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המכון לחקר סביבות צחיחות
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Evaluation of a Ph.D. thesis by Martin Weiser titled "Plant body as a behavioural platform – an ecologist's insight"

The thesis dwells on the determinants of the limitations of phenotypic plasticity in plants. While the interest in and the ongoing study of phenotypic plasticity are continuously increasing, the current thesis is bravely touching on a few rather neglected aspects of the boundaries of this phenomenon. Specifically, the current work and especially future work that will hinged on the current work may help to shed new light on some rather elusive implications of phenotypic plasticity on scaled-up ecological processes at the population and the community levels. The thesis clearly demonstrates the ability of the candidate to tackle deep theoretic aspects related to both the evolutionary background and rationale, and the ecological implications of the studied phenomena and to do it using both modeling and experimental approaches. The thesis's most novel aspects and thus its strengths lie in its utilization of large bodies of multi-species data and in the simple yet extremely large (almost heroic) comparative experiments that studies a few rather elusive determinants of the functional boundaries and interactive determinants of phenotypic plasticity.

The thesis is comprised of a general introduction and four stand-alone papers/chapters. The last chapter has been already published in a leading international journal (Proceedings of the Royal Society B: Biological Sciences (Impact Factor: 5.29) and the other chapters are presumed to be in preparation for publication as well, which amounts to a volume more than appropriate for a PhD thesis. In his work, the candidate has demonstrated an ability to fruitfully interact with fellow scholars and advisee students, as nicely reflected by the collaborative work done on the thesis chapters, the work on all of which has been initiated and coordinated by the candidate. In so doing, the candidate has demonstrated both high scientific merits and intellectual maturity that should award him with a PhD degree.

The following are a few topics that can be further elaborated on and discussed during the defense. Naturally, the list is partial and not necessarily itemized by importance.

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1. What is the (deeper) difference between behavior and phenotypic plasticity? Is it constructive to treat any 'active response' to environmental stimulus as 'behavior'? Aren't we throwing a few babies with the bathwater?

2. The central theme of the thesis is the limits of phenotypic plasticity but what about the costs of phenotypic plasticity, its tracing down, quantification and implications. Can/should we discuss limits and boundaries without discussing costs?

3. Can we really categorize whole species as being more or less plastic? At what scales (and grains) is this discussion legitimate and meaningful?

4. Page 16, lines 3-4: are there really traits and phenomena that are conspicuous to us, the observers, but not to natural selection?

5. The possible implications of the thesis's findings for future improvement of our understanding of plant communities are clear but can we really draw anything conclusive from the thesis's findings on that (important) front (e.g. p. 33, line 1-4 and elsewhere)? What would be needed to further the studying of that important topic?

First chapter - light experiment:

6. What is the ecological meaning of the applied homogeneous shade (tents)? To what extent are such artificial systems representative of natural shading in the field and what could have been missed using such a design?

7. I guess that here I am missing something important but it is not exactly clear how the (rather sophisticated) analyses teased apart the effects of R/FR cuing from those of light levels, especially given that the shade treatments consistently affected both R/FR and transmitted light levels under all regimes, i.e. decreased R/FR was always accompanied by a similar decrease in R/FR. Practical ways to tease those apart could include the use of narrow-range LEDs, specialized selective filters.

Second chapter - root foraging:

8. To what extent growing wild plants in sandy medium without microorganismal inoculi is representative of field conditions?

9. Why shoot parameters, at least shoot size/mass, were not included? While absolute and relative (allocation) placement of roots in soil patches is

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interesting, the ability, propensity, limits and costs of growing and allocating limited resources to shoot vs root structures could be important for the studying of the presented questions and hypotheses.

10. It is not clear if (or why not?) overall plant size was included in the analyses, e.g. as a covar. In the least, its inclusion is not clear.

11. It is known that morphological plasticity of root placement (length, biomass etc.) reflects merely ca. 15% of plant foraging responses to special heterogeneity (see Caldwell 1991 etc.), i.e. physiological plasticities of sorts may account for the "rest" 85% … should that observation change anything / the experimental approach or the studied variables?

12. Fig 3: was the overall decreasing trend tested? Here and elsewhere, legends are often rather skimpy and thus not sufficiently clear.

Third chapter – seed size vs. nutrient avialbilty:

13. Justification (not merely explanations of technical limitation) for the rather short span of the experiment can help. [e.g. comparing the responses of young vs. old plants is of great interest…]

14. Bottom of page 59: how can an increased sensitivity in small-seeded plants be interpreted as an adaptive trait/syndrome, that is in contrast to a mere consequence of 'passive' response to rapid seed depletion? [perhaps a more viable design would include plants with variable initial seed tissues, obviously controlled for wounding effects; see e.g. Novoplansky et al. 1989].

15. How were, if at all, shoot/total plant size/biomasses taken into account – see comment 10 above.

16. Analyses could use more detailing and justifications.

17. The results call for more work where seeds of variable sizes (due to damage, stress, pathogens, though limited- maternal nutrition etc.) from the same taxa will be compared…

18. Page 64, line 9 from bottom: some of the plants are climbers, which would call for additional hypothetical considerations as to their propensity to produce larger seeds and plastically respond more vigorously to light limitation etc.

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Fourth chapter - model:

19. It is not exactly clear how the hypotheses are sitting with the common notion and observations that clonal plants (as well as fungi etc.) often aggregate in rich patches and send long runners when in poor patches.
20. Page 74, near bottom: 'Competition cost' would only apply, in its simple form, if and when no S/NS discrimination exists.
21. It seems as if the model is based on an equal cost of length unit, regardless of position on the plant. Taking into account hierarchical construction and differential costs due to infrastructural support/services, such an assumption should be questioned (see e.g. Novoplansky and Cohen 1997). Would it change the main results and how?
22. How would the (more realistic) inclusion of foraging missed-opportunity costs change the results? [missed allocation to long searching runners that would, given some probabilities, find rich patches].
23. The results call for studying the role of 'neutral occupation' of space as **'garrison force'** against invasion of competitors…. Any work done on that in the clonal gang?

The thesis would gain substantially from the addition of an integrative discussion, where a bird's-eye handling of the main concepts, general theory, implications and called-for future work would be discussed. *Seemingly* redundant but written well, such a discussion would allow the author to construct a (mini-)review of the general topic in light of the broader context of the studied phenomena.

With the best wishes,

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