

What Happens When Two Algae Viruses Infects Algae Cells?

1

Two viruses can infect the same algae

Haptolina ericina virus RF02 (HeV RF02) and *Prymnesium kappa* virus RF01 (PkV RF01) are both members of the *Mimiviridae* family and can infect single celled haptophyte algae like *Haptolina ericina* (He 028) (Johannessen *et al.*, 2015). When a virus infects a host an evolutionary arms race can occur. The host evolve resistance to the virus, and the virus responds by counteracting the resistance (Sandaa *et al.*, 2021).

The aim of the study is to examine the dual infection on He 028 by HeV RF02 and PkV RF01.

2

Experimental design

In the experiment PkV RF01 and HeV RF02 was added to He 028 in triplicates (inf A-C). The experiment had three controls. In one control HeV RF02 was added to He 028 (ctrl HeV), in the other control PkV RF01 was added to He 028 (ctrl PkV), and in the third control no virus was added to He 028 (ctrl). (figure 1)

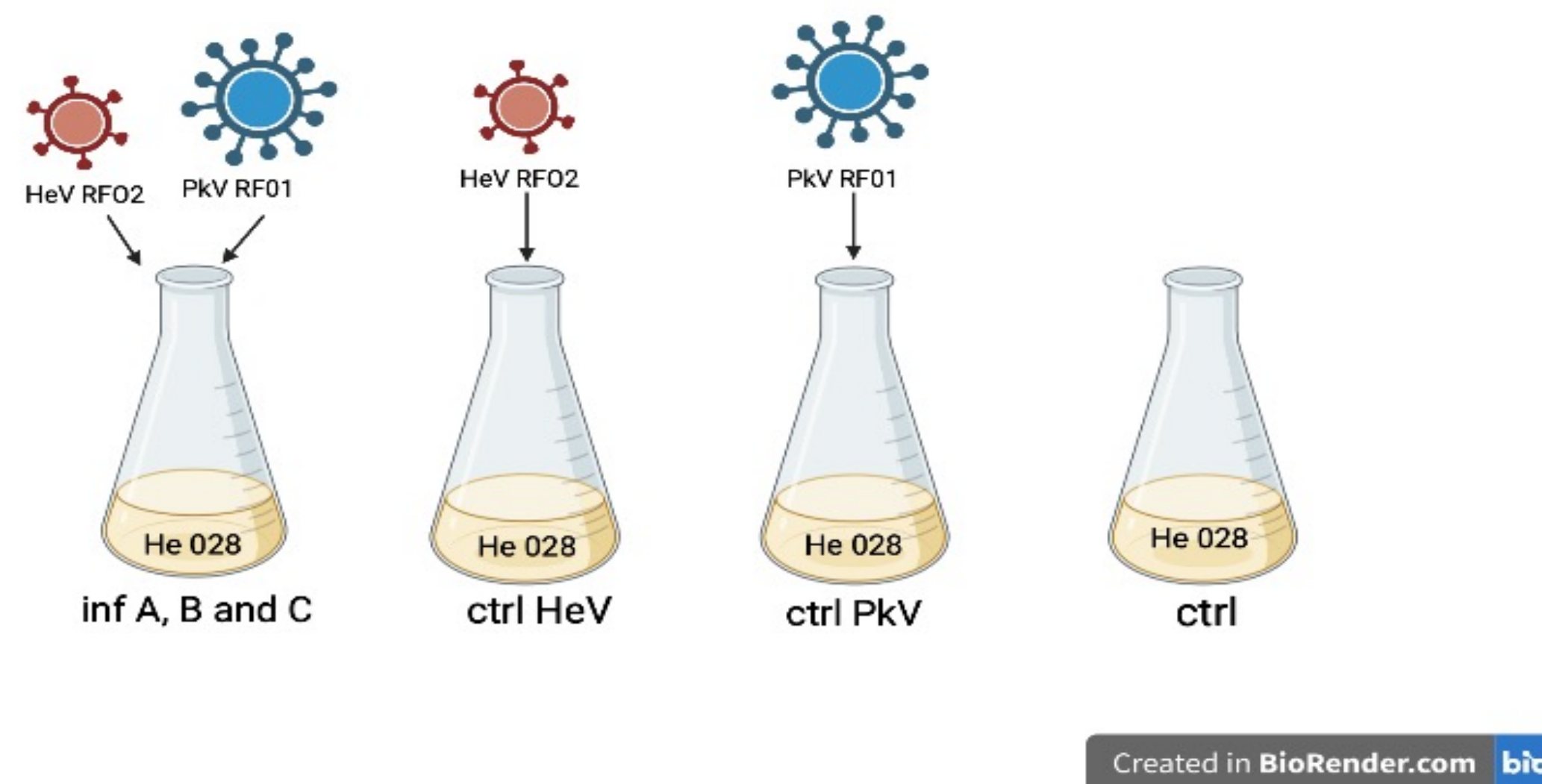


Figure 1: Experimental setup

References:

Johannessen, T. V., Bratbak, G., Larsen, A., Ogata, H., Egge, E. S., Edvardsen, B., Eikrem, W., & Sandaa, R. A. (2015). Characterisation of three novel giant viruses reveals huge diversity among viruses infecting Prymnesiales (Haptophyta). *Virology*, 476, 180–188. <https://doi.org/10.1016/j.virol.2014.12.014>

Sandaa, R. A., Saltvedt, M. R., Dahle, H., Wang, H., Våge, S., Blanc-Mathieu, R., Steen, I. H., Grimsley, N., Edvardsen, B., Ogata, H., & Lawrence, J. (2022). Adaptive evolution of viruses infecting marine microalgae (haptophytes), from acute infections to stable coexistence. *Biological reviews of the Cambridge Philosophical Society*, 97(1), 179–194. <https://doi.org/10.1111/brv.12795>

4

HeV RF02 was the winner!

HeV RF02 was the most successful in infecting the algae. The concentration of HeV RF02 increased more compared to the concentration of PkV RF01 in inf A and in inf C (figure 2 & 4). This is also true for ctrl HeV and ctrl PkV (figure 5 & 6).

In inf B (figure 3), results imply that when the concentration of PkV RF01 decreased, HeV RF02 concentration increased- and vice versa. This can be interpreted as **competition between the viruses occurred.**

In all of the cultures where virus was added, the algae started growing after 4-15 days. In other words, **the algae gained resistance against the viruses** (figure 2, 3, 4, 5 & 6).

In inf C (figure 4), both PkV RF01 and HeV RF02 continued growing despite the algae developed resistance against them. This indicates that **the viruses and the algae had an evolutionary arms race where they competed to be the best adapted.**

In ctrl (figure 7) the algae started to grow and then stabilized. This can be interpreted as the algae reached the carrying capacity only when viruses were not added.

3

Concentration of algae (cells/mL) and virus (VLP/mL) per day

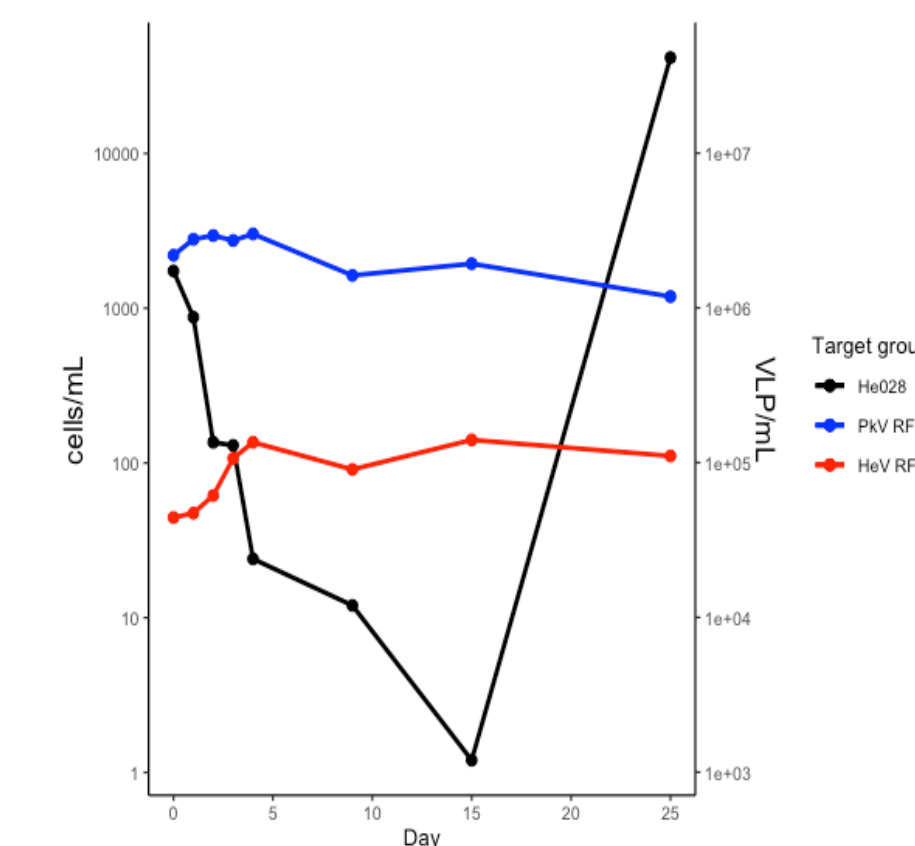


Figure 2: inf A

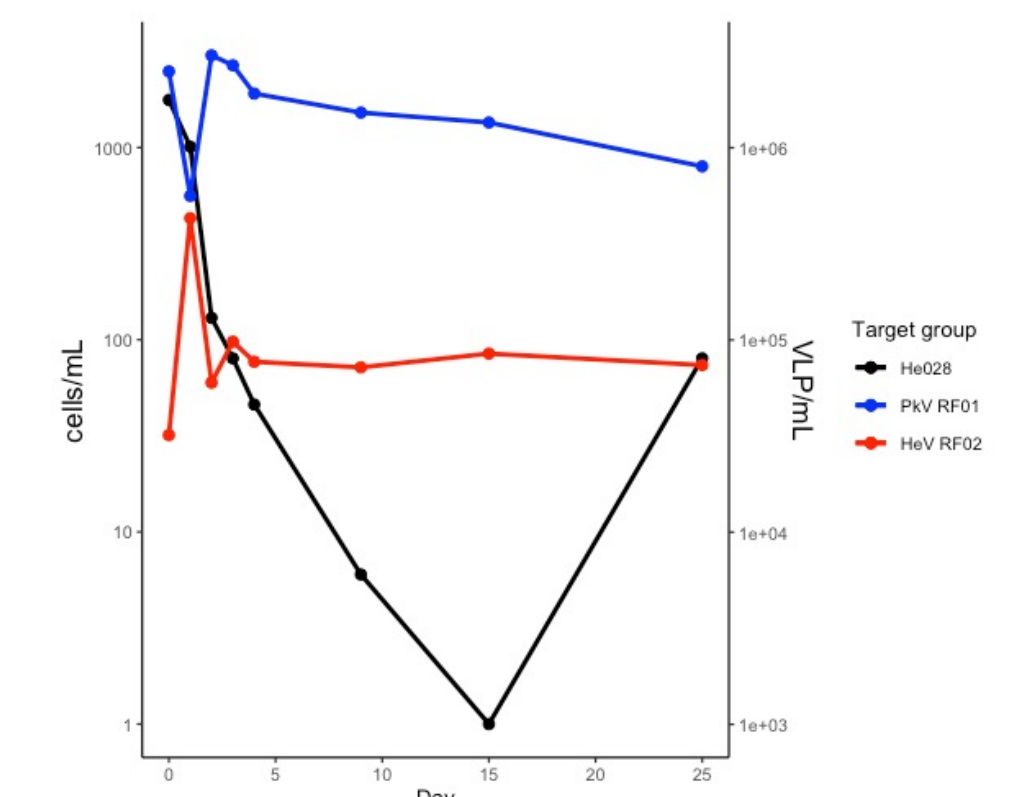


Figure 3: inf B

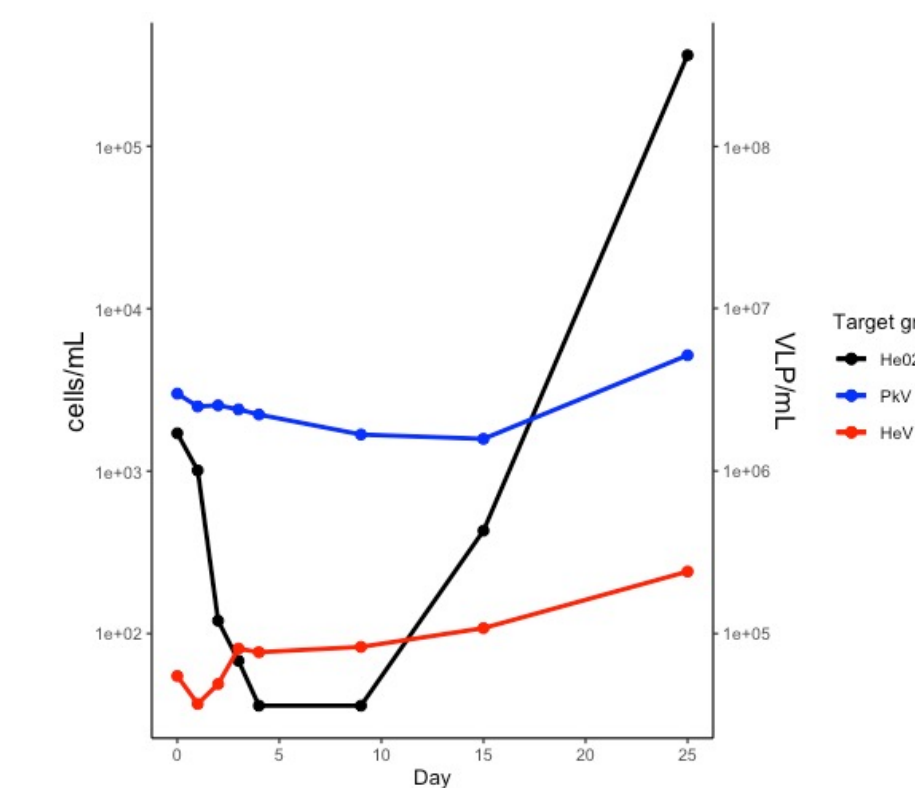


Figure 4: inf C

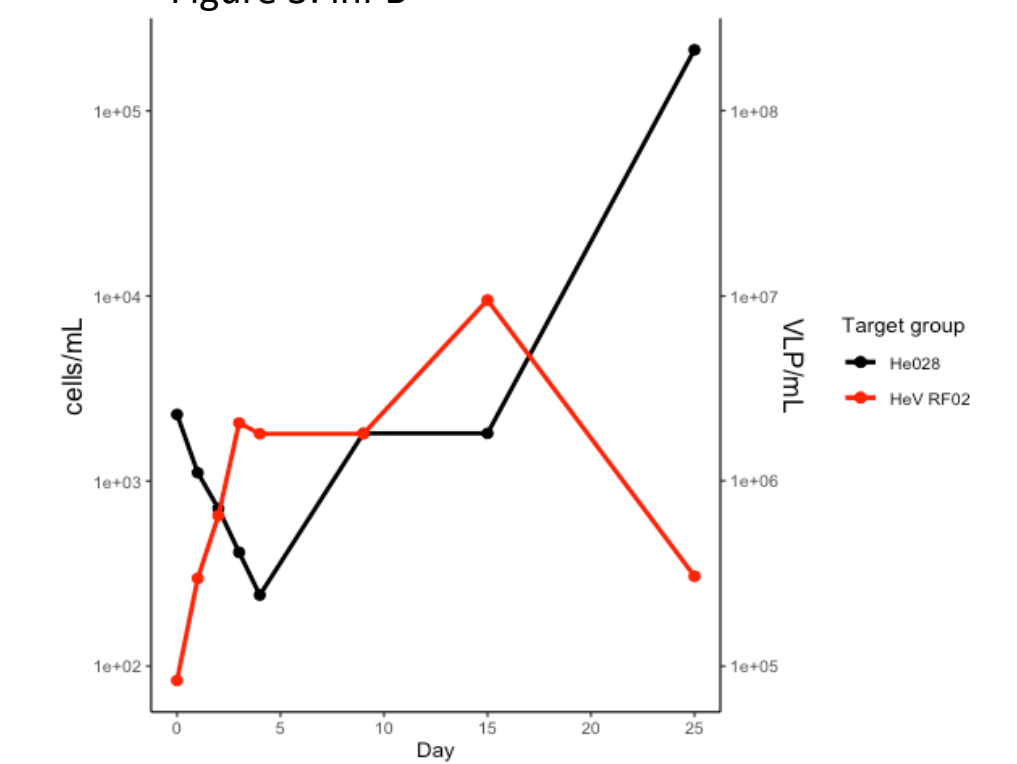


Figure 5: ctrl HeV

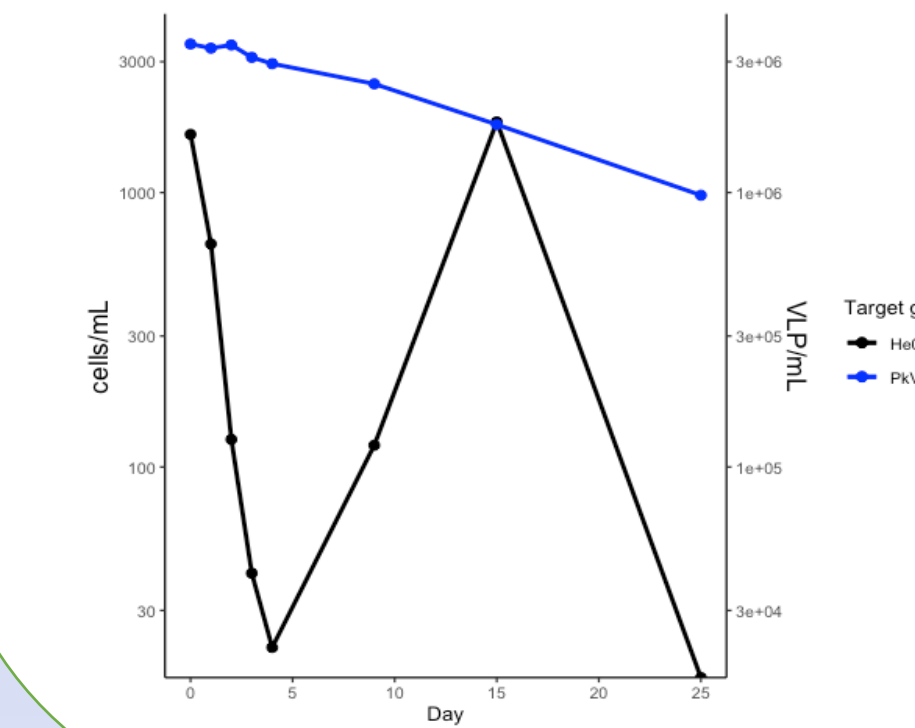


Figure 6: ctrl PkV

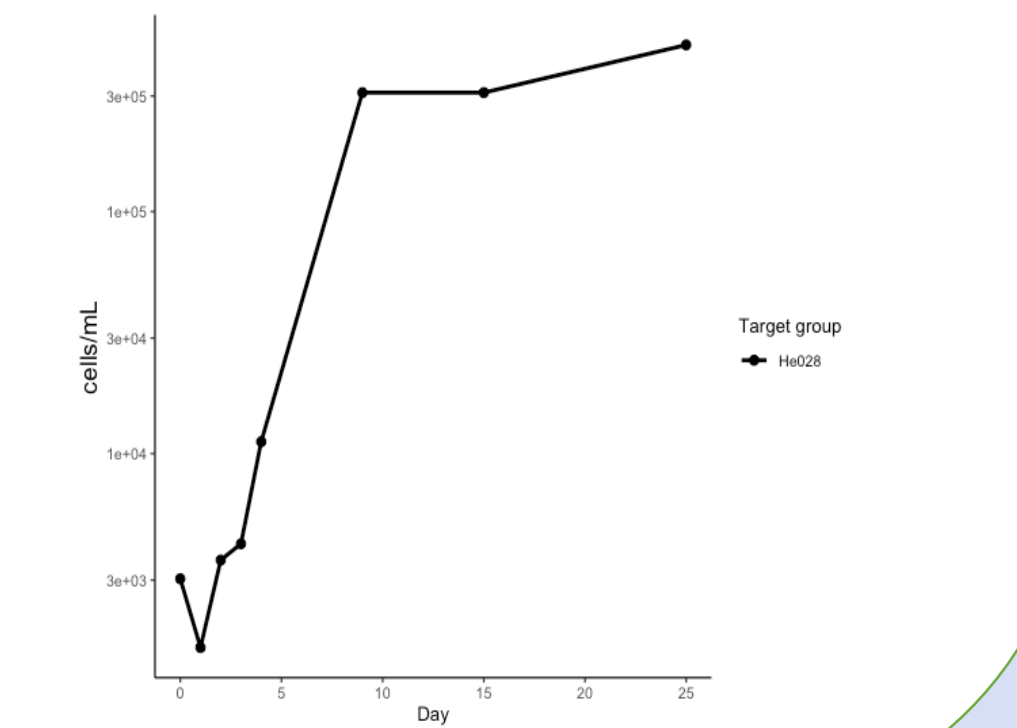


Figure 7: ctrl