BIOLOGY GUIDE &

OBSERVATION KIT

MEALWORMS

FLUKER'S®

ESTABLISHED 1953

WWW.FLUKERFARMS.COM

INTRODUCTION

In this guide we will explore the yellow mealworm, Tenebrio molitor. These beetles are believed to be indigenous to Europe. They were introduced into the United States around the time of the Revolutionary War. By the early 1800's, mealworms were being raised as a food source for pets, especially birds. Over the years, mealworms have escaped into the environment and are now commonly found all over the world. Here in the United States, they are more likely to be found in the northern states as a grain and stored product pest because they prefer cooler climates.

Tenebrio molitor is a species of darkling Beetle in the family Tenebrionidae. They belong to the order Coleoptera (see figure 1.1). Coleoptera is the largest order in the class Insecta. Like all holometabolous insects, Tenebrio molitor go through four life stages: egg, larva, pupa and adult. The larva of the adult beetle is called a mealworm. Students will enjoy being able to observe and identify all stages of their life cycle through the included Mealworm Life Cycle Observation Kit.

Included Materials:

- 25 or 35 – 2 oz. cups and lids
- 1 – push pin
- 50 – large mealworm larva
- Mealworm Rearing Medium

Getting Started:

With the included push pin, punch several holes in the lid. This will allow an adequate air supply. Place a small amount of mealworm rearing medium in the cup, just enough to cover the bottom surface. Place one large larva into the cup and seal with the lid.

Complete metamorphosis should take approximately 3 to 4 weeks, depending on the maturity of the larva. Ideal temperatures range from 80-85 degrees Fahrenheit. You will be able to observe Tenebrio molitor in each stage of its life cycle. The larva may not be in its last instar. If that is the case, you will see it molt when the cuticle is shed. Once pupation starts, you will observe the larva begin to curl up and change shape. This is the beginning of the pupal stage. Over the next 1 – 2 weeks signs of leg and wing development will appear. You will also notice the color begin to darken as they near the adult stage. When metamorphosis is complete the beetle will emerge. They will appear off white with brown points and within a few hours, will fade from light brown to black. Once your beetle is black, you will need to add a source of water (ex: produce or wet paper towel). Sample investigations, photographs, and an assessment are included in the kit.

SUGGESTED INVESTIGATIONS

ACTIVITY 1

Overview:

Students will observe their mealworm and record their observations on a data table.

Materials:

- Mealworm and bedding in 2 oz. cup
- Observation sheet

Directions:

Students will observe their mealworm weekly and record their observations. These can include descriptions of size, color, movement, and any other detail the student may deem important. Students should also try to identify the development stage the mealworm is in at the time of the observation. Continue to make weekly observations until the beetle emerges.

ACTIVITY 2

Overview:

Students will work through the steps of the scientific method to determine if a mealworm prefers moist or dry surfaces.

Materials:

- Mealworm
- Damp paper towel
- Dry paper towel

Directions:

Pose the question “Do mealworms prefer moist or dry surfaces?” Have students write a hypothesis and work with a group to determine the procedure they will follow to determine the conclusion. For example, students can gently place the mealworm on the damp paper towel and observe its reaction, then do the same on a dry paper towel. Another strategy may be placing the meal worm in between the dry and damp paper towel to see to which the mealworm moves. After conducting the experiment, students will write their conclusion, including an explanation of how they came to that conclusion.

SUGGESTED INVESTIGATIONS

ACTIVITY 3

Overview:

Students will create a line plot based on observations

Materials:

- Mealworm
- Metric ruler

Directions:

Each student will measure the length of their mealworm in millimeters. Create a class line plot and have students place their measurement on the line plot. Discuss the mode and any outliers. Smaller groups can create line plots and find the mean length of the mealworms for their group.

ACTIVITY 4

Overview:

Students will use a Venn Diagram to compare and contrast life cycle stages of the mealworm

Materials:

- Three circle Venn Diagram: label one circle “Pupa”, one circle “Larva”, and one circle “Adult”
- Samples of each stage of the life cycle
- Pictures or illustrations of each life cycle stage

Directions:

Students work in pairs or groups of three to compare and contrast the three stages of the mealworm’s life cycle.

SUGGESTED INVESTIGATIONS

ACTIVITY 5

Overview:

Students will use voice and perspective to write a postcard from the mealworm's point of view

Materials

- 5"x 7" index card, lined on one side

Directions:

Students will write a postcard as though they are the mealworm. Have them write a letter on the lined side of the index card to the mealworm's family, as though the mealworm is on vacation in the classroom. The postcard should include details about the setting and the activity that may not be the norm for a mealworm "in the wild". On the blank side, the student should illustrate a scene from the mealworm's "vacation".

ACTIVITY 6

Overview:

Students will display their knowledge of the life cycle

Materials:

- Blank sheet of 8 ½" x 11" paper

Directions:

Students will illustrate the life cycle of the mealworm. All four stages should be included, as well as appropriate labels and vocabulary.

MEALWORM OBSERVATION SHEET

WEEK	OBSERVATIONS	LIFE CYCLE STAGE
1		
2		
3		
4		
5		
6		

STANDARDS AND OBJECTIVES

Listed below are some of the 4th Grade Louisiana Science Level Expectations that are covered using Fluker's Mealworm Biology Guide and Observation Kit activities and assessment.

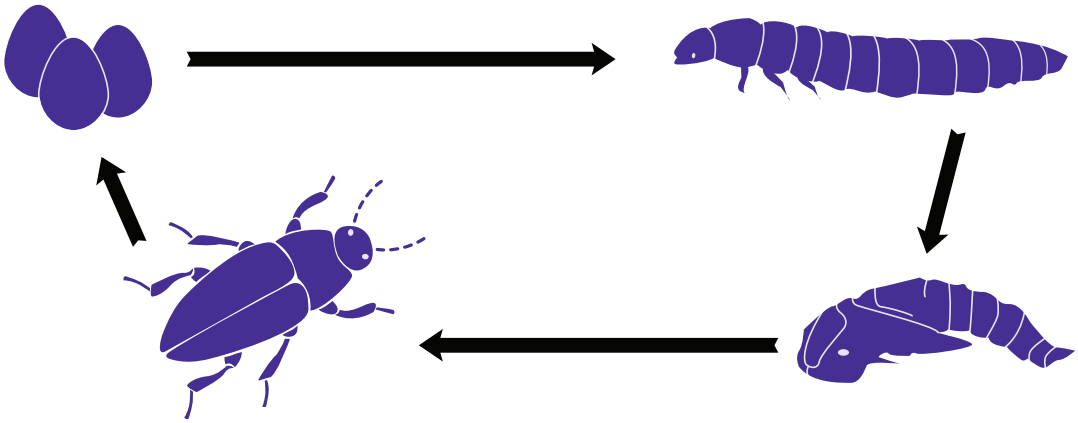
- Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
- Use observations to design and conduct simple investigations or experiments to answer testable questions (SI-E-A2)
- Predict and anticipate possible outcomes (SI-E-A2)
- Identify variables to ensure that only one experimental variable is tested at a time (SI-E-A2)
- Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
- Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
- Sequence stages in the life cycles of various organisms (LSE-B1)
- Compare similarities and differences between parents and offspring in plants and animals (LS-E-B3)

Listed below are some of the 4th Grade Common Core State Standards that are covered using Fluker's Mealworm Biology Guide and Observation Kit activities and assessment.

- Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why

OVERVIEW OF THE GROWTH AND DEVELOPMENT OF THE MEALWORM

Mealworms have indirect development, which means that the larvae do not resemble the adults. This type of development is termed complete metamorphosis. There are four stages of development: egg, larva, pupa and adult. Only the adults have wings and can reproduce. In this species, insects in the larva and adult stages are active during both the day and the night.



- **Egg:** The eggs are oval in shape and milky white in color with a slight shine. They are found singly or in a cluster. They are deposited directly into the rearing medium. The eggs are small, about 1.8 x 0.7mm. The incubation time at 80 degrees Fahrenheit is approximately 7 days.
- **Larval Stage:** The egg hatches into the first instar larva. After feeding, the larva molts into the next instar. At each molt, the cuticle is shed and a new, larger one is formed. The larvae eat and grow in each instar until the limit for that cuticle is reached, then molt again. The number of larval instars vary from *8-12; depending on temperature and available food. The duration of the larval stage is from a few weeks to several months depending on temperature. A full-grown final instar larva is about 30mm long and approximately 4mm in diameter.
- **Pupal Stage:** The full-grown last larval instar molts into a pupa. The pupa is quite vulnerable. They remain completely inactive and do not feed until the adult emerges. If rearing conditions are poor, the larvae and/or the adults will feed on the immobile pupa. During the pupal stage, the internal organs of the larva are digested and the adult internal organs develop. The color of the pupa is an off-white, grading into dark brown as they pupate. They are approximately 25mm long and 7mm in width. The duration of the pupal stage is approximately 6 days at 80 degrees F.
- **Adult Stage:** This is when the pupa emerges as a beetle. The adult male lives approximately 2 months, while the female lives 3 months. The mealworm beetles are prolific breeders. Mating starts within a few days after emergence and is repeated at intervals throughout the life of the beetle.

POSSIBLE ASSESSMENT

Use the following questions to supplement your assessments on the mealworm unit.

1. Name the four developmental stages of the mealworm.

2. Draw and label the life cycle of the mealworm.

3. Why do some insects, such as the mealworm, molt?

4. Your teacher asks you to determine if a mealworm prefers to be in an environment that is light or dark. What steps would you take to find out the answer for her? Include your question, hypothesis, materials and procedure.

5. Name one reason a mealworm burrows.

ABOUT THE AUTHOR

Dianne Moran
Instructor at University Laboratory School

Fluker Farms would like to thank Dianne Moran for helping us develop this biology guide resource.

Dianne Moran, a New Orleans native, is a fourth grade math and science instructor at University Laboratory School in Baton Rouge, Louisiana. She received her Bachelor of Science and Master in Education degrees from Louisiana State University and has taught for over fifteen years.

As an instructor at University Lab, she serves as the grade level chair and supervises student interns from LSU. She co-wrote a proposal that granted her fourth grade students forty iPads, and she has presented using iPads in the classroom at local conferences. Dianne organizes a school wide coat drive that benefits a local charity who donates the coats to school children in need.

Outside of school, Dianne and her children volunteer at Shepherd's Market , a client-choice food pantry. She is the swim team mom for her children's summer swim league and has coached her daughter's soccer team. When she's not busy with her three kids and their sporting events, she enjoys cheering for the Tigers!