A Problem in Evolution

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A Problem
In Evolution

As we know, a process responsible for evolutionary changes is natural selection. The purpose of this experiment is to observe how populations may have changed by observing the frequencies of competing genotypes in Drosophila. This species is being used because of many experimental advantages: a relatively short generation time (about fourteen days), the fly is small enough for easy handling yet large enough to observe mutations, and it breeds easily — with a large number of offspring.

Of course in nature evolutionary changes occur quite slowly and are difficult to observe; however, using a population cage in the laboratory we should be able to observe changes and acquire some understanding of evolution in a much shorter period of time.

By placing a known number of heterozygote flies into a population cage, calculating the hypothetically expected figures and comparing this to the observed frequency, there should be statistical evidence for one phenotype outbreeding and outliving the other phenotype.

PROCEDURE
Building a populating cage.
Apparatus.
   a. polyethylene freezing box, quart size
   b. small vials with food
   c. cotton
   d. cork borer

With a cork borer make ten holes in the plastic box, two on each side and two on the top. Place a vial in eight of the holes and cotton plugs in the other two. Make sure the vials fit tightly so that no flies can escape.

Place about 40 pairs of heterozygote flies, 20 male and 20 female, into the populating cage.

Approximately eight days after the flies have been put into the population cage remove two of the food vials, replacing them with fresh vials. Many pupa will be crawling about. Cap the food vial with a cotton plug, set it aside, and let these pupa develop into adults. Kill the adults and count the number of each phenotype observed. This will be a sample of the first generation.

On the 14th day, being careful to knock all live flies into the popula-
tion box first, remove all the food vials. Replace with fresh vials. On the 22nd day remove two of the food vials, following the procedure used with the first two vials. This count will be a sample of the 2nd generation.

On the 28th day remove all the vials and replace with fresh ones. If time permits wait 8 days and take a sample count of the 3rd generation.

RESULTS

Calculate the ratio of flies you should have gotten and compare this with the observed ratio. Use the chi-square test to measure the discrepancy of the observed results from the hypothetically expected figure. From this test how can you best explain your results?

This experiment was designed to show selection under normal conditions. If enough flies are available keep another population cage at a lower temperature.

The information for this experiment was obtained from Experiments in Genetics With Drosophila by Monroe W. Strickberger. Any additional information you feel is needed may be obtained from this book.

FOOD MEDIA

74.3 ml water
1.5 gm agar
13.5 ml dark Karo syrup
10.0 gm yellow corn meal
.7 ml tegosept M (10% solution in 95% ETOH) Some other old inhibitor may be used. If so follow the directions for that particular inhibitor.

This will make enough for about 8 small vials.

Put the agar into cold water and dissolve by boiling. Add the Karo and again bring to a boil. Next add the corn meal and stir while the mixture is boiling until viscous (about 5-10 minutes). Be sure the mixture isn’t too fluid as it will not harden, nor too thick as it will be difficult to pour.

After the proper consistency has been reached, remove from the heat and add the mold inhibitor. Pour into the vials and cap with cotton plugs. After cooling to room temperature, store in the refrigerator until ready for use. Do not keep over two weeks.

When the vials are ready to be used cut some absorbent paper towel into 2 inch strips. Make a yeast suspension by dissolving some Fleischmans dry yeast in warm water. This will keep in the refrigerator until it no longer has a yeasty odor. Add a drop of the yeast suspension to the food medium. Then push the paper toweling down into the medium forming a depression.

TEACHER’S GUIDE

About a month before the students begin the experiment start breeding the flies. Make one stock culture of wild type flies and another of whatever mutant is chosen, depending upon what is available. Some suggested mutants are:

1. Kinky This is a dominant trait which affects the bristles, making them shorter. It is convenient to use because it has a pink peachy eye color associated with it, making it easily recognizable. The heterozygote has incomplete dominance showing half size bristles.
2. Pin This is also a dominant trait affecting the bristles by making them shorter.
3. Curly This is a dominant trait but lethal in the homozygote. The heterozygotes wings curl up.
4. Dichaete This is also a dominate trait, lethal in the homozygote. The heterozygotes wings are held to the side.

In this experiment it shall be assumed that the students are using the kinky mutant.

About two weeks before the students are to begin the experiment, make a cross between the Kinky and Wild fly to obtain the heterozygote which is to be used. About two stock bottles should suffice for the average class. Place ten to twelve pairs of flies in each bottle, using Kinky males and wild virgin females.

In determining the number of flies to put into the population cage 5 pairs per food vial is considered best. However not having this many flies, the number of flies per food vial could be cut down, less food vials could be used, or a smaller population cage could be used.

Representative to UMREL

President Chelleveld has appointed Dr. Robert Yager to continue as the representative of the Academy on the Iowa Council for the Upper Midwest Regional Educational Laboratory. Dr. Yager represented the Academy last year as this new regional agency began its operation. The headquarters for UMREL is in St. Paul. The states involved are Iowa, Minnesota, Wisconsin, North Dakota, and South Dakota. Several Academy programs may appear in proposals for possible funding through UMREL.

Board of Directors Meet

The fall meeting of the Academy’s Board of Directors occurred on November 5 in Iowa City. The minutes of this meeting are to be circulated to the entire membership at a later time.

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