The Newest Synthesis: Understanding the Interplay of Evolutionary and Ecological Dynamics

This paper is a review of the research in eco-evolutionary dynamics. A new subfield that blends ecology and evolutionary biology, this discipline looks into the feedbacks between environmental changes and adaptations in populations on short timescales. The paper is based on the results and methods of preceding publications and stresses that while local conditions can elicit a behavioral or morphological response, that response (or other changes in a population) can impact the surrounding environment. Ecology’s affect on evolution has long been known, and indeed this relationship is how many scientists and laypeople think of evolution—a largely one-way cause and effect of life reaction to the forces at work around them. This also follows many people’s conceptions of evolution as a process that takes millions of years to become apparent. Experimental and field observations, however, indicate that evolution may occur over much shorter timespans and therefore may exert control on organisms’ environments. The methods used in this emerging field rely on field experiments conducted over generations, and use analysis of variance in population growth to (somehow) tease apart the relative contributions of internally-and-exterally-forced changes.

I admit that I largely wasn’t convinced by this review, although I don’t doubt the existence of a coupled ecology-evolution feedback system. I felt that the review did not sum up the evidence well, and did not connect said evidence back to their own stated definition of evolution (as changes in heritable traits). The study relating finch beak sizes to food supply was solid, but the study centered on lizard predation was shaky. While behavioral changes can lead to heritable morphological ones, I saw no such evidence cited. This review seemed speculative, which frustrated me. It also was not very illuminative of the evolution-affects-ecology side of things. The bird and bacteria studies were a classic ecology-on-evolution process, the lizard study was inconclusive and the ungulates study provided no real details. While I agree with the paper’s conclusions, I don’t think the examples cited were the strongest support. I was also disappointed that there was no explanation of experimental or analytical methods included, which I think would be appropriate in a review paper.

I did, however, like the paper’s accessible style, and felt that a non-expert would find it easy to follow. Depsite the lack of concrete evidence discussed above, I found the author’s reasoning to be solid. I especially liked his explanation for how the “slow evolution” paradigm has persisted; the fossil record’s long timespan biases our reading toward a long, gradual progression. This was an excellent point to include, and I wish the author had elaborated more on the paleontological evidence or lack thereof for rapid evolution. This topic also ties into one of my personal interests, the gradualistic view of evolution versus punctuated equilibrium. I would have loved to have seen the two models compared in this paper and related to the theoretical underpinnings of eco-evolutionary dynamics.

The figures were either simplified to the point of irrelevance (the lizard diagram was useless, as the same information was included in the text) or frustratingly abstruse. The graphs for the finch, ungulate and combined copepod/finch traits were mystifying to me even after prolonged examination during a ten-hour van drive. This is probably because methods were ever discusses, so the information conveyed in the graphs had no context; what can we conclude form the box-and-whisker plots in Figure 2? Are the units intended to sum to 1? If there are only two defined controls (phenotypic and environmental) on population growth, why don’t they sum to 1? If the units aren’t proportional, then what the heck do they mean? The caption does not describe the figure beyond the most basic information. Figure 3, however, was a compelling illustration of the fossil record’s unreliability in terms of evolutionary rate. I was glad to see the phenomenon replicated on an accessible timescale, and a quantitative closer look at it.