Comment on “Dispersal Limitations Matter for Microbial Morphospecies”

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Telford et al. (1) argued that if dispersal is ubiquitous among freshwater diatoms, as hypothesized by Finlay and colleagues (2, 3), then all geographic regions should share one underlying richness-environment relationship, governed by the global species pool. If, on the other hand, diatoms experience some dispersal limitation, then they should form regional-scale metacommunities that vary with respect to key properties such as colonization-extinction dynamics. On this premise, Telford et al. predicted that “if dispersal is limited, regional richness relationships will depend upon regional habitat availability.” In apparent support of this prediction, they found that across 16 regional-scale surveys [see table S1 in (1)], the pH at which diatom richness peaked (which they call “richness pH optima”) was significantly correlated with the modal pH of the region [see figure 1C in (1)]. Unfortunately, this correlation is spurious, because the richness pH optima and the modal pH values were necessarily constrained to lie between the variable, region-specific pH extremes. The following sampling exercise illustrates this point.

First, draw \( N \) pairs of values from a uniform distribution \( U(0,1) \), where \( N \) represents the number of regional samples (e.g., 16) and each pair of values represents the region-specific minimum and maximum pH values. Next, obtain a modal pH value for each of the \( N \) regions by drawing a single value from the available range of pH for each region, \( U(pH_{\text{min}},pH_{\text{max}}) \). Then, obtain a richness pH optimum for each region by drawing another single value from the available range of pH for each region, \( U(pH_{\text{richness}},pH_{\text{max}}) \). Finally, calculate the correlation between the resulting \( N \) modal pH values and \( N \) richness pH optima values. I conducted this sampling exercise 100 times (using \( N = 16 \)) and obtained an average Pearson correlation coefficient of 0.76 (SD = 0.146). This suggests that the correlation reported by Telford et al. is inconsequential and therefore cannot be used to test the merits of the ubiquitous dispersal hypothesis.

In contrast, the observation that richness-pH relationships vary in form among regions, even among neighboring regions [see figures 1B and S1 in (1)], is informative. Telford et al. interpret this pattern as evidence against the ubiquitous dispersal hypothesis, but a more accurate interpretation is that it is inconsistent with the hypothesis that all diatom taxa are ubiquitously dispersed. In other words, the hypothesis that some diatom taxa are ubiquitously dispersed remains unchallenged by the results presented by Telford et al. Identifying which taxa are ubiquitously dispersed represents an important task for future research. Preliminary evidence (3–5) suggests that environmental generalists and/or taxa adapted to the most common environments represent strong candidates, because these achieve large abundances over geographically extensive regions.

References

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