

## A Beetle Family

### *Betsy Beetle Lesson 2*

By Heather Bird Jackson



Figure 1. Egg, 1<sup>st</sup> instar, 2<sup>nd</sup> instar, 3<sup>rd</sup> instar, prepupa, and pupa of the betsy beetle (Coleoptera: Passalidae: *Odontotaenius disjunctus*)

### Objective

Students will compare the life cycles of selected organisms (LS-E-B1)

**This lesson addresses the following LOUISIANA STATE GRADE-LEVEL EXPECTATIONS FOR GRADE 2. It can easily be applied to objectives for other grade levels.**

- Compare the life cycles of selected organisms (LS-E-B1)
- Describe inherited characteristics of living things (LS-E B3)

### Science as Inquiry objectives

- Recognize that a variety of tools can be used to examine objects at different degrees of magnification (SI-E-B3)
- Pose questions that can be answered by using students' own observations and scientific knowledge (SI-E-A1)
- Predict and anticipate possible outcomes (SI-E-A2)

- Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
- Measure and record length in both metric system and U.S. system units
- Select and use developmentally appropriate equipment and tools 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)

### Note for teachers

Preserved beetle and larvae specimens are provided through the LSU Scope-On-A-Rope program (Contact Adrienne Lopez at [alopez@lsu.edu](mailto:alopez@lsu.edu) or 225-578-7780). Please note that beetles are easy to raise in the classroom. Place beetles in large plastic containers with plenty of dead wood material. Keep the wood moist. If things go well, you will find beetle larvae throughout the summer. Pupae followed by red (immature) adults will start to appear in August and September.

The best situation is to have a single couple in each container. The problem is figuring out the difference between boys and girls. Betsy beetles are not sexually dimorphic, meaning the sexes look the same. I can identify them by peeking in the hole in the rear of their abdominal cavity (boys have a maroon red tip to their edeagus [analogous to the human penis]). This is not recommended without training because the beetle can be damaged. Alternatively, if the beetles are collected in the spring (May is the best month in Louisiana), they will probably be found in mating pairs – in which case you won't have to worry about it. These beetles are monogamous (have only one mate) and engage in an extraordinary amount of parental care.

### Materials

- SOAR (Scope-on-a-Rope, contact Adrienne Lopez at [alopez@lsu.edu](mailto:alopez@lsu.edu) or 225-578-7780)
- Optional: a large section of wood
- Multiple betsy beetles (see How to Live in A Log: betsy beetle lesson 1)
- Betsy beetle larvae, eggs and pupa (preserved specimens are available through Scope-On-A-Rope).

### Introduction for Students

Have students draw a family on a piece of paper. Tell them they have to do it as fast as they can (five minutes or less) and to include as many members of the family as they can. Tape or tack the pictures onto a board and have the students return to their seats. Look at the pictures. How many pictures have a baby? A grandpa? A teenager. Point out the different stages in human development. If pets are included, point them out, too. Tell the students that now they are going to learn about another type of family: a beetle family. They may be surprised to learn that beetles have just as many stages in their lives as humans do. Not only that, but the beetle they are going to learn about even has other animals that live with it, sort of like our pets.

Using a 1x lens, show students an adult betsy beetle. Tell the students that betsy beetles are excellent parents. Other beetles usually leave their eggs without even waiting for the eggs to hatch. Both the mother and father betsy beetle stay with the eggs until they hatch. Then they prepare food for their young and take care of them until their offspring become adults. What do young betsy beetle larvae eat? Their parent's frass (also known as poop). Sounds gross, but this is how the parents pass on important microorganisms that enable their offspring to digest wood (see pictures from previous lesson). The adults line the walls of the galleries with their frass, which serves the additional purpose of keeping conditions nice and moist. Sometimes when the young become adults, they will stick around to help take care of their younger brothers and sisters. No other beetle spends that much time with its young.

Ask students what they think betsy beetle babies look like? How big might they be? What color? Would the young be as hard as the adult? You might consider asking them to make a drawing – a hypothesis – predicting what beetle babies look like. I suggest this activity because it will give you an idea of how much they already know about insect life history. I suspect that many students will draw small adult beetles.

Using 1x lens show students an egg, larva, pupa, teneral adult (if available) and adult betsy beetle. "Teneral" simply refers to the fact that the adult is freshly eclosed (hatched) from the pupal state, and is not fully mature. Teneral passalid beetles are bright red, and their exoskeleton is softer than mature adults. The teneral adult is red, while the mature adult is black. The eggs, larvae, pupae, and tenerals are kept in 95% ethanol (science grade alcohol), and should not be removed.

*Question: Would they have guessed that these are all the same organism? How does the larva compare to their drawings?*

Pass out classroom set of beetles, larvae, and adults. Have students describe the differences between larvae and adults.



**Figure 2. The modified third leg of a larva. By scraping this leg against their body, larvae "talk" to their parents.**



Figure 3. Human and betsy beetle life stages. The picture of small larvae was taken by Dr. Kristen Baum.

Possible observations:

Larvae	Adults
Two pairs of legs (the third pair are modified and are used to make sounds to communicate with the parents – see Figure 2)	Three pairs of legs
Very soft	Very hard
White with orange head	Black
Thin and long	Wide
No antennae	Large antennae with 3 teeth (lamellae) on the end
Tiny mandibles	Large mandibles
No hairs	Red hairs on legs and head

Question: How does the life cycle of a betsy beetle differ from the life cycle of a human?

Possible answers:

Betsy Beetle	Human
Baby develops in an egg	Baby develops inside her mother
“Children” look very different from parents	Children look like mini-adults
Have an inactive stage between “childhood” and adulthood: pupal stage	No inactive stage

## Activity

Question: How does the size of the betsy beetle change throughout its life time?

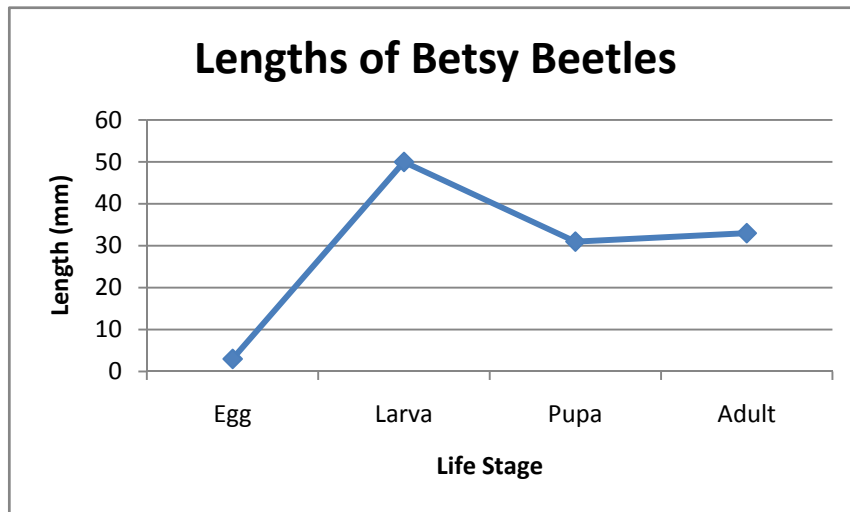
Measure the length (and possibly width) of betsy beetles at different life stages. To reinforce comparisons between English and metric systems, try both measuring systems.

Show students how to measure the larva and the adult with a ruler and record the lengths on the board. This can be done using the 1x lens of SOAR.

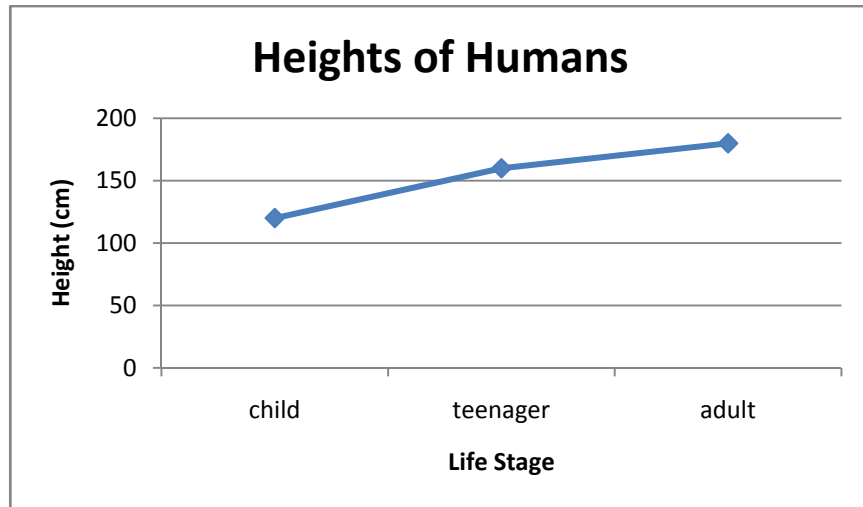
Measure a number of larvae and adults using a ruler. Larvae: measure from the tip of the rear end to the tip of the head. Students should not be allowed to remove larvae from containers, so their measurements will have to be estimated through the glass vials. Alternatively, you can give them the measurements for the larvae and have them measure the adults. Measure adults from the tip of the abdomen to the point of the horn. Depending on the capability of the students, students can do this themselves (or in groups) or with the direct assistance of the teacher.

There are not enough samples for all children to measure pupae and eggs, so perhaps the teacher can provide these data.

Students can make graphs of size over stage (see example below).



Suggested extra project: Find the sizes of a child, teenager, and adult. Choose humans of the same gender, since gender is related to height. Compare a graph of those sizes with that of a betsy beetle (see example below).



After creating a lot of these graphs, it may be apparent that humans grow steadily over time, while betsy beetles often decrease in length during pupation.