**Parents: Pr/Pr  Y/Y r/r (parent 1)   x    Pr/Pr  y/y R/R (parent 2)**

**What are the phenotypes of the parents**

Ans)

Let’s assume ‘Y’ for yellow endosperm color and y for white endosperm color; ‘R’ for colored aleurone and ‘r’ for colorless aleurone.

In corn, color is determined by 3 tissues, pericarp (Pr), aleurone (R) and endosperm proper (Y). Aleurone can be colored or colorless. Colorless aleurone (obtained by destruction of anthocyanins) is obtained if alleles are ‘cc’ or ‘rr’. So, parent 1 will have colorless aleurone. In such a condition, kernel color will be determined by endosperm proper. Therefore parent 1 will be yellow.

Pr will interact with R in parent 2 to give purple aleurone. So, parent 2 will be purple

**F1 genotype:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_F1 phenotype:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  
Ans. F1 genotype will be Pr/Pr Y/y R/r. F1 phenotype will be purple. Reason is same as given for parent 2 above.

**Draw a Punnett Square representing the F2 generation:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | PrYR | PrYr | PryR | Pryr |
| PrYR | PrPrYYRR  Purple | PrPrYYRr  Purple | PrPrYyRR  Purple | PrPrYyRr  Purple |
| PrYr | PrPrYYRr  Purple | PrPrYYrr  Yellow | PrPrYyRr  Purple | PrPrYyrr  Yellow |
| PryR | PrPrYyRR  Purple | PrPrYyRr  purple | PrPryyRR  purple | PrPryyRr  Purple |
| Pryr | PrPrYyRr  Purple | PrPrYyrr  yellow | PrPryyRr  Purple | PrPryyrr  white |

**Kernel color  
  
Observed: -** 12(purple):3(yellow):1(white)  
 **Expected: -**  9:3:3:1 **Difference   
  
Difference2  
  
Expected  
  
Purple:-** 9/16**Yellow: -**3/16 **White:-** 1/16 **Calculate the overall apparent ratio of the phenotypes. Which ratio does this most closely approximate?**The overall apparent ratio of phenotypes is 12:3:1 as shown in the Punnett square above. This ratio approximates dominant epistasis**.  
  
   
  
Do χ2 analysis to determine if this is really the ratio of the phenotypes. Explain your reasoning!**For Chi-square analysis, more data is required. You need to know the observed values. **What kind of epistasis is this? Explain why you do not see the usual dihybrid 9:3:3:1 ratio by relating the phenotypes you see to the genotypes in the Punnett Square you made.**This is known as dominant epistasis. We do not get the usual dihybrid ratio because of the interaction between dominant Pr and R alleles. None of the parents is having the recessive ‘pr’ gene. **Pr** gene interacts with R to give purple color. If recessive “pr” alleles interacted with R, then the color would be red, which is impossible in this case, because of absence of recessive ‘pr’ allele totally. **Corn Ear CG-65: Pr &amp; R genes  
  
   
  
Parents: Y/Y  Pr/Pr  R/R (**Parent X**)   x   Y/Y  pr/pr  r/r (**Parent Y**)  
  
 What are the phenotypes of the parents?\_**

Parent X will be purple.

Parent Y will be yellow.  
 **F1 genotype:** Y/Y Pr/pr R/r

**F1 phenotype:** purple **Draw a Punnett Square representing the F2 generation:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | PrYR | PrYr | prYR | prYr |
| PrYR | PrPrYYRR  Purple | PrPrYYRr  Purple | PrPrYYRR  Purple | PrprYYRr  Purple |
| PrYr | PrPrYYRr  Purple | PrPrYYrr  Yellow | PrPrYYRr  Purple | PrprYYrr  Yellow |
| prYR | PrprYYRR  Purple | PrprYYRr  purple | prprYYRR  red | prprYYRr  red |
| prYr | PrprYYRr  Purple | PrprYYrr  yellow | prprYYRr  red | prprYYrr  yellow |

**9purple: 4 yellow: 3 red  
  
Kernel color  
  
Observed:-** 9 purple: 4 yellow: 3 red  
 **Expected:-** 9:3:3:1 **Calculate the overall apparent ratio of the phenotypes. Which ratio does this most closely approximate?**As shown above, 9:3:4 ratio is found. **What kind of epistasis is this? Why? Devise a pathway which explains what you see &amp; correlate it to your Punnett Square.**

This is recessive epistasis. Because, the recessive “pr” allele is masking the effect of dominant ‘R’ allele making it red instead of purple.