

BIOLOGY 100
SOLUTIONS TO PROBLEMS

MENDELIAN GENETICS

1. In summer squash, white fruit color is dominant over yellow. If a plant homozygous for white fruit color is crossed with a plant homozygous for yellow fruit color, what will the F1 generation be like? If these F1 plants are self fertilized and 213 offspring are recovered, approximately how many will be white, and how many of these might be expected to breed true?

Parental phenotypes	White	x	Yellow	
Parental genotypes	WW		ww	(W = dominant allele; w = recessive allele)
Parental gametes	(W)		(w)	
F1 generation phenotype	White			
F1 generation genotype	Ww			
F1 generation gametes (each individual)	(W), (w)			

F2 phenotypes and genotypes:

(F1 gametes):	(W)	(w)
(W)	White WW	White Ww
(w)	White Ww	Yellow ww

From the above Punnett square, 3/4 of the offspring will be white. Out of a total of 213 offspring, we expect 160 to be white (3/4 x 213).

The above Punnett square also tells us that 1/4 of the offspring will be true breeding white (i.e., homozygous dominant). We expect 53 offspring to be white true-breeders (1/4 x 213).

2. A white-fruited squash plant when crossed with a yellow-fruited plant produces offspring about half of which are white and half of which are yellow in fruit color. What are the genotypes of the parent plants?

In problems that ask for the genotype of parents, follow these simple steps: a) write down the phenotypes of each parent; b) based on these phenotypes, write down what you know about their phenotypes (remember that an expressed recessive trait means that an individual is homozygous recessive); c) look for recessive offspring; they are homozygous recessive and must have inherited a recessive allele from each parent; d) fill in the missing genotype information based on the above evidence.

Phenotypes of parents	White	x	Yellow
Initial determination of parental genotypes	W?		ww

4. What are the parental genotypes of a white sphere plant and a white disk plant which, when crossed, yield 3/8 white disk, 3/8 white sphere, 1/8 yellow disk, and 1/8 yellow sphere offspring?

See comments in question #2 for determining genotypes of parents.

Phenotypes of parents	White-Disk	x	White-Sphere	
Initial determination of parental genotypes	W?D?		W?dd	
F1 generation phenotypes	White-Disk	White-Sphere	Yellow-Disk	Yellow-Sphere
F1 generation genotypes	W?D?	W?dd	wwD?	wwdd

Since there are offspring that are homozygous recessive for both traits, each parent must have at least one recessive allele for each trait. Therefore, the White-Disk parent has the genotype of WwDd and the White-Sphere parent has the genotype of Wwdd.

5. What are the parental genotypes of a white sphere plant and a yellow disk plant which, when crossed, yield all white disk plants?

See comments in question #2 for determining genotypes of parents.

Phenotypes of parents	White-Sphere	x	Yellow-Disk	
Initial determination of parental genotypes	W?dd		wwD?	
F1 generation phenotypes	all White-Disk			
F1 generation genotypes	W?D?			

No recessive phenotype appears in the F1 generation. This means that both parents cannot have the recessive allele for each trait. Therefore the parental genotypes must be WWdd x wwDD. As a check, this cross produces all individuals with a genotype of WwDd.