EEB2245: Evolutionary Biology

Spring 2009

Problem Set 3

1.) A scientist observed:

GENOTYPE →	AA	Aa	aa
# of eggs	33	100	45
Viability	0.3	0.7	0.4
# of adults			

a) Calculate the number of adults that were observed. (See table above)

b) Using the data in the table calculate the genotype frequency of AA (before and after selection) and the allele frequency of A (before and after selection).

2.) Egg-to-adult survival rates in a laboratory population of Drosophila melanogaster is as follows: 90%, 70%, and 60% for genotypes A_1A_1, A_1A_2, and A_2A_2, respectively. The fecundity values for each genotype are 50, 55, and 70 eggs, respectively.

(a) Complete the table below

Genotype	A_1A_1	A_1A_2	A_2A_2
# eggs			
w_x			
# adults			

(b) Calculated allele and genotype frequencies before and after selection.

(c) After the selection event from egg-to-adult, the adults are bred randomly. Assuming Hardy-Weinberg equilibrium into the next generation, what are the allele and genotype frequencies of eggs in the next generation?

3.) What mode of selection would you predict is acting in the following cases?

(a)

GENOTYPE →	**AA**	**Aa**	**aa**
# of eggs	**33**	**100**	**45**
# of adults	10	70	18

(b)

GENOTYPE →	**AA**	**Aa**	**aa**
# of eggs	**55**	**100**	**60**
# of adults	49	80	18

(c)

GENOTYPE →	**AA**	**Aa**	**aa**
# of eggs	**50**	**75**	**45**
# of adults	30	35	25

4.) Under artificial selection for increased body weight, what will be the response to selection (R), after one generation, for the following values of phenotypic variance (V_P), additive genetic variance (V_A), environmental variance (V_E), and selection differential (S)? (a) $V_P = 2.0$ grams^2, $V_A = 1.25$ g^2, $V_E = 0.75$ g^2, $S = 1.33$ g; (b) $V_P = 2.0$ grams^2, $V_A = 0.95$ g^2, $V_E = 1.05$ g^2, $S = 1.33$ g; (c) $V_P = 2.0$ grams^2, $V_A = 1.25$ g^2, $V_E = 0.75$ g^2, $S = 2.67$ g. If the parameters remain the same for successive generations of selection, and the initial mean weight is 10 grams, what is the expected mean after two generations of selection in each case? (Futuyma 2005)