LEVELS OF SELECTION: AN ANALYSIS OF THE FORCES DRIVING DIVERSIFICATION IN THE TURRITELLID GASTROPODS

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This analysis examines the evolution of the greater diversity of non-planktonic species relative to planktonic species in the turritellid gastropods. Two mechanisms for generating diversity gradients in larval types have been proposed in the literature. The first, species selection or the effect hypothesis, focused on the population biology of larval types. The second proposed that factors in development were responsible. Turritellids have been cited as a classic example of species selection. In order to test the validity of these mechanisms for the evolution of the turritellids two phylogenetic models are formulated. One is constructed to fit the predicted evolutionary results if species selection or the effect hypothesis are the operative processes driving diversification. The second model is constructed as if developmental constraints prohibiting the origination of planktonic species in non-planktonic lineages were responsible for the relative increase in non-planktonic species.

In order to test these two proposed mechanisms a phylogenetic analysis of the turritellids using molecular sequence data was performed to determine the evolution of larval types in this clade. This is compared to the phylogenetic patterns predicted by the two models. The model asserting the control of species selection or the effect hypothesis is rejected. It is predicted that species with non-planktonic larvae will increase at the expense of planktonic species because planktonic organisms are developmentally more open to change, while developmental change is buffered in the non-planktonics. Once a lineage has become non-planktonic, there is little chance for it to undergo subsequent changes in larval style through phylogenetic time. The process producing this pattern is termed the cell-lineage effect, and it is a mechanism governing changes in the timing of germ line sequestration in organisms. Thus, the fossil and recent turritellid biota will show a bias towards non-planktonic forms due to biases and constraints in development.

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