

Q. Define Hybrid Vigour or Heterosis? Discuss its mechanism and point out the practical application of Heterosis.

INTRODUCTION → The advantage of cross breeding in plants was known as early as the 18th century. Several workers such as Adreubes (1773), Sprengel (1793) and Darwin (1876) have recorded the advantages of cross pollination and favoured cross hybridization as a means for survival of a species. This observation were biologically exploited by the modern scientist. Shull (1909) recorded that hybrids between inbreds of diverse percentage generally give greater hybrid vigour than that shown by hybrids between inbreds derive open pollination variety. These finding have been confirmed by other workers. They have been used in the commercial production of hybrid corn, onion, alfa-alfa, cabbage, sugarcane and also in animals like cow, buffalo, sheep and others.

DEFINITION → It is the phenomenon in which hybrid show supple superiority over the parents in quantitative characters.

The term Heterosis was coined by Shull (1914). The hybrid

vigour and heterosis are practically synonymous.

According to Whaley (1944) hybrid vigour denotes the manifest effects of heterosis.

Manifestations of Heterosis → Hybrid vigour or heterosis can be manifested in many ways such as -

1. Excessive size,
2. Increase in productivity,
3. Increase in morphological characters such as number of nodes, leaves and panicles.
4. Greater resistant to diseases and insects.
5. Increase tolerance to climatic conditions.
6. Increase in yield.

Genetic basis of Heterosis → There are several hypothesis to explain hybrid vigour of which two of them are the most important.

- ① Dominance hypothesis.
- ② Over dominance hypothesis.

① Dominance hypothesis → It was first proposed by Davenport (1908) and then by Bruce and Keeble (1910). According to this hypothesis the inter crossing of inbreds give hybrids having deleterious recessive of one parent by

dominant alleles contributed by the other parent. This results in hybrid vigour. The crossing of inbreds bring together the dominant genes of the parents that give rise to vigour to the hybrid.

~~Demerits~~ → Demerits →

1. The individual homozygous from all dominant genes have not being obtained in hybrid figure.
2. If heterosis was solely due to dominance of independent factor, the F_2 distribution curve should be skewed.

② **Over dominance hypothesis** → It was proposed by Shull and East (1908) independently. It suggest that there are L_{osi} at which the heterozygote is superior to either homozygote and that vigour increases in proportion to the amount of heterozygosity.

This hypothesis has been variously name such as single gene hypothesis, cumulatively action of divergent alleles, stimulation of divergent alleles. Fisher (1930) has called it super dominance.

It can be explain to a simple example - Later suppose the heterozygous combination $a_1 a_2$ at a single locus is superior to either of the homozygous combination $a_1 a_1$,

and $a_2 a_2$. This implies that a_1 and a_2 perform different functions and some of their different products is superior to the single product produced by either allele in homozygous state.

East (1936) elaborated the idea by giving interallelic series of growth factors hypothesis. It proposes the presence of a series of alleles $a_1, a_2, a_3, a_4, \dots$ of gradually increasing divergent function. The heterozygotes were postulated to become increasingly more efficient as these components alleles were more divergent.

In most cases, both the hypothesis lead to same expectation.

Application of Heterosis → Heterosis has been exploited at commercial scale both in plants and animals.

1. Several hybrid plants have been obtained greater yield. This include hybrid corn, hybrid sugar etc.
2. It has been exploited in crop plants, ornamental and fruit crop commercially.
3. It is more important in vegetatively propagated perennial plants.
4. It has been also exploited in commercially important animals such as cows, buffalows, sheep and others.