Test Cross & Back Cross

Aim:-Experiments on test cross and back cross ratio and deducing the applicability of Mendelian laws (three examples of each ratio).

Introduction:-

The characteristics of the offspring of Mendel's crosses can be predicted from the genotype of the parents through knowledge of dominant and recessive genes i.e., TT for tall and tt for dwarf traits. Mendel wanted to know whether the genotype of the individual be determined just from its phenotype. For recessive phenotype, it is possible, because it has only one genotype for example, tt for dwarf trait. But, the phenotypically dominant individuals show two types of genotypes – homozygous dominant (TT) and heterozygous dominant (Tt). In order to determine the genotypes of such phenotypes, Mendel employed two types of crosses viz., back cross and test cross. Without the knowledge of the genotype, just by crossing experiment, one can determine the genotype of the given phenotype with the help of these crosses.

Back Cross:-

Backcross is a cross of a hybrid (F1) with any one of its parents i.e. homozygous dominant or homozygous recessive parent.

1. Monohybrid Back Cross:-

In a monohybrid cross of homozygous tall (TT) and homozygous dwarf (tt) pea plants, the F1 progeny are heterozygous tall (Tt). When the F1 heterozygote (hybrid) is crossed either with its dominant parent or with its recessive parent, it is known as back cross and the results obtained from such a cross is as follows:-

	T	T
t	Tt	Tt
t	Tt	Tt

All offspring will be TALL

	T	t
t	Tt	tt
t	Tt	tt

50% will be TALL
50% will be SHORT

Problems:-

1) A man with brown eyes (his father had blue eyes) marries a brown-eyed women (her mother had blue eyes), what is the proportion of children would be expected to have blue eyes? (The brown color is dominant).

2) A right handed man marries a left handed women & produce left handed children. Write the complete cross (right hand is dominant)

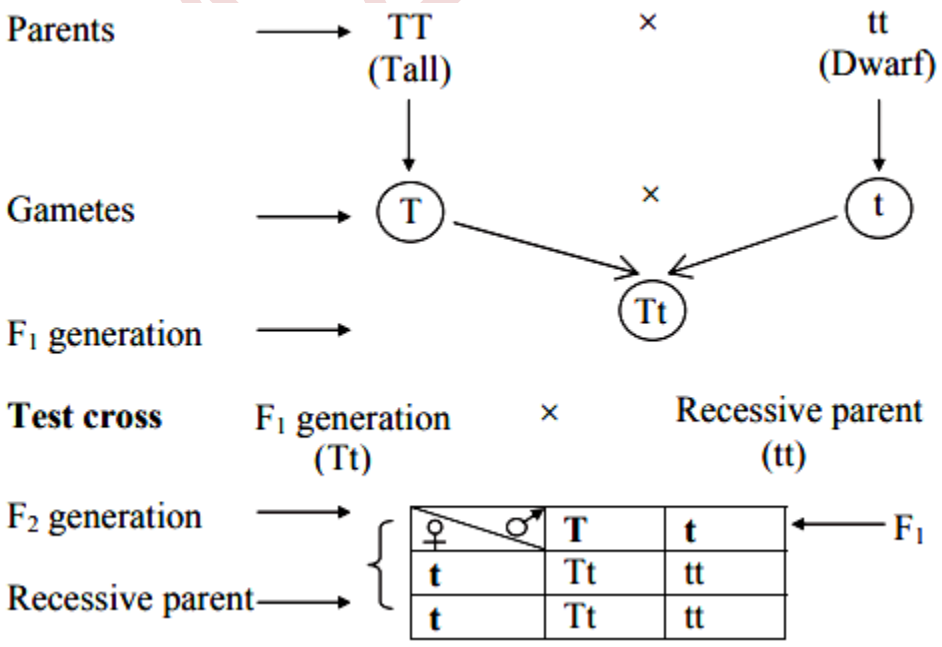
Result:-

Conclusion:-

When F_1 hybrid is crossed to a homozygous dominant parent, all progeny will be dominant in phenotype.

When F_1 hybrid is crossed to a homozygous recessive parent, 50% of progeny will be dominant and 50% will be recessive. Thus, dominant (tall) and recessive (dwarf) phenotypes appear in 1:1 ratio.

Test Cross:- Test cross is a cross of a hybrid (F1) with its parents homozygous recessive parent. To make a test cross, the organism whose genotype is being tested is crossed with an organism that is homozygous recessive for that trait. Every offspring from such a mating would receive one recessive allele from the homozygous recessive parent.



Problems:-

1) In fruit flies, red eyes are dominant over brown eyes.

a. Give the phenotypes (physical eye color) of the flies involved in your test-cross:

_____ X _____

b. If the two flies have 400 offspring that all turn out to be red-eyed, what would be the genotypes of the flies used in your test-cross? (Use "R" and "r")

_____ X _____

Complete the cross on the right:

What percentage is heterozygous? = _____%

What percentage shows the dominant trait? =_____%

2) Let's say you decide to become a sheep farmer. In sheep, black fur is dominant to white fur. Since black sheep coats cost more than white sheep, you decide to only raise black sheep. Everything is going well but the guy you bought your sheep from seemed a little crooked! You want to make sure they are pure breeds so you run a test-cross.

a. Give the phenotypes of the sheep in your test-cross:

_____ X _____

b. In your first test-cross, 30 out of 60 offspring are black and the rest are white! What are the genotypes of the sheep used in your test-cross? (Use "B" and "b")

_____ X _____

Complete the cross on the right:

What percentage is heterozygous? = _____%

What percentage shows the dominant trait? =_____%

Result:-

Conclusion:- If an offspring received a recessive allele from the other parent as well, then it would show the recessive phenotype. From these results we know that the other parent was hybrid and not pure for the dominant characteristic. If the offspring does not receive a recessive allele from the other parent, then it will show the dominant phenotype.