

Names: _____

BIOE 149 Disease Ecology Evolution of Virulence Homework Assignment

The evolution of Myxoma virus in rabbits in Australia

Myxoma virus is transmitted between rabbits by direct contact (and also by fleas, but we'll ignore that for now). Through a series of Dr. Evil experiments, biologists infected rabbits with five different strains of the virus and measured how infectious they were to other rabbits (the fraction of other rabbits that got infected after spending a day with the rabbits), how long they lived when infected, and how long they were shedding the virus. They also went out into the field and measured how long rabbits lived in areas without the virus. All units are in days.

Strain	Lifespan in the field when not infected	Lifespan, when infected	Probability of infecting another rabbit given contact	Average time surviving rabbits shed virus	
1	335	11	0.35	20	
2	335	15	0.3	26	
3	335	20	0.29	27	
4	335	40	0.19	28	
5	335	118	0.08	8	

1. The evolutionary fitness of a pathogen is proportional to its value of R_0 since this is a measure of the number of "offspring" in pathogen terms. Which of the 5 strains of this virus is the most fit? If you released one infected rabbit with each strain, which strain would you expect to find in the population (if any) three decades later if the rabbit density was 1 rabbit/ha, and rabbits roam (and contact other rabbits) about 1 ha each day? Put another way, if you first introduced strain 1 (which is what actually happened), but you knew the virus could evolve along a continuum of traits described by the other strains (which is what the data indicate), which set of traits do you think the virus would have after three decades? Why? Is it the deadliest strain? The most infectious strain? You will probably want to use a calculator or Excel to answer this problem.

2. The real data are given in the table below. Do these data match your predictions using the data from the table above?

Fraction of viral isolates in each strain

Year	1	2	Strain 3	4	5
1950–1951	100				
1952–1955	13.3	20.0	53.3	13.3	0
1955–1958	0.7	5.3	54.6	24.1	15.5
1959–1963	1.7	11.1	60.6	21.8	4.7
1964–1966	0.7	0.3	63.7	34.0	1.3
1967–1969	0	0	62.4	35.8	1.7
1970–1974	0.6	4.6	74.1	20.7	0
1975–1981	1.9	3.3	67.0	27.8	0