RAMA UNIVERSITY

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FACULTY OF AGRICULTURAL SCIENCES AND ALLIED INDUSTRIES

PENETRANCE AND EXPRESSSIVITY

PENETRANCE

The ability of a gene to express itself in all the individuals which carry it in the appropriate genotype (complete penetrance)

Many individuals fail to do so (Incomplete penetrance)

It is the 1% of individuals who carry the gene in proper combination to permit expression.

If a dominant gene is expressed inonly 70% of the individuals, the penetrance of the gene would be 70%.

If a dominant or recessive gene in a homozygous state always produces a detectable effect, it is said to have "complete penetrance". If dominant or homozygous recessive genes fail to show phenotypic expression in every case, it is called ' incomplete' or 'reduced penetance".

EXPRESSIVITY

The degree of phenotypic expression of a gene in the different individuals it may be uniform or variable.

e.g. In man poly dectytous condition may be penetrated in left hand (6 fingers) and not in the right (5 finges) or it may be penetrant in the feet and not in the hand.

Expressivity of a gene is influenced by termpvating nutrition etc. The character that develop thus depend upon the genotype as well as upon the environment. It is evident that, the expression of genes depend upon the environment in which the organism develops.

PLEIOTROPISM

A single gene may sometimes affect more than one chracteristics fo the organism eg. In cotton, Punjab hairy lintless gene ' lic'. It produces;

i. Seeds which are without lint.
ii. In complete laciniation of the bay
iii. Reduction in the number and length of internodes
iv. Reduction in boll size and fertility.

When a gene courses changes in two or more parts or characters that are not obviously related, the gene is called 'pleiotropic gene'.

Multiple or marigold phenotypic expression of a single gene is called 'pleiortropism'.

MULTIPLE ALLELES

Many genes have two alternative forms but some have more than two alternative forms. More than two alleles at the same locus gives rise to a multiple allelic series. It can be defined as a series of forms of genes situated at the same locus homologus chromosome.

The effect similar parts of processes.

The number of possible genotypes in a sew's of multiple alleles is calculated from the formala.

1/2 [n x 1 (n+1)]

Features

1. Multiple alleles are always at the same locus in the homologus chromosome.
2. There is no crossing over with in a multiple allelic series. When two alleles are involved in a crosss, the same two alleles are recovered in the F12 or test cross progeny.
3. Multiple alleles always affect the same characters.
4. The wild type allele is naturally always dominant.

e.g. 1. Colour corolla in Asiatic cotton

Full yellow ⟶ YY, YY^{p} < Yy

Pale ⟶ $Y^{p}Y^{p}$, $Y^{p}y$

White ⟶ yy

Degree of dominance Y > Y^{p} > y

eg.2. Coat colour in rabbit, mouse, rat, guinea pig and cat.

C^{+} ⟶ Agousi - Full colour (Black)

C^{ch} ⟶ Black + Grey hair

C^{h} ⟶ Himalayan- white hairs except nose, ear,feet and tail (where it is black)

e ⟶ Albino - Complete white.

C^{+} > C^{ch} > C^{h} > e - Degree of dominance.

eg. 3. A-B-O blood group in human beings three allels I^A . I^B, I^O, Where I^A and I^B are codomiant. (I^A = and I^B) > I^o

Genotype	Phenotype
I^A I^A , I^A I^O	'A' group
I^B I^B, I^B I^0	'B' group
I^A I^B	AB group
I^o I^o	'O' group.

PSEUDO ALLELES

Non allele so closely linked as often inherited as one gone, but are separate from each other. (by cross over studies).

These effects are found in Drosophila, corn, cotton, bacteria, Vrisues.

ISO ALLELES

Usually wild type alleles (respresented as +) is dominant over its recessive allels. In some natural populations different wild type allels affecting the same character were found and these wild type alleles had similarallelic dominance or they may differ in their degree of expression, that could be detected in special combinations. Such alleles are called ' Iso allels".

eg. Drosphila - different dominant alleles on red eye 3 wild type alleles. They are alike in homozygous conditions and their difference appeared only in special combination.