CONSERVATION MALAYSIA
A Bulletin Supporting Plant and Animal Conservation in Malaysia
Issue No 38 (2025)
ISSN 1823-7975

The Alarming Decline of the Rare Pitcher Plant, *Nepenthes ramispina*

AM Aliaa-Athirah (aliaathirah@frim.gov.my), WSY Yong & R Kiew

The conservation status of the endemic slender pitcher plant, *Nepenthes ramispina,* has been raised from Least Concern to Vulnerable due to its glooming situation.

Pitcher plants, called *pokok periuk kera* in Malay, excite curiosity by their uniquely shaped pitchers (monkey cups) that trap and digest insects. The rare, endemic *Nepenthes ramispina* grows only in mossy upper montane forest between 1400–2000 m elevation, where it grows together with the widely distributed mountain pitcher plants, *N. macfarlanei* and *N. sanguinea*. *Nepenthes ramispina* Ridl. is an elegant highlander where its slender pitchers dangle from the tree canopy. It is recognised by its unique fang-like, branched spur at the base of the lid. Most populations have green pitchers while one subpopulation has elegant blackish green pitchers with a glowing lime-green interior. *Nepenthes ramispina* is a rare pitcher plant known from less than 20 mountain tops on the Main Range (Cheek & Jepp, 2012).

Until the 2000s, *N. ramispina* was common and a profusion of dangling pitchers were a common sight in the wild to nowhere to be found (Kiew R, *pers. obs*.) but precise data on subpopulations from most sites was completely lacking. This worrying situation prompted the need to carry out detailed searches at accessible locations to count the number of individuals with the following results. Four accessible sites frequently used for trekking were selected. Due to conservation concern, we are not able to disclose the actual locations of the four subpopulations. Instead, we refer to them as Subpopulations A, B, C and D. The observations were made between 2018 to 2023.

Nepenthes ramispina inhabits cool, mossy forest on a few mountain summits on the Main Range.

Subpopulation A (September 2018 and February 2022). Not a single plant of *N. ramispina* was found. This subpopulation is particularly important as it is the type locality of the species (Aliaa-Athirah, 2023). The only pitcher plants on the summit were three plants of *N. sanguinea*. *Nepenthes macfarlanei* plants that were previously recorded here were nowhere to be found.

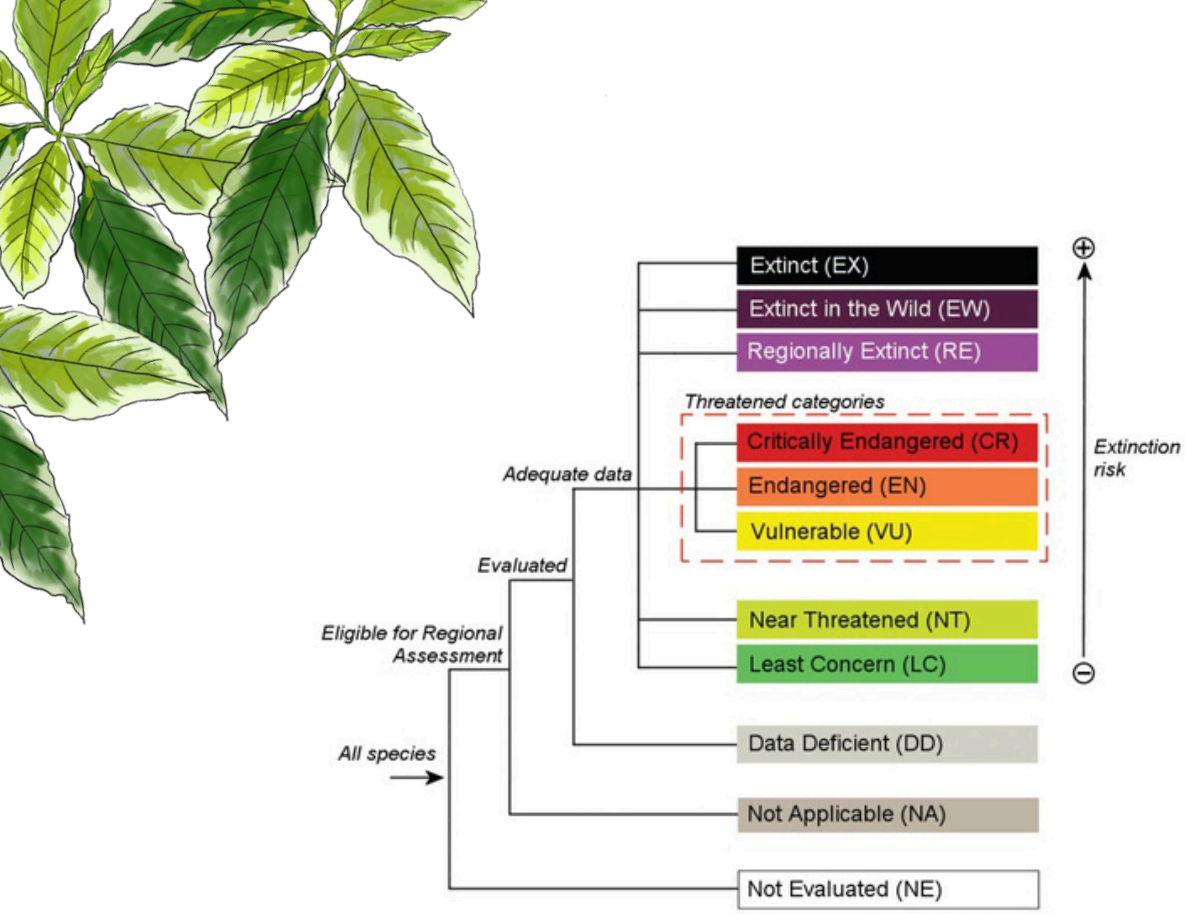


Figure 1. The structure of the Red List categories used at the regional level.

- **Subpopulation B** (December 2019 and December 2021). Not a single plant of *N. ramispina* was found. Norfaizal *et al*. (2022) only recorded *N. sanguinea* from this site.
- **Subpopulation C** (September 2022). Clarke (2002) noted *N. ramispina* was 'readily observed' here. However, only three plants of this unique subpopulation with black-green pitchers were found and these were deep in dense vegetation well away from the main path.
- **Subpopulation D** (June 2023). Only a single plant of *N. ramispina* was found and none of the other species of pitcher plants were seen.

The other mountain top sites are difficult to access so the current status of their subpopulations is not known. Pitcher plants are dioecious, which means an individual plant produces either male or female inflorescences. Therefore, a sizeable population with sufficient male and female plants is required to sustain a population in the long term. The alarming declines in these accessible subpopulations raised several questions.

Why have these subpopulations almost completely vanished?

There are three main threats to *Nepenthes* species. The first threat is overcollection of wild plants for the horticultural trade and is characterised by the wholesale collection of entire subpopulations of the desired species. Among carnivorous plant enthusiasts, pitcher plants are popular ornamentals (Yong & Wong, 2024). The origin of living carnivorous plants offered for sale within Malaysia is often obscure and appears to be 'under the radar' with several cases going unmonitored (Chua, 1995). These days, *N. ramispina* plants are in high demand on several online shopping platforms and social media which offer potted plants and seeds for sale.

Nepenthes species are highly sought after in the global market too, with a particularly strong demand in Europe, Japan and the USA (Chua, 1995). In recognition of this threat, all *Nepenthes* species, including *N. ramispina,* are listed on CITES Appendix II (except *Nepenthes rajah* that is listed in Appendix I) that aims to safeguard the survival of wild populations by regulating and monitoring international trade.

The second threat is habitat destruction caused by ecotourism. The mossy upper montane forest where *N. ramispina* grows is threatened by habitat disturbance caused by, for example, the undesirable practice of chopping down trees to make camp sites or to enjoy an unobstructed panoramic view. Habitat disturbance was observed in the four survey sites. This poses a significant threat to the subpopulations as *N. ramispina* uses tree for climbing. As ecotourism becomes more popular, the pressure from trekkers will only increase. Trekkers are known to snip off the dangling pitchers of all pitcher plant species as souvenirs. Although the mother plants are left intact and populations are not destroyed, the activity decreases the attraction of the site.

Nepenthes ramispina is also potentially threatened by natural hybridisation. Hybridisation has been observed within Subpopulations B and C, where five mature individuals of *N. ramispina* × *N. sanguinea* were found. The problem is this hybrid is fertile and has the ability to outcompete its parent species. *Nepenthes sanguinea*, a more widespread species with a wider altitudinal range (Cheek & Jepp, 2012),

is likely to be more competitive and may eventually "consume" the entire *N. ramispina* subpopulation.

Why does the rapid decline in the subpopulations on accessible peaks necessitate a re-evaluation of conservation status?

The IUCN Red List of Threatened Species lists the global conservation status of *N. ramispina* as Vulnerable (VU), i.e., it is vulnerable to extinction (Clark *et al.,* 2000) but in the Malaysia Red List, it is categorised as Least Concern, i.e. not threatened by extinction (Yong *et al.,* 2021, Cheek & Jebb, 2012). Based on the status of these accessible subpopulations today, it is necessary to re-evaluate its risk of extinction at the national level based on current trends to ensure appropriate conservation actions are taken to prevent further population decline. Being a rare and endemic species in Peninsular Malaysia and found nowhere else in the world, *N. ramispina* is a species of conservation importance. In addition, because it is already commercially traded, the wild subpopulations are important as a source of genetic material for selecting new cultivars or for hybridisation for ornamental purposes.

Nepenthes ramispina × *N. sanguinea* inhabits the mountain peak. It has the shape of *N. ramispina* and colours of *N. sanguinea.*

The reassessment was conducted following the International Union for the Conservation of Nature (IUCN) Red List Categories and Criteria Version 3.1 (IUCN, 2012a) (Figure 1), Guidelines for Using the IUCN Red List Categories and Criteria Version 16 (IUCN, 2024), Guidelines for Application of IUCN Red List Criteria at Regional and National Levels Version 4.0 (IUCN, 2012b) and Malaysia Plant Red List: Guide for Contributors (Chua & Saw, 2006).

It is estimated that in total there are no more than 10 individuals of *N. ramispina* from all four sites, indicating that these subpopulations have crashed by more than 90%. The subpopulations in other inaccessible sites are susceptible to the same threats and are assumed to be experiencing a similar declining trend. Overall, the total population of *N. ramispina* species is suspected to have decreased by more than 30% over a 30-year period indicating that this species is threatened by extinction in the wild. As a result, *N. ramispina* is now reassessed as Vulnerable, VU A4cde, at the national level, which is in line with its global assessment.

What steps can be taken to safeguard this rare endemic species in the wild?

Strengthening habitat conservation efforts

In situ conservation is the best option as it not only conserves the physical habitat but also all the biotic factors that ensure the plant's survival. However, not all subpopulations occur in state parks and protection forest that are designated under the National Forest Act of 1984. Areas above 1000 m altitude are categorised and managed as Environmental Sensitive Area Rank 1 under the Fourth National Physical Plan, with low-impact activities such as ecotourism permitted. However, trekking is increasing accessibility, exposing the species to overcollection. Thus, it is crucial to adopt proper management plans and best practices for ecotourism to minimise disturbances in these areas. This is necessary to protect and maintain the forest integrity to support and preserve *N. ramispina* and the montane forest ecosystem as a whole.

Nepenthes ramispina is a rare and endemic species in Peninsular Malaysia, and can be identified by the branched spur at the back of the lid (indicated by the arrow).

Regulation to control collecting wild plants

Even though *Nepenthes* is listed in CITES Appendix II, this only controls and monitors international trade. Regulation of the local trade of wild-collected plants is not yet in place. Therefore, there is an urgent need for a regulation that restricts the local trade of wild-collected plants. This will not only help to monitor the local trade, but also to prevent illegal harvesting.

Ex situ conservation of Nepenthes ramispina

For species under the threat of extinction, *ex situ* conservation is necessary. Mass propagation to flood the market is a way to reduce the temptation to collect from the wild. Methods like tissue culture are reliable to safeguard the plant's survival in the long term. Several companies have adopted this technique and have proven it is commercial successful. A single pitcher plant fruit pod contains hundreds, even thousands, of seeds, which can produce hundreds of seedlings representing both male and female plants. However, seed propagation presents challenges as the

seeds quickly lose viability (Miguel *et al.,* 2020) and must be sown immediately after being harvested. Despite these challenges, seed propagation is still a viable option for *Nepenthes*, as it does not require the removal of mature plants from the wild.

Raising awareness about the importance of *Nepenthes ramispina* conservation

Conserving *N. ramispina* relies heavily on us as its guardians. Trekkers can play a crucial role in monitoring and safeguarding the remaining subpopulations. It is essential to embrace a shift in perspective, especially for trekkers who often see their journey as a physical challenge to 'conquer the mountains' and reach the summit. It is crucial for them to understand that they are stepping into a 'Green Zone', a place where the ethos is to "take nothing but photos, leave nothing but footprints". This approach ensures that the area remains as untouched as when they first entered, without harming the forest by cutting down trees or taking any living plants (or animals) back home. Most state forestry departments have implemented a rule requiring trekkers to be guided by Malim Gunung Perhutanan (known as MGP) on the selected trails and hiking spots. These guides should not only lead the way and ensure the safety of trekkers but also use the opportunity to fostering a deep appreciation for outdoor ethics, biodiversity and the importance of conservation. In this way, they contribute towards building a community of people who care about the environment.

Conclusion

This survey of four of the 15 known *N. ramispina* subpopulations exposes the alarming decline of this rare and endemic species at accessible sites and highlights its precarious continued existence. The extinction risk of *N. ramispina* is upgraded from Least Concern to Vulnerable, signalling the urgent need for attention to prevent this endemic species from becoming extinct. Conservation actions, including *in situ* and *ex situ* conservation, are crucial to compensate for their declining subpopulations, and to preserve its genetic diversity. It is important to establish sufficiently large *ex situ* collections that encompasses its genetic variation, in particular to conserve rare forms with commercial interest, like the black form and also to maintain plants that have not been 'contaminated' by hybridisation. Promoting the concept of 'Green Zones' can encourage trekkers to appreciate and value the natural environment together with it plants and animals. Enhancing management of biodiversity and conservation requires collaboration among decision makers, stakeholders and the public. Furthermore, continued supports for research on the biology and ecology of rare and endangered species is vital. This will provide the necessary scientific evidence required to make informed decisions to ensure that the species can be effectively be conserved.

Acknowledgements

The study was part of the Flora of Peninsular Malaysia Project funded by the Ministry of Natural Resources and Environmental Sustainability (NRES) under the 12th Malaysia Plan (SPPII No. P230851000210003) and WWF Malaysia under 'The Checklist of Vascular Plants at Fraser's Hill' Project: Peninsular Malaysia Terrestrial Conservation Project (Protected Areas: Fraser's Hill).

References

Aliaa-Athirah, A.M. 2023. Gunung Ulu Semangkok, Selangor, Peninsular Malaysia, a forgotten type locality. *Malayan Nature Journal* 75(2): 259-266.

Cheek, M. & Jebb, M. 2012. Nepenthaceae. Pp 270. In: Kiew, R., Saw, L.G., Chung, R.C.K. & Soepadmo, E. (eds.) *Flora of Peninsular Malaysia* Series II: Seed Plants, Volume 3. Forest Research Institute Malaysia, Kepong.

Chua, L.S.L. 1995. *Conservation studies with Nepenthes macfarlanei* Hemsl. *in Peninsular Malaysia.* Unpublished PhD thesis, University Bath, U.K.

Chua, L.S.L. & Saw, L.G. 2006. Malaysia Plant Red List. Guide for Contributors. Forest Research Institute Malaysia, Kepong.

Clarke, C., Cantley, R., Nerz, J., Rischer, H. & Witsuba, A. 2000. *Nepenthes ramispina*. The IUCN Red List of Threatened Species 2000: e.T39691A10251700. https://dx.doi.org/10.2305/IUCN.UK.2000.RLTS.T39691A10251700.en. Accessed on 14 February 2024.

Clarke, C. 2002. *A Guide to the Pitcher Plants of Peninsular Malaysia*. Natural History Publications (Borneo), Kota Kinabalu, Malaysia.

IUCN. 2012a. *IUCN Red List Categories and Criteria*: Version 3.1. Second edition. Gland, Switzerland and Cambridge, UK: IUCN. iv+32pp.

IUCN. 2012b. *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels* Version 4.0. Gland, Switzerland and Cambridge, UK: IUCN. iii+41pp.

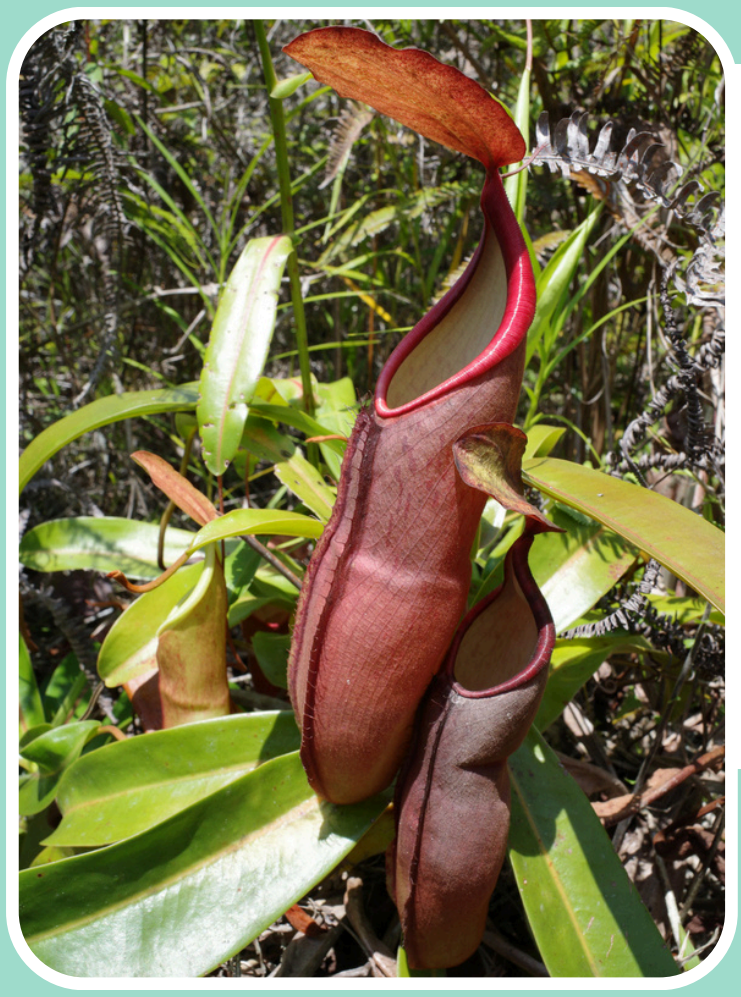
IUCN Standards and Petitions Committee. 2024. *Guidelines for Using the IUCN Red List Categories and Criteria* Version 16. Prepared by the Standards and Petitions Committee. Downloadable from http://www.iucnredlist.org/documents/RedListGuidelines.pdf

Miguel, S., Michel, C., Biteau, F., Hehn, A. 2020. In vitro plant regeneration and Agrobacterium-mediated genetic transformation of a carnivorous plant, *Nepenthes mirabilis*. *Sci Rep* (10)17482. https://doi.org/10.1038/s41598-020-74108-7

Mohd-Norfaizal, G., Anuar-Rasyidi, M.N., Nurshahidah, M.R., & Muhammad-Shafie, M.S. 2022. A Preliminary Survey of Wild Fruits and Pitcher Plants of Pine Tree Trail, Fraser's Hill. The Royal Scientific Biodiversity Expedition, Fraser's Hill Selangor State Park, Selangor.

Yong, B. & Wong, S.L. 2024. Mass producing to save pitcher plants, a tricky business. Macaranga: 16 February. Retrieved from https://www.macaranga.org/mass-producing-to-save-pitcher-plants- a-tricky-business

Yong, W.S.Y., Chua, L.S.L., Lau, K.H. *et al.* 2021. *Malaysia Red List: Plants of Peninsular Malaysia. Vol. 1, Part I.* Research Pamphlet No. 151. Forest Research Institute Malaysia, Kepong. 107 pp.



Nepenthes sanguinea (Photo credit: Imin Kamin)

Q. How many species of pitcher plant are there in Peninsular Malaysia?

R. Kiew *(ruth@frim.gov.my)*
The Herbarium, Forest Research Institute Malaysia

A1. Ten species*, according to the latest revision (Cheek & Jebb, 2012).

The first species recorded were lowland species, like *N. mirabilis* (first described from Vietnam) and *N. ampullaria* and *N. rafflesiana* both described from Singapore. As botanical exploration proceeded, further species were discovered. Only *N. gracillima* and *N. ramispina* are endemic in the Peninsula. Among them, probably the most attractive colourful species are *N. rafflesiana* in the lowlands and *N. sanguinea* in the highlands but none can compete with the weird and wonderful pitcher plants in Borneo and Sumatra.

*The identity of a species is based on a combination of several morphological characters not possessed by other species. 'Good' characters are unambiguous, like petal number, but many characters are variable. In which case, they should be discontinuous, like peristome teeth 0.7–1.25 mm long versus up to 0.1 mm long. Very variablecharacters like degree of hairiness, differences in shades of colour or patterns of variegation, are often poor or unreliable in separating species.

A2. As many as you like!

In the last three years, an astonishing number of new species (eight) have been described (Yong & Wong, 2024, Tamizi AA *et al*., 2023, May *et al*., 2025). Why this sudden surge of new species?

Pitcher plants are not only remarkable in producing pitchers to trap and consume prey, they also freely interbreed (hybridise) between species (Cheek & Jebb, 2012, Clarke, 2002). Hybrids between wild species in natural conditions are remarkably rare in the tropics (Kiew *et al.,* 2003) but in *Nepenthes*, hybrids are encountered wherever species grow together. The lowland hybrids have long been recognised (although at first thought to be species) and named: x *hookeriana* (*N. ampullaria* x *N. rafflesiana*), x *trichocarpa* (*N. ampullaria* x *N. gracilis*) and x *ghazallyiana* (*N. gracilis* x *N. mirabilis*). Highland species seem even more prone to hybridisation and hybrids have been recorded and illustrated between almost every combination of highland species, *N. macfarlanei* x *N. ramispina*, *N. macfarlanei* x *N. sanguinea*, *N. ramispina* x *N. sanguinea* (Clarke, 2002). Now they have been named as new species. *Nepenthes berbulu* is probably a hybrid between *N. macfarlanei* x *sanguinea*; *N. ulukaliana* between *N. ramispina* x *macfarlanei*; and *N. batik* between *N. ramispina* x *sanguinea*. Hybrids can be named, as for example in *N.* x *hookeriana*, "x" indicating hybrid status.

Hybridisation produces what is called a 'hybrid swarm' where the seeds (called F1 generation by plant breeders) produce a morphological continuum of plants from those that closely resemble either parent A or parent B, with intermediate plants, some more like parent A, others more like parent B and yet others completely intermediate between the two parents. Any striking individual can be picked out and, because it is a bit different from either parent A or B

Chronology of publication of *Nepenthes* species in Peninsular Malaysia

Date	*Nepenthes* species	Authority
Lowland species		
1790	*mirabilis*	Loureiro
1835	*ampullaria*	Jack
1835	*rafflesiana*	Jack
1840	*gracilis*	Korthals
1849	*albomarginata*	Lobb
1999	*benstonei*	Clarke
Highland species		
1849	*sanguinea*	Lindley
1905	*macfarlanei*	Hemsley
1908	*gracillima*	Ridley
1909	*ramispina*	Ridley
2020	*domei**	MN Faizal *et al.*
2020	*latiffiana**	MN Faizal *et al.*
2020	*malayensis**	Amin *et al.*
2023	*berbulu**	Tan HL & G. Lim
2023	*sericea**	Wistuba *et al.*
2023	*limiana**	Wistuba *et al.*
2023	*ulukaliana**	Alistair R. *et al.*
2023	*batik**	Lim G. *et al.*

**probable hybrids*

can be described as something new and given a new name. But this is where the problem arises. Is this 'new' entity a species or a hybrid? From the point of view of the commercial market it doesn't matter. After all, the orchid industry is based on hybrids. There's no reason why local growers can't follow suite and artificially hybridise local pitcher plant species to produce attractive hybrids and name them.

Is it a hybrid or a new species? The problem is kudos! There is the excitement of 'discovering a new species' and giving it a scientific name. Unfortunately, this can endanger the pitcher plant because there are pitcher plant collectors who must have the latest, rare 'new' pitcher plant species. These collectors will pay handsomely, even engaging local guides to collect plants from the wild. So describing a 'new species' can fuel the market for novelties, sometimes resulting in depredation of wild populations.

Fortunately today, there is a simple method of solving the hybrid or species problem. Molecular biology! It has already proved effective in 'fingerprinting' all the pitcher plant species and known hybrids in Singapore (Kiew *et al.,* 2003). It neatly separates species from hybrids. Today, it is even easier. There are commercial companies that will do the analysis as cheaply as the price of a blood test. Of course, you'll need the help of a scientist to extract the DNA and interpret the results. So until these 'new species' are analysed (a perfect project for a local student to take up for an MSc), the verdict is out on how many species there are in Peninsular Malaysia.

References

Cheek, M. & Jebb, M. 2012. Nepenthaceae. Pp 270. In: Kiew, R., Saw, L.G., Chung, R.C.K. & Soepadmo, E. (eds.) *Flora of Peninsular Malaysia* Series II: Seed Plants, Volume 3. Forest Research Institute Malaysia, Kepong.

Clarke, C. 2002. *A Guide to the Pitcher Plants of Peninsular Malaysia*. Natural History Publications (Borneo). 32 pp.

Kiew R., L.L. Teo & Y.Y. Gan. 2003. Assessment of the hybrid status of some Malesian plants using Amplified Fragment Length Polymorphism. *Telopea*. 10: 225–233.

Mey, F.S., Golos, M.R., Lim, G., Wistuba, A., Hagger, B. & Robinson, A.S. 2025. Hiding in plain sight: Nepenthes batik (Nepenthaceae), an overlooked tropical pitcher plant from Fraser's Hill, Peninsular Malaysia. *Telopea* 29:15-36

Tarmizi, A.A., Salasiah, M., Shakri, M.A., Nurshahidah, M.R., Noriha, M.A. & Mohamad Jamali, M.A. 2023. Insights into the diversity of Nepenthes L. (Nepenthaceae) across Peninsular Malaysia, including the first sighting of an undescribed taxon with flared peristomes and quadruple-row ventral wings. *Journal of Sustainable Natural Resources* 4 (1): 10–36.

Yong, B. & S.L. Wong. 2024. Mass producing to save pitcher plants, a tricky business. *Macaranga*: 16 February. Retrieved from https://www.macaranga.org/mass-producing-to-save-pitcher-plants-a-tricky-business/

Note on the disjunct distribution of the Common Gull, *Cepora nerissa* (Fabricius, 1775) *dapha* (Moore, 1879]) in Peninsular Malaysia

Nyok-Lin Liew (*nlliew66N@gmail.com*)

A male nectaring on *Asystasia gangetica*.

A male nectaring on species of *Synedrella*. Both pictures were taken on verdures lining the cave complex entrance trail.

The genus *Cepora* Billberg, 1820 is represented by three species in the Peninsular Malaysia of which *Cepora nerissa*[i] is the most northerly occurring species. It is confined to the Kedawi Region (Corbet & Pendlebury, 2020), and frequents open meadows and forest glades in the lowland. A small resident population was observed in central Peninsular Malaysia in a brief site survey in 2016. The said population of *C. nerissa* is only confined to a narrow cluster of lowland limestone hills on the extreme lower reaches of the Benom hills known locally as Gua Kechil in the district of Raub (3°48'04.6"N 101°51'38.0"E) in the state of Pahang, Peninsular Malaysia. The butterflies were mostly seen nectaring on the lower slopes of the limestone hills, on fringes of the surrounding secondary growths on sunny mornings. Both sexes were observed to nectar on common scrubland, on low flowering bushes in the area; *Chromolaena odorata* (L.) R.M.King & H.Rob., *Asystasia gangetica* (L.) T. Anderson and *Synedrella nodiflora* (L.) Gaertn.

Figure 1a. A satellite map of Gua Kechil from Google Maps (2021) indicating the location of the isolated population of *C. nerissa* in Raub, Pahang (red circle). The scarring are areas currently being occupied by limestone quarries.

Due to human activities, the said area has all but reduced to an inland island surrounded by small holdings consisting chiefly of oil palm, rubber, durian and cocoa plantations (Figure 1). It is also noted that there are currently two active limestone quarries flanking the isolated low hills. Subsequent visits to the site from 2016 to 2023 revealed that the population is stable and the appearance of *C. nerissa* is considered locally common but its abundance can fluctuate depending on time of the year. To ascertain that the population was not only confined to the said area, several collecting trips were carried out from 2016 to 2019 on surrounding localities in Kampung Gali, Kampung Ulu Gali and Kampung Hulu Jelu as well as another cluster of limestone hill known as Bukit Palong[ii], which is about 15 kilometres on a straight line from the site on Google Maps. Two separate collecting trips were also made to Gua Bama in Kuala Lipis within the stipulated period mentioned above. None of these said localities yielded any results of *C. nerissa*. For comparison, the distance from Raub to Kaki Bukit in Perlis on a straight line based on Google Maps is 368 kilometres and there are no existing records of *C. nerissa* along this line besides in the Kedawi region (Corbet & Pendlebury, 1992). The last observation of *C. nerissa* in the north by the author was at Kaki Bukit in Perlis in 2020.

So how does an isolated population of *C. nerissa* occur in this most unlikely of places? One plausible factor could be that a small colony had landed on the said locality in Raub by travelling through a jet stream[iii] and establisheditself on the said locality due to availability of suitable host plants. It is noted here that the specimens observed in Perlis were equally seen in the vicinities of limestone outcrops. This incidental occurrence could or could not be linked to migratory behaviour of *C. nerissa*. In general, butterflies of the family Pieridae are known to migrate and *C. nerissa* could have indulged in this migratory behaviour but unrecorded in the past literature. Geographically, Raub district sits on a long corridor flanked by the eastern facade of the Main Range and the western facade of the Benom Range, creating a natural barrier for faunistic migrations.

To illustrate the effect of this butterfly migratory barrier, comparisons could

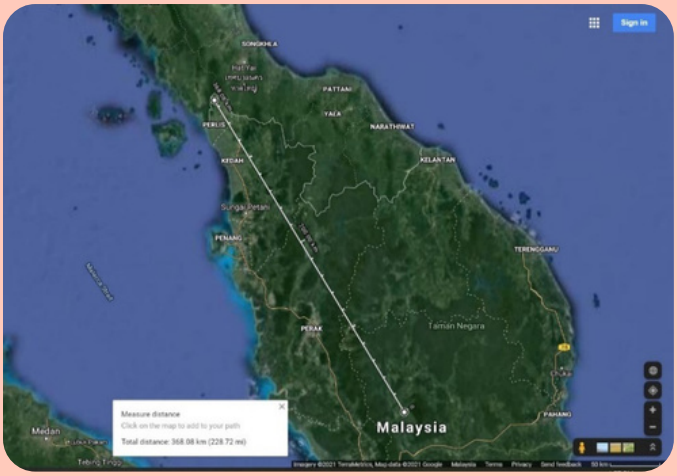
Figure 1b. A corresponding terrain map is provided to indicate the elevation of the area (140 metres above sea level).

be drawn to the arrivals of *Elymnias malelas*, *Acraea terpiscore* and *Dryas iulia* in the Klau Valley corridor of Raub. The presence of *E. malelas* was first detected in Peninsular Malaysia by Aoyama in 2012 on the isle of Langkawi and reached Raub in 2016 (Liew & Kirton, 2017). Prior to 2012, it was considered a Thai species and does not occur in Peninsular Malaysia. It has left a trace of southward expansion as specimens were also collected from Perak (Gopeng) and in Selangor (both Hulu Selangor and Gombak areas) by the author. By comparison, *A. terpiscore* was first spotted in Perlis in 1992 and was recorded in the Klang Valley by 2003 (Abang *et al.*, 2017). However, the author, being a resident of Raub in central Peninsular Malaysia, had only come across this species in 2013.

Its cousin, the Julia Heliconian, *D. iulia* (Fabricius, 1775), an escapee from butterfly farms in Thailand has had a very rapid southward expansion since its first observation in Langkawi in 2009 (Khew, 2009). It is now a widespread species in the Klang Valley but has yet to reach the district of Raub on the other side of the Main Range in 2024. However, it was already recorded as far south as Singapore (The Straits Times, 2022). This point illustrates the role of geographical barrier in faunistic expansion: unlike *A. terpiscore* which is basically a lowland butterfly with feeble flight that does not ascend the hills, *E. malelas* is a more robust species and was observed in hill topping activities on the peak of Gunung Jasar (1696 metres above sea level) in 2018 by the author. It took the *A. terpiscore* 20 years to breach the mountainous barriers (perhaps via a southern corridor by lowland access) but only 4 years for *E. malelas* thanks to its more robust flight habits.

Had *C. nerissa* experienced a similar southward-bound expansion like the described models of *E. malelas* or *A. terpiscore*, why were there no records of its occurrence in between Perlis and Raub? For record, the author is a frequent visitor to the limestone complexes near Gua Tempurung in Perak and Gunung Jasar since 2015 but have so far not come across *C. nerissa* in both localities.

Another possible explanation for the observed disjunct locality of *C. nerissa*



(Left) A straight line from Raub to Wang Kelian in Perlis denoting a distance of 368.08 km on Google Maps. (Right) A straight line from the site of *Cepora nerissa* at Kampung Tok Machang to the nearest limestone hills on the Main Range at Kampung Bukit Palong, Raub, denoting 15.19 KM.

would be human agency whereby the importation of horticultural plants could have functioned as the vector for the introduction of a species not localised to the area. However, the foodplant of *C. nerissa* (species of *Capparis* and *Crateva*) has no horticultural interest for the local agricultural economy and therefore an unlikely scenario for the introduction of this species into the studied site. Should the butterfly been introduced through decorative plants planted by the villagers, it would certainly be more widespread and common in the surrounding villages but it was not the case here. It was never observed to venture outside of the confinement of the limestone outcrops into the

surrounding villages. The map in page 9 shows the additional surveyed fringes outside of the initial surveyed locality where no traces of *C. nerissa* was found (areas circled in red).

A more distant possibility would point to past ecological environment of the Sundaland itself – that the peninsula was once connected to the larger Sundaland that covers the isles of Sumatra, Java and Borneo via a vast savannah in the Last Glacial Period (Bird *et al.,* 2005). As the savannah receded northwards, the isolated population could have been stranded in an ecological raft that was the limestone clusters in Raub, perhaps due to its microclimate and available host plants. Further ancestry investigations carried out on this isolated population against those from Northern region of Peninsular Malaysia and the populations from the Sunda Islands and Sulawesi would certainly shed some lights into the legitimacy of this seemingly disjunct distribution: on the question if it should be the same geographical subspecies with those occurring concurrently in Kedawi or to those in other parts of Sunda Islands i.e., Sumatra?

Acknowledgements

The author would like to thank Dr Laurence G. Kirton for insight into the observations of the subject in this article.

Presented below are sample specimens from various localities in the text.

UP	upper side
UN	under side
S01	site 01 – Gua Kechil, Raub, Pahang
S02	site 02 – Kaki Bukit, Perlis
S03	site 03 – Fraser's Hills

[i] The population of *C. nerissa* in Raub does not display seasonal forms and has only the dry-season brood form.

[ii] Bukit Palong figures as part of the Rotan Tunggal Tambahan Permanent Forest Reserve managed by the Raub District Forestry Department.

[iii] In an unrelated incident, the author had collected a very worn male specimen from atop Fraser's Hills on 15th June 2018. Since there are no corresponding populations from frequent visits to Fraser's Hills and its surrounding areas, it was concluded that the specimen could have travelled there via a jet stream incidentally, either from ex-site location or from elsewhere. Again, much needed confirmation of its origin should be carried out via DNA testing to ascertain the plausible scenario of its presence in the said location. Any eventual findings would warrant a wider field study on the current distribution of this pierid in Peninsular Malaysia.

References

Abang, F., Noor, S., Hazali, R. & Dieng, H. (2017). First Record and Occurrence of *Acraea terpsicore* (Linnaeus, 1758) (Lepidoptera: Nymphalidae) in Malaysian Borneo. *Serangga* 21(2): 21–31.

Bird, M., Taylor, D. & Hunt, C. (2005). Palaeoenvironments of insular Southeast Asia during the Last Glacial Period: A savanna corridor in Sundaland? *Quaternary Science Reviews* 24: 2228–2242.

Corbet, A.S. & Pendlebury, H.M. (1992). *The Butterflies of the Malay Peninsula*. (4th edition). (Revised by J.N. Eliot). Kuala Lumpur: Malayan Nature Society.

Corbet, A.S. & Pendlebury, H.M. (2020). *The Butterflies of the Malay Peninsula*. (5th edition). (Revised by Nancy & Michael Van De Poortens). Kuala Lumpur: Malayan Nature Society.

Khew, S.K. (2009). New Taxon for Malaysia: Discovery of a new butterfly species on Pulau Langkawi - *Dryas iulia*. https://butterflycircle.blogspot.com/2009/09/new-taxon-for-malaysia.html

Liew, N.L. & Kirton, L.G. (2017). First Record of the Spotted Palmfly in Central Peninsular Malaysia. Conservation Malaysia No. 25. Forest Research Institute Malaysia.

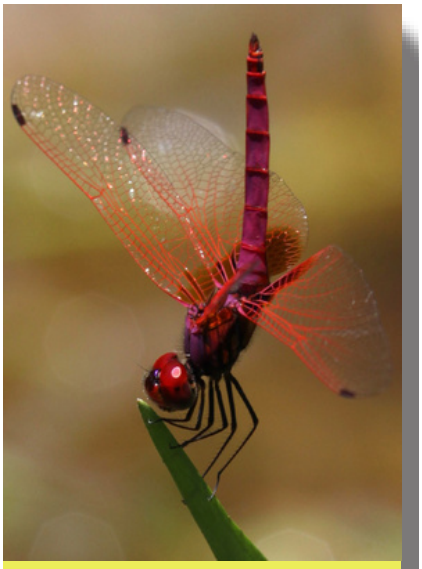
The Straits Times. (2022). South American butterfly, the julia heliconian, makes Singapore home https://www.straitstimes.com/singapore/environment/south-american-butterfly-the-julia-heliconian-makes-singapore-home

Documenting the Dragonflies and Damselflies of FRIM and Developing a Specimen Reference Collection

Chooi-Khim Phon (phonchooikhim@frim.gov.my),
Veronica Khoo, Su Ping Ong & Laurence G. Kirton

Introduction

Damselflies and dragonflies make up the insect order Odonata and are therefore often called odonates. The Latin word Odonata means "toothed ones," and they are indeed fierce predators. Their immature stages are found in water and prey on all sorts of aquatic organisms including mosquito larvae, small fishes and tadpoles using their sharp-toothed, extendible jaws to grab and pierce prey in an instant. Adults are nimble fliers that catch insects in flight as prey. Some species fly extremely fast and can alter their direction faster than the human eye can perceive. They have fascinating behaviours that are a thrill to watch—those keen on nature observation will marvel at their territorial fight displays. Despite being ancient creatures that have been around from before the time of the dinosaurs, they are among the most radiant day-flying insects in the world that in life display many bright and beautiful colours. Just watching them at rest or sunbathing at the tips of leaves is breathtaking. Little known to people is that dragonflies and damselflies can also tell us the quality of water in the environment (May, 2019). They make good bioindicators because the species composition of dragonflies and damselflies found in and around rivers, ponds and lakes indicate whether the water is clean, well-vegetated, has a healthy aquatic life, or is polluted.



A male Crimson Marsh Glider (*Trithemis aurora*) in an obelisk posture, which enables it to regulate its body temperature by reducing its body-surface exposure to direct sun.

Inception of the Project

The grounds of FRIM and the Kepong Botanic Gardens under FRIM provide many good habitats for dragonflies and damselflies with their forest cover and park-like landscapes that are crossed by streams and rivers and dotted with ponds. The question of what species can be found in FRIM has always lingered in our minds. The institute's Entomological Reference Collection has

Habitat of the Dark-tipped Forest Skimmer (*Cratilla metallica*) along the Rover Track. This species is often seen near pools of water along the forest path. Inset: A male Dark-tipped Forest Skimmer perching on a fallen branch.

A pair of Fiery Coraltail damselflies (*Ceriagrion chaoi*) in a tandem position. The male (above) guards the female (below) while she lays eggs, a behaviour called contact guarding.

The low light levels in the morning make it difficult to see dragonflies as they begin to fly along the forest trails in FRIM. As the morning sun broke through in a forest opening near a stream, a female of the very large Yellow-banded Forktail (*Macrogomphus quadratus*) (inset), was seen perching along a path on a twig.

A frontal view of the head of a White-faced Clearwing (*Echo modesta*) (left) and a Common Flashwing (*Vestalis amethystina*) (right) from FRIM. The former can be distinguished from the latter and from the similar-looking Charming Flashwing (*Vestalis amoena*) by the white patch between its eyes.

only 35 specimens collected from FRIM between 1953 and 2006, and these comprise an estimated 16 species. Up till 2021, the collection only housed about 90 odonate specimens. Many of these specimens are damaged or have incomplete body parts, and most are difficult to identify to species level because they have lost their colours. Odonate preservation requires special techniques to minimise colour loss.

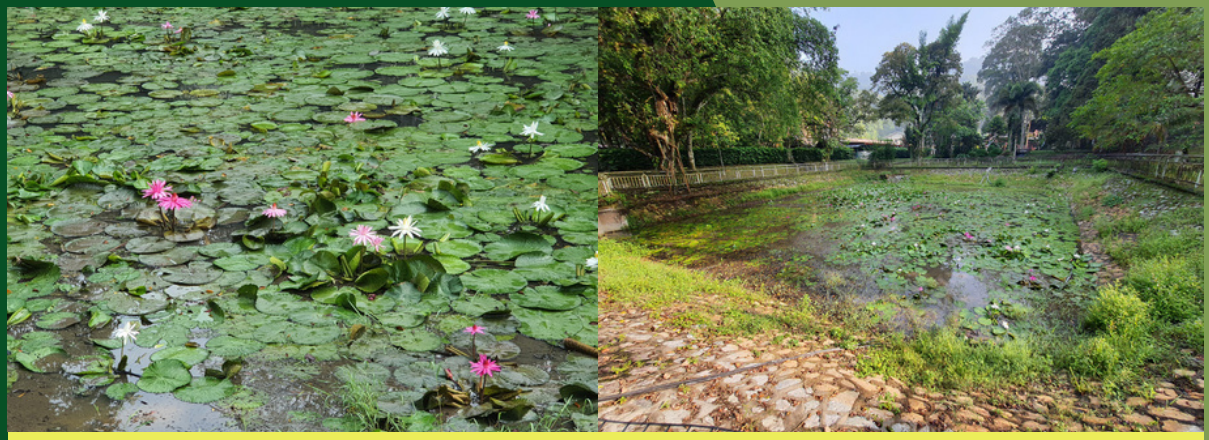
No formal inventory of dragonflies and damselflies has previously been conducted in FRIM. And yet encounters with these fascinating insects are common in our work environment. Gazing out of our laboratory or office window when our eyes require a break, we often see a dragonfly or two flying or perching in the canopies of the bamboos, beach barringtonias, figs and other trees that surround the building we work in. Observing them gives our weary eyes and minds a brief respite, but also reminds us that information on the dragonfly and damselfly species in our own institute has been sadly lacking. To answer the question of what species can be found in FRIM, we embarked on a project from 2022–2023 to document dragonfly and damselfly diversity in FRIM and the Kepong Botanic Gardens, supported by the UNESCO Sultan Qaboos Prize for Environmental Preservation.

Areas surveyed during this project were the ponds and streams at the Kepong Botanic Gardens, the ponds near the mosque and Visitor Information Centre, the wetlands and waterfall areas, the Rover Track, Engkabang Trail, the trails near Bukit Bujang and the trail from Perah Camp to the botanic gardens. In addition, a few specimens were found at building lights at night or late in the evening. Both field photography and selective collecting of representative specimens of each species with nets were employed.

Developing a Reference Collection

Since the colours of odonates can be completely lost when they are dead and air-dried, we used a variety of methods to reduce colour loss including immersing them in acetone, rapid oven drying, and a novel method of drying at low temperature. The colour patterns of odonates are very important in differentiating between species and in taxonomic studies. Therefore, we also documented colours by bringing live specimens back to the laboratory and photographing them at different angles before preserving the specimens. However, this is not as simple as it sounds. Damselflies easily escape in the blink of an eye during handling and are difficult to find and retrieve. Dragonflies are strong fliers, can break free if not restrained adequately and may even bite. Over time, these photographic records will become a valuable resource of odonate colour characters that supplement the physical specimen collections.

Representative specimens of each species were preserved on a pin with their wings spread (i.e., set). Others were kept flat with their wings folded upwards. The former specimens have been housed in the regular insect cabinet drawers in the collection room but require much space. The latter were each placed individually in a small polypropylene sleeve (plastic bag), which was then placed in a slightly larger polyethylene zip-lock bag with a label. They were then



A pond near the FRIM mosque, which is a good place to watch dragonflies and damselflies. Vegetation in ponds provide a good breeding habitat for many species.

stored in specially constructed Odonata drawers housed in their own locally-sourced, custom-made cabinets. The plastic sleeves are stored vertically so that they are less easily damaged and more easily located and retrieved. Therefore, the drawers need to be deeper than regular drawers that are used for pinned specimens. This method of storage enables many specimens to be stored without requiring as much space as set specimens. However, it has the disadvantage of making wing venation harder to see and study.

A male Spring Shadowdamsel (*Drepanosticta fontinalis*) inhabiting a shady spot with glimmers of sunlight near a small stream.

Results of the Survey

From the FRIM odonates inventory alone, within a period of just one year, we added to the collection more than 170 specimens of odonates comprising 50 species. It sets the stage for the ongoing work of building up a well-preserved and better-documented reference collection of the odonates from Peninsular Malaysia in the FRIM Entomological Reference Collection. A good and well-maintained collection is essential for future reference and taxonomic studies.

A male Spine-legged Redbolt (*Rhodothemis rufa*) basking in the sun on a waterlily leaf at the pond near the FRIM mosque.

A total of 54 species of odonates from eleven families were recorded in the main FRIM grounds and the Kepong Botanic Gardens, including four species that occurred in the collections but were not found during this survey. It is possible that many species have been overlooked in a survey as short as this. However, the composition of species could also have changed slightly over the years as the forest and landscape matured and developed. Most dragonfly and damselfly species were active from mid-morning to the early evening. However, there were species that were active until late evening and some dragonfly species that flew mainly at dawn and dusk, or when light levels in the forest were low.

The most widespread species in FRIM appeared to be *Orthetrum testaceum* and *O. chrysis,* which were found in a wide variety of habitats across FRIM. However, the majority of species were specific to one habitat. The greatest richness in species was found at ponds and the lake-like wetland area. Some species were only found in pond and lake habitats, for example, the damselflies *Lestes praemorsus*, *Onychargia atrocyana*, *Ceriagrion chaoi* and *Pseudocopera ciliata*, and the dragonflies *Ictinogomphus decoratus*, *Tetrathemis hyalina*, *Chalybeothemis chini* and *Rhodothemis rufa*.

A pair of Grizzled Pintails (*Acisoma panorpoides*) at the edge of a pond in the Kepong Botanic Gardens. The male (top) has intricate bright bluish-white markings while the female (bottom) has yellow-green markings.

A temporary rainy-season puddle caused by wild animals digging up the ground in an open grassy area can be a breeding site for some species such as *Neurothemis fluctuans* (Common Parasol) (inset, male). Its nymphs develop quickly in the shallow water and can withstand high temperatures from direct sunlight.

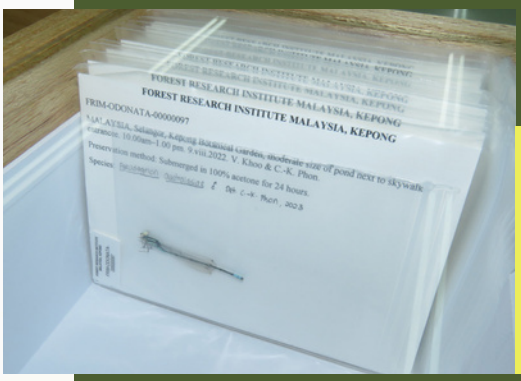
Others such as *Prodasineura laidlawii*, *Lathrecista asiatica*, *Tyriobapta torrida* and *Neurothemis fluctuans* occurred in ponds and along forest trails.

Along forest streams and rocky rivers, damselflies such as *Echo modesta*, *Heliocypha biforata* and *Euphaea impar* were seen, as well as dragonflies such as *Macrogomphus quadratus* and *Lyriothemis biappendiculata*. The large, metallic green damselfly *Vestalis amethystina* may venture further from streams and can often be seen along forest paths in FRIM. A few species, such as the dark metallic blue dragonfly *Cratilla metallica*, were common along trails wherever there were puddles of water. Species of dragonflies like *Lyriothemis cleis* and *Gynacantha basiguttata*, which breed in water-filled tree holes and water accumulated within the whorls of plant leaves, were sometimes seen along relatively dry trails like the trail to Taman Bidara.

A full checklist of species found is given (page 16). The survey took place over a short period of only one year, with most forest areas visited only once. Therefore, this preliminary checklist may need to be updated in the future.

A collage of images of a damselfly specimen (left, *Euphaea impar*) and dragonfly specimen (right, *Idionyx yolanda*) combining photographs of the specimens taken at different angles.

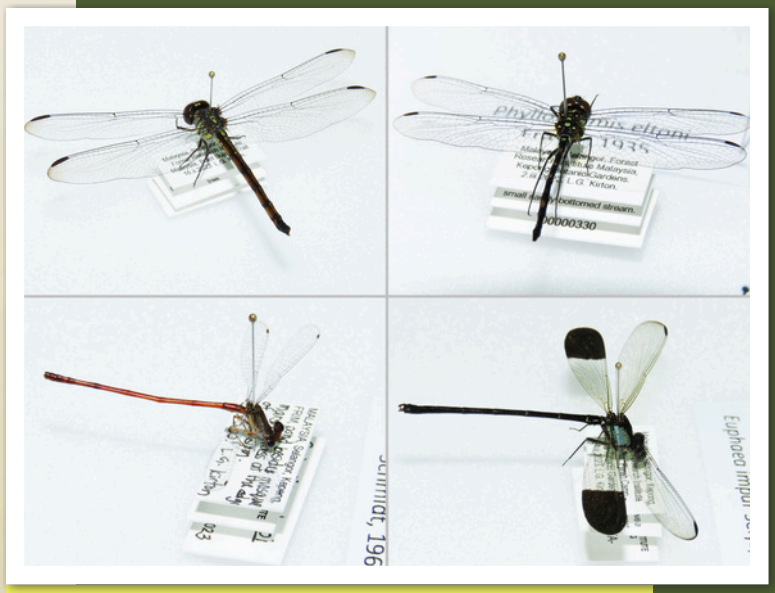
Two collection drawers from the project containing pinned and labelled damselfly (top) and dragonfly (bottom) specimens with their wings spread. A well-preserved reference collection containing representative specimens of each species is vital for future studies on each species.



Most specimens are preserved with their wings folded in labelled double plastic-sleeves, which are arranged vertically in custom-made collection drawers.

Examples of better colour preservation of dragonfly and damselfly specimens collected during this project. Without special techniques, the original colours of dragonflies and damselflies are lost within days or even hours.

Examples of dragonfly specimens in the FRIM collection that were collected from 1953 to 2006 and are in poor condition, with much of their colour having faded due to poor preservation techniques used at the time.



Examples of specimens collected, pinned and preserved using special techniques during the current FRIM dragonfly and damselfly inventory.

Checklist of Species

CALOPTERYGIDAE	
	Echo modesta Laidlaw, 1902
	Vestalis amoena Hagen in Selys, 1853
	Vestalis amethystina Lieftinck, 1965
CHLOROCYPHIDAE	
	Heliocypha biforata (Selys, 1859)
EUPHAEIDAE	
	Euphaea ochracea Selys, 1859
	Euphaea impar Selys, 1859
LESTIDAE	
	Lestes praemorsus decipiens Kirby, 1893
PLATYSTICTIDAE	
	Drepanosticta fontinalis Lieftinck, 1937
PLATYCNEMIDIDAE	
	Onychargia atrocyana Selys, 1865
‡§	*Copera marginipes* (Rambur, 1842)
‡	*Pseudocopera ciliata* (Selys, 1863)
	Prodasineura humeralis (Selys, 1860)
	Prodasineura laidlawii (Förster in Laidlaw, 1907)
COENAGRIONIDAE	
	Ceriagrion chaoi Schmidt, 1964
	Pseudagrion australasiae Selys, 1876
	Pericnemis stictica Hagen in Selys, 1863
	Agriocnemis femina (Brauer, 1868)
GOMPHIDAE	
‡	*Ictinogomphus decoratus* (Selys, 1854)
	Macrogomphus quadratus Selys, 1878
	Macrogomphus thoracicus McLachlan, 1884
AESHNIDAE	
‡	*Gynacantha basiguttata* Selys, 1882
‡§	*Indaeschna grubaueri* (Förster, 1904)
SYNTHEMISTIDAE	
	Idionyx yolanda Selys, 1871
LIBELLULIDAE	
	Tetrathemis hyalina Kirby, 1889
	Phyllothemis eltoni Fraser, 1935
	Lyriothemis cleis Brauer, 1868
‡	*Lyriothemis biappendiculata* (Selys, 1878)
	Lathrecista asiatica (Fabricius, 1798)
	Cratilla metallica (Brauer, 1878)
	Orthetrum sabina (Drury, 1773)
‡	*Orthetrum testaceum* (Burmeister, 1839)
	Orthetrum chrysis (Selys, 1891)
	Orthetrum triangulare (Selys, 1878)
‡	*Orthetrum luzonicum* (Brauer, 1868)
	Tyriobapta torrida Kirby, 1889
	Chalybeothemis chini Dow, Choong & Orr 2007
	Brachydiplax chalybea Brauer, 1868
	Brachydiplax farinosa Krüger, 1902
	Acisoma panorpoides Rambur, 1842
‡	*Rhodothemis rufa* (Rambur, 1842)
	Pseudothemis jorina Förster, 1904
‡	*Neurothemis fluctuans* (Fabricius, 1793)
‡§	*Neurothemis fulvia* (Drury, 1773)
	Brachythemis contaminata (Fabricius, 1793)
‡	*Trithemis aurora* (Burmeister, 1839)
	Trithemis festiva (Rambur, 1842)
‡	*Zyxomma petiolatum* Rambur, 1842
‡	*Tholymis tillarga* (Fabricius, 1798)
‡§	*Pantala flavescens* (Fabricius, 1798)
	Camacinia gigantea (Brauer, 1867)
	Rhyothemis triangularis Kirby, 1889
	Urothemis signata (Rambur, 1842)
	Aethriamanta gracilis (Brauer, 1878)

‡ indicates a species present in the FRIM collection prior to this project; *§ indicates* a species that was not recorded in the present field inventory.

Acknowledgements

This work was funded by the UNESCO Sultan Qaboos Prize awarded to FRIM in 2021. We thank Assoc. Prof. Dr. Choong Chee Yen for helping to verify the species in some of our photographs, and Dr. Albert G. Orr for taxonomic advice.

References

Choong, C.Y. 2024. Dragonflies and Damselflies of Malaysia. https://dragonfly-and-damselfly-malaysia.blogspot.com/.

May, M.L. 2019. Odonata: Who They Are and What They Have Done for Us Lately: Classification and Ecosystem Services of Dragonflies. Insects 19(3): 62. doi: 10.3390/insects10030062. PMID: 30823469; PMCID: PMC6468591.

Orr, A.G. 2003. *A Guide to the Dragonflies of Borneo: Their Identification and Biology.* Natural History Publications (Borneo), Kota Kinabalu. 195 pp.

Orr, A.G. 2005. *A Pocket Guide: Dragonflies of Peninsular Malaysia and Singapore.* Natural History Publications (Borneo), Kota Kinabalu. 127 pp.

We welcome articles on new research information on flora or fauna and discussions related to biodiversity or conservation. Please send articles to:

The Editor,
Conservation Malaysia Bulletin,
Forest Research Institute Malaysia,
52109 Kepong, Selangor.
(Attn: Ms. Ong Su Ping, ongsuping@frim.gov.my)

Conservation Malaysia is published twice a year and hardcopies are free upon request. Please contact The Editor for queries or comments. Past issues are available at: *https://www.mybis.gov.my/one/publication. php?menu=27&g=1*.

Funded by the Ministry of Natural Resources, Environment and Climate Change (currently known as Ministry of Natural Resources and Environmental Sustainability). Editorial team: Ms. Ong Su Ping and Mr. Lau Kah Hoo.