Bugula neritina host genotype and symbiotic status of colonies along the East Coast, USA, ranging from latitudes 38.61283 to 29.753272

Website: https://www.bco-dmo.org/dataset/719479
Data Type: experimental
Version: 2
Version Date: 2018-08-23

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

Contributors	Affiliation	Role
Lopanik, Nicole	Georgia Institute of Technology (GA Tech)	Principal Investigator
Lim-Fong, Grace	Randolph-Macon College	Co-Principal Investigator
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Abstract
Bugula neritina host genotype and symbiotic status of colonies along the East Coast, USA, ranging from latitudes 38.61283 to 29.753272.

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Coverage

Spatial Extent: **N**:38.61283 **E**:-75.072524 **S**:29.753272 **W**:-81.421
Temporal Extent: 2015-03-16 - 2016-06-15

Dataset Description

Bugula neritina host genotype and symbiotic status of colonies along the East Coast.

Methods & Sampling

Bugula neritina colonies were collected by hand using a haphazardly placed 15x15 cm grid on submerged area of floating dock, and placed into a tube of RNAlater. Colonies were collected along the Western Atlantic coast, ranging from latitudes 38.61283 to 29.753272. Surface waters, on sides of floating docks.Host genotype, either Type S or Type N, was determined by PCR amplification of the host cytochrome oxidase I gene followed by restriction analysis as in Linneman et al. 2014. The presence of the symbiont, either + for present or – for absent, was determined by PCR assays with two portions of the functional bryostatin biosynthetic gene documented in Sudek et al. 2007.

Temperature was measured with a digital thermometer, and salinity with a refractometer at the time of collection.

Data Processing Description

We have analyzed the proportions at differing latitudes and performed regression analysis with various factors (latitude, longitude, temperature, salinity) using SPSS Statistics 24.

BCO-DMO Processing:
- applied date, location name, location code, lat, lon, temp, and sal to each relevant row (was only included the first row for each sample set);
- created location_descrip column for more detailed location place name;
- modified parameter names;
- moved "Total" to the "Grid" column;
- removed commas and apostrophes from place names; replaced spaces with underscores;
- replaced blanks and "N/A" with "nd" (no data).

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Data Files

File	
B_neritina_genotype_dist.csv	(Comma Separated Values (.csv), 22.10 KB) MD5:eabc8067e7e2b41cec56890604ef35b4
Primary data file for dataset ID 719479	

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Related Publications

Linneman, J., Paulus, D., Lim-Fong, G., & Lopanik, N. B. (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
General

Sudek, S., Lopanik, N. B., Waggoner, L. E., Hildebrand, M., Anderson, C., Liu, H., … Haygood, M. G. (2007). Identification of the Putative Bryostatin Polyketide Synthase Gene Cluster from “CandidatusEndobugula sertula”, the Uncultivated Microbial Symbiont of the Marine BryozoanBugula neritina. Journal of Natural Products, 70(1), 67–74. doi:10.1021/np060361d
General

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Parameters

Parameter	Description	Units
date_collected	Date of collection, formatted as mm/dd/yyyy	unitless
location	Location samples collected	unitless
location_descrip	Specific area within location where samples were collected	unitless
location_code	Location code	unitless
Latitude	Latitude of location	decimal degrees
Longitude	Longitude of location	decimal degrees
temp	Water temperature	degrees Celsius
salinity	Water salinity	parts per thousand
grid_num	Sampling effort replicate	unitless
num_B_neritina	Total number of B. neritina colonies in grid	unitless
num_Type_S_symb	Number of Type S symbiotic colonies	unitless
num_Type_S_asymb	Number of Type S aposymbiotic colonies	unitless
num_Type_N_symb	Number of Type N symbiotic colonies	unitless
num_Type_N_asymb	Number of Type N aposymbiotic colonies	unitless
prop_Type_S_symb	Proportion of Type S symbiotic colonies	unitless
prop_Type_S_asymb	Proportion of Type S aposymbiotic colonies	unitless
prop_Type_N_symb	Proportion of Type N symbiotic colonies	unitless
prop_Type_N_asymb	Proportion of Type N aposymbiotic colonies	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	digital thermometer
Generic Instrument Description	An instrument that measures temperature digitally.

Dataset-specific Instrument Name	
Generic Instrument Name	Refractometer
Generic Instrument Description	A refractometer is a laboratory or field device for the measurement of an index of refraction (refractometry). The index of refraction is calculated from Snell's law and can be calculated from the composition of the material using the Gladstone-Dale relation. In optics the refractive index (or index of refraction) n of a substance (optical medium) is a dimensionless number that describes how light, or any other radiation, propagates through that medium.

Dataset-specific Instrument Name	
Generic Instrument Name	Thermal Cycler
Generic Instrument Description	A thermal cycler or "thermocycler" is a general term for a type of laboratory apparatus, commonly used for performing polymerase chain reaction (PCR), that is capable of repeatedly altering and maintaining specific temperatures for defined periods of time. The device has a thermal block with holes where tubes with the PCR reaction mixtures can be inserted. The cycler then raises and lowers the temperature of the block in discrete, pre-programmed steps. They can also be used to facilitate other temperature-sensitive reactions, including restriction enzyme digestion or rapid diagnostics. (adapted from http://serc.carleton.edu/microbelife/research_methods/genomics/pcr.html)

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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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