Lysogens in the Natural Microbial Communities of the Warm Red Sea

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Abstract

Viruses are the most abundant microorganisms in marine environments. Viral infections can be either lytic (virulent) or lysogenic (temperate phage) within the host cell. The Red Sea is a narrow oligotrophic basin classified as the warmest water temperatures, which may affect the dynamics of microbial community. Studies on lysogenic bacteria in the Red Sea remain unexplored. The aim of this study was to quantify viral dynamics in the Red Sea and to investigate the occurrence of lysogenic bacteria based on a temporal study. Over two years, we quantified fortnightly environmental parameters and virus and bacterial abundances in a coastal station of the Red Sea. During the second year, monthly seawater samples were examined for prophage induction by mitomycin C. Water temperatures were high, from 25.4 to 31.93 °C, and total viral and bacterial abundances ranged from 1.51 to 8.56 × 10^6 and from 1.94 to 3.16 x 10^5 cells mL^{-1}, respectively. The burst size was calculated as 13.81. We determined that 12.24 % ± 4.82 (SE) of the treated bacteria were lysogenized with the highest percentage of 55.8% observed in January 2018 when bacterial abundances were low. Second small proportions were identified in July and September, which potentially related to the stressful conditions to phages with no induction was observed in the spring time where bacterial abundances were at the highest. Our results confirm that lysogenized cells were favored when bacterial populations were low; however, there was no clear relationship between lysogeny and seasonal changes in the Red Sea environmental conditions, as the stressful summer did not induce high lysogeny neither lytic infection.

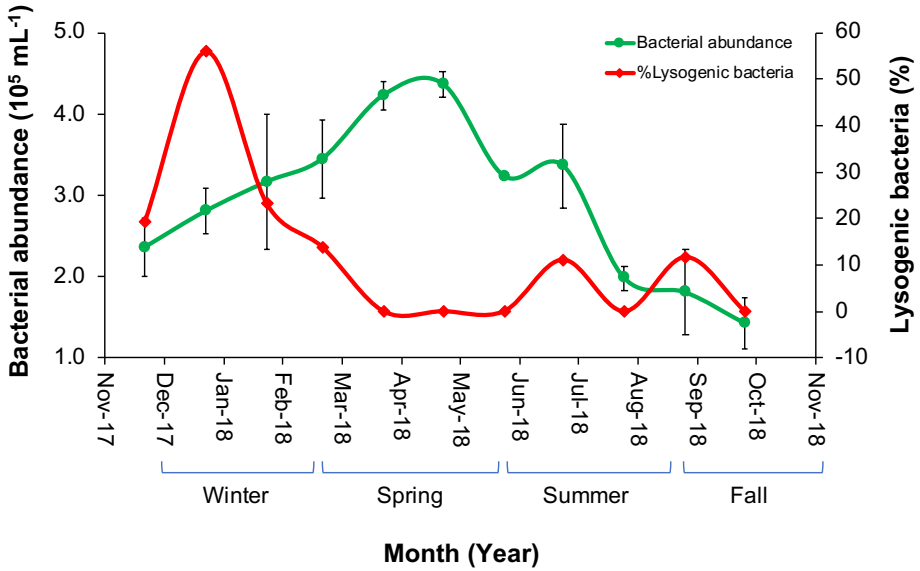


Figure: Percentages of lysogenic bacteria (red line and diamonds) and monthly mean (±SE) bacterial abundance (green line and dots) quantified in the natural microbial communities of the coastal Red Sea during the second year of the study (December 2017 to October 2018).



My name is Ruba Abdulrahman Ashy, a Ph.D. candidate in Environmental Science and Engineering Department, Red Sea Research Center at King Abdullah University of Science and Technology, Thuwal, Saudi Arabia. I worked as a teacher assistant of Microbiology Science from 2009 at King Abdulaziz University, SA. Therefore, I have been given a scholarship award from 2012 to present to continue my postgraduate studies at Master level (2013-2014) on Medical Microbiology at the University of Westminster, London, UK and a Ph.D. level (2015-present) on Environmental Microbiology in SA. My Ph.D. research interest is in environmental microbiology and virology. My main aim focuses on determining the potential viability of lysogenic bacteria or infectious viruses and their survival in certain environmental areas by the development and the evaluation of virus detection methods. This research will explore the factors behind the spread of viral infections in different environmental areas including the Red Sea.

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