



29th January 2022, in Prague

Evaluation of Anna E-Vojtkó's doctoral dissertation

The thesis of Anna E-Vojtkó has challenged a difficult aim – in the four first-authored chapters, supplemented by concise but a interesting introduction and a general discussion, it is looking for the connection between vegetation ecology and pollination ecology. Although plants are in the centre of both these fields, their research concepts and approaches strongly differ, and the involved researchers rarely communicate among these disciplines. For me, an animal ecologist and pollination biologist, it has always been surprising that vegetation egologists mostly ignore effects of the higher trophic levels, especially herbivores and pollinators, on interspecific interactions within plant communities. Therefore, I am not even trying to hide my enthusiasm for the thesis topic.

The **Chapter I**, already published in *Journal of Vegetation Science*, is a comprehensive literature synthesis focused on the mentioned connection of the two disciplines. It works as the introduction into the thesis and its topics, whilst keeping the methodology of systematic reviews. I wish every Ph.D. student approached her/his thesis review with an ambition to publish it. Nevertheless, however I enjoyed reading the review, I found some its parts being “too vegetation ecological”, sometimes even a bit naïve. I strongly appreciate the call for the whole-community approach in pollination ecology, although it is often very difficult because of the ‘additional’ trophic level. On the other hand, considering the effect of plant-animal interactions (and the related distribution of floral and other traits in communities) on competition between plant species and composition of plant communities has still been rather neglected by the authors, and the synthesis did not meet all its potential in this. Especially because of the journal’s audience, I would also appreciate much clearer definition of the ‘floral traits’, as well as a better discussion on the potential effects of individual traits on competition among plant species within a community. However, I consider this chapter as a highly original work showing the student’s (and her co-authors’) knowledge and ideas in the field, and I enjoyed its reading. I wish it will become an influential synthesis for the field.

The **Chapter II**, an unpublished manuscript, analysed relationships between the ‘traditional functional traits’ and floral/pollination traits in the two plant communities. Unsurprisingly, the authors found a weak relationship between the two trait groups. I personally like the conclusion from Abstract that the floral traits are responsible for so far neglected variation in plant communities. However, Discussion offered a different explanation: “the lower evolvability of floral traits versus vegetative traits”. Such presumption has opposed the huge literature, including Darwin’s work, on the evolutionary plasticity of numerous floral traits, and therefore would have deserved much stronger clarification (or re-consideration based on a thorough literature review). In this rather explorative study, I strongly miss two related issues: Firstly, at least some hypotheses on the relationship between the trait groups, or at least between some individual traits. Secondly, any information on how and why the individual analysed traits were selected for this study, because some commonly studied traits were obviously neglected. The manuscript is claimed as ‘submitted’, and I am curious how it will be modified during the review process. Altogether, although I would prefer much better justification of the study approach supported by the well-defined hypotheses,



the study ideas are novel, the data and applied analyses seems robust, and I do not doubt it will be published in some high-profile journal.

In **Chapters III and IV**, a manuscript and a publication in *Folia Geobotanica*, respectively, I am already finding myself slightly 'out of my comfort zone', because they represent examples of 'typical vegetation ecology', at least in my strongly biased point of view. The former compares phylogenetic diversity and functional diversity in the large dataset from the Czech National Phytosociological Database. The latter focuses on the distribution of selected functional traits in plant communities along environmental gradients. As much as I am able to evaluate, both studies are based on strong datasets and are performed properly. For me, they both could have been presented in a broader ecological context, but I am obviously not the typical audience of the focal journals.

In general, the thesis presents a concise scientific work framed in the modern community ecology, with a diverse applied approaches and methods. I strongly appreciate that it is combining the two sub-disciplines of community ecology which surprisingly rarely communicate with each other. All four chapters are first-authored, and the approved student's contribution clearly evidences her key role in all parts of the related research work. Although not being most important part of the research work, I was surprised by the formal quality of the thesis, virtually no typos, high quality of language, together with the attractive and highly informative figures, especially in Introduction. Moreover, according to the attached CV, the student has been active in research way beyond her thesis. By co-authoring of 16 additional papers published in respected journals, she has surely approved to be already an experienced ecologist, and I do not doubt she will deserve the PhD title.

Altogether, it is my pleasure to recommend the evaluated doctoral thesis for the defence, I look forward the student's presentation.

For these three questions, I would like to hear the student's broader opinions, rather than some simple answers or rebuttals:

Question 1, pollination syndromes: In the thesis focused on various floral and plant reproduction traits, I was very surprised to find almost no mention on the concept of pollination syndromes. Especially in Chapter II which focused the relationships among traits, including the discussed bias of the evolutionary relationships among the floral traits. I am well aware about numerous limitations of the pollination syndrome concept, however it has been the leading concept in the research of floral traits for decades. Was the pollination syndrome concept generally ignored in the thesis by some accident, or on purpose? Can the student briefly introduce the pollination syndrome concept and compare it with similar concepts using the 'traditional' functional traits? Can we expect any evolutionary or ecological relationships among these concepts? Can phylogenetic corrections applied in the analyses avoid the bias of this relationship among some analysed floral traits?

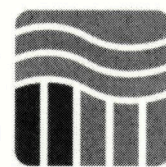
Question 2, problems with some floral traits: Unlike the 'traditional' functional traits, floral traits are not commonly used in similar studies, and they thus lack a conceptual methodology. The student obviously faced these issues because some traits were treated differently in individual chapters. For instance, floral



colour was described as 'a fuzzy variable, converted to RGB colours' in Chapter II, whilst as 'a categorical variable, with 10 colours' in Chapter III. Did the student try to run the analyses with variously coded traits? What was the decision on which system of floral colour was used in which chapter? Are there some other ways how to treat floral colours, as an important example, in similar analyses and why these were not selected?

Question 3, trait databases: As much as I understand, most (if not all) analysed floral traits were taken from databases and other published resources. How much are such trait values generally reliable? For instance, I am very sceptical in similar data on pollinators of individual plant species. In the current pollination biology, it has become apparent that the spectrum of individual plant species' pollinators differs with space and time, sometimes affecting local floral phenotypes and sometimes not (*see the influential concept of 'geographic mosaic of coevolution' by John Thompson*). Additionally, most common floral visitors are often not the key pollinators, whilst the key pollinators can differ among plant populations, or even in different seasons; such important details are rarely considered in databases. Moreover, most plant species are pollinated by a few species of animals, sometimes even from different functional groups. All presented chapters focused on the composition of local communities, can the results be affected by the non-local values for the analysed traits? Is the mentioned data mining from general databases the reasonable way to study local communities?





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Review of the PhD Thesis of Anna E-Vojtkó "Reproductive form and function in trait-based plant ecology: from species to communities"

I really enjoyed reading the doctoral thesis of Anna E-Vojtkó. The thesis is made up from a brief introduction, four chapters and a brief summary. Of the four main chapters, at the time of submission, two have been published, one is submitted and the other is yet to be submitted. The topic of the thesis is original and clearly demonstrates an advance in the field of plant ecology.

Introduction. This was an impressive synthesis of the state of the art and was so structured that it was very easy for the reader to understand the purpose of the thesis and what to expect from the succeeding chapters. I

Chapter 1. Some of the writing is overly definite, e.g. "Therefore, plant species need to separate their pollination niches in order to coexist in a community" might be better written as emphasising enhanced competition for resources if they are too similar and thus there is local selection against too similar species coexisting.

However, the overall structure and aim of the chapter are sound and it is very useful that it ends in a "to do" list for ecologists. This is very generous in setting out the direction the research field has to take over the next few years.

Chapter 2. This is a clearly written chapter. I am especially impressed with the clarity that the methods section has been written in making sure that the complex analysis undertaken can be followed. However, at the start of the results there is a mix up between the text and the two parts of Figure 1. Also, I'm confused about the colours in Figure 1. The very small scale of the text in legend for the correlation plots also made it hard to understand what is going on – not immediately obvious that very dark and very pale both mean highly correlated and medium grey not correlated.

The finding is really interesting – that floral traits are a major axis of plant form and function that has largely been overlooked or just seen as not distinct from the vegetative traits. I would not have expected this strength and it to be a stronger axis than the leaf economics spectrum.

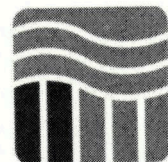
Chapter 3. As for Chapter 2, this is a very complex analysis and once again Anna leads the reader through the methods in a clear and concise manner. The main issue I have with the paper is that there are many really interesting results crammed into a relatively short chapter. I'm not sure what the alternative would be, but I think there is probably enough in the supplementary material to make

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another paper, especially the relationships between PD-FD correlation and habitat (as described by Ellenberg values)!

The main take home messages were that PD and FD are only weakly correlated, and PD can't really be used as a substitute for FD. However, it was really interesting that this did not hold for all traits groups and for forests. It was also interesting that wetlands come out as places where PD-FD correlations are high.

One thing I would like to have seen acknowledged is that the study is set in a region whose flora has recently arrived after the last glacial maximum. I do wonder if a similar set of results would emerge from Mediterranean or tropical regions. Finally, I was expecting to see other studies that had related FD to other environmental gradients such as disturbance at least mentioned and the incomplete coverage of Ellenberg values as descriptors of habitats acknowledged.

Chapter 4. This is an interesting chapter that clearly shows that vegetative reproductive traits need to be taken into account in trait studies, especially as there are clear relationships between their functional diversity and the environment. However, the Leaf-Height-Seed approach has selected key traits to summarise strategies, it is not clear if that could be done with reproductive traits.

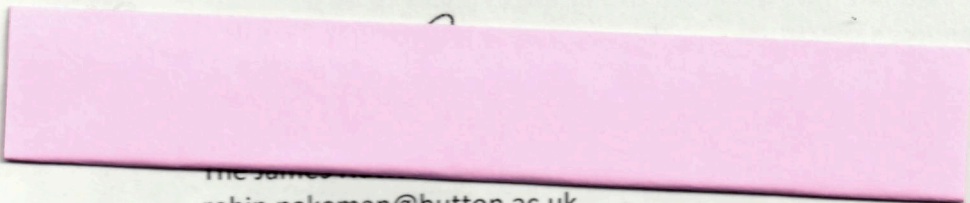
I was expecting to see some other papers here which have looked at the relationship between FD and the environment where they have included vegetative reproduction traits as part of a wider study. I wonder if more could have been made of papers that predate CloPla.

General discussion. This is a good summary of the thesis and also makes it clear where the strengths and weaknesses of the approach taken lie.

This thesis is a coherent and well put together body of work.

Yours faithfully

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