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Subject Biology

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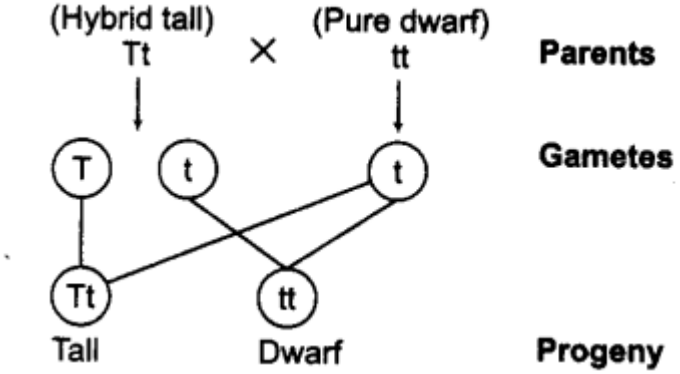
Principles of Inheritance and Variation –

13. Multiple allelism It can also be explained by ABO blood grouping. In this case, more than two, i.e. three alleles are governing the same character. Multiple alleles can be found only when population studies are made since, an individual can have only two alleles.

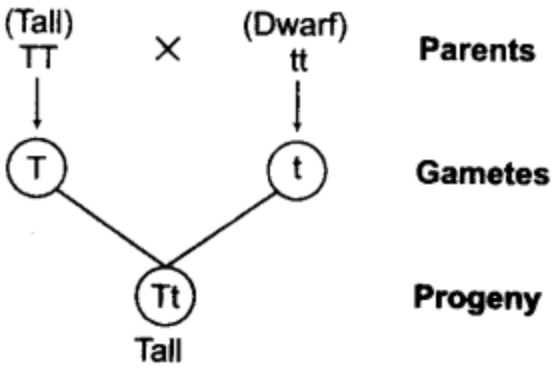
14. Test cross It is a method devised by Mendel to determine the genotype of an organism. A cross is made of unknown dominant genotype with the recessive parent.

(i) For example, Fj hybrid (Tt) heterozygous of a pure tall plant (TT) and a pure dwarf plant (tt) is crossed with a pure dwarf plant.

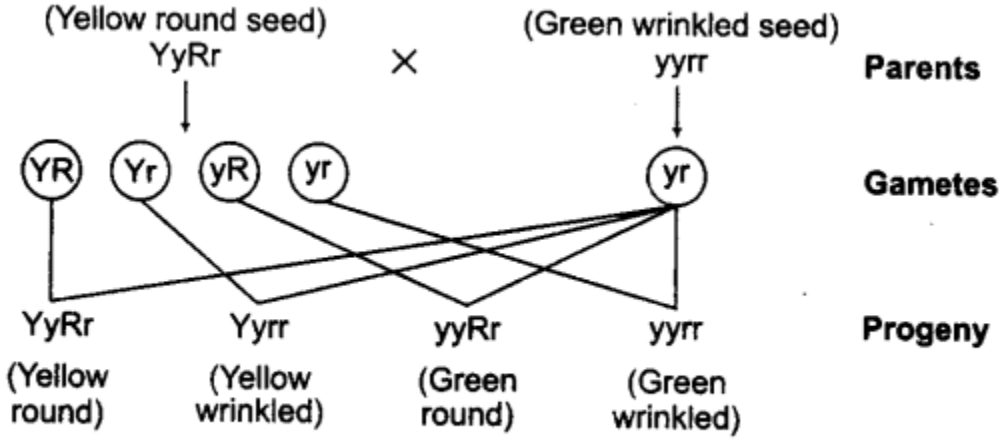


In this example, the progeny consists of tall and dwarf plants in the ratio 1:1. Thus, monohybrid test cross ratio is 1:1.

(ii) In case of both homozygous parents, i.e. TT, the progeny obtained will have to tall plants. (Tall)



(iii) In case of dihybrid test cross, where two traits are taken, a heterozygous individual is crossed with a homozygous recessive parent.



The dihybrid test cross ratio comes as 1 : 1 : 1 : 1.

15. Pleiotropy It is the phenomenon in which a single gene exhibits multiple phenotypic expressions. A single pleiotropic gene may produce more than one effect.

For example,

(i) Phenylketonuria, a disorder caused by mutation in the gene coding the enzyme phenylalanine hydroxylase. The affected individuals show hair and skin pigmentation and mental problems.

(ii) Starch synthesis in pea seeds is controlled by one gene with two alleles (B and b).

(a) Starch is synthesised effectively by the homozygotes, BB and hence, the starch grains are large and the seeds at maturity are round.

(b) The homozygotes, bb are less efficient in starch synthesis, hence they have small starch grains and the seeds are wrinkled.

(c) The heterozygotes, Bb produce round seeds, indicating that B is the dominant allele, but the starch grains are intermediate in size and hence, for the starch grain size, the alleles show incomplete dominance.

(d) It is an example of pleiotropy as the same gene controls two traits, i.e. seed shape and size of starch grains.

(e) Here, it is to be mentioned that dominance is not an autonomous feature of

the gene or its product, but it depends on the production of a particular phenotype from the gene product.