

LAND SNAILS AND SLUGS OF MARAI PARAI AREA, WESTERN PART OF MOUNT KINABALU, KINABALU PARK, SABAH

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ABSTRACT

Mount Kinabalu is a renowned biodiversity hotspot for land snails, with numerous species documented since the 19th century. Despite extensive studies, significant portions of the mountain, particularly the western and northern areas, remain unexplored. Twenty-six species of land snails and slugs were recorded in seven-day sampling along at the standard sampling plots and random locations along the two trails ascending to the Marai-Parai area, between 1000 m and 2500 meters above sea level at the western part of Mount Kinabalu, Sabah. While no new species were identified, our findings contribute to the taxonomic understanding of *Vitrinula* and *Microparmarion* species. Notably, we rediscovered *Microparmarion pollonerai* and observed novel behaviours of *Microparmarion* species in association with *Nepenthes* plants.

Keywords: *Biodiversity hotspot, Land snails, Mount Kinabalu, Marai-Parai*

INTRODUCTION

Mount Kinabalu has been recognised as a biodiversity hotspot for land snails, attracting naturalists since the 19th century who aimed to collect specimens. Numerous species described by malacologists were based on specimens gathered by these naturalists during the settlement period, including contributions from Whitehead J, Everett AH and Low H. Subsequently, a total of 82 species, including new species, were documented through various studies conducted over the past century and a half, including works by Smith (1887, 1895), Collinge & Godwin-Austen (1895), Laidlaw (1937), Tiller & Bouchet (1988), Liew et al. (2009), Liew et al. (2010), Vermeulen & Liew (2022) and Liew et al. (2024). However, significant portions of Mount Kinabalu, particularly the western and northern areas, remain unexplored in terms of land snail diversity (see Figure 1). In this study, we document the land snails and slugs found in the western part of Mount Kinabalu, based on samplings conducted in 2018 and 2023.

MATERIALS AND METHODS

Two sampling sessions were conducted at the western part of Mount Kinabalu. The first one was done between 19 September and 21 September 2018 along the trail from Kiau community forest to the Marai-Parai via Tahubang, while the second session was done between 9 October and 12 October 2023 along the trail from Nunuk Camp to Kobuturan via Marai Parai. A total of four standard sampling plots were established in undisturbed habitat in the second sampling session (Figure 1). Land snails were searched in six 20 m × 20 m plots for two person-hours. Live snails and dead snails (i.e. empty shells) were collected by examining vegetation, forest floor, under fallen logs and under leaf litter during the day. About five litters of loose topsoil and leaf litter were also collected, from which the micro snails are extracted under a stereomicroscope. In addition to the standard samples, specimens were also collected that were encountered by chance at the nine sites (random sampling), mainly along the paths between the plots during the night and day.

Upon returning to the laboratory, we cleaned all empty shells to eliminate any dirt on their surfaces before drying them in an oven. Live snails and slugs were drowned by submerging them in water within a sealed container, after which they were preserved in 70% ethanol for long-term storage. Then, we classified all specimens to the species level, utilising identification guides by Vermeulen & Liew (2022) and Liew & Foon (2022). The specimens were then kept in the BORNEENSIS Mollusca Collection at Universiti Malaysia Sabah (BOR/MOL 13979 – 13991; BOR/MOL 15798 – 15816; BOR/MOL 15828 – 15849), with duplicate samples stored at the Sabah Parks Museum's collection.

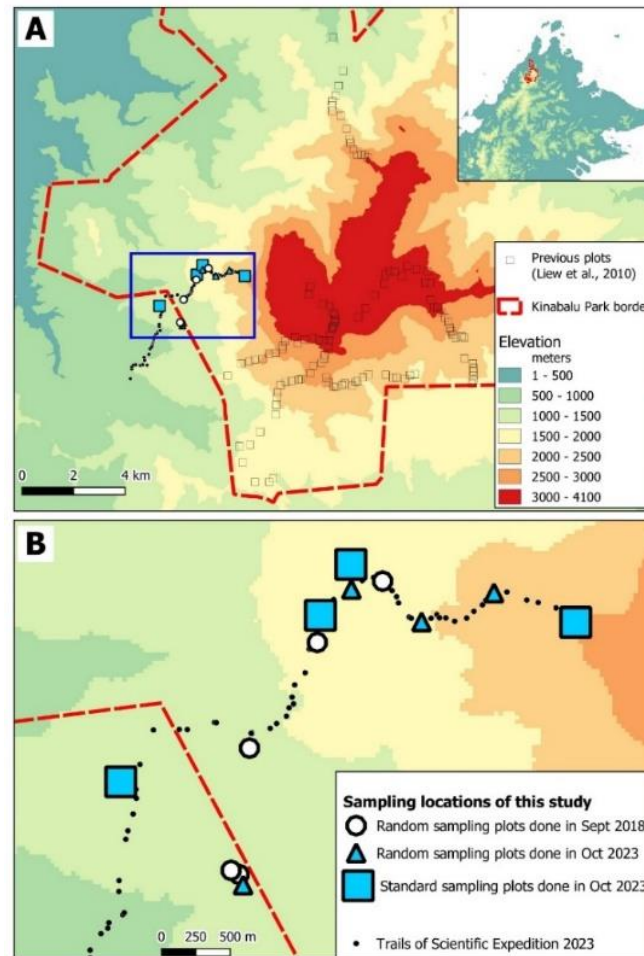


Figure 1. Sampling locations of land snails and slugs at Mount Kinabalu: (A) Sampling locations in the western part of Mount Kinabalu, compared to previous land snail samplings conducted at other parts of Mount Kinabalu since 2004 and published in Liew et al. (2010). (B) Standard sampling plots and random sampling locations in the western part of Mount Kinabalu conducted in September 2018 and during the expedition in October 2023.

RESULTS AND DISCUSSION

In this study, 26 species from 17 genera belonging to 9 families were recorded (Table 1, Figure 2). A total of 103 specimens were collected from both standard sampling plots and random sites, all of which were identified to species level, except for 13 juvenile shells. As the samplings only covered parts of the elevation gradients between 1000 m and 2600 m of Mount Kinabalu, the number of species recorded in this study represents around one-third of the species that are known from Mount Kinabalu. There were no new records. However, specimens of a *Vitrinula* sp. and *Microparmarion pollonerai* that were collected could be of interest to resolve the taxonomy of these two little known taxa.

So far, the four *Vitrinula* species that are known from Sabah were based on empty shells, and thus, very little is known about the animal themselves and the genetic diversity of the species. The shells of the different species, especially *Vitrinula baramensis* (Kobelt, 1897) and

Vitrinula padasensis (E A Smith, 1895) are highly variable. The specimens found in this study, *Vitrinula* sp. "Marai Parai" (both living snails and empty shells), together with other specimens found previously from Mesilau and Mamut (Fig. 2: *Everittia* sp. "Mesilau", Liew et al., 2024) will be used in future studies to clarify the taxonomic status of this genus in Sabah.

In addition, we rediscovered a *Microparmarion* sp. reported by Schilthuizen & Liew (2008: Fig. 5). The previous record was based on a photograph taken by a climber at Marai Parai (c. 1700 m a.s.l.) in 2001 (Schilthuizen & Liew, 2008). However, we found this not at the original location where it was recorded previously in 2001, but at higher elevations, around 2500 m at the Kobuturan camp site. Despite its colouration being darker, the external morphology of the specimen resembles *Microparmarion pollonerai* (Figures 2 & 3). Hence, it is unlikely this is a new species as postulated by Schilthuizen & Liew (2008).

Furthermore, we also found interesting behaviour of the *Microparmarion* semi-slug that has not previously been recorded for this genus. We found two of the *Microparmarion* species, *M. pollonerai* and *M. simrothi*, in pitchers of *Nepenthes* plants, and for most of the encounters, egg masses were also found, which could likely belong to the semi-slugs (Figure 3C). This observation warrants more detailed study into the possible homing behaviour and close association between the semi-slugs and the *Nepenthes* plants.

Table 1. Species list of land snails and slugs of the Marai Parai area, Mount Kinabalu, collected in 2018 and 2023.

Ariophantidae

- Hemiplecta humphreysiana* (Lea, 1841)
Ibycus rachelae (Schilthuizen & Liew, 2008)
Microcystina consobrina (Van Benthem Jutting, 1959)
Microcystina microrhynchus Vermeulen, Liew & Schilthuizen, 2015
Microcystina physotrochus Vermeulen, Liew & Schilthuizen, 2015
Microparmarion basifixus Vermeulen & Liew, 2022
Microparmarion exquadratus Schilthuizen et. al. 2018
Microparmarion pollonerai Collinge & Godwin-Austen, 1895
Microparmarion simrothi Collinge & Godwin-Austen, 1895

Camaenidae

- Amphidromus martensi* (Boettger, 1894)

Charopidae

- Sundacharopa infrastrata* Vermeulen & Liew, 2022

Cyclophoridae

- Japonia quinquelirata quinquelirata* (V. Moellendorff, 1887)
Japonia trilirata kinabaluensis (Smith, 1895)
Leptopoma sericatum (Pfeiffer, 1851)
Leptopoma undatum (Metcalf, 1851)
Pincerna globosa (Adams, 1870)
Pterocyclos trusanensis (Godwin Austen, 1889)

Diplommatinidae

- Diplommatina electa* Fulton, 1905
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Dyakiidae

Vitrinula sp. "Marai Parai"

Everettia dominiki Liew, Schilthuizen & Vermeulen, 2009

Everettia subconsul (Smith, 1887)

Rhinocochlis chlorosoma (Vermeulen, Liew & Schilthuizen, 2015)

Philomycidae

Meghimatium striatum van Hasselt, 1824

Chronidae

Exrhysota brookei (A. Adams & Reeve, 1850)

Geotrochidae

Geotrochus subscalaris Vermeulen, Liew & Schilthuizen, 2015

Geotrochus whiteheadi (E.A. Smith, 1895)

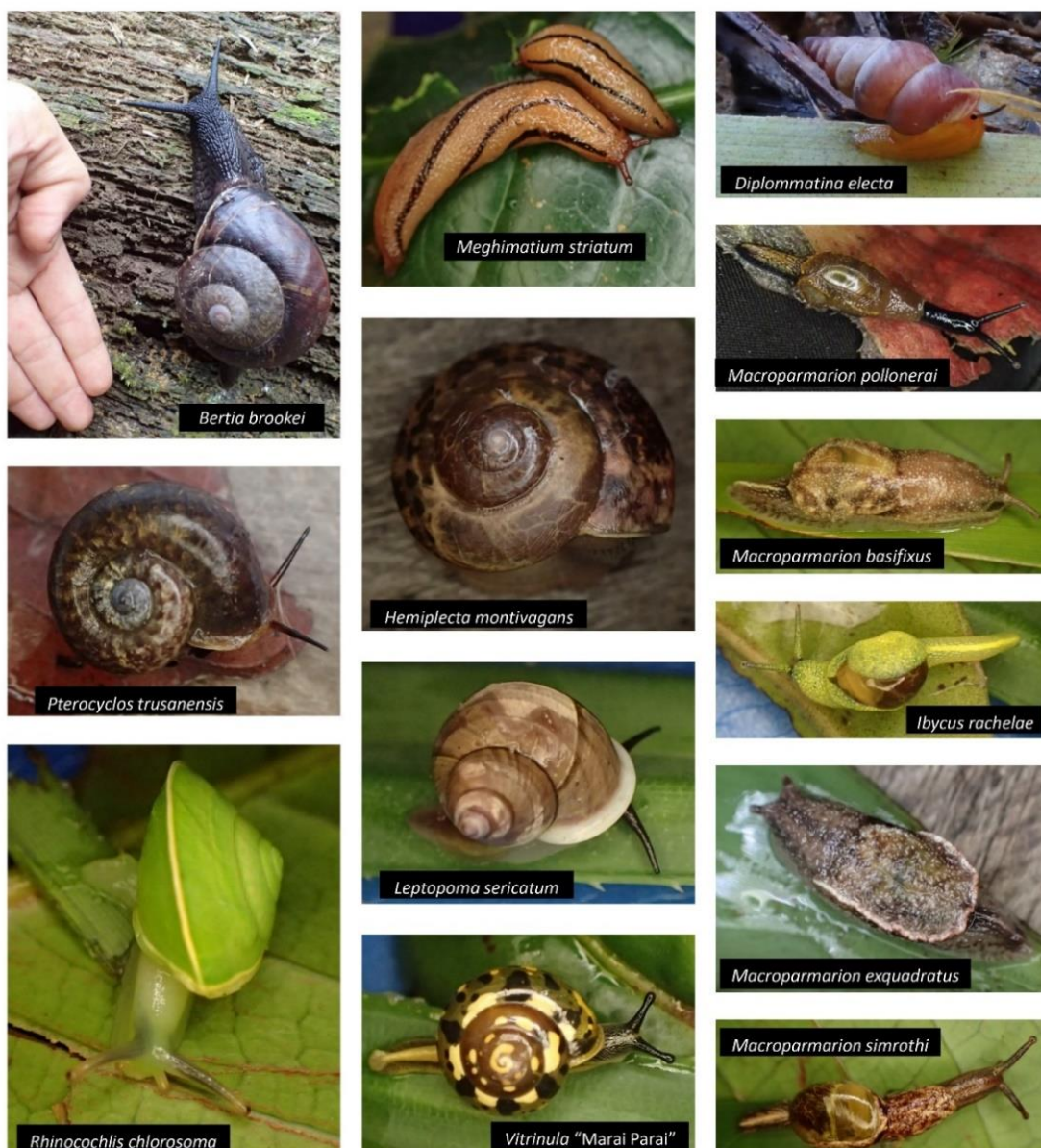


Figure 2. Thirteen of the 26 land snail and slug species that were recorded from the Marai Parai area, Mount Kinabalu.

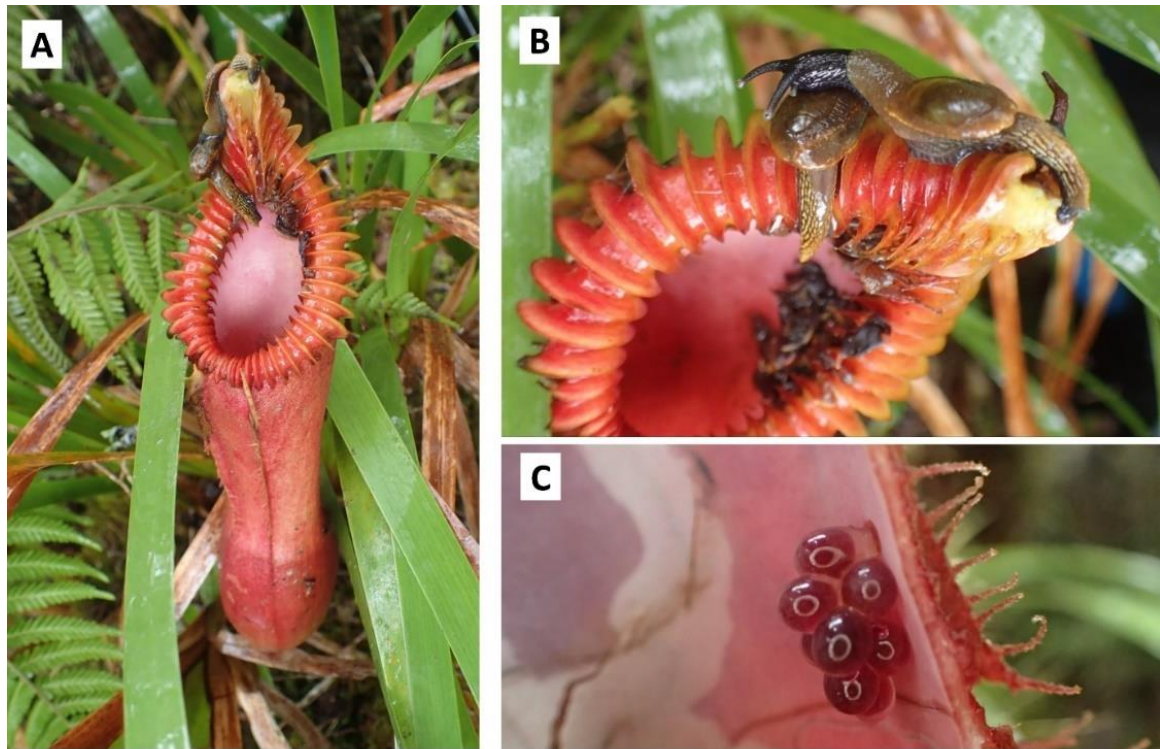


Figure 3. Behaviour of semi-slugs in association with *Nepenthes* plants at the Kobuturan campsite (~ 2500 m a.s.l.). A & B: Two individuals of *Microparmarion pollonerai* observed inside the pitcher of *Nepenthes harryana*, subsequently moving around the pitcher's rim when disturbed. C: Eggs found inside the pitcher, likely attributed to the semi-slugs.

CONCLUSION

Our study highlights the rich biodiversity of land snails in the western part of Mount Kinabalu, contributing valuable data to the existing knowledge of this region's malacofauna. The identification of 26 species, including intriguing specimens of *Vitrinula* and *Microparmarion*, emphasises the importance of further taxonomic and ecological studies. The rediscovery of *Microparmarion pollonerai* and the novel behavioural observations associated with *Nepenthes* plants suggest complex ecological interactions that merit further investigation.

ACKNOWLEDGEMENT

We thank Jasrul Dulipat, Franey J. Chong, Bryan Wong, Evan Seng Huat Quah, Alvinus A. Joseph for their help with sampling. This study was conducted during the Marai Parai Scientific Expedition 2023 organised by Sabah Parks. Sukaibin Sumail identified the pitcher plant for Figure 3. The sampling in 2018 were conducted with the permission of Sabah Parks (TS/PTD/5/4 Jld.54(112) and supported by Fundamental Research Grant Scheme (FRGS), under Ministry of Higher Education of Malaysia (FRGS/1/2019/WAB13/UMS/02/1).

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