Amanda McNussen
Genetics BIO2450 E158 Tuesday
Prof. Michael Gotesman

Lab Report 2: Genetic Cross of *Sordaria fimicola*

Abstract: This experiment utilized two crosses of *Sordaria fimicola* strains to observe the genetic recombination that can occur during meiosis and lead to offspring that differ genetically from their parents.

Introduction: *Sordaria fimicola* are a species of fungi that belong to the phylum Ascomycota that are characterized by their sac like structure. All Ascomycota, including *Sordaria*, have an alternation of generations life-cycle. This lab is concerned with the sexual reproduction phase. *Sordaria* sexual reproduction occurs via the production of haploid spores called ascospores which are contained within a structure called the ascus. Each ascus holds eight ascospores that can be characterized by their phenotypic color. Wild-type spores are a dark color and mutant varieties are either tan or gray. Upon karyogamy, the fusion of nuclei from different mycelia, a diploid zygote is produced in the ascus. The zygote then undergoes meiosis producing four haploid nuclei that undergo mitosis and produce eight haploid ascospores. If crossing over has not occurred an ordered ratio of 4:4 of wild-type to mutant spore color is expected from a cross between strains. If crossing over did occur, deviations in ratio are expected. For example, 2:2:2:2 or 2:4:2 ratios may occur because of the swapping of genetic information during metaphase meiosis 1.

Meiosis, unlike mitosis, is able to produce genetically non-identical daughter cells. Both processes begin with one 2N cell, however, mitosis results in two 2N daughter cells and meiosis results in four daughter cells after meiosis I and II are complete. In *Sordaria*, following meiosis II the four daughter cells proceed through mitotic division resulting in a final count of eight cells produced. With the exception of mutations, there is no genetic variation during mitosis. In meiosis I there are two ways that the chromosomes can create genetic variation for their off spring. During prophase I of meiosis I, crossing over can occur, or the swapping of genetic information between parental homologous chromosomes. In metaphase 1 of meiosis 1, the homologous pairs line up at the metaplate and each chromosome is equally likely to be found on one side of the midline. Consequently, as the pairs separate during anaphase I of meiosis I there is increased genetic variation in the resulting daughter cells. Variation is beneficial to populations because it enables adaptations to the environment that increase survival of that population.

Methods: *Part 1:* Working with a partner, students collected prepared cultures of three types of *Sordaria,* wild-type, mutant tan, and mutant gray, to make two cross plates in dishes containing agar. Each dish was divided into quadrants using a marker on the exterior of the dish. Cross plate 1 was marked wild-type and mutant tan in alternating quadrants and cross plate 2 was marked wild-type and mutant gray in alternating quadrants. Using a wooden splint, small cubes (about 0.5 cm) were cut from the stock culture dishes and placed in their respective quadrants. The dishes were incubated for 2 weeks.
Part 2: The genetic crosses between the wild-type and mutant strains were examined via microscope to determine if the asci show signs of genetic recombination based on the color distribution of spores. To view the asci, we scraped each cross plate near the quadrant divide where crossing over is most likely to occur and created a wet mount for each. To rupture the perithecia that contain the asci, the cover slips were gently pressed over the specimen. The sample from each cross was analyzed under the microscope to collect data on the ratio of spore color to determine if crossing over had occurred.

Results:

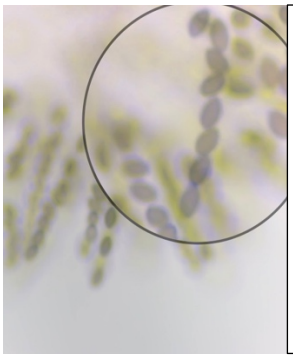

Image 1: attempted cross between *Sordaria* wild-type and mutant gray. There was no successful cross and therefore no crossing over occurred resulting in no heterosporic assortment.

Our cross between wild-type and mutant tan *Sordaria* looked like individual cells instead of 8 cells in an ascus likely due to breaking the sac while plating.

Discussion: The goal of this lab was to gather data on the number of asci where crossing over occurred and the number of asci where there was no crossing over in effort to calculate the percent of crossing over. From the percentage obtained we can then determine the map units, the gene to centromere distance, by dividing the percentage by two. Dividing by 2 accounts for the mitotic division that occurs after meiosis II in *Sordaria.* Unfortunately, our specimen were not viable samples and data could not be obtained.

References:

1. Department of Biological Sciences. “BIO2450L Genetics Laboratory Manual”. Lab handbook. New York City College of Technology. Print.