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## **The Shell evolution of the hydrocenidae of Malaysian Borneo**

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**Summary**  
**Samenvatting**



## Summary

This thesis started with a general overview on the evolutionary process of animals due to ecological changes. In **Chapter 1**, I introduced my model organism and stated the aims of this PhD project. I included preliminary findings on the ontogenetic measurement of *Georissa* shells. Also, I reconstructed a time-calibrated phylogeny, which is then used in **Chapter 5** for the ancestral state reconstruction of selected characters of *Georissa*.

My study has revealed that the Bornean *Georissa* are more diverse than previously anticipated. In **Chapters 2 and 3**, dedicated to the taxonomic revision of the genus *Georissa*, I discussed the morphological features, phylogenetic relationships, and the biogeographic distribution of *Georissa*. I examined material from various natural history museum and personal collections (as listed in **Chapters 2 and 3**). Furthermore, this approach has benefited me in the process of species delimitation, which, at the beginning of our research, was still in a state of confusion. As a result, I concluded that there are at least 29 species of minute land snails of the genus *Georissa* occurring in Malaysian Borneo.

In **Chapter 4**, I focused on the morphological and genetic variation of a pair of *Georissa* species sympatric in a small geographical region. One species is epigeal, the other one cavernicolous. The morphological variation among these populations were surprisingly high. Therefore, I investigated the genetic relationships and morphological characters among these populations. Interestingly, I found that the hypogean species is a descendant of the above ground species, which is similar to the case of shell divergence in other *Georissa* species near Sepulut, Sabah.

In **Chapter 5**, I studied the shell character evolution of the Bornean *Georissa* in a phylogenetic framework. Based on the phylogeny, I found convergence in the formation of scales. Additionally, I discussed the differentiation of size and coloration of the Bornean *Georissa* in dependence on different habitats.

Finally, in **Chapter 6**, I summarised the research findings from my study. I suggested prospective research related to the evolutionary study of Bornean *Georissa* that could improve our understanding and knowledge on the evolution of terrestrial shelled organisms.