species that occurs across Peninsular Malaysia, Singapore, Sumatera and Borneo. The pitchers are found in hues of green, red, or green mottled with red, and black-purple. It is interesting to note that N. gracilis flowers have been variously described as white, green, light red or brown.

Ecology and habitat
Lowland peat-swamp forests, *kerangas,* podsol heath scrub, swamp edges or disturbed areas, e.g. roadsides; on poor soils, sometimes on sandstone or ultramafic soils; sea level to 800 m. It can be found thriving along the roadsides in Peninsular Malaysia and Borneo.

15206
Nepenthes gracilis
Nepenthaceae
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Figure 23: *Nepenthes gracillima* lower pitchers. (Courtesy of Kenneth Hiew)



Figure 24: *Nepenthes gracillima* intermediate pitchers. (Courtesy of Kenneth Hiew)



Figure 25: *Nepenthes gracillima* rosette pitchers. (Courtesy of Kenneth Hiew)





Figure 26: *Nepenthes gracillima* upper pitchers. (Courtesy of Kenneth Hiew)

15512
Nepenthes gracillima
Nepenthaceae
Periuk kera
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Nepenthes gracillima Ridl.
(Figures 23-26)

Nepenthes gracillima Ridl., J. Linn. Soc., Bot. 38 (1908) 320; Macfarl. in Engl., Pflanzenr. 4, 3 (1908) 38; J. As. Soc. Beng. 75, 3 (1914) 282; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 296, excl. syn. *Nepenthes ramispina*; Shivas, Pitcher Plants of Peninsula Malaysia & Singapore (1984) 31, part in; Kiew, J. Wildlife and National Parks 10 (1990) 36; Jebb & Cheek, Blumea 42 (1997) 43.

Type:
Wray & Robinson 5309 (lecto SING; iso BO), Peninsular Malaysia, Pahang, Gunung Tahan, 990 m, 29 May 1905.

Nepenthes gracillima diagnostic character are the lid glands are larger, fewer and more uniform in size, and the whole plant is glabrescent. The coloration of the upper pitchers of *N. gracillima* is beautifully striking, they are green in their lower part, becoming pale yellow to ivory-white in their upper parts, with reddish-rose coloured markings throughout.

Ecology
Open areas or amongst scrub, on quartzitic soils or heavily weathered rock; 1,300-2,100 m.



Figure 27: *Nepenthes mirabilis* upper pitchers



Figure 28: *Nepenthes mirabilis* lower pitchers



Figure 29: *Nepenthes mirabilis* upper pitcher.



Figure 30: *Nepenthes mirabilis* upper pitcher, with reddish peristome.



Figure 31: *Nepenthes mirabilis* female inflorescense.

Nepenthes mirabilis (Lour.) Druce
(Figures 27-31)

Druce, 1916. *Report of the Botanical Society and Exchange Club of the British Isles, Second Supplement* 637. Merrill, Interpr. (1917) 242; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 330; Sh. Kurata, *Nepenthes* of Mt Kinabalu, Sabah (1976) 56; Tamin & Hotta in Hotta, Diversity and Dynamics of Plant Life in Sumatra (1986) 88; Jebb, Science in New Guinea 17 (1991) 32, f. 16; Adam & Wilcock, Mal. Nat. J. 46 (1992) 76; Phillipps & Lamb, Pitcher-Plants of Borneo (1996) 109, f. 57; Jebb & Cheek, Blumea 42 (1997) 63; Clarke, *Nepenthes* of Borneo (1997) 105, f. 70 & 71; Adam & Wilcock, Sarawak Mus. J. 50 ('1996', 1998) 160.— Syn. *Phyllamphora mirabilis* Lour., Fl. Cochin. 2 (1790) 606. — *Nepenthes phyllamphora* Willd., Sp. Pl., ser. 4, 2 (1805) 874.

Type:
Loureiro s.n. (Pn.v.), Vietnam, near Hue.

Nepenthes mirabilis, almost all encountered in lowland, is variable but unique in having leaves with fimbriate margin, the leaves of rosettes and short stems. These fimbriae are not trichomes, but attenuated extensions of the leaf. Distinctive characteristics of *N. mirabilis* are the numerous longitudinal nerves scattered throughout the leaf blade, the sericeous, dorsiventrally flattened spur with a rounded apex. Large populations of this species are said to exist in Sarawak, but herbarium material is scant.

Ecology and habitat
Found in a remarkable range of habitats, but usually most abundant in disturbed, swampy or grassland situations. Usually at low altitude up to 200 m, but up to 1,000 m, and more rarely to 1,500 m.





Figure 32: *Nepenthes ramispina* upper pitchers

Figure 33: *Nepenthes ramispina* upper pitcher

41026
Nepenthes ramispina
Nepenthaceae
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VU

Nepenthes ramispina Ridl.
(Figures 32-36)

Ridley, 1909. Journal of the Federated Malay States Museum 4: 59. Fl. Malay Pen. 3 (1924) 22; Jebb & Cheek, Blumea 42 (1997) 77. — TYPE: Ridley 12064 (lecto. SING; iso. SING), Peninsular Malaysia, Selangor, top of Ulu Semangko, Aug. 1904. Syn. *Nepenthes gracillima* var. major Ridl., Fl. Malay Pen. 3 (1924) 22.

Type:
Ridley s.n. (SING), Peninsular Malaysia, Pahang, Gunung Telom. *Nepenthes gracillima* auct. non Ridl.: Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 296, partim, f. 7 toto

N. ramispina can be recognised by its larger habit, broader, oblong-obovate leaves, slender and longer upper pitchers with long, fasciculated spur, the glands on the underside of the lid which are numerous, unbordered, and range from 0.1 mm near the margin to 0.4 mm wide near the middle and the pubescent stem and midrib.

Ecology and habitat —
Forest edges, ridge tops; 900-2,000 m.

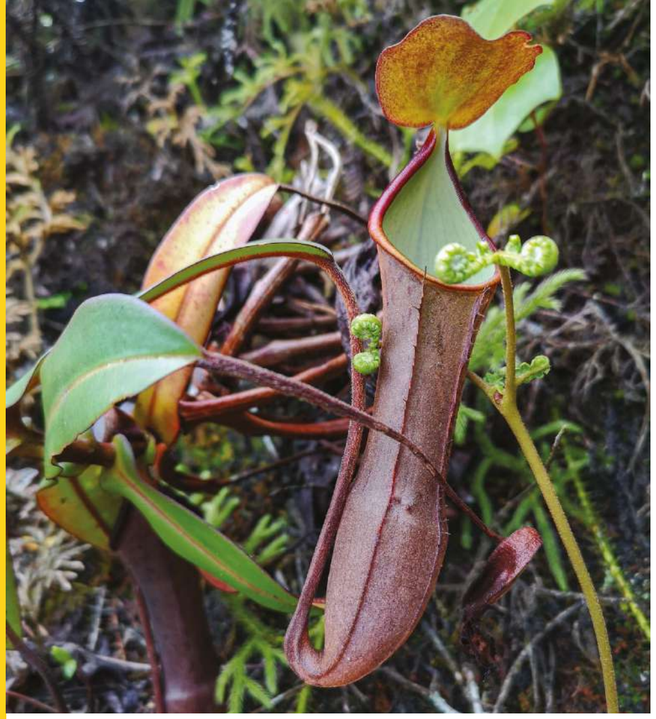


Figure 34: *Nepenthes ramispina* lower pitchers



Figure 35: *Nepenthes ramispina* lower pitchers

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Nepenthes ramispina
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Figure 36: *Nepenthes ramispina* natural hybrid with *N. macfarlanei* observed on Genting Highlands, Pahang, Malaysia



Figure 37: *Nepenthes sanguinea* lower pitchers



Figure 38: *Nepenthes sanguinea* thriving on the hill slope in Gunung Gunung Brinchang, Pahang, Malaysia

43552
Nepenthes sanguinea
Nepenthaceae
Periuk kera
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Figure 39: *Nepenthes sanguinea* lower pitcher





Figure 40: *Nepenthes sanguinea* lower pitcher

43552
Nepenthes sanguinea
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Figure 41: *Nepenthes sanguinea* upper pitchers

Nepenthes sanguinea Lindl.
(Figures 37-41)

Lindley, 1849. The Gardeners' Chronicle and Agricultural Gazette 580. cum icon.; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 366, f. 20; Shivas, Pitcher Plants of Peninsular Malaysia & Singapore (1984) 43 & 79; Jebb & Cheek, Blumea 42 (1997) 79.

Type:
Griffith 4411 (K), Gunung Ledang. Syn. *Nepenthes pumila* Griff., Post. Papers 4 (1854) 349

Nepenthes sanguinea is distinguished from *N. macfarlanei* in the more or less sharply three-angled, glabrescent stems, the lower lid surface either lacking or possessing very few hairs, the pitchers not abruptly contracted below the peristome, and the inner edge of the peristome lacking teeth. It is not likely that *N. sanguinea* would be confused with the other montane species of Peninsular Malaysia (*N. ramispina*) since these are of much smaller species with more slender pitchers. They come in either all green or with pitchers spotted with red-brown, inner surface blotched with red; peristome green, striped red; rarely the whole outer surface vivid red, the peristome yellow, and the inner surface lacking red pigment.

Ecology and habitat
Mountain ridges; 900-1,800 m.



Figure 42: *Nepenthes malayensis* upper pitchers



Figure 43: *Nepenthes malayensis* upper pitchers



Figure 44: *Nepenthes malayensis* lower pitchers

Nepenthes malayensis A. Amin, M.N. Faizal et N. Dome

(Figures 42-44)

Amin Asyraf Tamizi et al. 2020. Kew Bull. (2020) 75: 63.

Type:
Malaysia, Terengganu, East Coast Range (Banjaran Pantai Timur), Amin Asyraf, Mohd Norfaizal, Dome, Edward & Muhamad Ikhwanuddin MDI 12422 (holotype MDI!; isotypes K!, KEP!).

N. malayensis is a newly discovered species from a montane forest in the eastern part of Peninsular Malaysia. The species is considered as highly threatened since only a few individuals have been discovered within a limited area and almost all of them grow on humus-covered boulders scattered at the summit. This species has broadly angular, pubescent climbing stems, pitchers contracted below peristome, cylindrical peristome, lower part of pitcher broadly ovoid. The new species is also considered as a facultative lithophyte.

Distribution
Peninsular Malaysia, endemic.

Ecology and habitat
Terrestrial climber in lower montane forest.

NE

49469
Nepenthes malayensis
Nepenthaceae
Periuk kera
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Figure 45: *Nepenthes domei* lower pitchers.



Figure 46: *Nepenthes domei* lower pitchers



Figure 47: *Nepenthes domei* lower pitchers

Nepenthes domei M. N. Faizal, A. Amin & Latiff

(Figures 45-48)

Mohd N. Ghazalli et al. (2020). Webbia. Journal of Plant Taxonomy and Geography 75(1) : 5. Type: : Malaysia, Peninsular Malaysia, Terengganu, Setiu, 30 April 2019, MNFG750 (MDI!), MDI12423, Mohd. Norfaizal, Amin Asyraf, Dome Nikong, Muhamad Ikhwan, Edward Entalai [holotypus, MDI].

Named in honour of Mr. Dome Nikong, the first person to discover a population of the species, *N. domei* is currently known only in a restricted area in Setiu, Terengganu. A terrestrial climber in humus-rich soil, immature and mature lower/rosette pitchers tend to burrow in the soil up to a third or half of its body. *N. domei* is described with these morphological characters such as thick coriaceous texture lower pitcher, broad rounded formation in the lower 1/3 or 1/2 of the lower pitcher, two fringed wings up to 7 mm wide narrowest at the base and widest at the mouth, multicellular fringe elements up to 2-4 mm long. The lower pitchers exhibit whitish red to dark ruby red colouration with the majority of individuals sparsely overlain or entirely absent of specks on the inner and outer wall. The inflorescence rachis length is measured up to 35 cm long.

Distribution
Peninsular Malaysia, endemic.

Ecology and habitat
Terrestrial in rich humus soil, rosette/lower pitchers tend to burrow in the soil up to ½ of the pitcher body.



Figure 48: *Nepenthes domei* upper pitchers.

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Nepenthes domei
Nepenthaceae
Periuk kera
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Figure 49: *Nepenthes latiffiana* lower pitchers



Figure 50: *Nepenthes latiffiana* upper pitchers



Figure 51: *Nepenthes latiffiana* lower pitchers

Nepenthes latiffiana M. N. Faizal, A. Amin et N. Dome
(Figures 49-51)

Mohd N. Ghazalli et al. (2020). Webbia. Journal of Plant Taxonomy and Geography 75(1) : 5.

Type:
Malaysia, Peninsular Malaysia, Terengganu, Setiu, 30 April 2019, MNFG751 (MDI!), MDI12424, Mohd. Norfaizal, Amin Asyraf, Dome Nikong, Muhamad Ikhwan, Edward Entalai, [holotypus, MDI]

The species is named in honour of Emeritus Professor Dato' Dr. A. Latiff Mohamad, a prominent figure in Malaysian Botany who pioneered the study of *Nepenthes* in the 1980s. *N. latiffiana* is described to have green-yellowish to brownish (peach colour) lower pitchers overlain with red blotches); upper pitcher green throughout with external surface sparsely overlain with red blotches, peristome is considerably developed, loosely cylindrical, expanded towards both sides of the mouth forming a flap-like structure which is especially prominent in upper pitchers, climbing stem with simple hairs and lid margin slight wavy to wavy.

Nepenthes latiffiana is currently known only in a restricted area in Setiu, Terengganu.

Distribution
Peninsular Malaysia, endemic.

Ecology and Habitat
Terrestrial climber in lower montane forest.



Figure 52: *Nepenthes rafflesiana* upper pitchers.



Figure 53: *Nepenthes rafflesiana* lower pitcher



Figure 54: *Nepenthes rafflesiana* with ear-like appendage discovered in Padang Tujuh, Rompin, Pahang, Malaysia.



Figure 55: *Nepenthes rafflesiana* lower pitcher



Nepenthes rafflesiana Jack
(Figures 52-55)

Jack 1835. Companion to the Botanical Magazine 1: 270. Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 357; Shivas, Pitcher Plants of Peninsular Malaysia & Singapore (1984) 39; Tamin & Hotta in Hotta, Diversity and Dynamics of Plant Life in Sumatra (1986) 90; Phillipps & Lamb, Nature Malaysiana 13,4 (1988) 14; Pitcher-Plants of Borneo (1996) 123, f. 66-68; Jebb & Cheek, Blumea 42 (1997) 75; Clarke, *Nepenthes* of Borneo (1997) 116, f. 77-80.

Type:
Jack s.n. (lecto. SING), Singapore, s. loc.

Nepenthes rafflesiana is a widespread and variable lowland species often abundant in weedy regrowth at the sides of roads. It can be recognised by its characteristic white arachnoid indumentum, its distinctly petiolate leaves and the manner in which the peristome rises into an extended, and laterally flattened neck, which is broadest immediately below the lid. The lid is often notched or blunt at its apex, and the glands are confined towards the edge.

Distribution
Sumatera, Peninsular Malaysia, and Borneo.

Ecology and habitat
Kerangas or swamp forest, often with *N. ampullaria*, also in secondary forest and old clearings, often on sand, rarely on ultramafic; sea level to 300 (-1000) m.





Chapter 3

THE NATURAL HYBRIDS OF *NEPENTHES*

N. macfarlanei X *N. gracilis [= N.* X *setiuensis* A. Amin, M. N. Faizal et N. Dome]
N. ampullaria X *N. mirabilis [= N.* X *kuchingensis* Sh. Kurata]
N. ampullaria X *N. gracilis [= N.* X *trichocarpa* Miq.]
N. ampullaria X *N. rafflesiana [= N.* X *hookeriana Veitch ex Mast.]*
N. gracilis X *N. mirabilis [= N.* X *sharifah-hafsahiae* J.H. Adam et Hafiza]
N. mirabilis X *N. rafflesiana*
N. sp. *nov.* X *N. mirabilis = N.* X *langkawiensis ined.*
N. ramispina X *N. sanguinea*
N. macfarlanei X *N. sanguinea*
N. macfarlanei X *N. gracillima*



Figure 56: *Nepenthes* x *setiuensis* lower pitcher



Figure 57 *Nepenthes* x *setiuensis* upper pitchers

The Natural Hybrids

Nepenthes x *setiuensis*
A. Amin, M. N. Faizal et N. Dome
(Figures 56-57)

Tamizi et al. 2020. Mal. Nat. J. , 72(1) 27.

Type:
Malaysia, Terengganu, Setiu, 30 April 2019, Amin, A.T. et al. MDI 12419 (MARDI, holotype). Wet specimen: Malaysia, Terengganu, Setiu, 30 April 2019, Amin, A.T. et al. MDI 1458 (MARDI-pitcher part).

This natural hybrid involves the parental *Nepenthes macfarlanei* and *N. gracilis* and is named after the district of Setiu, Terengganu, Malaysia. This new nothospecies possesses fairly large lower pitchers (up to 22 cm tall) and slender upper pitchers which are predominantly dark and heavily blotched.

Distribution
Peninsular Malaysia, endemic.

Ecology and habitat
Terrestrial climber in hilly terrains under closed-canopy of lower montane trees. The habitat zone was identified as lowermost boundary of cloud forest 900-1,000 m.

Nepenthes x *kuchingensis*
Sh. Kurata
(Figures 58-59)

Kurata, Sh., J. Insectiv. Pl. Soc. 33: 36 (1982). In: The World Checklist of Vascular Plants. This natural hybrid involves the parental *Nepenthes ampullaria* and *N. mirabilis* and is named after the city of Kuching, Sarawak.

Distribution
Peninsular Malaysia and Borneo.

Ecology and habitat
Damp, shady forest, in Borneo it is found in swamp and kerangas forests, also in secondary forest, open microphyllous vegetation, or swamp grassland; sea level to up to 1,100 m.



Figure 58: *Nepenthes* x *kuchingensis* lower pitchers



Figure 59: *Nepenthes* x *kuchingensis* upper pitchers







Figure 60: *Nepenthes* x *trichocarpa* upper pitchers

Nepenthes x *trichocarpa* Miq.

(Figure 60)

Miquel, 1858. Fl. Ned. Ind. 1(1): 1072. J. Bot. Neerl. 1, 3 (1862) 275, t. 1; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 389; Tamin & Hotta in Hotta, Diversity and Dynamics of Plant Life in Sumatra (1986) 108; Phillipps & Lamb, Pitcher-Plants of Borneo (1996) 140, f. 75; Jebb & Cheek, Blumea 42 (1997) 87; Clarke, *Nepenthes* of Borneo (1997) 150, f. 104.

Type:
Teijsmann 532 p.p. (BO, L n.v., U n.v.), Sumatera, Sibolga, Feb. 1856. Syn. *Nepenthes trichocarpa* var. *erythrosticta* Miq., J. Bot. Neerl. 1, 3 (1862) 276. — TYPE: Teijsmann 533 p.p. (BO, L n.v., U n.v.), Sumatra, Sibolga, Feb. 1856.

This natural hybrid involves the parental *Nepenthes ampullaria* and *N. gracilis* that grows as a climber. Most of the pitchers are in spotted, speckled or green varieties. *Nepenthes x trichocarpa* has sessile leaves which exhibit *N. ampullaria* like venation, texture and hairiness, whilst the angular stems, with sub-decurrent leaf bases and the lid with its few, broad-bordered glands are similar to *N. gracilis*. The pitchers are characteristically cylindrical-barrel shaped and slightly constricted at the mouth.

Distribution
Peninsular Malaysia and Borneo.

Ecology and Habitat
Can be found throughout the lowlands nearby the peat swamp forest and roadside.

Nepenthes x *hookeriana* Veitch ex Mast.

(Figures 61-64)

Masters, M.T. 1881. New garden plants. *Nepenthes hookeriana*. The Gardeners' Chronicle, new series, 16(417): 812–813. Lindley, Gard. Chron. (1848) 87, nomen; Mast., Gard. Chron. (1881) 812, f. 157; Nicholson, 111. Diet. Gard. 4 (1886) 436; Gard. Chron. (1892) 561, ic. 557; Boerl., Handl. 3, 1 (1900) 54; Burb., Flora & Sylva II, 12(1904) III; Macfarl. in Engl., Pflanzenr. 4, 3 (1908) 34; Danser, Bull. Jard. Bot. Buitenzorg III, 9 (1928) 309, f. 9; Shivas, Pitcher Plants of Peninsular Malaysia & Singapore (1984) 33; Phillipps & Lamb, Pitcher Plants of Borneo (1996) 94, f. 7; Jebb & Cheek, Blumea 42 (1997) 50; Clarke, *Nepenthes* of Borneo (1997) 153, f. 106.

Type:
Low (not located), Borneo.

Nepenthes x *hookeriana* is a naturally occurring hybrid between *Nepenthes ampullaria* and *N. rafflesiana* and can be spotted thriving in certain localities throughout the lowlands of Peninsular Malaysia. The leaf blade exhibits the typical venation of *N. ampullaria*, with the longitudinal nerves in the outer ½ of the blade only, and a shortly petiolate base; the lower pitchers are urceolate with broad pitcher wings and a broad, rounded peristome, but this is not developed into the long apical neck of *N. rafflesiana*; the lid is oblong to oblong-ovate, with a blunt or notched apex, and two prominent lateral veins, the lid glands are distributed throughout.

Distribution
Peninsular Malaysia and Borneo.

Ecology and habitat
Can be found throughout the lowlands, near peat swamp forests and roadsides.



Figure 61: *Nepenthes* x *hookeriana* upper pitchers



Figure 62: *Nepenthes* x *hookeriana* lower pitchers



Figure 63: *Nepenthes* x *hookeriana* lower pitchers



Figure 64: *Nepenthes* x *hookeriana* upper pitcher



Figure 65: *Nepenthes* x *sharifah-hafsahiae* upper pitchers



Figure 66: *Nepenthes* x *sharifah-hafsahiae* upper pitchers

Nepenthes x *sharifah-hafsahiae* J.H. Adam et Hafiza
(Figures 65-66)

Jumaat H. Adam & Hafiza A. Hamid. 2007. International Journal of Botany 3(1): 71-77.

Type:
Peninsular Malaysia, Selangor, Bangi Forest Reserve, JHA8000, 2nd August 2001.

Nepenthes x *sharifah-hafsahiae* is a naturally occurring hybrid between *Nepenthes mirabilis* and *N. gracilis* and was named after the Universiti Kebangsaan Malaysia ex Vice Chancellor, Professor Emeritus Tan Sri Dr. Sharifah Hafsah Syed Hasan Shahabudin and can be spotted thriving in certain localities throughout the lowlands of Peninsular Malaysia. *N.* x *sharifah-hafsahiae* is characterised by its cylindrical upper stems, lamina base attenuate into petiole like form and not wings, lower lid surface densely covered with nectar glands, digestive glands on inner cavity is covered by extended epidermal roof, peristome ribs distinct and pedicels commonly 2-flowered.

Distribution
Peninsular Malaysia.

Ecology and habitat
lowlands, in peat swamp forest, forest edges and roadside, endemic.

Nepenthes mirabilis x *N. rafflesiana*
(Figures 67-68)

This beautiful natural hybrid involves the parental *Nepenthes mirabilis* and *N. rafflesiana* and can be found in several localities such as in Bukit Tagar, Selangor and Ayer Hitam Utara Forest Reserve, Johor. This unique nothospecies is characterised by its robust wings of lower pitcher, medium length neck formed by a beautiful red-striped peristome comprised of fine spine-like teeth.

Ecology and habitat
Can be found at the lowlands of certain locations in Peninsular Malaysia, near peat swamp forests and roadsides.



Figure 67: *Nepenthes mirabilis* x *rafflesiana* lower pitchers



Figure 68: *Nepenthes mirabilis* x *N. rafflesiana*



Figure 69: *Nepenthes sp.* x *N. mirabilis* lower pitcher

Nepenthes sp. x *N. mirabilis nothosp. nov.*
(Figures 69-70)

This natural hybrid involves the parental *Nepenthes sp.* (yet to be identified and named) and *N. mirabilis* that can be found in Langkawi Island, Malaysia. It has tubulose upper pitchers measuring up to 12 cm in height by 3.5 cm in width. The wings are up to 4 mm wide and spaced 4–6 mm apart. The pitcher mouth is broadly ovate and has an oblique insertion.

Ecology and habitat
Lowlands up to 100 m a.s.l., endemic to Pulau Langkawi, Peninsular Malaysia.



Figure 70: *Nepenthes sp.* x *N. mirabilis* upper pitcher

Nepenthes ramispina x *N. sanguinea*
(Figures 71-72)

This natural hybrid involves the parental *N. ramispina* and *N. sanguinea* that can be found in several highland localities such as in Genting Highlands, Pahang, Malaysia. Unique characteristic of this natural hybrid is it has a 3-point spur, compared to *N. sanguinea* (single spur) and *N. ramispina* (multiple spurs).

Ecology and habitat
Can be found throughout the highlands of certain locations in Peninsular Malaysia, up to 1,500 m a.s.l., endemic to Peninsular Malaysia.



Figure 71: *Nepenthes ramispina* x *N. sanguinea*



Figure 72: *Nepenthes ramispina* x *N. sanguinea* lower pitchers, grows together with *N. sanguinea* (reddish pitcher)





Figure 74: *Nepenthes macfarlanei* x *N. gracillima* lower pitcher.
(Courtesy of Kenneth Hiew)

Figure 73: *Nepenthes macfarlanei* x *N. gracillima* lower pitchers.
(Courtesy of Kenneth Hiew)

Nepenthes macfarlanei x *N. gracillima*
(Figures 73-74)

This enigmatic natural hybrid involves the parental *N. macfarlanei* and *N. gracillima* that can be found only in Gunung Tahan, Pahang, Malaysia.

Ecology and habitat
Gunung Tahan, Pahang, Peninsular Malaysia, up to 2,100 m a.s.l., endemic to Peninsular Malaysia.

Nepenthes macfarlanei x *N. sanguinea*
(Figure 75)

This natural hybrid involves the parental *N. macfarlanei* and *N. sanguinea* that can be found in several highland localities such as in Genting Highlands, Pahang, Malaysia.

Ecology and habitat
Highlands of certain locations in Peninsular Malaysia, up to 1,500 m a.s.l., endemic to Peninsular Malaysia.



Figure 75: *Nepenthes macfarlanei* x *N. sanguinea* lower pitchers



Figure 76: *Nepenthes benstonei* x *N. mirabilis* upper pitchers

Nepenthes benstonei x *N. mirabilis*
(Figures 76-77)

This natural hybrid between *Nepenthes benstonei* and *N. mirabilis* can be observed at the foot and along the way to the summit of Bukit Bakar, Kelantan. This interesting natural hybrid is very attractive by having unique reddish-green peristome characteristics and green body.

Ecology and habitat
Road side of Bukit Bakar, Machang, Kelantan, Peninsular Malaysia.



Figure 77: *Nepenthes benstonei* X *N. mirabilis* lower pitchers





Figure 78: *Drosera burmannii* found in Setiu Wetland, Terengganu, Malaysia

Other Carnivorous Plants

Drosera and *Utricularia* of Peninsular Malaysia
(Figures 78-79)

There are two other groups of natural trappers in Peninsular Malaysia, namely *Drosera* (Droseraceae) or sundews with three species and *Utricularia* (Lentibulariaceae) or bladderworts with ca. 13 species.

NE

04599
Drosera burmannii
Droseraceae
Tropical sundew
©Dome Nikong





Figure 79: Charming *Utricularia bifida* and *U. caerulea* or bladderworts thriving nearby Setiu Wetlands, Terengganu, Malaysia



Figure 80: *Utricularia caerulea*



Figure 81: *Utricularia bifida*

Utricularia of Gunung Tahan, Pahang, Peninsular Malaysia





















13275
Utricularia gibba
Lentibulariaceae
Bladderwort
© Mohd Norfaizal Ghazalli &
Ahmad Aiman Mohd Azmi
LC



Chapter 4

DISTRIBUTION AND HABITAT



Distribution and Habitat

***Nepenthes* in Peninsular Malaysia is mostly found in areas with up to 700 m of altitude, as well as in disturbed secondary forests, swamp or heath (*kerangas*) forests.** However, only a few species occur in these habitats, including *Nepenthes ampullaria* and *N.rafflesiana*. *Nepenthes* is known to grow best in humid climate, mostly in exposed habitats on nutrient-poor soils. River banks, ridge tops and in wet mossy forests are the common habitats of *Nepenthes*.

It commonly grows in locations with a sparse or thin canopy and uncommon in dense forests. *Nepenthes* commonly grows on white podsolic soils, wet peaty soils or heavily leached volcanic soils, but is almost completely absent from rich alluvial or clay soils. More species but fewer individuals exist in montane habitats, at 1,500-2,500 m, mostly in open mossy, stunted, ridge-top forests.

Table 2. *Nepenthes* species and its distribution

SPECIES	DISTRIBUTION	HABITAT	ECOLOGY
Nepenthes alba	Pahang	Upper montane forests.	1,600-2,187
N. albomarginata	Pulau Pinang, Johor, Sarawak	Heath forests, summit and ridges of low mountains.	up to 1,100
N. ampullaria	Borneo, P. Malaysia	Damp shady-forests, swamp and kerangas forests, in secondary forest, or swamp grassland.	up to 2,100
N. benstonei	Kelantan, Pahang, Terengganu	Growing terrestrially in open, lowland, hill and lower montane forests.	150-1,200
N. domei	Terengganu	Terrestrial in humus-rich soil. Commonly in lower montane forests.	850-1,000
N. gracilis	Borneo, P. Malaysia	Lowland peat swamp forests, *kerangas*, podsol heath scrubs, swamp edges or disturbed areas, Can be found thriving along the roadside in Peninsular Malaysia and Borneo.	up to 1,100
N. gracillima	Pahang	Upper montane forests.	1,400-2,200
N. latiffiana	Terengganu	Lower montane forests.	1,000-1,100
N. macfarlanei	Selangor, Pahang, Terengganu	Mountain ridges, commonly in shady sites on mossy banks.	900-2,150
N. malayensis	Terengganu	Terrestrial climber in lower montane forests.	1,000-1,100
N. mirabilis	Peninsular Malaysia, Borneo	Found in copious number in disturbed, swampy or scrubland.	up to 1,500
N. rafflesiana	Johor, Pahang, Terengganu, Selangor	*Kerangas* or swamp forests, secondary forest and old clearings, often on sandy areas, rarely on ultramafic substrates.	up to 1,200
N. ramispina	Selangor, Pahang	Lower to upper montane forests.	900-2,000
N. sanguinea	Negeri Sembilan, Selangor, Pahang, Terengganu	Mountain ridges.	300-1,800



Figure 82: Distribution of *Nepenthes* taxa in all states of Peninsular Malaysia

Nepenthes of Ayer Hitam Utara Forest Reserve, Johor





Figure 83: *Nepenthes* x *trichocarpa*



Figure 84: *Nepenthes rafflesiana*

Figure 85: *Nepenthes rafflesiana*



Figure 86: *Nepenthes mirabilis* x *N. rafflesiana*



Figure 87: *Nepenthes* x *hookeriana*



Figure 88: *Nepenthes ampullaria*



Figure 89: *Nepenthes ampullaria*



Figure 90: *Nepenthes gracilis*

Nepenthes of Langkawi Island, Malaysia



Figure 91: *Nepenthes sp. nov.* thriving profoundly in Gunung Machinchang, Langkawi



Figure 92: Upper pitchers of *Nepenthes sp. nov.* thriving profoundly in Gunung Machinchang, Langkawi.



Chapter 5

CONSERVATION AND MANAGEMENT



Conservation and Management

It is estimated 25% of the *Nepenthes* species were recognised as threatened species (Walters and Gillett, 1997). CITES, the International Union for the Conservation of Nature (IUCN) progressively assessing the conservation status of *Nepenthes* species using specific set of criteria. These are ultimately aimed to estimate the conservation status of species which is readily understood and communicated among conservationists.

The IUCN ratings for 14 Malesian taxa are as follows:

- Indeterminate (*N. burbidgeae, N. deaniana, N. philippinensis*)
- Vulnerable (*N. edwardsiana, N. rajah, N. villosa*)
- Rare (*N. burkei, N. lowii, N. paniculata, N. veitchii*)
- Endangered (*N. gracillima, N. muluensis, N. northiana, N. neglecta*)

There are several others which are probably more vulnerable to threats, including the endemic species of Peninsular Malaysia such as the newly described species, *Nepenthes domei, N. latiffiana*, *N. malayensis* and other unnamed natural hybrids.

Nepenthes are particularly vulnerable to threats because so many of the species have highly restricted distributions in a single locality, such as a mountain, including *N. alba, N. gracillima, N. domei, N. latiffiana* and *N. malayensis*.

There are two main threats to *Nepenthes* known in today's world: horticultural trade and habitat destruction.

Horticultural trade
Despite being popular house plants, it is not advisable to harvest pitcher plants from the wild as some species are vulnerable to extinction this way. Instead, obtain them through a nursery. They are best suited to bog gardens, apart from requiring sunlight and mildly acidic soil for their growth. Europe, and the United States of America are known as the main markets for *Nepenthes* species. The method of sourcing from tissue-cultured plants has become an alternative way adopted by the specialist nurseries to fulfil the today's market demand in horticultural trade.

All species of the genus *Nepenthes* are listed on CITES Appendix II, *N. rajah* which appear on Appendix I (CITES is the Convention on International Trade in Endangered Species).







Habitat Destruction
Lowland to lowland-highland species, particularly those of restricted distribution, are prone to the risk of habitat destruction. Non-sustainable logging and the clearance of forests for agriculture, forest plantation, habitation, infrastructure, tourism, and housing development has taken a toll on lowland rainforest species as they are the most vulnerable species to habitat destruction. Ultramafic-obligate species, and to a lesser extent species of limestone hill forests are vulnerable, particularly to mining operations since ultramafic substrates contain a super abundance of metals such as manganese and nickel.

Montane species of *Nepenthes* which often constitute most of the genus, are generally less threatened with habitat destruction. However, the increase in number of tourism activities in the mountains of Peninsular Malaysia has become a great concern as the activity could potentially destroy some populations of the endemic *Nepenthes* species there, specifically the ones in Pahang and Terengganu.



Chapter 6

EX SITU CONSERVATION

Ex Situ Conservation

The act of over-collection of species by plant collectors poses a grave threat to pitcher plants in their natural localities. The constant decrease in the number of population of *Nepenthes* in its natural habitats constantly occurring as forest fires, mining, conversion of forest to agricultural land or plantations and over exploitation for commercial purposes pursue. An immediate execution of ex situ conservation by the responsible authorities through the means of domestication, cultivation and breeding mechanisms is necessary in order to retain its sustainability, considering that all types of *Nepenthes* in Malaysia are protected, and all *Nepenthes* are either listed in CITES Appendix I or Appendix II as above.

The International Trade In Endangered Species Act 2008 [ACT 686] prohibits imports or exports of any scheduled species without a permit and any offender under this provision can be fined not exceeding in the aggregate of RM 1 million, or imprisonment for a term not exceeding seven years or both. The National Forestry Act 1984 [ACT 313] provides the same provision where it prohibits collecting without permit and any offender can be imposed with the fine of RM500,000.00 and imprisonment for a term which shall not be less than one year but shall not exceed 20 years.

Threats
1. Over-collection of the specimens from the wild.
2. Loss of habitats.
3. Environmental pollution.
4. Culinary purposes.







Figure 93: Taman *Nepenthes* Kledang Saiong,

Ex situ conservation by Perak Forestry Department at Kledang Saiong
(Figure 93)

The *Nepenthes* Garden operated by the Perak State Forestry Department was launched on January 1, 2016. This venue has also become an international research and study centre relating to carnivorous plant species. There is a total of 70 different species of pitcher plants found in this garden, consisting of 55 endemic species and 15 hybrids from around the globe.

Ex situ conservation by Wild Dome Conservatory
(Figures 94-97)

Mr. Dome Nikong's rare plant journey began with his own personal interest and awareness in saving genetic resources from extinction. His private conservatory garden in Sungai Tong, Setiu, Terengganu conserved a number of lowland and highland species of *Nepenthes*, that also thrive together with a few *Nepenthes* natural hybrids.



Figure 94: *Ex situ Nepenthes* conservation effort at Wild Dome Conservatory at Sungai Tong, Setiu, Terengganu.



Figure 95: *Nepenthes albomarginata* at Wild Dome Conservatory at Sungai Tong, Setiu, Terengganu.



Figure 96: *Ex situ* conservation effort at Wild Dome Conservatory at Sungai Tong, Setiu, Terengganu.



Figure 97: *N. rafflesiana* conservation effort at Wild Dome Conservatory at Sungai Tong, Setiu, Terengganu.



Nepenthes gracilis 'squat' at Mr. Fauzi's *Nepenthes* nursery in Ampang.

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Glossary

Abaxial	Lower side of the leaf
Adaxial	Upper side of the leaf
Acute	The leaf apex ends in a short sharp point
Attenuat	The leaf or leaflet base is broadly to narrowly tapering, appearing triangular to wedge-shaped
Decurrent	A leaf blade base that extends down the petiole
Dorsal	The upper side or back of plant, or organ
Dimorphic	Occurring in two distinct forms
Epiphyte	A plant that grows on another plant or part of the plant, especially one that is not parasitic.
Elliptic	A simple leaf shaped like an ellipse
Emarginate	Having a notched tip or edge
Fimbriate	Having a fringe or border of hair-like or finger-like projections
Glaucous	Having a powdery or waxy coating that gives a frosted appearance and tends to rub off
Habit	The characteristic form in which a given species of plant grows
Indumentum	A covering of hairs on plant
Infundibular	Funnel-shaped
Nectar	A sugar-rich liquid secreted by plants that serves to attract and feed insects or birds
Coriaceous	Having the texture of leather
Cuneate	Wedge-shaped
Canaliculate	Channelled lengthwise; grooved
Lanceolate	Shaped like a lance head; of a narrow oval shape tapering to a point at each end.
Lithophyte	A plant that grows on bare rock or stone
Tomentose	Covered with densely matted woolly hairs
Obtuse	A simple leaf having a rounded or blunt tip
Oblanceolate	A leaf having a rounded apex and tapering base
Operculum	A cap-like structure in some flowering plants
Pubescense	Soft down or fine short hairs on the leaves and stems of plants
Rosette	The leaves are spread in a horizontal plane from a short axis at ground level
Sessile	Attached directly by its base without a stalk or peduncle
Spathulate	Broad at the apex and tapered to the base
Spur	A slender projection from the base part of the plant
Tendril	A slender threadlike appendage of a climbing plant, often growing in a spiral form, that stretches out and twines round any suitable support
Trichome	A small hair or other outgrowth from the epidermis of a plant, typically unicellular and glandular
Peristome	A fringe of small projections around the mouth structure
Ventricose	Swelling out in the middle or on one side

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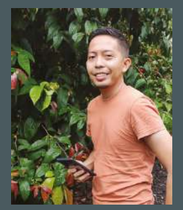
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Utricularia gibba 61

Authors Background

Mohd Norfaizal Ghazalli



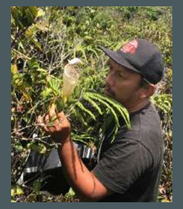
B. Sc. (Hons.), M.Sc., Ph.D. (UKMalaysia) currently serving as Plant Taxonomist at the Agrobiodiversity and Environment Research Centre, Malaysian Agricultural Research and Development Institute (MARDI) Serdang, Selangor. His research interests encompass the application of anatomy, micromorphology and palynology to species identification, understanding evolutionary relationships and conservation. His work spans numerous plant families, extending into the plant genetic resources for food and agriculture (PGRFA) including Anacardiaceae, *Dioscorea*, *Nepenthes*, Sapindaceae and other minor wild fruits species. He has been involved in local and international projects on agrobiodiversity related species and tropical fruit trees funded by Ministry of Agriculture and Food Security (MAFS), Ministry of Energy and Natural Resources (KeTSA), Department of Forestry Peninsular Malaysia, Bioversity International and JIRCAS. He is currently the Deputy Director for Programme of Resource Utlisation and Agrobiodiversity Conservation, Agrobiodiversity and Environment Research Centre, MARDI

A. Latiff



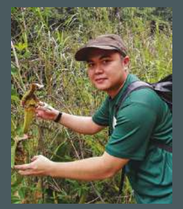
B.Sc. (Hons) (Malaya), M.Sc., Ph.D. (Reading), an Emeritus Professor at Universiti Kebangsaan Malaysia. His previous posts include Dean, Faculty of Science and Technology and Director, Institute for Environment and Development. His research interests were in the field of Plant taxonomy and Biodiversity. Throughout his career he has been active in the national leadership of scientific expeditions under the auspices of Jabatan Perhutanan Semenanjung Malaysia, Sabah Foundation and Academy of Sciences Malaysia. A. Latiff was awarded the Malaysia-Toray Award in Science and Technology in 1995, Langkawi Award in 2004 and Merdeka Award in 2015. Currently Chairman of the Pulau Banding Foundation.

Dome Nikong



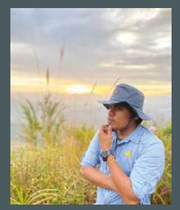
Born and raised in Setiu, Terengganu, Dome began his photography career in 2004, with his photographs having since been exhibited widely at home and abroad. Since 2009, he has been documenting the life history of the indigenous Bateq community in Kuala Koh, Kelantan. He has also worked in collaboration with renowned media teams including National geographic, Canal+ and RTM on a series of documentaries about the Bateq people. In 2014, he began to record the floral diversity in the Setiu Wetlands, Terengganu with focus on wild orchids. The idea to create an ex situ conservation project for wild orchids began when he discovered that much of the natural landscape in Setiu was being cleared for agricultural and residential purposes. The project was later expanded into work to rescue them from being wiped out as a result of these logging activities. During this project, Dome also photographed various species of flora and fauna he encountered along the way.

Edward Entalai Besi



B.Sc. (Hons.), (UMPahang), M.Sc., Ph.D (UPMalaysia). He does research in Plant Taxonomy, Systematics, and Ecology. His current project is focusing on diversity and conservation strategies for rescued orchids from logging concessionaires in Peninsular Malaysia, and DNA barcoding and floral anatomy studies of selected flagship species. Edward has so far authored 15 research articles and 2 conference proceedings on Orchidaceae, and co-authored another 8 research articles on other plant groups, including *Nepenthes*, Zingiberaceae, and Malvaceae. Edward is also a Member of the IUCN Species Survival Commission (SSC), and a recipient of the Conservation Recognition Award for the year 2022, awarded by the Conservation Committee of the American Orchid Society (AOS).

Muhamad Ikhwanuddin Mat-Esa



B.Sc. (Hons.), M.Sc. (UPMalaysia) is a Research Assistant at the Department of Biology, Faculty of Science, Universiti Putra Malaysia His research interests focused on screening of potential Malaysian medicinal plants and ethnobotany. He has enthusiasm in plant diversity and conservation of wild and rare plant species.

Noraini Talip



B.Sc. (Hons.), M.Sc (UKMalaysia); Ph.D. (Reading, UK). Associate Professor Dr. Noraini Talip specializes in plant anatomy, micromorphology, palynology and plant taxonomy, at the Faculty of Science and Technology, UKM Bangi, Selangor and is the Head of Bangi Botanical Garden Faculty of Science and Technology-UKM. She has published more than 100 papers in bulletins, proceedings, journal, chapters in books, books and monographs. She has won many awards and among others are National Book Award 2018 and 2021, MAPIM Book Award 2018 and 2021, the Science and Technology Book Award of the Faculty of Science and Technology UKM 2015, Bitara Science and Technology Book Award UKM 2010 and 2019.

Mohd Alias Shakri



Mohd Alias Shakri graduated with a diploma in mechanical engineering and enjoys photography and nature guiding. He has travelled all around Malaysia to capture beautiful forest landscapes.

Mohd Masri Saranum



B.Sc. (Hons.)(UPMalaysia). Mohd Masri currently is an Entomologist at Biological Control Programme, Agrobiodiversity and Environment Research Centre, Malaysian Agricultural Research and Development Institute (MARDI), Serdang, Selangor. Major studies involve integrated pest management, biological control of pests, exploration and bioprospection of biological control agents from fungi, bacteria and nematodes to control pests, plant extracts as biopesticides, insect biodiversity, plant-insect interaction, insect semiochemicals and studies on new invasive pests in Malaysia. He obtained Science research funding from MOSTI in 2015 related to the production of biopesticides from plant extracts. He was also involved as a collaborator on the FRIM-led Herbs NKEA project to control tiger moth caterpillar pests on tongkat ali. He has also been tasked with developing the Kenyir Lake station under MARDI with the study of Agricultural Biology Under the Forestry System. He is currently doing research on biological controls and biopesticides to combat new invasive pests fall armyworm (FAW) *Spodoptera frugiperda*.

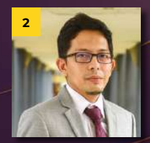
Project Management Team

Project Advisor



1. Emeritus Prof. Dato' Dr. Abdul Latiff Mohamad

Author

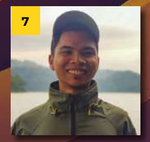


2. Dr. Mohd Norfaizal Ghazalli

Photographers



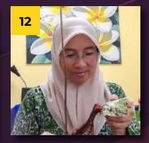




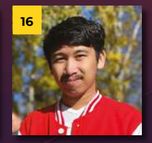



3. Dr. Mohd Norfaizal Ghazalli
4. Dome Nikong
5. Dr. Edward Entalai Besi
6. Muhamad Ikhwanuddin Mat-Esa
7. Mohamad Alias Shakri
8. Mohd Masri Saranum
9. Kenneth Hiew
10. Azlan Sulaiman

Team Members





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12. Salmaniza Salleh
13. Ezanor Mohamed Kasah
14. Dato' Salim Aman
15. Siti Noratikah Mustafa
16. Ahmad Aiman Mohd Azmi

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18. Nurfarhana Hizan Hijas
19. Sarah Nabila Rosli
20. Nur Hazwanie Abd Halim
21. Badrul Amin Jaffar



27949
Nepenthes macfarlanei
Nepenthaceae
Periuk kera
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NE

49469
Nepenthes malayensis
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