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HIDDEN BIODIVERSITY Series

Mosquitoes: The Double Life

Study Guide

Written and Photographed by Rubén Duro Pérez

Supplement to Video Program

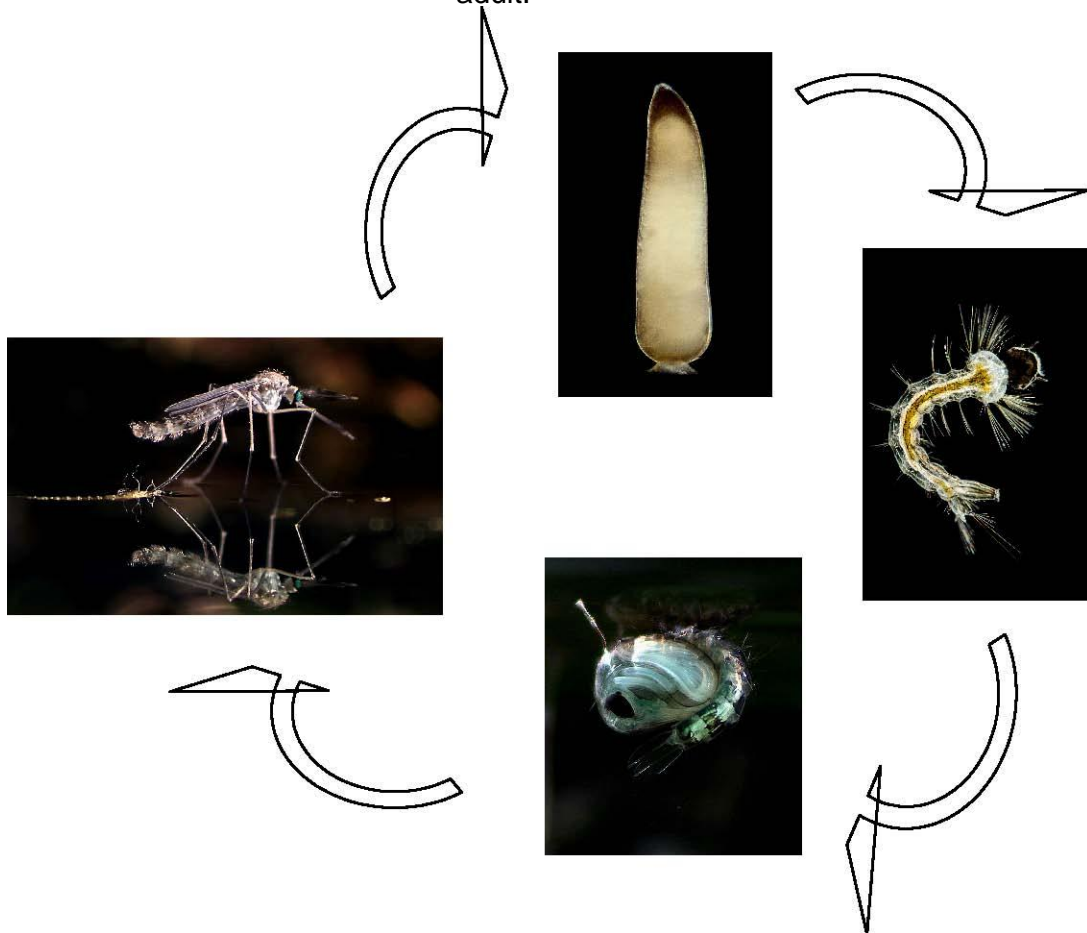
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Mosquitoes are insects of the order Diptera (two wings) belonging to the suborder Nematocera (thread horn), which make up the family Culicidae. Thirty-five hundred species of these insects have been described. They are organized into 43 different genres. The name "mosquito" is a diminutive of the Spanish word "fly", meaning "little fly". According to many scientists, these insects are among the most dangerous, since some species are vectors of diseases such as malaria, filariasis and tularemia, affecting millions of people each year. For this reason, it is interesting to know its biology, ecology and role in the ecosystem.

Mosquitoes are holometabolous insects, i.e. insects that go through a full or complicated metamorphosis in which a drastic and radical transformation of the larval stages into an adult state or imago takes place.

During its life cycle, the mosquito goes through four distinct stages: egg, larva, pupa and adult.



Of these four states or phases of development, the first three occur in aquatic ecosystems, while during the last stage, the adult or imago, mosquitoes leave the aquatic ecosystem to become part of terrestrial ecosystems. We can say, therefore, that mosquitoes have a double life, one aquatic and the other terrestrial.

Some questions:

- What is the metamorphosis of insects?
- Which means that mosquitoes are holometabolous insects?
- Can you identify other holometabolous insects?

The eggs of several species of mosquitoes frequently appear on the surface of water forming "rafts". These formations contain a variable number of eggs attached to each other that can reach up to 500 eggs in some instances.



The egg has an elongated shape, with the bottom thicker than the upper end. At the bottom also presents a structure called "float" allowing it to stay on the surface of water without sinking.

The larvae develop inside the egg during about 24 hours, depending on the environmental conditions, mainly temperature. After this period of development, the bottom opens and a tiny and whitish larva goes out directly into the water.

Some questions:

Why do you think that the eggs of mosquitoes need a "float"? What might happen if they did not have it? Do you think that lay eggs in "rafts" have any advantage for mosquitoes? How do you think temperature affects the duration of the embryonic development of the mosquito? Why do you think is the bottom and not the upper part of the egg that opens to allows the larva hatch?

The larvae of Culicidae measure just over 2 mm at the time of birth, and from that moment begin to feed and grow. They are now fully integrated into the aquatic ecosystem, where they play an important role as prey of many other animals, from insects to fish or amphibians that feed on them.



Larval development lasts approximately 12 days. During this period the larvae pass through four stages or phases. They molt or shed the exoskeleton at the end of each phase.



The larvae feed on algae, bacteria, protozoa and organic matter in the water, using their brush-like mouthparts. And breathe air from the surface through a special structure called a "siphon", a small tube that appears at the end of their bodies and whose outer extreme has hydrophobic tiny hairs that allow them to break the surface tension of water and reach the open air.

Some questions:

Given that larvae have many predators why do you think that the females lay such a large number of eggs? Why the larvae have to perform some molts to grow? Why the hairs at the end of the siphon are hydrophobic? What would happen if these hairs were not hydrophobic?

After the fourth and final phase, the larvae transform into "pupae" that look very different.



The pupa, with its unmistakable look of "comma," is a phase dedicated to the metamorphosis.



During this phase, which usually lasts around 24 hours, we can see outlined the main morphological characteristics of the adult mosquito, since structures such as wings, legs or antennae are gradually forming within.

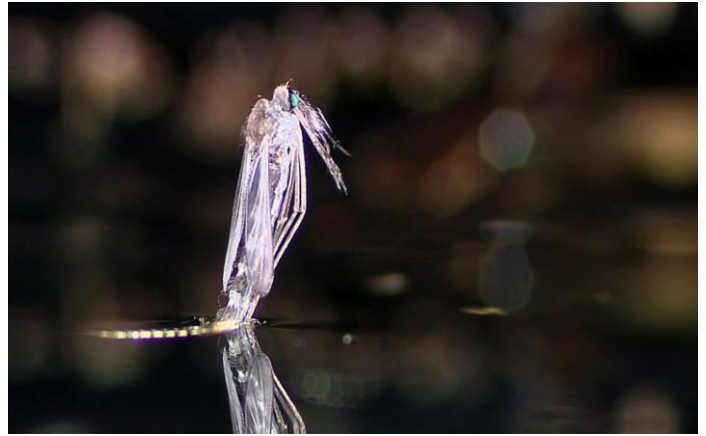
Unlike the earlier larval stages, the pupal stage does not feed at all, and may be considered exclusively a "container" that protects the body during the complicated process that transforms the larva into an adult insect.

Some questions:

Why the pupal phase is so important for the development of mosquitoes? If pupa does not feed during this stage how can she live? From where comes the energy needed to perform the metamorphosis?

When the metamorphosis is complete the pupa remains motionless just below the water surface and breaks at the top. This allows the emergence of the adult insect. By means of contracting and expanding, the adult mosquito body will gradually emerge from the pupa, stretch its legs and wings, and finally abandon the exoskeleton.

This process, often no longer than a few minutes, is one of the most dangerous moments in the life of the mosquito. The external skeleton of the emerging adult has not reached the final hardness and strength and is still very weak. So it is unable to protect the body from external agents such as excessive heat, which may cause dehydration. That is why in most cases, adult emergence occurs during the late hours of the day when the temperature has moderated.



The newborn adult mosquito remains motionless while its exoskeleton becomes resistant enough to support the strength of muscles, especially those that move the wings. During this time the mosquito is able to stay on the surface of the water thanks to its light weight and the structure of its legs that do not break the surface tension, a major water feature.

Once its body is fully developed and hardened, the mosquito flaps its wings and flies away. At that moment the mosquito begins the adult life that, if lucky, will last from one week to a few months depending on the species.

Some questions:

Why is the time of adult emergence so dangerous for mosquitoes? How does the adult get out of the pupa? What could happen if mosquitoes emerge during the hottest hours? What will happen if the pupa fails to remain motionless just under the surface of the water? Why is it so important to the mosquito not to break the surface tension of water? Do you know other insects able to stay on the water surface without sinking?



Common frog (*Pelophylax perezii*)



Dragonfly Nymph (Odonata)



Spotted Flycatcher (*Muscicapa striata*)