

Abstract

Phages differ in the amount of hosts they can adsorb to. Narrow host range phages adsorb to one host, while broad host range phages adsorb to many hosts. We investigated the difference between the two groups in their ability to adsorb to resistant cyanobacteria. The myoviruses we tested adsorbed to the resistant hosts, while the podovirus did not adsorb to resistant strains. The difference in adsorption in the ability to adsorb to resistant strains might not be related to the host range but to the family which the phage belongs to.

Introduction

Cyanobacteria are the most abundant photosynthetic organisms in the oceans and are estimated to be responsible for 25% of global oceanic primary production (Flombaum *et al.* 2013)

Phages are viruses that infect bacteria. Cyanobacteria are infected by 3 families of cyanophages: myoviruses, podoviruses and siphoviruses (Sabehi *et al.* 2012). Phages can infect only certain bacteria bearing receptors to which they can adsorb to, this in turn determines the phage's host range (Gabashvilli *et al.* 1997) (Image 1).

Broad host range phages - adsorb to a high number of hosts

Narrow host ranged phages - adsorb to only one specific host. Myoviruses tend to be broad host range and podoviruses tend to be narrow host range.

Resistant cyanobacteria are bacteria that do not undergo lysis – they do not burst as a result of interaction with the virus, while **sensitive bacteria** strains are lysed when they are exposed and infected by the phage.

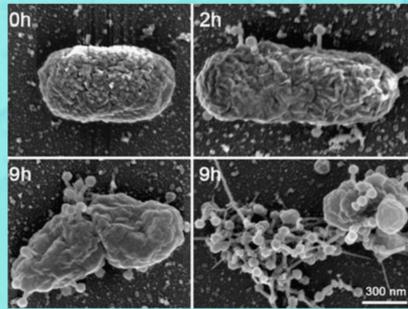


Image 1. Infection of cyanobacteria by cyanophage. SEM images at different stages of infection show uninfected cells (0 h), phage adsorption (2 h), cell lysis (9 h), and viral release (9 h). Sabehi et al. 2012

Research Aim

The purpose of this research project is to compare between the tendencies of different cyanophages (narrow or broad ranged hosts) to adsorb to resistant cyanobacteria.

Hypothesis: There might be a difference in adsorption to resistant strains between narrow and broad host range phages. It's more likely that the broad range phages will adsorb to the resistant hosts.

Methods and Materials

We took two broad host range myoviruses, one narrow host range myovirus and a narrow host range podovirus and checked adsorption to resistant bacterial strains. Phages:

- Syn9- broad host range myovirus.
- TIM4- broad host range myovirus.
- TIM61- narrow host range myovirus.
- PSSP7- narrow host range podovirus.

Adsorption assay

Adsorption assay was used to determine whether there was adsorption of the phage to the cell. Bacteria and cyanophages were mixed together. A sample was taken every hour and filtered in order to remove the bacteria and to measure the concentration of the viruses in the extracellular medium.

Plaque assay

This assay was used to determine the phage concentration. The sample was serially diluted and the higher dilutions were plated on petri dishes (Image 2,3).



Image 2. plaques. Schwartz, D., Lindell lab

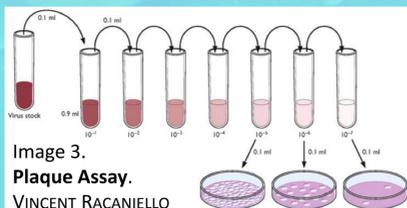


Image 3. Plaque Assay. VINCENT RACANIELLO

Results

Syn9 can adsorb to resistant cyanobacteria

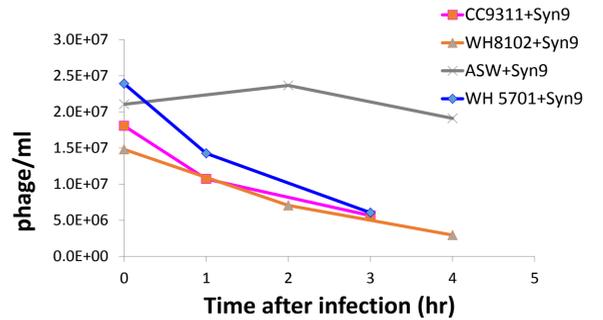


Figure 1: Syn9 adsorption to cyanobacterial strains. Extracellular phage concentration was measured for several hours after infection. Positive control- sensitive host WH8102. Negative control- no cells, growth medium ASW. Resistant strains- CC9311, WH5701.

TIM4 can adsorb to resistant cyanobacteria

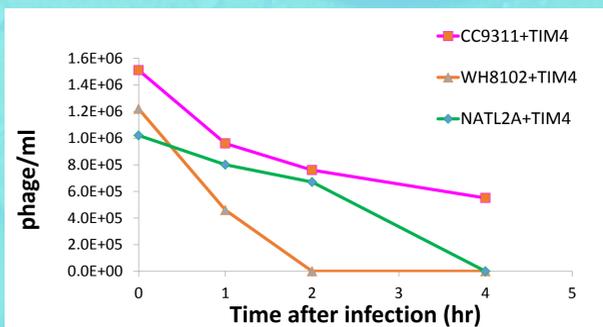


Figure 2: TIM4 adsorption to cyanobacterial strains. Positive control- sensitive host WH8102. Resistant strains- CC9311, NATL2A.

TIM61 can adsorb to resistant cyanobacteria

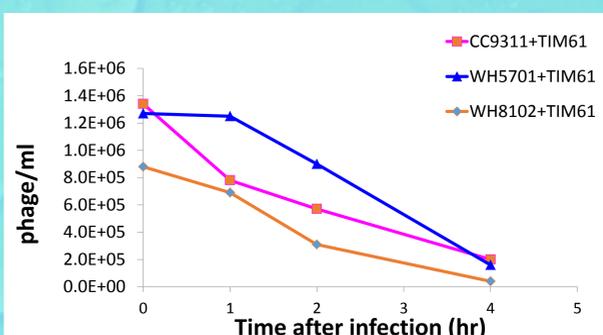


Figure 3: TIM61 adsorption to cyanobacterial strains. Positive control- sensitive host WH8102. Resistant strains- CC9311, WH5701.

PSSP7 cannot adsorb to resistant cyanobacteria

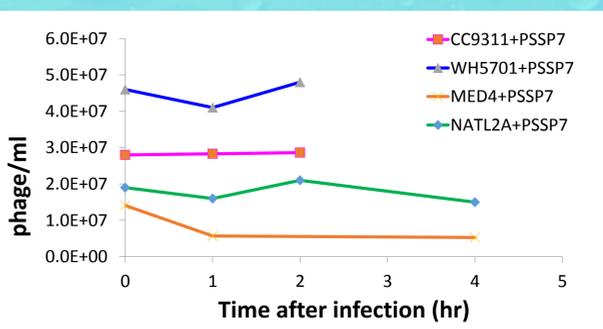


Figure 4: PSSP7 adsorption to cyanobacterial strains. Sensitive host-MED4. Resistant strains-NATL2A, WH5701, CC9311

Conclusions

All myoviruses, both narrow and host range, tested positive for adsorption to resistant hosts (Figure 1,2,3). PSSP7, the podovirus, tested negative for adsorption to resistant hosts (Figure 4).

Discussion

Unlike our hypothesis, it seems that there is no difference in adsorption to resistant bacteria between narrow and broad host range phages. However, it seems that there is a difference between the families of phages (myovirus and podovirus) in their ability to adsorb to resistant bacterial strains.

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