

Supervisor assessment of Ph.D. thesis by Jimmy Moses

'Ecology of ants along elevational rainforest gradients in the tropics'

Jimmy Moses is my third phd student, who continues in the line of ecological research of the insect community ecology using ants as a model taxon to disentangle the role of many ecological drivers of the structure of the exceptionally diverse tropical communities. He is the first student, however, who has explored the ecology of ground-dwelling ant communities for that region since the pioneer studies of E. O. Wilson. This might be surprising, as the studies conducted at the ground level are many times more common across world, while studies of the canopy ants are rather rare. Yet, the situation for New Guinea is the opposite, and after previous many publications on the canopy ant ecology, Jimmy could delve finally to the fauna living and foraging among the leaf-litter and on the ground. I must say this has been a labour-intensive journey, with the sorting of many samples by Jimmy under my supervision, finding many novel species for our collections.

Jimmy is from Rabaul in New Britain by origin, where his childhood' house was burnt to ashes by a volcanic eruption. This did not stop him to help build another town nearby, and later move to even more risky environment of science. Jimmy joined my team in Ceske Budejovice after working on the ant fauna of Mt. Wilhelm previously with colleagues (Vojtech Novotny and Tom Fayle) for his Masters at the University of Papua New Guinea. While part of his phd thesis follows up on his Masters' sampling, all analyses and interpretations are novel and conducted from a different angle. Furthermore, the thesis contains data from extensive field work by Jimmy for his phd, where he led the ant sampling campaign in Southern PNG along a gas pipe line' corridor. I was glad to see Jimmy' succession from a naive student who struggled with getting the sample IDs and data structure in the excel sheets right, to an experienced researcher who is able to sort his ants to the species, as well as to run complex statistical models on the finely structured data. Although he struggled sometimes with reading and interpreting the literature, the statistics and programming is the main skill Jimmy is advanced, and I think he likes this discipline the most. Everyone can check this by looking at the associated dataset in Dryad of the first published paper: one can run "the miracle R-code" in a single file to reproduce all analyses and Figures again!

The main connection line through the chapters is ant diversity and ecology explored along extensive elevational gradients, in particular in Papua New Guinea, but also in part in other two regions (Neotropics and Africa). However, the topics presented in the thesis are broad, as they are not only about the effects of elevation itself on the communities. Rather, the thesis looked also at the other environmental factors as climate (temperature and seasonality), leaf-litter, vegetation changes; and how such attributes interact with elevation and shape the community structure. Moreover, every chapter is quite different in its questions and methods and explores novel ideas and scope of the research.

In chapter I, Jimmy conducted ant sampling along the Mt. Wilhelm gradient, looking at changes of abundance and species richness with elevation in leaf-litter species. This has been done many times. What is, however, the main novelty is a simple measure by a ruler in the field also the leaf-litter depth, and showing how this variable can interact with elevation. We were surprised to find out that such a simple idea has been not tested yet not only on ants, but on any other litter inhabitants, to our knowledge. The work has important implication for varying elevational patterns of species richness among different mountains that might be (entirely or partly) explained by the interaction of climate with leaf-litter depth.

In Chapter II, Jimmy explored two data series from the Exxon pipe line' project from 2017 and 2019. This is a massive project, where researchers were allowed to participate in the monitoring of vegetation inside and nearby the pipe line corridor. Plants and insects were monitored across a 300-km gradient, where a strip of pristine forest has been removed. This allowed Jimmy to take advantage of this unique situation of collaborating with a private company to explore simultaneously the effects

of elevation and forest succession after a complete vegetation clearance. The findings on the ants themselves are very interesting, as they suggest significant shifts in the ant abundance and species richness after just two years. Moreover, invasive ant species did not seem take over the communities, as rather native species were abundant along the corridor.

Finally, **in Chapter III**, Jimmy compared his dataset from Mt. Wilhelm with similar experiments that were conducted at Mt. Kilimanjaro and the Andes, using a set of the six nutrients offered as liquids to the ants. This is the first such multi-continental study on the invertebrate nutrient preferences in the tropics. Interestingly, while the ant communities showed rather similar changes in their species richness and trophic guild composition along the three extensive gradients, this did not result to the same nutrient use patterns, as would be expected by theory. Rather, seasonal differences and varying food availability played a role.

I would like to stress that Jimmy is the first author on all of these interesting chapters, he led all analyses, and led also the writing of two of the chapters. The first chapter was published in a good ecological journal, *Biotropica*. Hence, it is clear in my opinion that Jimmy has demonstrated in the thesis his ability to conceive and carry out independent research. Therefore, I am happy to recommend Jimmy Moses to defend his thesis, and be awarded his Ph.D.



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