

Programme: Bachelor of Science

Subject: Botany

Paper Code: BOC 108

Paper Title: Cytogenetics and Plant Breeding

Unit: X

Module Name: Quantitative Inheritance: Inheritance of
Kernel Colour

Module No: 54

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- **Introduction: Quantitative Inheritance of Kernel Colour**
- A whole grain or seed of a cereal plant such as corn, wheat, barley, etc., is called kernel.
- Kernel colour in wheat is a quantitative trait and its inheritance was studied by Swedish geneticist H. Nilsson– Ehle for the first time in 1908.
- **Quantitative Inheritance of Kernel Colour**
- When H. Nilsson– Ehle crossed a certain red strain to a white strain, he observed that the F₁ was all light red and
- that approximately 1/16 of the F₂ was as extreme as the parents, i.e., 1/16 was white and 1/16 was red.
- He interpreted these results in terms of two genes, each with a pair of alleles exhibiting cumulative effect
- **Quantitative Inheritance of Kernel Colour**
- When H. Nilsson– Ehle self crossed the F₁, he observed that approximately 1/16 of the F₂ was as extreme as the parents, i.e.,
 - 1/16 was **white** and
 - 1/16 was red.
- He interpreted these results in terms of two genes, each with a pair of alleles exhibiting cumulative effect
- **Cross 2: For F₂**
- **Cross 2**
- **Phenotypic Ratio: 1:4:6:4:1**

1 - Darkest Red

4 – Dark/ Dark Red

6 – Light / Light Red

4 - Intermediate / Medium Red

1 - White

- **Quantitative effect**
- Each of the contributing alleles A or B adds some red to the phenotype of kernel colour.
- Such that the genotypes of whites contain neither of these alleles.
- A red genotype contains only A and B alleles.
- These results have been shown in the images earlier.
- **Quantitative effect**
- Here five phenotypic classes are obtained in F₂;
- Each 'dose' of a contributing allele for pigment production *increases depth of colour*.
- At this stage one point should be clear that in case there were two genes involved, there would be obtained 15 : 1 ratio (15 coloured : 1).
- However, that is not the case. The 15 coloured have varied shades, because of the quantitative effect.
- **Phenotypic and genotypic ratios of F₂ generation of cross**

• Phenotype	• Genotype
• AABB	• Darkest Red
• AABb	• Dark / Dark Red
• AaBb	• Intermediate / Medium Red
• Aabb	• Light / Light Red
• aabb	• White

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- The cumulative effect of alleles A and B is thus understood.

- It can therefore be understood that, the increase or decrease of A and B cause variable phenotypes in F2 in the ratio of 1:4:6:4:1
- **Summary**
- Kernel colour in wheat is a quantitative trait and its inheritance was studied by Swedish geneticist H. Nilsson– Ehle for the first time in 1908.
- When he crossed a certain red strain to a white strain, he observed that the F1 was all light red and that approximately 1/16 of the F2 was as extreme as the parents, i.e., 1/16 was white and 1/16 was red.
- He interpreted these results in terms of two genes, each with a pair of alleles exhibiting cumulative effect.
- The F2 phenotypic ratio expressed is 1:4:6:4:1 with various intermediate shades of colour.