Session 4: Introduction to Mendelian Genetics Assignment

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Problem 1

Following SSYy × SsYy cross what fraction of the offspring to have a genotype that is heterozygous for both characters

Solution:

Table 1: Punnett square

	SY	sY	Sy	sy
SY	SSYY	SsYY	SSYy	SsYy
SY	SSYY	SsYY	SSYy	SsYy
Sy	SSYy	SsYy	SSyy	Ssyy
Sy	SSYy	SsYy	SSyy	Ssyy

Table 2: Genotypes frequencies

Genotypes	Frequencies
SSYY	12.5%
SsYY	12.5%
SSYy	25.0%
SsYy	25.0%
SSyy	12.5%
Ssyy	12.5%

The genotype that is heterozygous for both characters is: SsYy Therefore the fraction of this genotype: $\frac{4}{16} = \frac{1}{4}$ which is 25% □

Problem 2

In tomato vines, Tall vines (T) are dominant to Dwarf vines (t) and Red fruit (R) is dominant to Yellow fruit(r). A farmer mates a homozygous tall red tomato (TTRR) with heterozygous Tall red (TtRr). What is the % chance that the off-springs will be dwarf plants with yellow fruit.

Solution:

Table 3: Punnett square

	TR	tR	Tr	tr
TR	TTRR	TtRR	TTRr	TtRr
TR	TTRR	TtRR	TTRr	TtRr
TR	TTRR	TtRR	TTRr	TtRr
TR	TTRR	TtRR	TTRr	TtRr

Table 4: Genotypes frequencies

Genotypes	Frequencies
TTRR	25.0%
TtRR	25.0%
TTRr	25.0%
TtRr	25.0%

For a dwarf plant with yellow fruit to be formed, the genotype required is ttrr - which is not be formed in this genetic crossing. Therefore, there is 0% chance that the offspring can be dwarf with yellow fruit. □

Problem 3

List the gametes of a plant of genotype SSYy.

Solution: The genotypes will be as follows:

(a) SY

(b) Sy

□

Problem 4

Long eye lashes are (E) dominant to short eye lashes(e). Across occurs between a homozygous recessive male and a heterozygous woman.

(a) What % chance will their first child have long eyelashes ?

(b) What % chance will their 8th child have long eyelashes ?

Solution:

Table 5: Punnett square

	E	e
e	Ee	ee
e	Ee	ee

Table 6: Genotypes frequencies

Genotypes	Frequencies
Ee	50.0%
ee	50.0%

(a) The first child will have 50% chance of having long eyelashes.

(b) The 8th child will also have 50% chance of having long eyelashes because all the children have the same probability.

□

Problem 5

In humans Suspended ear lobes (S) are dominant over attached ear lobes (s). If a couple have son with attached ear lobes (ss) then what will be the genotypes of his father and mother.

Solution: The possible genotypes of father and mother are:

(a) Father - Ss Mother - Ss

(b) Father - Ss Mother - ss

(c) Father - ss Mother - Ss

(d) Father - ss Mother - ss
There will be 100% chance of a son with attached ear lobes in case (d)

□