Size of Bugula neritina colonies with and without symbiont grown at different temperatures in laboratory mesocosms at Georgia Tech

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Project
» Biogeography of a marine defensive microbial symbiont: relative importance of host defense vs. abiotic factors (BiogeogDefensiveSymb)

Contributors	Affiliation	Role
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Abstract
Size of Bugula neritina colonies with and without symbiont grown at different temperatures in laboratory mesocosms at Georgia Tech.

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Coverage

Spatial Extent: **Lat**:34.7 **Lon**:-76.8

Dataset Description

Size of *Bugula neritina* colonies with and without symbiont grown at different temperatures in laboratory mesocosms.

Methods & Sampling

Bugula neritina colonies were collected by hand off the sides of floating docks around Morehead City, NC (latitude: 34.7, longitude: -76.8). Larvae from individual colonies were collected and settled into 10 mL of filtered seawater with (treated) or without (control) 100 ug/mL of gentamicin. Larvae were allowed to settle overnight. The control and treated seawater was changed the next morning for the next 3 days. The plates were transported to Georgia Tech where they were placed in 2.5 gallon tanks with artificial seawater maintained in environmental chambers at 16 degrees C and 22 degrees C. They were fed *ad libitum* an artificial diet of the phytoplankton *Rhodomonas lens* for approximately one month. After the 1-month period, the size of the colonies was measured by counting the number of bifurcations in each colony. A Leica stereomicroscope was used while counting the number of colony bifurcations. Samples of larvae, juvenile, and the grown colonies

were placed in RNAlater for symbiont quantification analysis by quantitative PCR (currently in progress).

Data Processing Description

Data were analyzed using IBM SPSS Statistics 24.

BCO-DMO Processing:
- created a column for temperature;
- combined the two tables into one;
-modified parameter names.

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Data Files

File
mesocosm_growth_data.csv (Comma Separated Values (.csv), 648 bytes) MD5:c5b834e19bc0b25dbb6e2fc566e7c352 Primary data file for dataset ID 719459

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Parameters

Parameter	Description	Units
temperature	Temperature in microcosm	degrees Celsius
colony_num	Specific colony identifier	unitless
genotype	Host genotype/symbiont presence: S+ means Type S host bryozoan (S), with the symbiont (+, as opposed to -); N+ is Type N host (N), with the symbiont (+).	unitless
cont_avg	Average size in bifurcations in control colonies	unitless
cont_sd	Standard deviation of average size in bifurcations in control colonies	unitless
cont_N	Number of control colonies in which size was measured	unitless
treat_avg	Average size in bifurcations in antibiotic treated colonies	unitless
treat_sd	Standard deviation of average size in bifurcations in treated colonies	unitless
treat_N	Number of treated colonies in which size was measured	unitless

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Instruments

Dataset-specific Instrument Name	tank
Generic Instrument Name	Aquarium
Generic Instrument Description	Aquarium - a vivarium consisting of at least one transparent side in which water-dwelling plants or animals are kept

Dataset-specific Instrument Name	Leica stereomicroscope
Generic Instrument Name	Microscope - Optical
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

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Project Information

Biogeography of a marine defensive microbial symbiont: relative importance of host defense vs. abiotic factors (BiogeogDefensiveSymb)

Coverage: Western Atlantic coast, ranging from latitudes 38.61283 to 29.753272

Recent research has shown that microorganisms can be very important to their eukaryotic hosts, by providing nutrition or contributing to host defense against enemies, such as pathogens or predators. In many cases, however, hosting a bacterial symbiont imposes a physiological cost on the host organism, resulting in reduced growth or reproduction in the presence of the symbiont. Further, these costs may be more pronounced in some habitats than others, causing natural selection to act in eliminating symbiont-containing hosts from the population. In this project, the investigators are studying the relationship between the marine bryozoan invertebrate, Bugula neritina, and its uncultured symbiont. The symbiont produces natural products with activity against cancer, Alzheimer's disease, and HIV. Interestingly, these compounds also are distasteful and protect larvae from predators, indicating that this symbiotic relationship is defensive in nature. Along the East Coast of the US, the investigators have found a much higher proportion of individuals that have the defensive symbiont at lower latitudes, while the symbiont is absent in individuals collected at higher latitudes. This pattern is consistent with the theory that higher predation pressure exists at lower latitudes. Other environmental factors, such as temperature, can also vary over a wide geographical area, and may also play a role in influencing the relationship. In this project, the investigators will evaluate the ecological and environmental parameters that influence the distribution of a defensive symbiont, including predation pressure and temperature. Defensive symbionts represent another level of ecological complexity, and likely play an important role in structuring marine communities. This study will provide insight into how environmental factors can influence host-symbiont interactions and drive partner co-evolution. Furthermore, the bioactive products have pharmaceutical potential, and understanding how environmental factors influence the relationship between B. neritina and its symbiont may improve bioprospecting for novel compounds that could be developed into drugs.

In this research, the investigators will determine the ecological and environmental parameters that influence the distribution of a defensive symbiont in the marine bryozoan, Bugula neritina. The goal of this research is to

determine the mechanism that results in the defensive endosymbiont being restricted to hosts that inhabit lower latitudes. This pattern of symbiont distribution could be the result of differing levels of costs and benefits at different latitudes: where predation pressure is low, the costs of hosting the symbiont outweigh the benefits, and aposymbiotic individuals outcompete their symbiotic conspecifics. In areas of higher predation, the defensive benefit outweighs the cost, and symbiotic individuals have higher survival rates than their undefended, aposymbiotic conspecifics. An alternative, but not mutually exclusive hypothesis, is that symbiont growth is inhibited at higher latitudes, where it is not as beneficial, and growth is induced in areas of higher predation. Specific goals are to determine if (1) a biogeographical cline in predation pressure corresponds to a gradient of symbiont frequency associating with the host, (2) symbiotic hosts have a higher fitness at low latitudes, and aposymbiotic hosts have a higher fitness at high latitudes, and (3) symbiont growth is promoted at low latitudes and inhibited at high latitudes. A combination of field and laboratory-based experiments will be conducted using ecological and molecular biology techniques. Bioactive compounds produced by symbionts of marine invertebrates can mediate multi-trophic interactions and potentially influence benthic community structure. There has been almost no research, however, on how ecological and environmental parameters influence the distribution of marine defensive endosymbionts.

Related Reference:

Linneman J, Paulus D, Lim-Fong G, Lopanik NB (2014) Latitudinal Variation of a Defensive Symbiosis in the Bugula neritina (Bryozoa) Sibling Species Complex. PLoS ONE 9(10): e108783. doi:10.1371/journal.pone.0108783

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Funding

Funding Source	Award
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