Larval strategies and connectivity in marine gastropods

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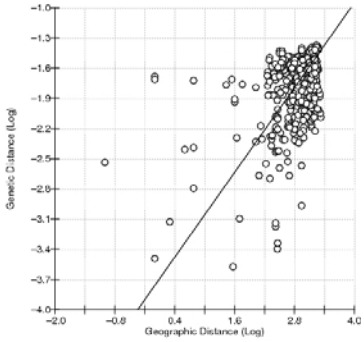
Connectivity is defined as the property and degree of interchange between populations. In the marine environment, this property is strongly influenced by the strategy of larval development. This is especially true for benthic organisms, which have a sessile adult lifestyle and can rely only on the larval phase for dispersal. Larval developments can be classified into two main types: planktotrophic development, whith larvae feeding actively on phytoplankton and lasting for a long time in the pelagic phase; non-planktotrophic (mostly lecithothrophic) development, whith larvae feeding on the yolk supply only and with a limited duration in the pelagic phase. It is reasonable to hypothesize that different larval developments produce different patterns of connectivity, high or low in planktotrophs and lecithotrophs, respectively. In marine gastropods, embryonic/larval shells (protoconchs) are conserved at the apex of adult shell, making extremely simple the inference of the larval developmental type of the individuals.

Several hypotheses can be tested on the relationship between genetic connectivity and duration of the larval phase:

1) Isolation by distance, or correlation between geographic and genetic distance, occurs in species with non-planktotrophic development and not in species with planktotrophic development;

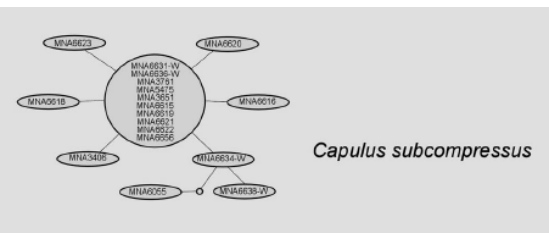
2) Genetic diversity and variance distribution are different in the two classes: low diversity and larger intrapopulation variance with planktotrophic development; high diversity and larger interpopulation variance with lecithothrophic development;

3) Different phylogeographic structure: phylogenetic trees not geographically structured with planktotrophic development and geographically structured with lecithothrophic development;



4) Different haplotypes networks: few haplotypes shared by most with planktotrophic development, and more haplotypes shared by geographically related groups with the lecithothrophic development.

We first positively tested these hypotheses on literature datasets of three species of the genus *Crepidula* with different larval developments: planktotrophic, lecithothrophic and completely intracapsular. Then we applied the same approaches on three original case studies: the sibling species *Columbella rustica* (Mediterranean, lecithotrophic) and *C. adansoni* (Atlantic, planktotrophic); and the Antarctic *Capulus subcompressus* and *Marseniopsis* spp. (both planktotrophic). All analyses positively tested the hypotheses of relationship between genetic connectivity and duration of the larval phase. Noteworthy, in Antarctica the planktotrophic development is usually severely counterselected, due the strictly seasonal presence of phytoplankton. *Capulus subcompressus* is the only Antarctic capulid with a planktotrophic development, and the genetics analyses confirmed the high connectivity patterns among populations. A similarly exceptional group in Antarctica is represented by species of the genus *Marseniopsis*, which also have long lasting planktotrophic larvae. In this genus we have identified far more species than the few currently supposed. Phylogenetic analysis clustered these species into two main groups: one including species widely distributed (from Weddel to Ross Seas) with genetic patterns congruent with planktotrophic development; the other including species from only the Weddel Sea, for which the scanty data do not allow to rule lecithotrophy out.



The methods herein used for testing hypotheses on the relationship between genetic connectivity and duration of the larval phase seemd appropriate. Future developments include the implementation of marine currents patterns for distance calculation to have a most realistic view of larval dispersal potential.