

Microbial symbionts buffer hosts from the demographic costs of environmental stochasticity

Author List:

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General Comments

Dear Dr. Han,

Thank you for the opportunity to further revise our manuscript. We have made the following changes in response to the feedback we received:

1. Clarified connections between our results and our conceptual figure
2. Adjusted the color scheme within our figures to reference Symbiotic and Non-Symbiotic consistently
3. Double-checked references to figures and citations throughout the manuscript and added a table of contents to the Supporting Information.

All of these changes can also be found in the “track changes” version of our re-submitted manuscript and supplemental material.

On behalf of myself and my coauthors,

Joshua Fowler

RESPONSE TO THE EDITOR:

COMMENT 1

“The two contacted reviewers highly appreciate your thorough revision of your interesting contribution. One of these reviewers has three more useful suggestions based on your new and updated figures, and I would like to give you the opportunity to further revise your manuscript accordingly.

While I had hoped that the reviewer who commented on standardizing lambda-s across variance treatments early on would have explained their comment more in this new round of revisions, no such explanations were received. I’m assuming that your revised manuscript has made the earlier suggestion obsolete.”

Response:

We thank the editor for facilitating a constructive and positive experience throughout the revision process, which we feel has improved the manuscript.

RESPONSE TO REVIEWER 1

COMMENT 1

“I thank the reviewers for the clarifications, new analyses and added discussion points. I only have some small remaining comments on the revised manuscript.”

Response:

We thank reviewer one for their attention to our revised manuscript.

COMMENT 2

“Comment 4: I really like the new Fig. 1. Can the authors come back to this figure in the discussion section a bit more, explicitly discuss which of these different hypotheses are supported by the data of this study?”

Response:

We have added additional discussion to highlight connections to our conceptual figure (line 440).

Line 440 <Our taxonomically-replicated, long-term field experiments that manipulated the presence/absence of fungal symbionts in plants revealed that heritable microbes can commonly benefit hosts not only through improved mean fitness -- the focus of most previous research -- but also through buffering against environmental variance (Fig. 1). Benefits to mean fitness dominated the overall fitness advantage of endophyte symbiosis under observed environmental variability. However, the strongest symbiotic benefits derived from the combination of both mean effects and variance buffering (Fig. 1B), and simulation experiments point to an increasing role for demographic buffering under increased temporal environmental stochasticity (Fig. S81-S82).>

COMMENT 3

“ Comment 7: I also appreciate the updated figure 2 (previously figure 1). I do find it a bit confusing that blue and red are used in panels D-E, similar to the color scheme used in panel A, although the colors indicate something completely different in these panels. Would it help to use the same colors as in Fig. 1 to indicate S- and S+ hosts in panels D-E?”

Response:

Thank you for this suggestion. We have updated the color scheme in Fig. 2 to make the colors representing S- to S+ contrast consistent across the figures.

COMMENT 4

“ Comment 9: Thank you for doing this analysis. Please verify that all references to the figure that show these results are correct throughout the main text and SI (Fig. S53? S82? S72?) Related, the SI needs a table of contents at the start of the SI (ideally with links to relevant sections), and perhaps a list of all figures.”

Response:

Thank you for pointing out these errors. We have corrected these figure references (e.g Line 436 now refers to the correct figure Fig. S81, rather than Fig. S71) and have verified others throughout the manuscript. We have also added a table of contents to the SI.

RESPONSE TO REVIEWER 2

COMMENT 1

“I thoroughly enjoyed the new version of this manuscript. As the manuscript currently stands, the paper describes a cutting edge research question - i.e., what is the role of microbial symbionts on demographic variance/buffering in stochastic environments? The methods are clearly laid out and the data represent a gold mine of hard-fought data - used in this analysis and I am sure many more in the future. I am also especially impressed with how the authors have integrated the numerous comments from all reviewers - this is no small feat. All in all, I look forward to citing this paper and the many more that will come from this dataset in the future.”

Response:

We thank Reviewer 2 for their constructive feedback during the review process and for prompting us to expand our discussion in several interesting directions. We hope that our research can be a lasting contribution to understanding of symbiosis in variable environments.