

Supervisor assessment of Ph.D. thesis by Nichola Sarah Plowman 'Mechanisms structuring arboreal ant communities along ecological gradients in New Guinea rainforests'.

Nichola is my first doctoral student and her work continues in the direction of previous research on the diversity and ecology of arboreal ants in one of the most diverse ecosystems on the planet – the rainforests of New Guinea, a research field in which I myself defended my Ph.D. seven years ago. Ants living on trees in rainforests are among the most abundant and ecologically important invertebrates. Typically multiple ant species co-exist in a single tree, yet most of our previous knowledge about their ecology has been limited to individual trees that were fogged or baited, or to research on a handful of dominant ant species. My former work within group of prof. Vojtech Novotny established a pioneering “plot-based approach”, where we studied complete canopy communities of the ants within a whole-forest area for the first time through tree felling and dissection. This included mapping of all trees and sampling of the ant nest microhabitats within them. While such plot-based census is common for plant communities, it is still unique for insects, including the ants.

This approach has been followed by Nichola in her thesis. While mine previous plot-based research was limited to a single lowland forest locality and focused solely on species diversity, in this thesis Nichola largely extended this scope: she explored a range of multiple localities and also utilised new methodologies, comparing tree-dwelling ant assemblages from plot-based and transect-based censuses of trees along elevational and successional gradients. In total, approx. 3-ha of forest and 2,000 individual plant stems were explored in this thesis. Of course, such a scope would not be possible without building on existing samples and data, as well as on Nichola's ability to collect new datasets and collaborate with the many colleagues in our team. Indeed, collaboration was a key component of this work and this thesis is evidence that Nichola succeeded in this task. Beyond that, she has established and brought new techniques to our research team to explore the functional and phylogenetic diversity of these species-rich communities. Although there were some difficult and stressful moments, and finishing off the thesis took longer than I expected (with several postponements - perhaps not surprisingly given the huge material to sort and measure, and the large datasets to join and interpret), I am happy that Nichola did not give up and eventually met initial expectations, drafting her results into several chapters focusing on highly diverse topics. It should be mentioned that in addition to her work on this thesis, Nichola was active in other tasks that benefitted the 'Ant ecology laboratory' and the University and Biology Centre departments during the past six years. Those are not so evident but also important: for instance, she established the first version of our lab webpages and has created a pdf identification key for ant subfamilies of New Guinea. She also kindly helped to edit many manuscripts for language to many Czech colleagues. During her Ph.D, apart from mastering multiple skills, ranging from the entomological (identifications, pining, measuring the ants) to the statistical ones (managing large matrices and null models in R), Nichola has spent several months in the field collecting data in the difficult terrain of the Mt. Wilhelm rainforests.

In my opinion, the thesis brings together some very interesting and sometimes unexpected results. It consists of **four chapters**, including three first author ones on the arboreal ants of New Guinea (Chapter I – III: two manuscripts and Chapter II published in *Proceedings of the Royal Society B*). **Chapter I** compares species diversity and community structure across three elevational sites at the 0.2 ha plot-scale. It shows a surprisingly strong mid-elevation peak in ant diversity, and discusses the complex mechanisms likely to be at play. In particular, differences in the utilisation of nest sizes and microhabitats by the ants combined with a decline in numbers of the huge nests of dominant ant species explain the peak. **Chapter II** continues in the topic of elevational changes, but this time explores understorey myrmecophytes and their interaction with ant partners. This work also looks at the mutual benefits of plants and ants using behavioural tests, as well as complete-networks with statistical modelling. It demonstrates a decline in benefits of ants to plant towards higher altitude.

Chapter III builds upon published data from the lowlands by comparing primary and secondary forest communities, but this time for the first time disentangling by Nichola functional and phylogenetic diversity of the ants. This chapter shows, somewhat surprisingly, that while species diversity is doubled in pristine forest, the differences in functional and phylogenetic diversity are rather small, but still interesting: e.g., ant species tend to have a larger body-size in pristine forest and foragers contribute more to functional diversity in secondary forest. Finally, the thesis is concluded with **Chapter IV**, that Nichola has led together with her student colleagues and published in *PLOS One*, within the University courses ‘Functional Ecology and Creative Publishing’. This work was conducted in collaboration with our colleague from Department of Botany, Dr. Francesco de Bello. This chapter, although not limited to only ant data, has a clear methodological link to the functional indices problematic used in previous chapter.

In summary, this thesis brings together many interesting and novel findings. It represents an important step forward in our understanding of not only the observed patterns but ecological drivers of biodiversity in arboreal tropical ant assemblages. I believe that the two remaining manuscripts contained in the thesis both have potential also for strong publications interesting to general ecologists. In my opinion, Nichola Plowman has demonstrated in this work the ability to conceive an independent research, and she is thus clearly a suitable candidate to defend this thesis, and be awarded her Ph.D.



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