

AS90459 Describe genetic variation and change

Dihybrid Cross Worked Example

In sweet pea plants there are three possible colours of flowers

RR = red flowers

Rr = pink flowers

rr = white flowers

and two possible shaped pollen grains,

L = long pollen grains and l = round pollen grains

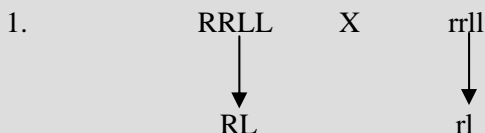
Incompletely dominant

1. If a pure breeding red flower, long pollen grained plant was crossed with a white flowered round pollen grained plant. Complete a punnet square and calculate the phenotype and genotype ratio of the F1's.
2. Now the F1 offspring were allowed to breed. Complete a punnet square and calculate the phenotype ratio.
3. After completing the cross in part 2, they counted the phenotypes of 1000 offspring and found
 - 190 Red flowered long pollen grained
 - 372 Pink flowered long pollen grained
 - 65 Red flowered round pollen grained
 - 120 Pink flowered round pollen grained
 - 186 White flowered long pollen grained
 - 67 White flowered round pollen grained

Are these the expected results? If not explain why they are different.

4. It was discovered that flowers with long pollen grains have a medicinal quality. Discuss how you would determine pure breeding long pollen grained flowers to breed from for their special pollen.

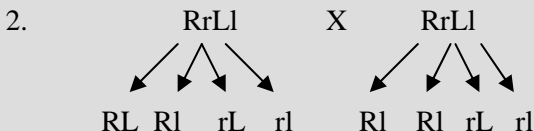
Answers.



	RL
rl	RrLl

Phenotype ratio: all Pink flowered with long pollen grains

Genotype ratio: all RrLl



	RL	Rl	rL	rl
RL	RRLl	RRLl	RrLL	RrLl
Rl	RRLl	RRll	RrLl	Rrll
rL	RrLL	RrLl	rrLL	rrLl
rl	RrLl	Rrll	rrLl	rrll

Phenotype ratio:

3 red flowers long pollen grained (RRL₋)

1 red flower round pollen grained (RRll)

3 white flower long pollen grained (rrL₋)

6 pink flower long pollen grained (RrL₋)

2 pink flower round pollen grained (Rrll)

1 white flower round pollen grained (rrll)

3. The expected ratio for this cross is shown above (3:6:1:2:3:1) or 188: 375: 62: 125: 188: 62. This ratio rarely occurs because fertilization is a chance event. The smaller the number of offspring the less likely the ratio will occur as a result of chance. Other factors maybe operating to affect the ratio e.g. natural selection.
4. Carry out a test or back cross, crossing the long pollen grained flowers (that you want to know is pure breeding), with a round pollen grained flower and examine the offspring. If any offspring have round pollen the long pollen grained parent wasn't pure breeding, it is heterozygous and should not be used for breeding purpose. Punnet square 1. If all the offspring are long pollen grained with no round produced then the offspring must be pure breeding (homozygous) and you want to use this plant for breeding. Punnet square 2.

Punnet Square 1

	L	l
L	LL	Ll
l	Ll	ll

Some round pollen produced, so parent was not pure breeding it was heterozygous. Don't use for breeding.

All offspring are long grained so the parent is pure breeding. Use this plant for breeding.

Punnet Square 2

	L	L
L	LL	LL
L	LL	LL