

Olivier Blight
Assistant professor
Université d'Avignon
UMR CNRS-IRD 7263 IMBE
olivier.blight@univ-avignon.fr

Avignon, October 30th, 2023

Evaluation report on the Thesis of Marie Konečná entitled “Ants as seed dispersers and ecosystem engineers in temperate region”.

Thesis content

The structure of the document is clear. This 162-page thesis, written English, is structured in six parts, with a general introduction (16), four chapters in the form of article manuscripts and a general discussion.

The work of the thesis is currently being published as first author in Biodiversity and Conservation (Chapter 4). Chapter 1 is published as co-author in Preslia.

General comments

The thesis focuses on the roles of ants in structuring vegetation in temperate region. Particularly, it focuses on two focal roles of ants in their ecosystem, i.e. seed dispersal and their activity as ecosystem engineers. Different approaches involving experimental and observational approaches have been adopted to investigate the roles of ants.

I enjoyed reading this thesis, it is clear and well written. The scientific contributions of the thesis to the evaluation of the ecological roles of ants are significant. It's a timely topic, as evidenced by the growing literature, with key applications in the field of ecological restoration.

In terms of content, while the presentation of each of the four studies includes, as it should, an appropriate state of the art and a complete discussion, the general parts of the thesis, especially the discussion, do not entirely fulfil their function. This is probably (and classically) due to the urgency of writing at the end of the thesis. In my opinion, a thesis discussion should be an all-encompassing analysis of all the results obtained. The defense should provide an opportunity to demonstrate progress in this direction.

In conclusion, the manuscript presented by Ms M. Konečná contains many very interesting results. As reviewer, it is my job to dissect a piece of work in depth and highlight its benefits for science, while at the same time mentioning some limitations (will be discussed during the defense) inherent in any study.

I congratulate Ms M. Konečná for the important work carried out.

Detailed comments

Introduction

The introduction clearly sets out the general context of the thesis work.

I regret, however, that the structure of the introduction gives the impression of a succession of sections without always having a link (e.g. between “The reward for ants in myrmecochory” is followed by the “ecosystem engineers” section). In addition, the third section presents ant-animal interaction in the temperate region, while the rest of the introduction presents examples from different biogeographical regions. I would have expected some generalities on ant-plant interactions and then a focus on what we know on seed dispersal and engineering activities in temperate region. This would have facilitated the transition to the objectives of the thesis.

I would have appreciated more information on the ants present in temperate grasslands (diversity, ecology and diet), which could have been partly resolved by a section devoted to ant-plant interactions in temperate regions. Finally, I would have appreciated a presentation of the research hypotheses tested on the basis of the objectives (specifically for Chapter 2, 3 and 4).

Chapter 1

Chapter 1 is part of an overall work on the Czech flora, with a specific assessment of myrmecochory as a feature. This work must have been difficult but relevant because it provides a basis for future studies of myrmecochory in the Czech Republic, but not only.

Chapter 2

In Chapter 2, Ms M. Konečná studied the ecology and habitat preferences of myrmecochores in the Czech Republic. She found that myrmecochores concentrate in thermophilic habitats (oak forests) and dry grasslands. This discovery provides information that should help us to understand the evolution of myrmecochory in temperate regions. It requires now an in-depth study of the partner, i.e. the ants (ecology, distribution, with both specific and functional approaches). Some of this data could have been provided here to support the statement about the correlation between ants and myrmecochore distributions. Overall, this is an interesting study that should be submitted in the next few weeks, with the correction of a few typos in the text and graphics.

Chapter 3

Chapter 3 presents an experimental study of seed dispersal by ants. Ms M. Konečná conducted a manipulative experiment in which she offered seeds to ants in a cafeteria experiment. In combination with a sticky trap method, it allowed them to quantify the contribution of ants to seed dispersal relative to autochory in a grassland. Mrs M. Konečná set up enclosures to suppress ant activity, which enabled a comparison of seed dispersal with and without ants. Such a comparison is relevant and rarely carried out. However, I wonder about the size (3x3m), which is relatively small given the distance over which ants can transport seeds. Moreover, I see a problem with enclosures. They also prevent predators and other seed dispersers from getting in or out. I think this should be discussed as it may have an impact on the rate of seed removal in the absence of ants. If available information on observations of non-ant predators or dispersers could be added.

Ant exclusion is difficult work, rarely done although it is useful for experimentally testing the effects of ants on their environment (e.g. Parr et al. 2016). So, even though it has certain limitations, I'm enjoying the experience.

Chapter 4

To demonstrate the engineering role of ants, Ms M. Konečná has described the species composition of vegetation, measured traits, and quantified seedling establishment at anthills in comparison to the surrounding vegetation. Mrs M. Konečná adopted interesting approaches, such as: night-time monitoring (I would have been interested in comparisons between seed removal events during daytime and night-time sessions); the anthills were monitored at two locations (centre and margins), which provides interesting results as the margins may be more favourable to plants than the anthill centre; she investigated functional differences in plant communities between anthills and control plots; and she monitored two ant guilds (dispersers and non-dispersers). Although interesting, I have some doubts about this last point because the group of non-dispersers was made up of a single species that represented 83% of the total anthills monitored, whereas the group of dispersers was made up of 7 species, which probably induces higher variability due to ecological differences between species.

A multivariate analysis (partial RDA) of plant composition with soil parameters as explanatory variable could have been interesting in explaining the composition of plants in the anthills compared with the controls.

The results agree with many previous studies, suggesting that ants create heterogeneity in their habitats, acting as sources or refuges for many organisms. However, ants are not the only soil engineers and potential synergic effects may be expressed at anthills. Differences in soil fauna between the anthills and the surrounding control have been recorded in other ecosystems, including earthworms. It would have been interesting to see this discussed here or in the general discussion.

General discussion

The discussion section summarises the four chapters separately. Ms M. Konečná suggests avenues for future research. This is important, but I would have appreciated an overall analysis of all the results obtained with perhaps one or two future research questions developed. For example, the impact of ants on soil fauna and bacteria, which play a key role in soil functioning with a bottom-up effect on plants, is not addressed.

Specific questions:

- 1) In Ms. M. Konečná's study system, several species have been recognized as seed-dispersing ants but they are not dominant in the community. Even grouped together, they represent about 10% of the total colonies identified. Do you have an explanation for this diet differences between dominant and sub-dominant/subordinate ant species?
- 2) A related question: From your data, could you provide an analysis of seed dispersal efficiency (removal events) per unit time as a function of the number of ant species involved? I would be interested to see if seed removal events increase with the number of species involved in seed dispersal.
- 3) It is well known that biotic processes such as competition or facilitation and abiotic conditions can filter species and explain local assemblage. In view of your results, do you consider that ants act as a filter on plant species in temperate grasslands on a local scale? If so, can this be applied on a regional scale as suggested in Chapter 1?
- 4) The ecosystem engineer concept has been the subject of debate, with some colleagues arguing that all organisms engineer their environments to some degree. I would like to know Ms M. Konečná's opinion on that debate and the contribution

of her work to this concept. In the light of her results, would Ms M. Konečná consider all ants to be ecosystem engineers?

Dr. Olivier Blight

A handwritten signature in blue ink, appearing to be 'O. Blight', with a long horizontal stroke extending to the right.