Mealworm Metamorphosis: Effect of Temperature

Learning Objectives:

1. Observe the development of mealworms.
2. Explore how temperature affects mealworm development.

Background:

Mealworms exhibit complete metamorphosis. The four stages of development include: egg, larva, pupa, and adult. Adult beetles begin laying eggs a week to ten days after they emerge. Eggs may hatch in a week. Larval development is influenced by temperature, food quantity and quality, access to water, and crowding. At 30E C and 55% relative humidity, mealworms require 80 days from hatching to pupation and adults emerge three or four days later. The adults will live about two months.

Mealworms, like all insects, are are cold-blooded organisms and so changes in the environment affect the rate at which physical changes occur. Normally, increases in temperature speed up the rate of change. Rapid development is due to an increase in metabolism and hormone action brought about by the increased temperature.

Mealworms are easily reared on bran (breakfast cereal will do). Whatever food source is used, place an inch or two in the bottom of the container. A shoebox or terrarium can easily accommodate several hundred. Occasionally adding a piece of raw potato or apple will provide the mealworms with a sufficient moisture source.

Student Activity:

1. Develop a hypothesis to predict how an increase or decrease in temperature may affect the length of time needed for a larva to become an adult.

2. Divide the students into groups of 3 to 6 students. Each group needs 9 vials:

    vial 1,2,3 - labeled Temperature 1 (room temperature)
    vial 4,5,6 - labeled Temperature 2 (refrigerator)
    vial 7,8,9 - labeled Temperature 3 (85 degrees)

3. Place a single larva in each of the vials and add a foam plug to each. Push the plug half way into each vial. Add 1 to 2 tsp of bran meal to each vial.

4. Place all vials in their appropriate temperature location.

5. Check vials for the presence of adult mealworms. Once an adult mealworm is observed in a vial, record the number of days since the experiment began.

6. After all adults have emerged, collect the data from each group and calculate an average time for adult emergence at each temperature. Average time is determined by dividing the total number of days by the total number of emerged adults.

Results

Vial Temperature	Rep	Date Started	Date of Adult Emergence	Number of days
Room Temperature	1			
Room Temperature	2			
Room Temperature	3			
Average				
Refrigerator	1			
Refrigerator	2			
Refrigerator	3			
Average				
Growth Chamber (85 F)	1			
Growth Chamber (85 F)	2			
Growth Chamber (85 F)	3			
Average				

Conclusions

1. How was the rate of development affected by temperature?

2. Why do you think that temperature influenced the rate of development?
3. Did your results support your hypothesis? Why?

Additional Inquiries:

- Examine your mealworm carefully. Can you tell where your mealworm's head is? How many legs does it have?
- Examine the way your mealworm moves. Place your mealworm on the table. How far does it move in 1 minute? Take several readings and get an average.
- Place your mealworm on different types of surfaces (sandpaper, carpet, wood, aluminum foil) and measure the distance it travels in 1 minute. Take several readings and get an average for each surface. Which surface provides the easiest movement? The most difficult?