Peer Community In
Evolutionary Biology

The evolution of a hobo snail

Ben Phillips *based on peer reviews by* ***David Reznick*** *and 2 anonymous reviewers*

Elodie Chapuis, Philippe Jarne, Patrice David (2024) Rapid life-history evolution reinforces competitive asymmetry between invasive and resident species. biorxiv, ver. 2, peer-reviewed and recommended by Peer Community in Evolutionary Biology.
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At the very end of a paper entitled "Copepodology for the ornithologist" Hutchinson (1951) pointed out the possibility of 'fugitive species'. A fugitive species, said Hutchinson, is one that we would typically think of as competitively inferior. Wherever it happens to live it will eventually be overwhelmed by competition from another species. We would expect it to rapidly go extinct but for one reason: it happens to be a much better coloniser than the other species. Now all we need to explain its persistence is a dose of space and a little disturbance: a world in which there are occasional disturbances that cause local extinction of the dominant species. Now, argued Hutchinson, we have a recipe for persistence, albeit of a harried kind. As Hutchinson put it, fugitive species "are forever on the move, always becoming extinct in one locality as they succumb to competition, and always surviving as they reestablish themselves in some other locality."

It is a fascinating idea, not just because it points to an interesting strategy, but also because it enriches our idea of competition: competition for space can be just as important as competition for time.

Hutchinson's idea was independently discovered with the advent of metapopulation theory (Levins 1971; Slatkin 1974) and since then, of course, ecologists have gone looking, and they have unearthed many examples of species that could be said to have a fugitive lifestyle. These fugitive species are out there, but we don't often get to see them evolve.

In their recent paper, Chapuis et al. (2024) make a convincing case that they have seen the evolution of a fugitive species. They catalog the arrival of an invasive freshwater snail on Guadeloupe in the Lesser Antilles, and they wonder what impact this snail's arrival might have on a native freshwater snail. This is a snail invasion, so it has been proceeding at a majestic pace, allowing the researchers to compare populations of the native snail that are completely naive to the invader with those that have been exposed to the invader for either a relatively short period (<20 generations) or longer periods (>20 generations). They undertook an extensive set of competition assays on these snails to find out which species were competitively superior and how the native species' competitive ability has evolved over time.

Against naive populations of the native, the invasive snail turns out to be unequivocally the stronger competitor. (This makes sense; it probably wouldn't have been able to invade if it wasn't.) So what about populations of the native snail that have been exposed for longer, that have had time to adapt? Surprisingly these populations appear to have evolved to become even weaker competitors than they already were.

So why is it that the native species has not simply been driven extinct? Drawing on their previous work on this system, the authors can explain this situation. The native species appears to be the better coloniser of new habitats. Thus, it appears that the arrival of the invasive species has pushed the native species into a different place along the competition-colonisation axis. It has sacrificed competitive ability in favour of becoming a better coloniser; it has become a fugitive species in its own backyard.

This is a really nice empirical study. It is a large lab study, but one that makes careful sampling around a dynamic field situation. Thus, it is a lab study that informs an earlier body of fieldwork and so reveals a fascinating story about what is happening in the field. We are left not only with a particularly compelling example of character displacement towards a colonising phenotype but also with something a little less scientific: the image of a hobo snail, forever on the run, surviving in the spaces in between.

References:

Chapuis E, Jarne P, David P (2024) Rapid life-history evolution reinforces competitive asymmetry between invasive and resident species. bioRxiv, 2023.10.25.563987, ver. 2 peer-reviewed and recommended by Peer Community in Evolutionary Biology. https://doi.org/10.1101/2023.10.25.563987

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Slatkin, Montgomery. (1974) Competition and Regional Coexistence. Ecology 55, no. 1: 128–34. https://doi.org/10.2307/1934625.

Reviews

Evaluation round #1

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Version of the preprint: 1

Authors' reply, 20 February 2024

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Decision by Ben Phillips, posted 31 December 2023, validated 02 January 2024

Minor revisions necessary

Congratulations on an interesting piece of science. We now have three independent reviews, and they are unanimously positive about the work. Each reviewer has also included some useful thoughts about ways the

manuscript might be improved. Some thoughtful responses to the reviewer's suggestions will improve the manuscript.

I see that you have alreday mentioned Chesson's framework. It might be worth touching back to that again in the Discussion. I also agree that it might be worth thinking about the role of dispersal, at least in the discussion. Hutchinson's 'fugitive species' concept is probably also worth a look in the context of your results. I also struggled a little with the figures. They are great in that they show a large amount of the structure of your data, but they are a lot to process. I wonder if it might be useful to remove the population labels and group the population points (jittered) for each treatment. Worth playing with, anyway.

I look forward to reading the revised version.

Reviewed by David Reznick, 18 December 2023

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Reviewed by anonymous reviewer 1, 30 November 2023

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Reviewed by anonymous reviewer 2, 22 December 2023

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