

Factors Controlling Intra- and Interspecific Competition in Bryozoans

Jane Doe

Biol 105, Spring 2003

Competition, which is frequently associated with overt displays of aggression between active animals, is common among sessile organisms as well. Colonial organisms have particular ways of exhibiting this form of interaction. There are, however, special challenges to measuring and determining factors influencing competition between sessile, colonial organisms such as bryozoans. Of particular interest is whether morphological or environmental factors are most influential, and whether there is a relationship between competitive ability and growth rates. Barnes and Rothery (1996) and Padilla and Harvell (1996) examined these issues while investigating competition in bryozoans. Their results were strikingly similar, though they examined different characteristics and types of competition.

Barnes and Rothery (1996) examined the structures of Antarctic bryozoan communities to determine which environmental or morphological characteristics influenced competitive success both between and among species, as well as the relationship between competitive ability and growth rate. Interspecific competition, which resulted in one species "winning" or dominating another, was the focus of the experiment. They placed rocks with different bryozoan species into contact in different environments and measured the competitive outcome (as win, loss, or tie) for occupancy of space after a certain period of interaction. They found that the opponent's identity was most important factor in determining a species' competitive success, while water depth and rock surface characteristics having less of an effect. This result suggests that colony morphology and growth patterns were more important than environmental factors in determining interspecific competitive ability, because the location of the encounter did not determine the outcome.

Among the morphological strategies of competition, some tactics were more successful than others. Raising the colony's growing edge above the competitor's significantly aided the colony in domination, while erecting extra spines did not. The experiment's design, however, overlooked several factors that may have influenced the results. Probably the most important of these was the experiment's constrained period of observation. The experiment did not observe changes in competitive success over long periods of time and admitted that seasonal differences in growth rates may influence which species "win" at different times of year.

The experiment also elucidated the relationship between growth rate and the ability to successfully compete. This relationship appears to be a trade-off; species that quickly move in to colonize new areas tend to be slow growers, while the quick growers were very slow at colonizing. This pattern suggests an evolutionary advantage to organisms that concentrate their energies on one tactic rather than attempting to do both poorly.

Padilla and Harvell (1996), though focusing only on intraspecific competition in the bryozoan *Membranipora membranacea*, found remarkably similar trends in competitive influences and growth-competition relationships. This experiment measured the influence of food availability and direction of water flow on the production of stolons, tube-like extensions produced along the edge of a colony. Stolons may provide a competitive mechanism by allowing colonies to quickly spread into open space. To test for the effect of stolons, they punctured--and thereby deactivated--stolons daily and measured how quickly the colony could overrun its competitor. They found that colonies with intact stolons dominated their competitors more quickly than colonies with deactivated stolons. However, they found little effect of either food availability or water flow on the outcome of competition. In a result

similar to those of Barnes and Rothery (1996), therefore, morphological characteristics (stolon growth) were more influential than environmental characteristics (food availability and water flow). With stolon production demonstrated to be a benefit to competitive ability, an unresolved question is whether stolons act to physically limit how closely two colonies can grow toward one another, or to chemically induce separation between colonies.

Padilla and Havell (1996) came to similar conclusions about the relationship between growth rate and competitive ability. They, too, discovered a trade-off between the two characteristics. As the size disparity between two competing colonies increased, so did the number of stolons produced by the larger of the two. If stolons give a competitive advantage, then reasonably all competitors would benefit by producing them. However, because only larger colonies that were likely to "win" produced stolons, there may be a cost to stolon-production. The colonies whose stolons were deactivated grew at much faster rates and produced new stolons at much slower rates than the control colonies. Again, this indicates an evolutionary advantage to either investing in producing stolons or trying to outgrow the competitor, but not both.

Literature cited

Barnes D.K.A. and P. Rothery (1996). Competition in encrusting Antarctic bryozoan assemblages: outcomes, influences and implications. *Journal of Experimental Marine Biology and Ecology* 196:267-284.

Padilla D.K., C.D. Harvell, J. Marks and B. Helmuth (1996). Inducible aggression and intraspecific competition for space in a marine bryozoan, *Membranipora membranacea*. *Limnology and Oceanography* 41(3):505-512.