

Mosquito Larvae Hunters: Level 2 Training

Name: _____

Today's date: _____

Attention:

Another personal message has just come in for you from the Training Director of the Mosquito Larvae Hunters (MLH) program. It is posted below; **please read carefully.**



Greetings!

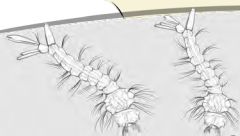
Congratulations on successfully completing your Level 1 Training. As a result of your achievement, I have approved your enrollment in **Level 2 Training**, which explores the “MLH Essential Skill” of Visual Analysis of Mosquito Larvae.

Examining and identifying mosquito larvae is challenging and important work. **Your practice involves identifying two mystery larvae specimens.** To help you with this task, we are introducing you to a tool called an **identification key**. Through steps, the key will allow you to distinguish *Aedes*, *Anopheles*, and *Culex* mosquito larvae.

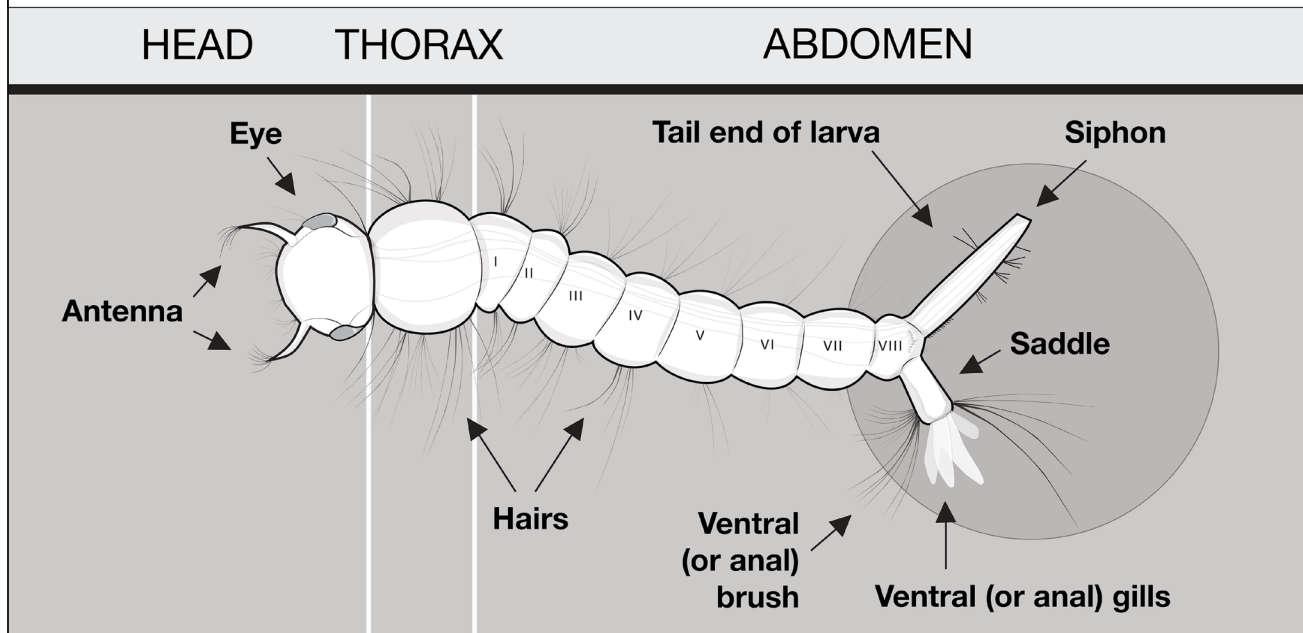
This notebook's key includes:

- **Smart phone images** (left side of pages 3-14). Each step features one characteristic. Pick the one that best matches the mystery larva photo.
- **Mystery larva to identify.** These photos are on the top or right side of pages 3-14.
- **Examination notes.** Pay attention to these notes and hints that will help you to identify the mystery larva.
- **Answer worksheets.** Worksheets on pages 16 and 17 can help you track your answers.
- **Answer keys.** Check your answers on pages 18 and 19 to see how you did!

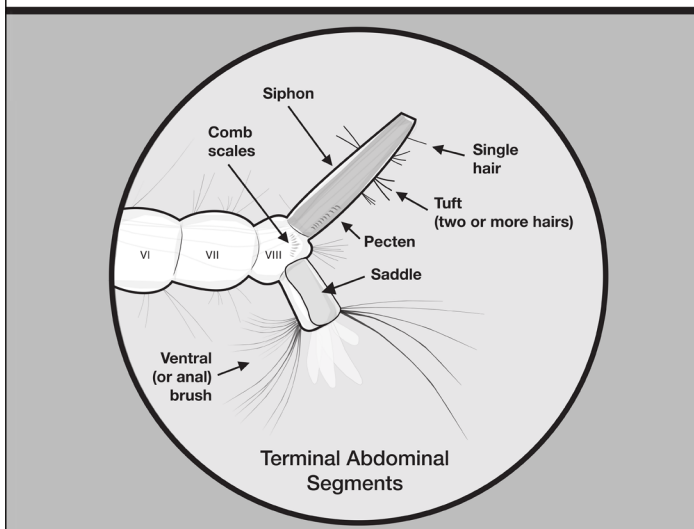
This training exercise prepares you for fieldwork using the **GLOBE Observer Mosquito Habitat Mapper**! Learn more about this mobile app at <https://observer.globe.gov>



MOSQUITO LARVA ANATOMY



TAIL END OF A LARVA



First Steps: Larva Anatomy

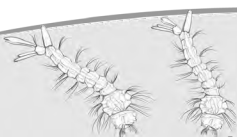
Anatomy is the branch of science that deals with the structure of a body. For example, the body of an adult mosquito includes the head, antennae, legs, wings, etc. But as Mosquito Larvae Hunters, we will focus on the structures that make up the body of a mosquito larva - structures that are totally different from those of an adult. These include the **head, thorax, abdomen, siphon, pecten, hairs, saddle, comb scales, and anal brush**.

The diagrams above and to the left, created by our MLH artist, feature structures that you will use in larvae identification. Each part is labeled.

Next MLH Challenge: Larvae Identification Practice

Your MLH identification exercise begins on the next page. Carefully examine each smart phone device image (*left side of the page*) and larva photo (*right side of the page*).

The photo on the right side of each page has a question below it. Record your answers on the worksheets (*pages 16 and 17*). **Note:** when you complete your answer sheets, please check the answer keys provided on pages 18 and 19 to see how you did!



Examine these three photos depicting your first larva specimen



ID-106335576©Kitthanes Ratanasira Anan/Dreamstime.com

Larvae seen in a water sample with the naked eye.

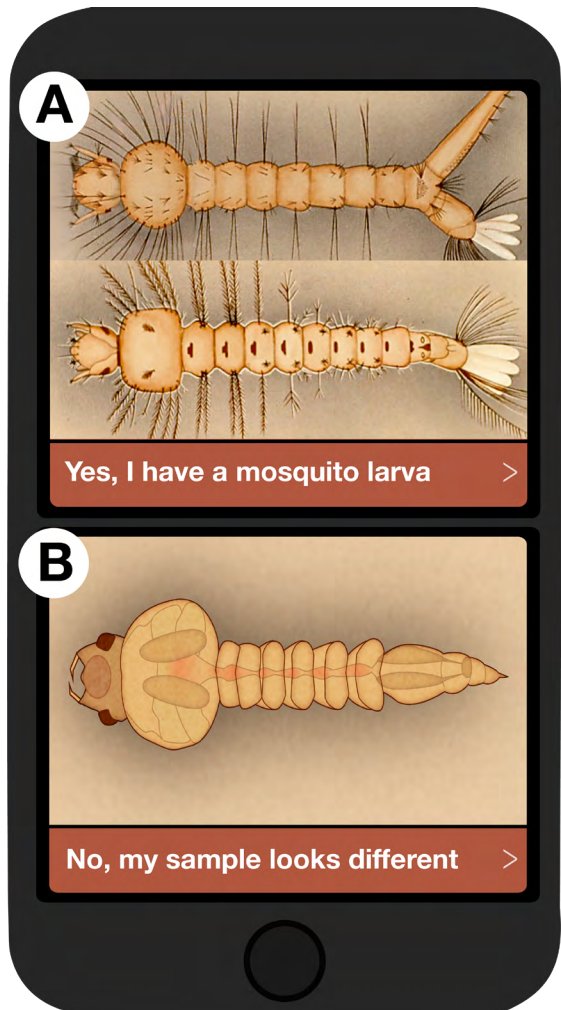


A single larva from the sample magnified.



Higher magnification image of the tail end of your larva. Note the siphon off to the top right.

Step One: Is your sample a mosquito larva?



Examination Notes

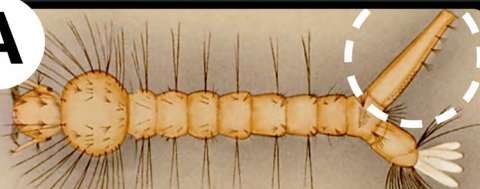
A mosquito larva has three distinct body sections: a head, thorax, and abdomen. The head is rounded, the thorax is generally wider than the head, and the abdomen has distinct segments that extend down from the thorax.

Hairs (not legs or wings) should be visible along the length of the body.

Almost all larvae have a siphon - a distinctive tube coming off the tail. Only one genera of mosquitoes, *Anopheles*, does not have a siphon.

Is your specimen a mosquito larva?

Step Two: Examining the siphon

A

Long thin siphon >

B

Stout blunt siphon >

C

No siphon >

D

Sharp pointed siphon >



Examination Notes

The siphon is tube-shaped and branches off the tail end of the larva. Larvae are often found at the water's surface hanging by the siphon, because they use it to breathe air.

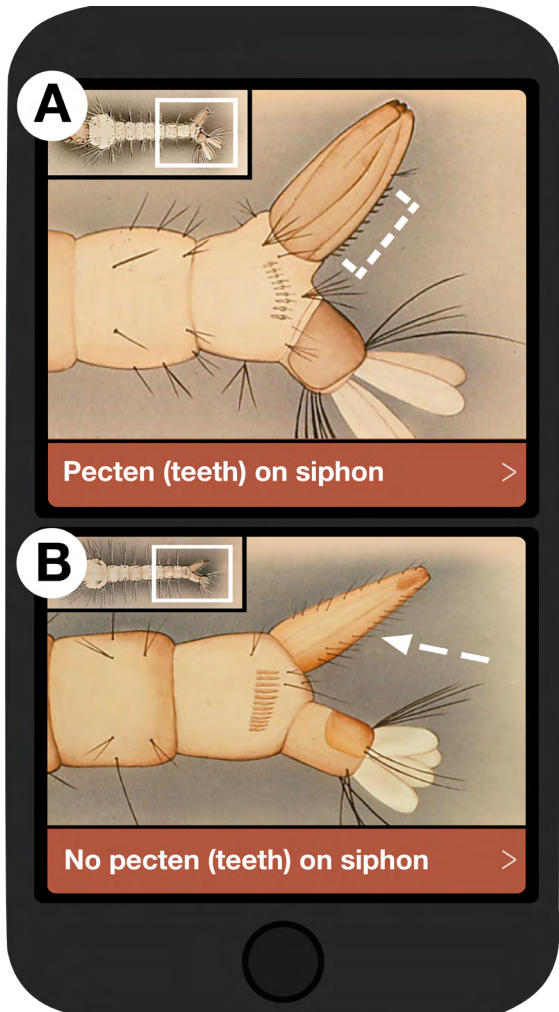
Because the shape of the siphon varies between different types of mosquitoes, it is an important feature in larvae identification.

Extra credit: What is the genus of the larva you see in example "C" (No siphon)?

What is the shape of the siphon on your specimen?



Step Three: Examining the pecten



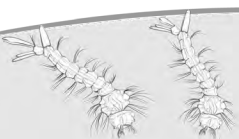
Examination Notes

Pecten is a row of small, tooth-like spines found on the siphon. (Do not confuse pecten with hairs; pecten are shorter and more uniformly shaped). The row of pecten extends from the base of the siphon to some point along its length.

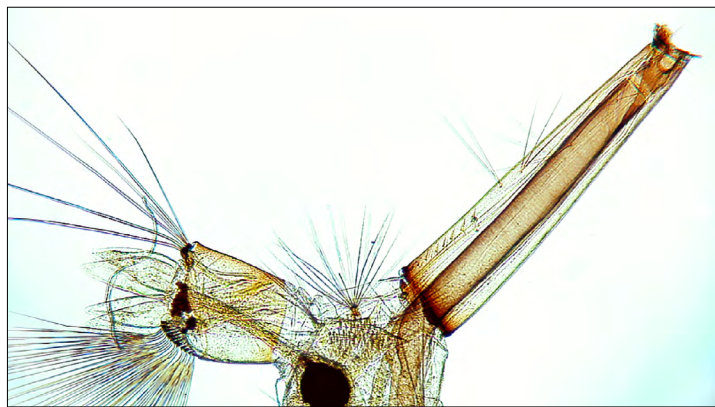
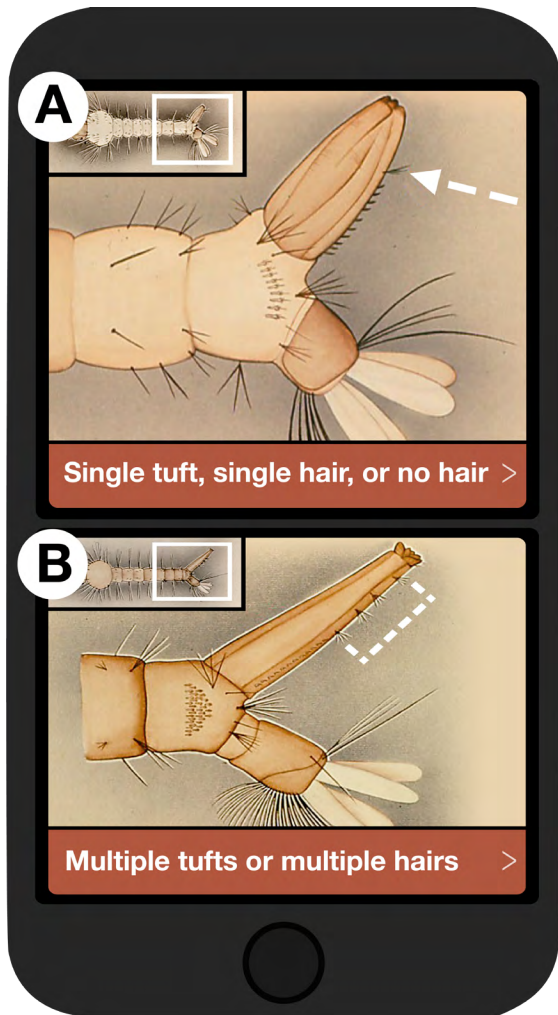
Hint: Larvae are 3D. Each time a larva is laid out for observing, it may be in a different position than the photos in the key. The head could be facing to the right or left. The siphon may be pointed to the top or bottom.

Your ability to see detail, in this case the pecten, will depend on how they are laying on the slide or plate you are using. You may need to use a toothpick to move them around.

Does your specimen's siphon have pecten?



Step Four: Examining the hairs



Examination Notes

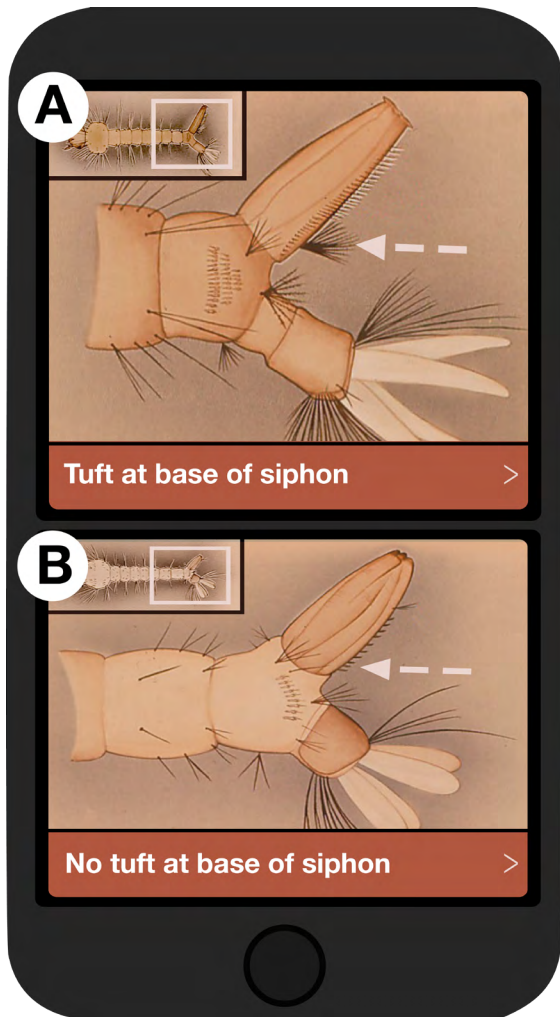
The arrangement of hairs on the siphon varies from a single hair to tufts or clumps of hairs; either can be found in different positions along the siphon. The arrangement and placement of hairs on the siphon is an important identification tool.

Looking only at the hairs on the siphon or at the base of the siphon, which of the following best describes your specimen?

- **A. No hair / single hair / one tuft of hair**
- **B. Multiple hairs or tufts**



Step Five: Examining the base of the siphon



Examination Notes

The base of the siphon is where it attaches to the abdomen.

A tuft is a clump or cluster of hairs that are close together at the base (where they attach to the larva) but appear as separate hairs at the opposite end.

Is there a tuft of hair at the base of your specimen's siphon?

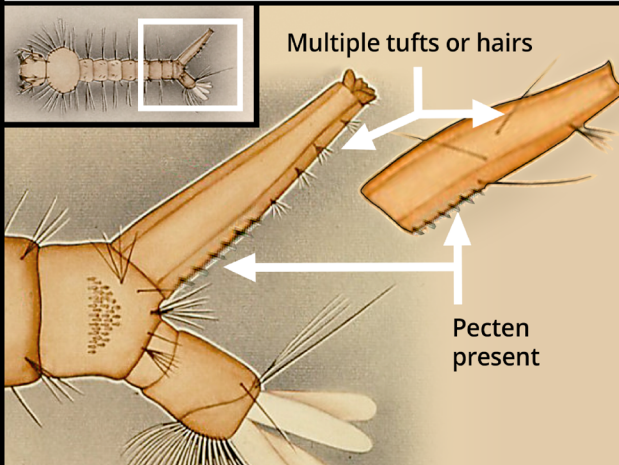


Identification of Mystery Larva Specimen #1

Is the larva a *Culex*?

If there is no basal tuft, this larva is probably a *Culex*. Review your photos for the key characteristics:

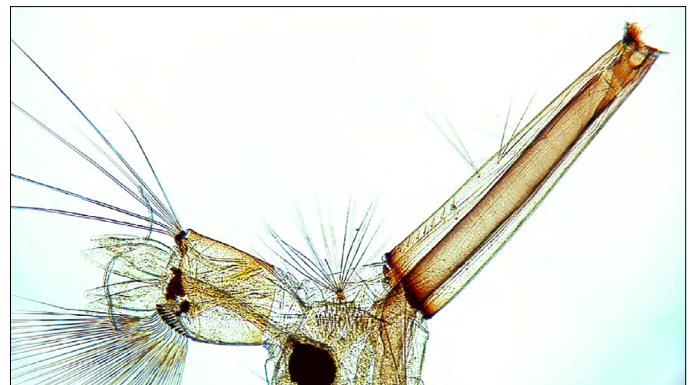
1. Cylindrical siphon
2. No basal tuft
3. Multiple tufts or hairs on siphon
4. Pecten present



Yes, this is *Culex*



No, this not *Culex*



Examination Notes

- You have keyed out your specimen to ***Culex***.
- Compare your specimen to the larva illustrated in the app diagram to the left, and then confirm your identification of Mystery Larva Specimen #1.
- After determining your specimen's identification, check the **Answer Key** on page 18 of this notebook.

My larva is _____.



Examine these three photos depicting your second larva specimen

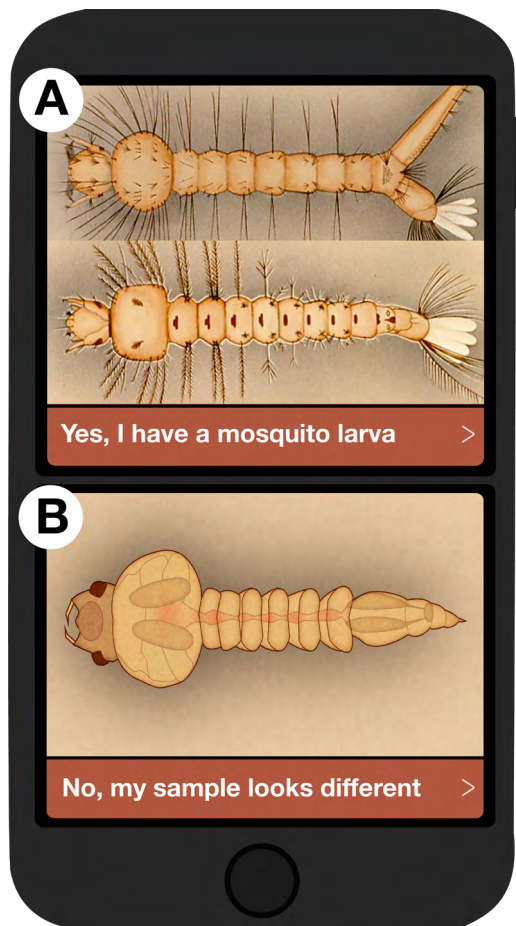


The photo above features a single larva magnified 60 times (60X).



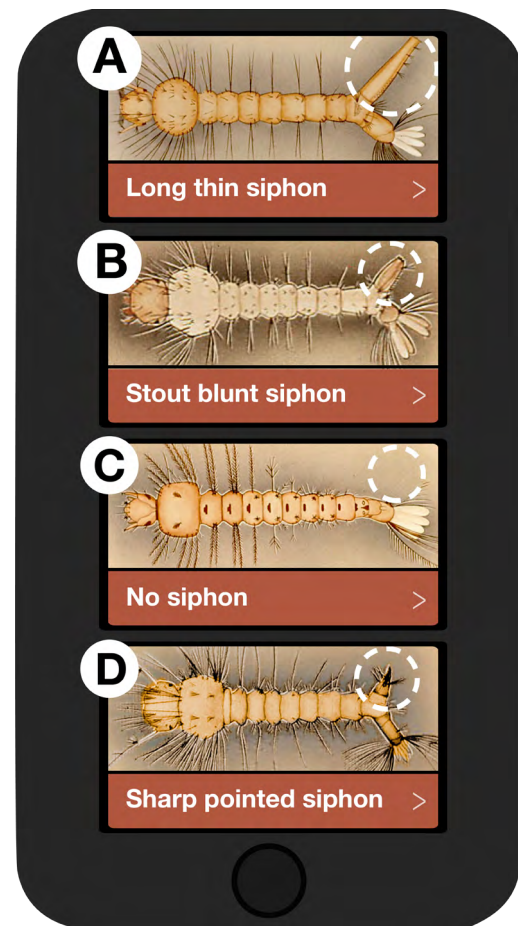
The two photos above feature the siphon. Each is magnified 100 times (100X).

Step One: Is your sample a mosquito larva?



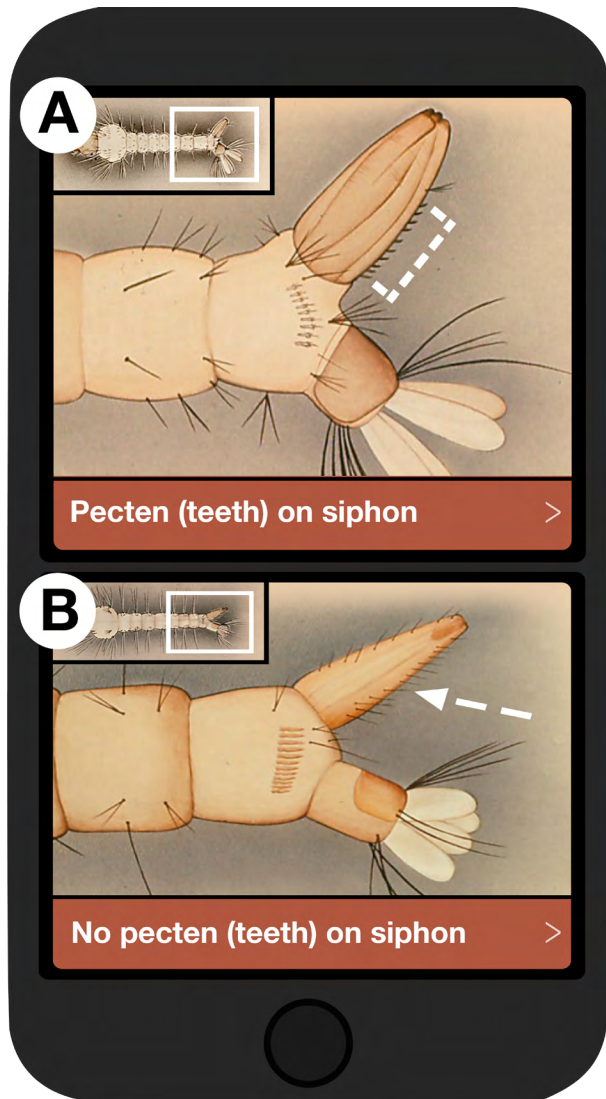
Is your specimen a mosquito larva?

Step Two: Examining the siphon



What is the shape of the siphon on your specimen?

Step Three: Examining the pecten

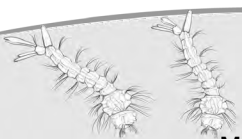


Examination Notes

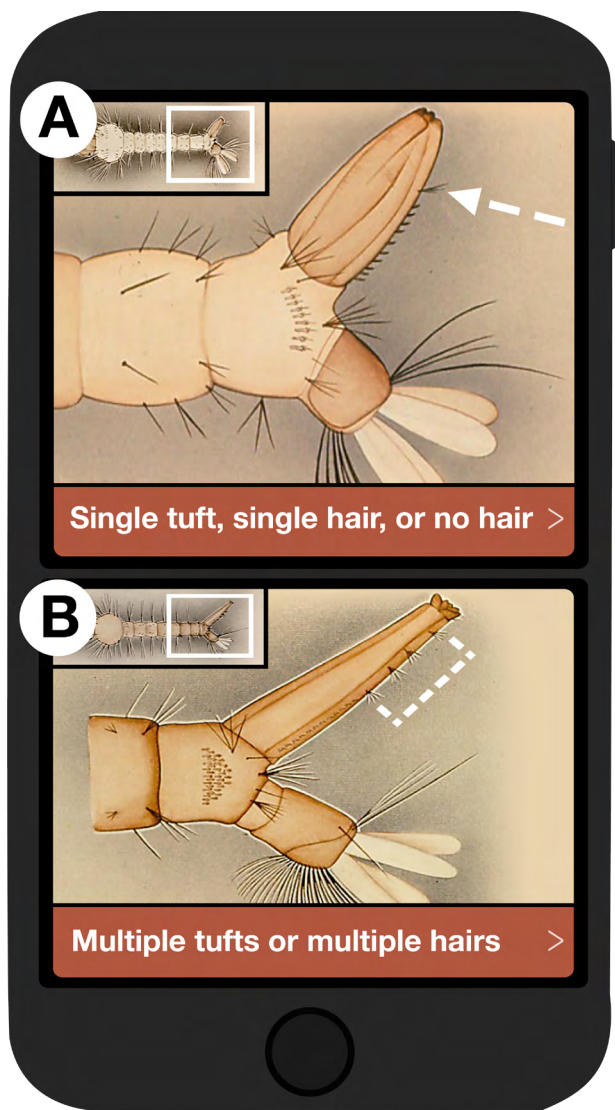
Pecten is a row of small, tooth-like spines found on the siphon. (Do not confuse pecten with hairs; pecten are shorter and more uniformly shaped). The row of pecten extends from the base of the siphon to some point along its length.

Magnification: To see pecten and hairs, you may need more magnification. The siphon in the above photo is magnified more than 100X, so that you can see its features clearly.

Does your specimen's siphon have pecten?



Step Four: Examining the hairs



Examination Notes

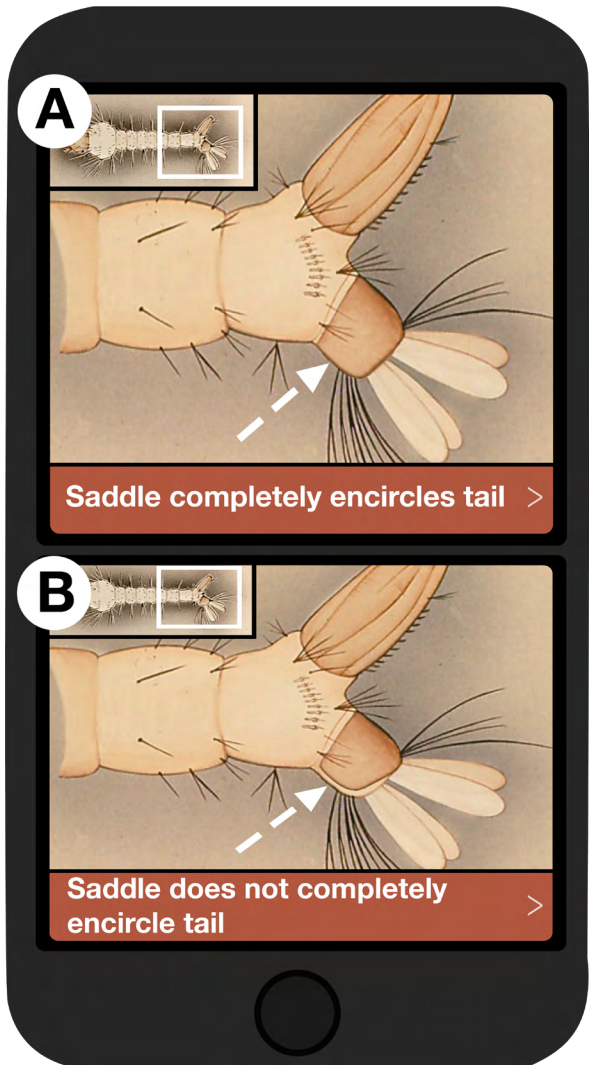
Do not confuse hairs with pecten. Hairs are longer and randomly spaced (scattered).

Looking only at the hairs on the siphon or at the base of the siphon, which of the following best describes your specimen?

- **A. No hair / single hair / one tuft of hair**
- **B. Multiple hairs or tufts**



Step Five: Examining the saddle

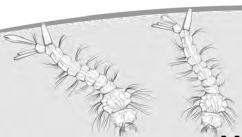


Examination Notes

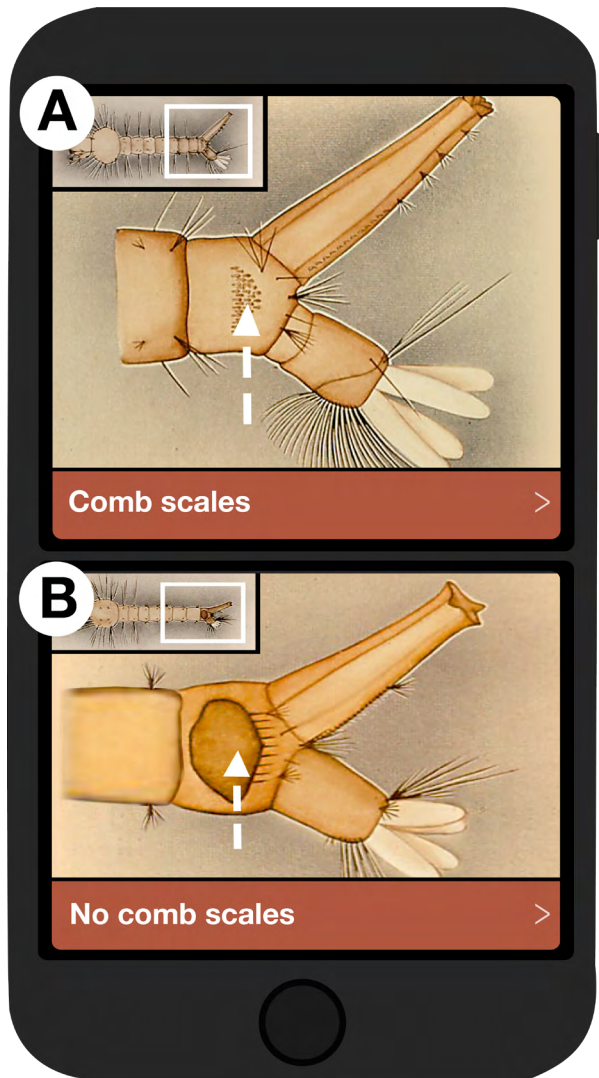
The saddle is a darker patch found on the anal segment. The saddle may completely or partially encircle the anal segment. It gets its name from the fact that it resembles a horse saddle.

Note: It is important to determine the position of the larva to ensure that you are examining the correct structures. In this photo, the siphon is off to the right side. The anal segment showing the saddle is off to the left.

Does the saddle completely encircle the tail or partially encircle the tail?



Step Six: Examining the comb scales



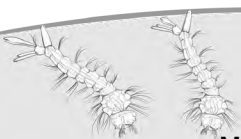
Examination Notes

Reminder: This photo is the same one used in Step Five. Again, note the position in which the larva is lying - with the siphon off to the right.

Comb scales are found at the tail end where the siphon and the anal segment branch. They are spine-like projections that appear as dark marks on the segment. Comb scales can occur in a row or in a patch.

Some genera of mosquito larvae have a large dark plate - but not the spine-like scales - in that area.

Does your specimen have comb scales?

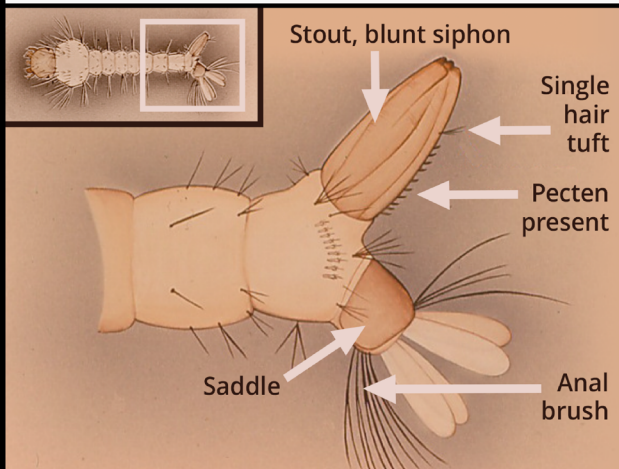


Step Seven: Identification of Mystery Larva Specimen #2

Is the larva *Aedes*?

Your larva appears to be of the genus *Aedes*. Review your photos for the telltale signs:

1. Stout, blunt siphon
2. Pecten present
3. Single tuft or tufts of hair above pecten
4. Saddle does not completely encircle
5. Comb scales present



Yes, this is *Aedes* >

No, this not *Aedes*



Examination Notes

- You have keyed out your specimen to ***Aedes***.
- Compare your specimen to the larva illustrated in the app diagram to the left, and then confirm your identification of **Mystery Larva Specimen #2**.
- After determining your specimen's identification, check the **Answer Key** on page 19 of this notebook.

My larva is _____.



CONGRATULATIONS MLH HUNTERS



Greetings on this special occasion!

You have completed the Mosquito Larvae Hunters training for both Level 1 and Level 2. As with most MLHs, you probably entered the program with lots of experience *getting* mosquito bites. But through perseverance and determination, you leave the program knowing more about larvae anatomy and how to identify the larva that grew into that adult mosquito that bit you. You have accomplished much!

You are now ready to find, identify, and send in photos of mosquito larvae using the GLOBE Observer Mosquito Habitat Mapper. Learn more about this mobile app at <https://observer.globe.gov/about/get-the-app>.

Always remember that safety in the field is your top priority.

Thank you for participating in the MLH program.

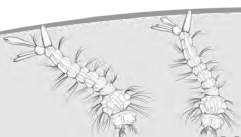
Carry your MLH Level 1 and Level 2 badges and MLH Certificate of Completion with pride.

You will find badges to the right, and the certificate on page 20 of this notebook. Alternatively, you can download both of these at <https://strategies.org/mosquito-notebook>.

We wish you the best.

Training Director

MLH International Program



Worksheet

MYSTERY LARVA SPECIMEN

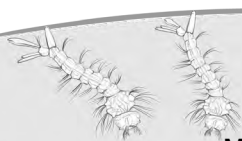
#1



	Diagnostic Characteristic	Your Answer	Explanation
1	Is this a mosquito larva?		
2	Siphon		
3	Pecten		
4	Hairs on siphon		
5	Hair tufts at base of siphon		




Type of
Mosquito Larva

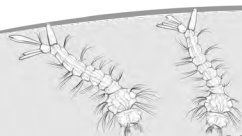


Worksheet

MYSTERY LARVA SPECIMEN # 2



Step	Diagnostic Characteristic	Your Answer	Explanation
1	Is this a mosquito larva?		
2	Siphon		
3	Pecten		
4	Hairs on siphon		
5	Saddle		
6	Comb scales or dark plate?		
			Type of Mosquito Larva



Answer Key

MYSTERY LARVA SPECIMEN #1

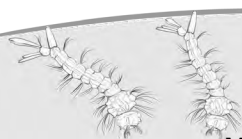


Step	Diagnostic Characteristic	Your Answer	Explanation
1	Is this a mosquito larva? <ul style="list-style-type: none"> • Yes • No 	A: Yes.	Diagnostic: Rounded head, separated at thorax by indentation (neck), eight abdominal segments, plus the tail-end segments.
2	Siphon <ul style="list-style-type: none"> • Long and thin • Stout and blunt • Absent 	A: Long and thin siphon.	Diagnostic: Siphon is a tubular organ, found at the tail end of most genera of mosquitoes.
3	Pecten <ul style="list-style-type: none"> • Present on siphon • Not present on siphon 	A: Pecten present on siphon.	Diagnostic: The pecten are two rows of small, somewhat regularly spaced spines found on both sides of the siphon.
4	Hairs on siphon <ul style="list-style-type: none"> • Single tuft, single hair, or no hair • Multiple tufts or hairs 	B: Multiple tufts of hair on siphon.	Diagnostic: A tuft is a description of a group of two or more hairs. There are two tufts seen on this siphon.
5	Hair tufts at base of siphon <ul style="list-style-type: none"> • Present • Absent 	B: No hair tufts at base of siphon.	Diagnostic: There is no tuft of hair found at the place where the siphon joins abdominal segment VIII.



Type of
Mosquito Larva

Culex





Step	Diagnostic Characteristic	Your Answer	Explanation
1	Is this a mosquito larva? <ul style="list-style-type: none"> • Yes • No 	A: Yes.	Diagnostic: Rounded head, separated at thorax by indentation (neck), eight abdominal segments, plus the tail-end segments.
2	Siphon <ul style="list-style-type: none"> • Long and thin • Stout and blunt • Absent 	B: Stout and blunt siphon.	Diagnostic: Siphon is a tubular organ, found at the tail end of most genera of mosquitoes.
3	Pecten <ul style="list-style-type: none"> • Present on siphon • Not present on siphon 	A: Pecten present on siphon.	Diagnostic: The pecten are two rows of small, somewhat regularly spaced spines found on both sides of the siphon.
4	Hairs on siphon <ul style="list-style-type: none"> • Single tuft, single hair, or no hair • Multiple tufts or hairs 	A: Single tuft of hair on siphon above pecten.	Diagnostic: A tuft is a description of a group of two or more hairs. A single hair is observed above the pecten.
5	Saddle <ul style="list-style-type: none"> • Completely encircles tail • Does not completely encircle tail 	B: Saddle does not completely encircle tail.	Diagnostic: The saddle is an area of thickened tissue found on the terminal end segments. When it does not completely encircle the tail, it resembles a saddle.
6	Comb scales or dark plate? <ul style="list-style-type: none"> • Present • Absent 	A: Present.	Diagnostic: Comb scales are a line or patch of dark, thin scales on abdominal segment VIII. Comb scales are observed on abdominal segment VIII.



Type of
Mosquito Larva

Aedes

MLH Level 2 Notebook entry image and photo credits: Illustrations from the GLOBE Observer Mosquito Habitat Mapper were originally created by the Centers for Disease Control and restored by the Biodiversity Collections department at the University of Texas. Larvae photos are courtesy of University of South Florida; Department of Medical Entomology, Westmead Hospital, Australia; Salt Lake City Medical Entomology Laboratory; and Florida Medical Entomology Laboratory, University of Florida.



Mosquito Larvae Hunter (MLH) Certificate

.....
Name

has earned the title **Mosquito Larvae Hunter** by successfully completing both **Level 1** and **Level 2** Training.

This Mosquito Larvae Hunter can confidently identify mosquito larvae and submit photographs of those larvae through the **GLOBE Observer Mosquito Habitat Mapper** mobile app.

Thank you for your dedication to this training.

.....
Date

Training Director • MLH International Program

