Insect Life Cycle and Timeline

Goal: Understanding that insects have complex life cycles which are often dependent on host plants. These complex interactions between host plants and some species of insects are important to understanding food webs.

Objective:

Knowledge- Students investigate complex insect life cycles to understand that insects' life needs must be met to produce more insects. Host plants are an important component of an insect's life cycle.

Skills- Students graph insect life cycles to compare the length of each stage and of the entire cycle.

Values- A diversity of plants is necessary to have a diverse food web and healthy/fit ecosystem.

Grade(s):4th

Special Safety:

VA Standards addressed: Science (2018) 4.2, 4.8 Math (2016) 4.4 , 4.5, 4.14

Materials:

- 5 field tapes (52 ft minimum)
- Lepidoptera information sheets (2 sets of each of the 5 organisms)
- Lepidoptera Data sheet (one per pair of students)
- Colored pencils/markers/crayons (red, yellow, green, blue)
- (2) Egg, Larva, Pupa, Adult signs for each organism (a total of 10 sets)
- 5 flags labeled with the same shapes as the different organisms.
- Pencils
- Dry erase board and markers
- Life cycle Tables (for reference)

Setup

- Weather permitting, pull out field tapes to 52 feet, placing them parallel to each other and securing the "0" end with a marked flag. Divid the class into 5 groups and then each group divided into two sets (partners or teams of 3).

Instructional Strategy:

1. Introduction
    a. Explain to students they will work in pairs. Ask: What does it mean to work with a partner? (Share responsibility, take turns, help, and be polite). Two sets of partners will be working on the same organism in order to make twice/double the observations with our research and to check each other's work.
    b. Inquire with students: Ask students to recall the stages of an insect life cycle. Generate an description of a complete insect life cycle (egg, larva, pupa, adult).
2. Modeling: Model the following process with the instructor edition Monarch Caterpillar information and data sheets. Explain to students that they will get their own type of butterfly to investigate and the monarch is an example for them.

Developed by Education Programs at Blandy Experimental Farm Boyce Va
www.virginia.edu/blandy 540-837-1758

a. Duration of life cycle:
    i. Students read over the Lepidoptera information sheet and record how long the organism spends in each stage in the little squares on the datasheet (show students).
    ii. Add the number of weeks the organisms spends in all stages together and record in the white center square.
b. On the datasheet, circle any stage during which the insect uses a host plant. (As time permits, you can ask what fraction of the time the organisms depends on the host plant.)
c. Instruct students to draw or describe the organism in its habitat and with its food of that stage.
    i. Not all stages will eat food, for example – do eggs eat food?
    ii. Many animals can only eat a few types of food, for example – what do Monarch caterpillars (larvae) eat (milkweed leaves)?
    iii. Other organisms eat from many sources of food – what do adult Monarch butterflies eat (nectar from many different flowers)?
    iv. Host Plant- a plant that an organism MUST use for a portion of its life cycle. Ex., milkweed is the host plant for Monarch eggs and larvae, but not the pupae or adults.
d. Partners decide which person will draw or describe which two stages of the cycle. The other individual should help them by reading the information.

3. Student Observations/Work:
    a. Students conduct activity using the process modeled above.
    b. Once complete, ask pairs to share the length of their organism's life cycle. Two are significantly longer than the others, but how long? Ask students how many days are in a year? (365). How many in a week? (7) How many weeks are in a year? (52)
    c. If students need help with determining this, work out the long division on a dry erase board with student help. If they do, check the response by multiplying 52*7. There should be a remainder of one day.
    d. Students then make a human graph. Give each group a set of place markers and tell students to find the matching flag (diamond shapes to diamond flag).
    e. Each group member will space themselves along a number line (field tape, with each foot representing one week). Starting at zero, move the number of weeks that the insect is in an egg and place the egg sign under the field tape. Another group member then adds the number of weeks the insect is a larva to this number and moves to that spot along the number line, places the larva sign, and so on. This will require some addition! The end point should match the "total length of the life cycle." Adult chaperones can really help with this!
4. Wrap up:
    a. Once student groups are arranged on the number line, discuss and compare the different lengths of time for each stage of development for each organism.
        i. Is the length of time the organisms spend in the egg portion of the life cycle roughly the same? Are they very different? (See Lepidoptera Information Sheets. A distinction that may arise is that some stages of life cycles occur at different TIMES of year but the time the organism is IN a particular stage is about the same. [For ex. All organisms are in the egg stage for 1-2 weeks except for the tussock moth which is in the egg stage for 33 weeks.]).
        ii. Are there any organisms that have very different times spent in any particular part of the cycle?
    b. Then compare the total length of each insect life cycle. Ask:
        i. Do each of the life cycles make up a year? Is a life cycle need to be the same as a calendar year?
        ii. Do insects follow the rules of a calendar year? Connect to the needs of the organism – what does it eat?
        iii. Is that food available all winter long?

5. Conclusions: As time allows, instruct students to find the following information on their data sheets and discuss the following questions. (See Data sheet.)
    a. **Host plant:** During which stage or stages is the organism on the host plant? (Usually egg and larva, sometimes pupa too.) How long, total, is it on the host plant? What fraction of its life cycle is the organism on the host plant?
    b. **Habitat:** Do students think they'll see the organism in their garden? Are the caterpillar hosts available in the garden or nearby? Are adult food sources available in the garden or nearby? What about habitat – can they overwinter in the garden? Draw out the conclusion that the garden will not be good habitat for all organisms, but it can host a diversity of residents – for example:
    c. **Other pollinators and garden residents:**
        i. Did we discuss all types of insects and their preferred plants? We only discussed lepidopterans/ i.e. butterflies and moths.
        ii. Based on what you know, do you predict that other insects will have life cycles that are the same? How will they be the same, how will they be different?

Extensions:

- Discuss other life cycles: bees, flies, cicadas, etc.
- Use a calendar to figure out when each stage of the cycle starts and ends. Calculate the number of days/weeks/months (division with remainders) and in which season each stage happens. Make predictions about the organism's needs and survival strategies during each stage.
- Each group can create a bar graph to compare the lengths of each stage. As a class, discuss and model how to label the axis on a dry erase board. Use colors that correspond to the colors used to represent each stage so far in the activity (egg – red, larva – green, pupa – yellow, adult – blue)
    - Groups can share their graph to compare the length of time each organism spends as an egg, larva, pupa, and adult.
    - Optional - compare the lengths of times for each stage (all eggs compare, all larvae compare, etc.) in the same manner as the total life cycle was compared.
- If time allows, share information how each organism spends the remainder of the year – have students discuss the way each species spends the winter (overwintering stages in bold on life cycle tables). What does each organisms need to survive this season without food? (e.g. Luna moths need beds of leaves.)

Developed by Education Programs at Blandy Experimental Farm Boyce Va
www.virginia.edu/blandy 540-837-1758

Name(s) _____

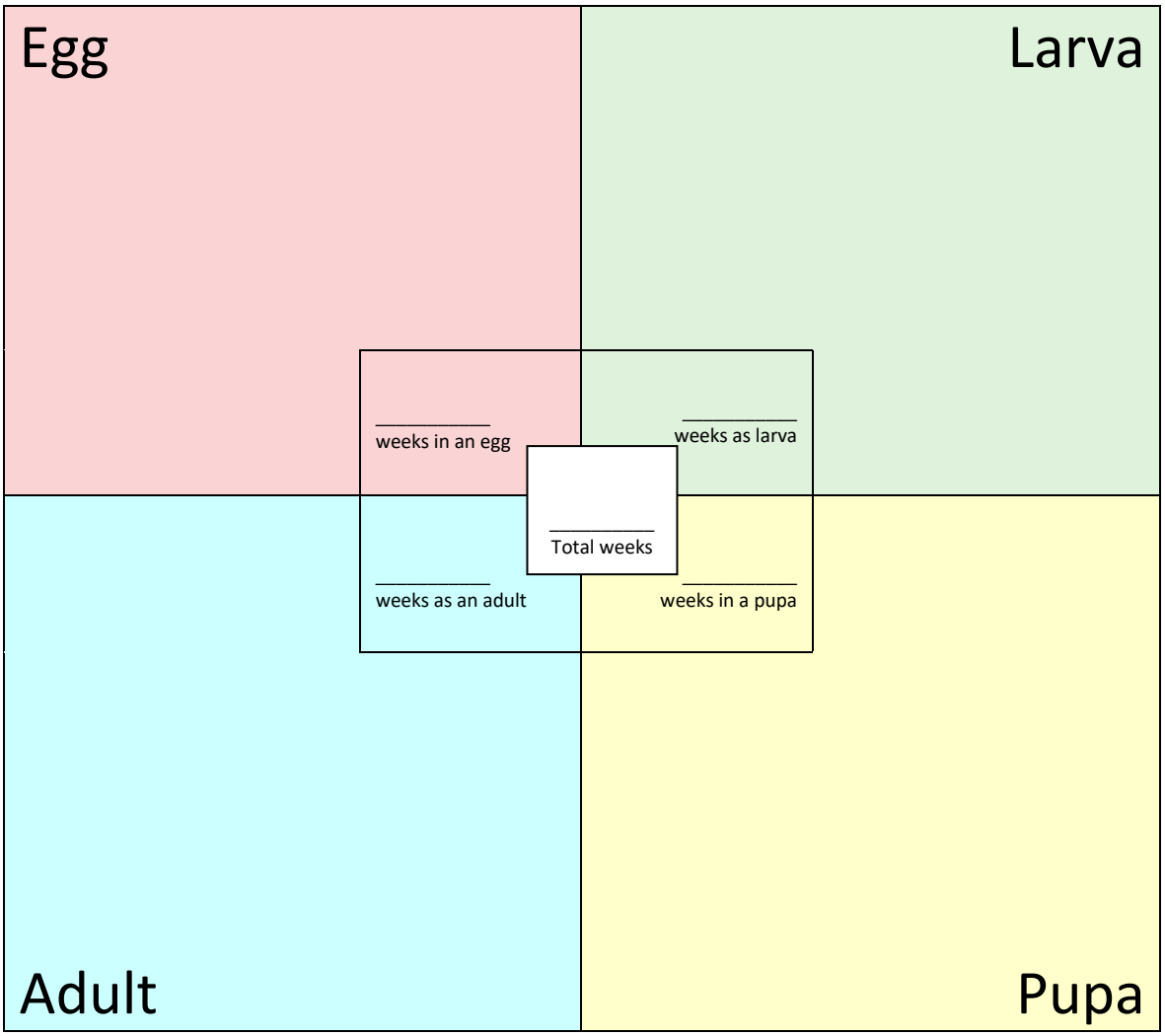
Lepidoptera (Butterfly and Moth) Life Cycle Needs

What is your organism? _____

What are its host plants? _____

Instructions:

1. Write how long each life stage is in the little boxes. Add them all together to get the total life cycle and write that in the white center box.
2. Draw or describe the animal during each life-cycle stage in its habitat and with its food.
3. Circle the name of all life-cycle stages that use the host plant.



1. What is a host plant? How is it important to an animal's life cycle?

2. What happens if the animal can't find what it needs during a life stage?

3. Do you think this animal will visit your pollination garden at school? Why or why not?

Developed by Education Programs at Blandy Experimental Farm Boyce Va
www.virginia.edu/blandy 540-837-1758

		Luna Moth	Mourning Cloak	Tussock Moth	Spicebush Swallowtail	Viceroy
Spring	Egg	2 weeks (hatch May 7)	2 weeks (hatch April 1)	**33 weeks (Hatch May 1)**	4 days (Hatch May 26)	1 week (Hatch June 14)
	Larvae	3 weeks	4 weeks	6 weeks	4 weeks	4 weeks
	Pupae	2.5 weeks	2 weeks	2 weeks	3 weeks	1.5 weeks
	Adult	1 week	**44 weeks**	1 week	1.5 weeks	3 weeks
Fall	Egg	2 weeks		1 week	4 days	1 week
	Larvae	3 weeks		6 weeks	4 weeks	**38 weeks**
	Pupae	**36 weeks**		2 weeks	**37 weeks**	1.5 weeks
	Adult	1 week		1 week	1.5 weeks	3 weeks

Bold dates are overwintering stage

Word bank, egg larva pupa, adult, host plant, weeks, year

Some Host Plants:

Trees: sweetgum, walnut, hickory, persimmon, poplar, elm, willow, cottonwood, oak, birch, locust, cherry

Shrubs: spicebush, sassafras

Flowers: Joe-pye, thistle

Developed by Education Programs at Blandy Experimental Farm Boyce Va
www.virginia.edu/blandy 540-837-1758

		Luna Moth	Mourning Cloak	Tussock Moth	Spicebush Swallowtail	Viceroy
Spring	Egg	Eggs are laid 4-7 at a time on the underside of host plant leaves.	Eggs are laid in ring clusters around a willow, poplar, or elm tree twig.	**Eggs are laid on top of the female cocoon and there can be up to 300 eggs**	Eggs are laid one-by-one on the underside of spicebush leaves	Eggs are laid on the ends of willow and cottonwood leaves.
	Larvae	Eat the leaves of sweetgum, walnut, hickory, and persimmon trees	Caterpillars stay together on a single plant. If a predator comes near, they all shake to scare it away.	Caterpillars eat the leaves of oak, birch, locust, cherry, and elm	Caterpillars eat spicebush and sassafras leaves.	Caterpillars eat the leaves of willow and cottonwood trees. Young larvae eat the leaf from the tip, and rest on the center vein.
	Pupae	Larvae wraps itself in a leaf and a single layer of silk to form a cocoon	Caterpillars crawl away from the host plant to pupate.	Cocoons' are formed under leaves and covered with the itchy hair of the caterpillar.	The chrysalis is formed on the stems of the host plant	The chrysalis looks like bird poop.
	Adult	Adults do not eat, only search for mates and lay eggs	**Adults feed on sap and decaying matter. Sometimes they eat flower nectar.**	Male adult moths are gray and fly at night. Female moths have no wings, and stay near their cocoon.	Adults drink nectar of joe-pye flowers and thistle flowers	Adults drink flower nectar, but also will feed on rotten fruit, carrion, and feces.
Fall	Egg	Eggs are laid 4-7 at a time on the underside of host plant leaves.	Only one generation per year	Eggs are laid on top of the female cocoon and there can be up to 300 eggs	Eggs are laid one-by-one on the underside of spicebush leaves	Eggs are laid on the ends of willow and cottonwood leaves.
	Larvae	Eat the leaves of sweetgum, walnut, hickory, and persimmon trees		Caterpillars eat the leaves of oak, birch, locust, cherry, and elm	Caterpillars eat spicebush and sassafras leaves.	**Young caterpillars spend the winter in a tube they make on the center rib of a leaf.**
	Pupae	**Larvae wraps itself in a leaf and a single layer of silk to form a cocoon. The cocoon spends the winter under piles of leaves.**		Cocoons' are formed under leaves and covered with the itchy hair of the caterpillar.	**The chrysalis is formed on the stems of the host plant**	The chrysalis looks like bird poop.
	Adult	Adults do not eat, only search for mates and lay eggs		Male adult moths are gray and fly at night. Female moths have no wings, and stay near their cocoon.	Adults drink nectar of joe-pye flowers and thistle flowers	Adults drink flower nectar, but also will feed on rotten fruit, carrion, and feces.

Developed by Education Programs at Blandy Experimental Farm Boyce Va
www.virginia.edu/blandy 540-837-1758

VICEROY

Host plant

egg

larva

pupa

SPICEBUSH SWALLOWTAIL

Host plant

egg

larva

pupa

Viceroy			
Stage	**Time**	**Habitat**	**Food**
egg	1 week (Hatch June 14)	Eggs are **laid on the ends of leaves of host plants** (willow trees, cottonwood trees)	Does not eat in this stage
larva	4 weeks	Larvae rest on the center leaf vein of **host plants** (willow trees, cottonwood trees)	**Larvae eat leaves of host plants** (willow trees, cottonwood trees)
pupa	1.5 weeks	The chrysalis forms **away from the host plants** and looks like bird poop.	Does not eat in this stage
adult	3 weeks	Adults prefer to stay near wet, marshy areas, but can fly to find food.	Adults drink flower nectar, but also will feed on juices from rotten fruit, dead animals, and scat.

Spicebush Swallowtail			
Stage	**Time**	**Habitat**	**Food**
egg	1 week (Hatch May 26)	Eggs are laid one-by-one on the **underside of leaves of their host plant**, spicebush.	Does not eat in this stage
larva	4 weeks	Caterpillars look like bird poop when little, and like snakes when they get big.	Caterpillars eat the **leaves of their host plant**; spicebush.
pupa	3 weeks	The chrysalis is formed on the **stems of the host plant (spicebush)**	Does not eat in this stage
adult	1.5 weeks	Adults prefer open areas near the forests with the caterpillar host plant: spicebush.	Adults drink nectar of joe-pye, thistle, and other flowers.

TUSSOCK MOTH

Host plant

egg

larva

pupa

LUNA MOTH

Host plant

egg

larva

pupa

Tussock Moth			
Stage	**Time**	**Habitat**	**Food**
egg	33 weeks (Hatch May 1)	Up to 300 eggs are laid on top of the female cocoon on the **underside of the leaves of host plants** (oak, birch, locust, cherry, and elm trees)	Does not eat in this stage
larva	6 weeks	Caterpillars stay on or near the host plant.	Caterpillars eat the **leaves of their host plant** (oak, birch, locust, cherry, and elm trees)
pupa	2 weeks	Cocoons covered with the itchy hair of the caterpillar are **formed under leaves of their host plant** (oak, birch, locust, cherry, and elm trees)	Does not eat in this stage
adult	1 week	Male adult moths are gray and fly at night. Female moths have no wings, and stay near their cocoon.	Adults do not eat.

Luna Moth			
Stage	**Time**	**Habitat**	**Food**
egg	2 weeks (hatch May 7)	Eggs are laid 4-7 at a time on the **underside of the leaves of host plants: walnut, hickory, and persimmon trees**	Does not eat in this stage
larva	3 weeks	Caterpillars stay on the **host plants: walnut, hickory, and persimmon trees**	Eat the leaves of **host plants: walnut, hickory, and persimmon trees**
pupa	2.5 weeks	Coccons are formed from a single layer of silk wrapped in a leaf and hide in leafy piles.	Does not eat in this stage
adult	1 week	Adults search for mates and lay eggs	Does not eat in this stage

MOURNING CLOAK

Host plant

egg

larva

pupa

MONARCH

Host plant

egg

larva

pupa

Mourning Cloak			
Stage	**Time**	**Habitat**	**Food**
egg	2 weeks (hatch April 1)	Eggs are laid in ring clusters **around the twig of a host plant (willow, poplar, or elm trees).**	Does not eat in this stage
larva	4 weeks	Caterpillars stay together after hatching. If a predator comes near, they all shake to scare it away.	Caterpillars eat the **leaves of host plants (willow, poplar, or elm trees).**
pupa	2 weeks	Caterpillars crawl away from the host plant to make a chrysalis.	Does not eat in this stage
adult	44 weeks	Adults live in forests where the caterpillar host plants grow.	Adults feed on tree sap and juices from rotten fruit and dead animals. Sometimes they drink flower nectar

Monarch			
Stage	**Time**	**Habitat**	**Food**
egg	1 week	Eggs are laid **one-by-one on its host plant, milkweed.**	Does not eat in this stage
larva	2 weeks	Caterpillars stay on the **host plant, milkweed.**	Caterpillars are eating machines, gobbling up **leaves of the host plant, milkweed.**
pupa	1.5 weeks	Caterpillars usually crawl away from the host plant to make a chrysalis.	Does not eat in this stage
adult	4 weeks	Adults prefer flower-filled areas near the host plant, milkweed.	Adults feed on nectar from many different flowers.