

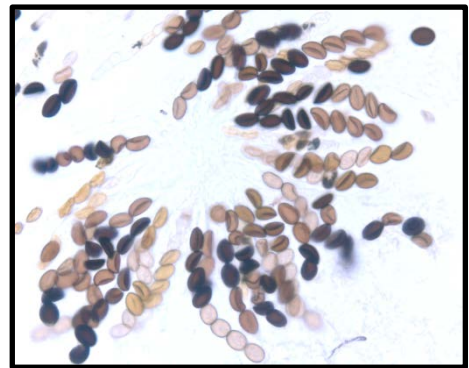


Genetics. 1st course in Biology

Laboratory Practice 3: Genetics of Ascospore Color in *Sordaria*.

INTRODUCTION

Tetrad analysis of meiosis and recombination is a procedure that allows an allele marker located on each chromatid of a synapsed tetrad to be followed through the entire meiotic process, including the events of recombination and crossing over if they occur. Two major types of important information can be obtained in this way. The first (using ordered tetrad analysis) allows identification of which two of the four chromatids actually participate in crossing over during recombination. The second allows the mapping of a gene marker relative to the centromere of the chromosome, thus positioning a gene on a chromosome relative to a directly observable cytological marker; i.e., the centromere. Once one gene is mapped to the centromere, all other genes showing linkage to that gene can also be assigned a relative position on the chromosome with respect to the centromere.



Sordaria spends most of its life cycle in a haploid vegetative state. However, under certain conditions, two haploid strains can be induced to undergo a sexual process in which they fuse to form diploid zygotes. Instead of dividing mitotically, these diploid zygotes almost immediately undergo meiosis to form haploid ascospores that are maintained in a linear order in the asci. Thus, the order of the chromatids within a tetrad of a diploid zygote is directly reflected in the linear order of the ascospores in an ascus.

In the 1950s Lindsay Olive initiated studies of ascospore colour mutants in *Sordaria*. They found that ascospore colour is autonomously determined by the genotype of the spore itself. Thus, segregation of alleles affecting spore color can be observed directly in the asci; each haploid spore's phenotype is determined by the spore-colour allele that it possesses. Because of the easily recognised phenotype of spore mutants and the ordered behaviour of their chromosomes during meiosis, both *Sordaria* and *Neurospora* have been very useful in studying linkage and the mechanisms of recombination

Objectives:

1. Analyse the results from a mating example with *Sordaria*.
2. Calculate the map distance between a gene and the centromere, given the frequency of the different types of asci resulting from the cross of two genetically different strains of *Sordaria*.
3. Deduce the situation of the chromosomes during meiosis in a particular cross.

Material provided to the student:

A set of microscope slides with various ascospores arrangements in the asci after being ejected from the perithecia. The asci came from a cross between a wild type strain (with black ascospores) and a *tan* mutant (that produce brown ascospores)

Procedure:

Examine the slide under low power and then under high power. What you observe should resemble Fig. 1 on the first page. Ejected from the crushed perithecium are many slender, saclike asci. Each ascus contains all of the meiotic products or ascospores produced when one diploid zygote underwent meiosis.

Collecting data:

You will note that the arrangement of grey and black ascospores differs in the various asci.

1. How many different arrangements do you find? _____
2. What are they? (In answering this questions, list the black spores as + and the mutant spores as g; e.g. ++++tttt is a common ascospore arrangement)

+						
+						
+						
+						
t						
t						
t						
t						

3. The different patterns of crossing over that produce the ascospore patterns that we can detect in these practical exercises have been explained in class. With this information, examine the slides and count the number of asci having each of the possible arrangements studied. The data will be added in a common table.

First division Segregation	Your data	Class data
Second division segregation	Your data	Class data

4. Calculate the map distance. _____

5. Draw the map of the chromosome region. _____

6. Draw an outline of the crossovers and chromosome situations that explain the origin of the asci _____ (it will be different for each group).

Bibliography

Mertens, T.R. and Hammersmith, R.L. "Genetics. Laboratory Investigations". Ed. Prentice Hall. Upper Saddle River, New Jersey 07458.