

Scientific article. Repository University of El Salvador.



---

**Study of new physiological characteristics as protein receptors (RP55) of light, color, heat, motion, smell, electric, vibration and position located in head, body and abdominal, found in mosquito larvae. 2015-2016**

**DR. ANTONIO VASQUEZ HIDALGO, Ph.D, MD. Prof  
Universidad de El Salvador**

#### Summary

The main objective of the research is to demonstrate new physiological characteristics receptors in the presence of mosquito larvae. 100 larvae of different species were collected and studied for a week in periods of 8-24 hrs. Larvae stages I, II, III and IV have photo-thermo receptors of light and heat housed in the body is divided into head, thorax and abdomen, perceive hot or cold environments, and have fibers in chest or hairs lining your body or abdomen, and a pair of antennae on the head. Stages II and III are more developed than the initial stages. They are attracted by the dark green at the bottom, a pair of eyes that perceive light and color. Have receptors proteins (RP55) that capture motion at a speed the slightest movement of waves in the water. Its nose is not well developed but have chemoreceptors. They adapt to changes in pH in alkaline media, are sensitive to chemical, thermal and mechanical changes nociceptors have electroreceptors or galvanoreceptores sensitive to electrical stimuli, have mechanoreceptors that are sensitive to touch, pain, pressure, gravity, sound. They have a GPS position that seems the guides. It is precisely in the fibers, mushrooms or bristles are recipients along with the micro villi in head, thorax and abdomen.

**Keywords:** mosquito larvae, receivers.

## Introduction

Malaria and dengue are two major diseases of medical importance, however the transmitter *Aedes aegypti* transmits three potentially aggressive to human diseases, including dengue, Zika and Chikungunya, when considered epidemiologically as Disease reporting statistical figures increasing by the Ministry of Health. Defined as high risk in endemic areas. Similarly it has been reported today in coastal regions and in urban areas with higher morbidity. Global efforts are sponsored or conducted by WHO, PAHO and others to control and eradicate the vector, but has so far been impossible to achieve promising results. We used various methods of control, in which the use of chemicals in plantations and domiciliary areas highlighted, with the risk of causing poisoning in humans. The most common vectors reported in El Salvador as producer's disease: *Aedes aegypti* and *Anopheles albimanus*.

When malaria and dengue are two problems of Public Health and governments, because millions of dollars are invested in eradicating the vector and treat disease, derived from the national budget allocated to health, today added Zika.

Current biology books mostly have a physiological description of new properties that have mosquitoes especially larvae, allowing a new scientific contribution to the exciting world of microbiology.

## Materials and method.

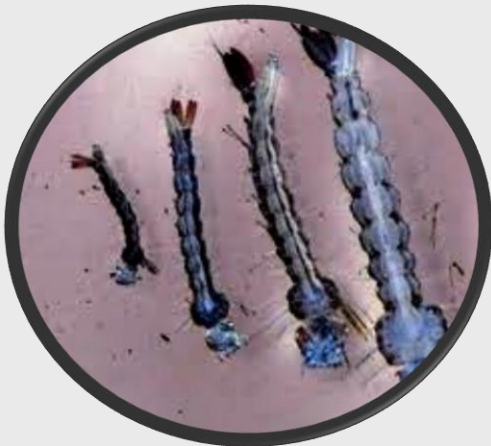
Larvae stages I, II, III, IV and pupae and adults of various species of mosquitoes were collected in a water container known as a stack of about 2700 mts<sup>3</sup>. The sample was 100 larvae were studied in approximately 24 hours to see their behavior day and night for a week were subjected to various temperatures, perception of coffee, green, yellow, black, different vibrations, pH changes colors. Morphological characterization stereomicroscope mosquito larvae and is then made. Simple photographs are taken and electron microscopy.

## Result

Lifecycle: In the experiment larvae of several stages were collected, found in its natural form in its life cycle first go through egg lasting from 1 to 3 days being in the water surface, can float without difficulty Malaria, the other species are grouped to float, then pass larvae in 4 stages see Fig 1 shed their cuticle between each stage that protects and thickens when they reach stage IV, being the smallest initial and immature I that

others increase in size at each stage, mosquito larvae need water, have to inhale respiratory oxygen siphon except Malaria larvae but not siphon is placed parallel to the water surface for breathing. These larvae feed on small organisms and organic material to survive. On average, each larva is between 2 to 10 mm, has a long thin terminal and tube called a siphon that serves to breathe in the water surface, last in this phase of 10 to 13 days, then pass pupa less dense weight which easily fleet, which is the pre-adult stage mechanical pressure exiting the cuticle, at this stage last 2 to 4 days. Then in adult phase are on average 3 to 6 weeks see Fig 2.3, males live less, the female needs to mate in two days where they need to find water to lay eggs and especially the female needs blood supply, looking male pollen, juices and other foods except blood. As epidemiological and entomological surveillance is necessary to cut the cycle of life here in larval stage among others, and will not transmit viral diseases in its chain of transmission.

Epidemiology: its main habitat is water, need oxygen in larval stage as a preliminary stage to reach adult breathing. The larvae of malaria breeds in clean and contaminated water, dengue, Chickungunya, Zika live in clean water. They live at an altitude less than 600 meters from sea level, are easily adapted to temperate and warm climates.



**Photo 1. Types of larvae of I, II, III and IV (left to right)**



Figure 2. Egg, larva, pupa and adult mosquito life cycle.



Figure 3. Adult mosquitoes.

### A DAY IN THE LIFE OF A mosquito larvae. Physiological characteristics.

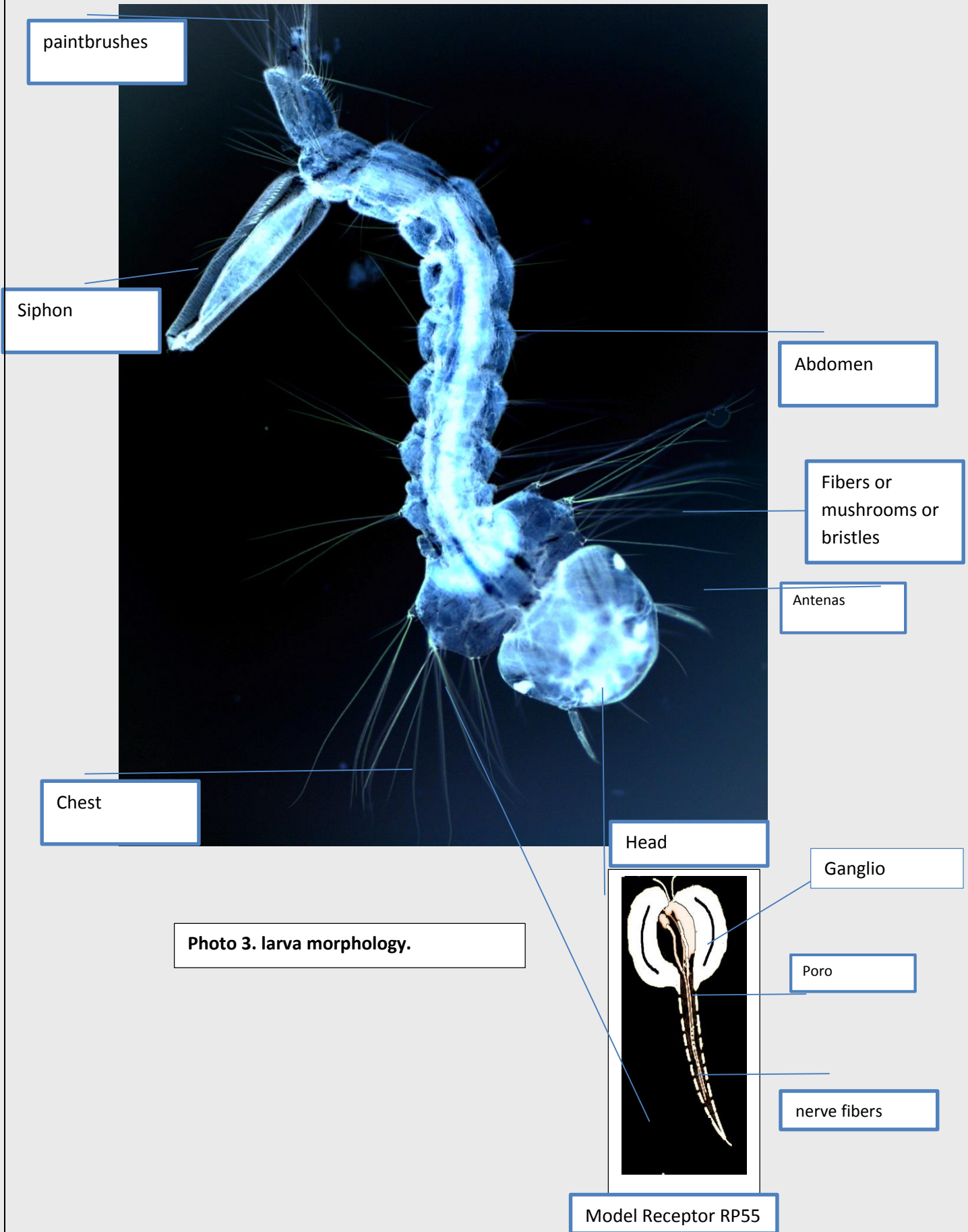
Its behavior of larvae for 8 hours was studied in a container of 2700 mts<sup>3</sup>, resulting larvae stages III and IV come to the surface to take in oxygen are between 5 to 10 seconds, any movement defend submerging up

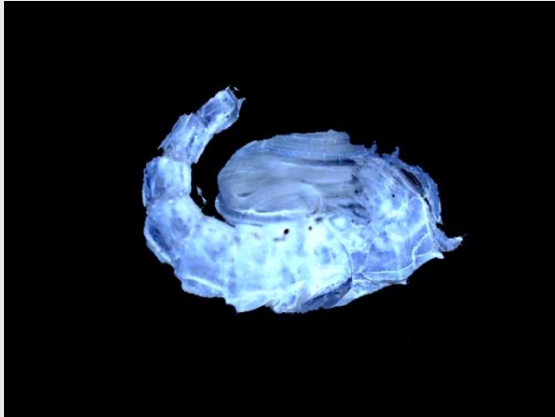


Photo 2. Larva stage IV

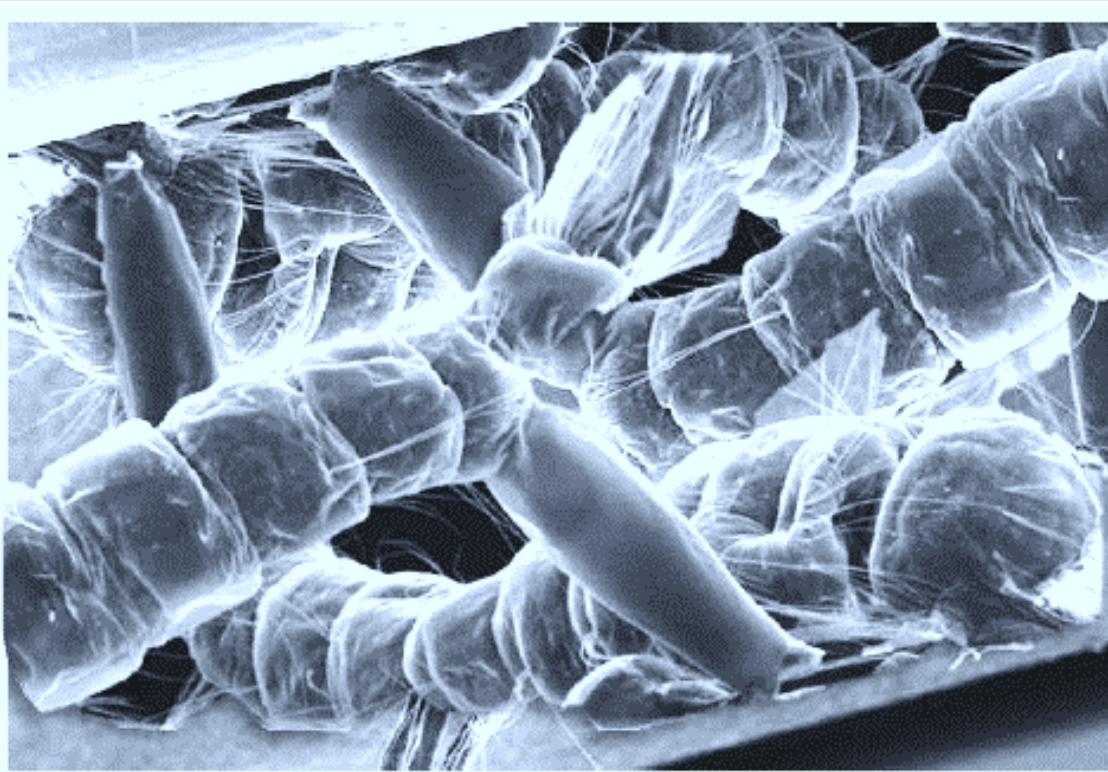
background being between 10 to 15 seconds then go back up to the surface. The time it takes to get from the surface to the bottom depends on the depth of the container but arrive in 30 seconds and ascend or descend a zigzag other queued between 20 to 30 sec. Stages I and II larvae spend most of the time in the bottom of container until they pass III and IV rise to the surface to take in oxygen for longer in an open diameter of 26x30 cm container with natural light, known in the Salvador as "water basin". They have protein receptors (RP55) photo-thermo receptors of light and heat housed in the body is divided into head, thorax and abdomen and have fibers in chest or hairs lining their body or abdomen, and a pair of antennae on the head indicating that if they possess receptors. His behavior in the container looking light the biggest stadiums. They are attracted by the dark green at the bottom, a pair of eyes that

perceive light and color. His nose is not very developed. Have receptors that capture motion at a speed the slightest movement of waves in the water. They adapt to changes of pH in alkaline media. They have to look like a GPS position that orients. Electrical charges in response to electrical changes were made evasion. They feel pressure and pain when touched. It is precisely in the fibers, bristles are mushrooms or the aforementioned receptors along with tiny hairs in the body. They not easily adapt to very extreme pH changes. They were tested at various temperatures in hot and cold water, prefer the tibia and perceive hot or cold environments. It is a frenzy up and down continuously 24 hours a day in the container, pupation waits longer on the surface until they leave adults. It seems that evolution has played an extraordinary way of adapting to their environment, from the beginning of egg, larva, pupa and adult behave similarly in adult phase in which their antennas have receptors obstacle avoidance capture very While the sound waves in the air displaced. Their receptors captain water containers, perceive various temperatures among others. Its smell is perceived and developed since sniff CO<sub>2</sub>.





**Photo 4. Pupa stadium**



**Photo 5. Electron micrograph of larvae.**

Table I shows that the receptors are present throughout the body including head, thorax and abdomen. They are in immature form but as receptors increase the larva develops its function. For as adults this increased capacity as a defense mechanism and evasion environmental adversities.

TABLE I. Presence of protein receptor RP55 in the mosquito larvae.

Larva/receptor	fotoreceptor	termoreceptor	quimioreceptor	propireceptor	galvanoreceptor	nociceptor
Larvae I	+	+	+	+	+	+
Larvae II	+	+	+	+	+	+
Larvae III	+	+	+	+	+	+
Larvae IV	+	+	+	+	+	+
pupa	+	+	+	+	+	+
adult	+	+	+	+	+	+

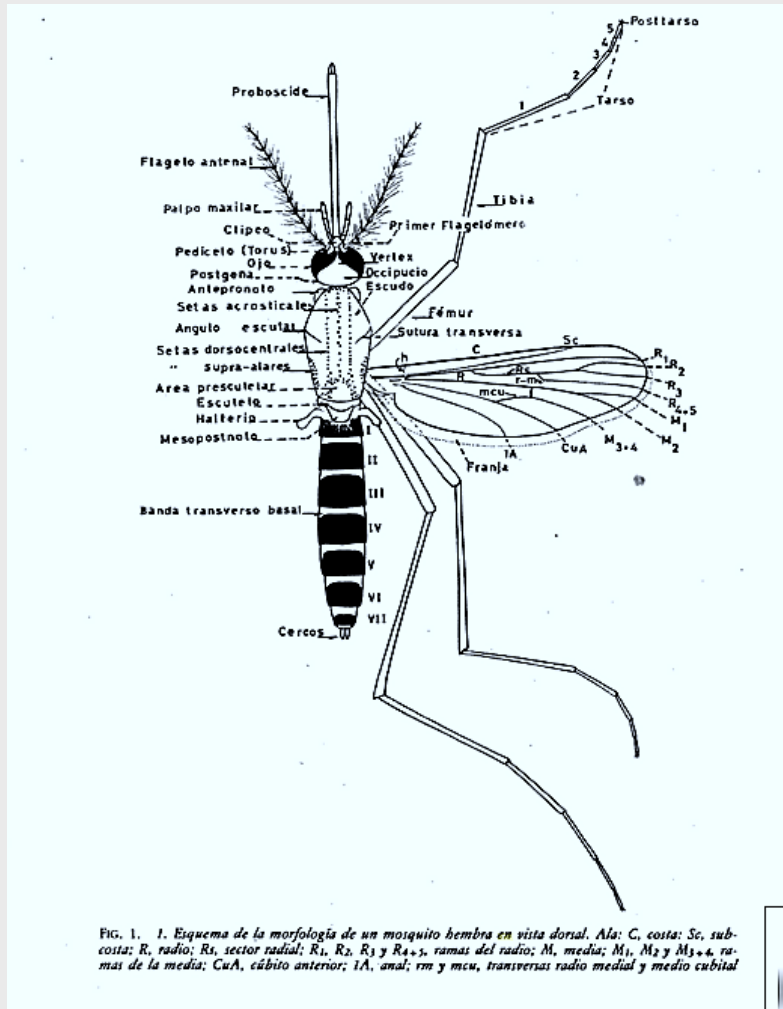
## Discussion

It was observed that the larvae of mosquito species have different receptors, in other studies describe only the mosquito life cycle and disease transmission. But not delve into the study of the larvae. Larvae have four instars observed. To move to adult stage need to pass from larva to pupa and then adult. The approximate time to go one stage to another is 48 hrs. Between 24 hrs to 72 hrs mosquitoes need to feed, female blood that is hematophagous and the male pollen plants.

The study found that the water phase is 10 days, in others report 7 days on average ranges between three to twelve depending on temperature. The adult differs from other species, mainly that of dengue (*Aedes aegypti* is zarado) the malaria (*Anopheles albimanus*) no white spots. Other features to distinguish the male from the female is in the palps, the female is straight as spear and the male is shaped racket, male antennae are feathery and hairy female they are not very bulky. Larvae in water species behave in some zigzag therwise.

It is possible that mosquitoes have already developed their receptors, since they perceive the CO<sub>2</sub> (carbon dioxide), sweating skin of animals and humans, body heat, skin color and clothing in adults prefer black and red, sense of body position among others, which enables selection of their victims, as not all are chopped equal frequency. It made a wide search mosquitoes in articles and books and none of the authors mentioned receptors in their studies.





**Fig 4. Mosquito adult.**

Efforts to eradicate larvae using multiple resources by the Ministry of Health have been systematic and advertising expenses is expensive. greater education and awareness with support for communities to collective and individual level is needed. When the Abbe intradomiciliar use as prevention and sanitary control without the expected impact is made. Today fry used as fish hatcheries in containers and sanitary control.

**Conclusion**

Larvae stages I, II, III and IV have protein receptor RP55 of photo-thermo receptors of light and heat housed in the body is divided into head, thorax and abdomen, perceive hot or cold environments, and have fibers

in chest or hairs lining your body or abdomen, and a pair of antennae on the head. Stages II and III are more developed than the initial stages. They are attracted by the dark green at the bottom, a pair of eyes that perceive light and color. Have receptors proteins (RP55) that capture motion at a speed the slightest movement of waves in the water. Its nose is not well developed but have chemoreceptors. They adapt to changes in pH in alkaline media, are sensitive to chemical, thermal and mechanical changes nociceptors have electroreceptors or galvanoreceptores sensitive to electrical stimuli, have mechanoreceptors that are sensitive to touch, pain, pressure, gravity, sound. They have a GPS position that seems the guides. It is precisely in the fibers, mushrooms or bristles are recipients along with the micro villi in head, thorax and abdomen.

### **Gratitude**

We thank the Department of Microbiology, Faculty of Medicine, University of El Salvador for giving their research facilities.

### **Bibliography consultation**

Bastidas, Rodolfo y Zavala, Yanet. 1995. Principios de Entomología Agrícola. Ediciones Sol de Barro. ISBN 980-245-006-5.

Antonio Encinas Grandes.1982. Taxonomía y biología de los mosquitos del área salmantina. Editorial CSIC - CSIC Press. Pp 437.

Rossi, Gustavo y Almirón Walter. Clave ilustrada para la identificación de larvas de mosquito de interés sanitario encontrados en criaderos artificiales de Argentina. Publicación monográfica 5.

Pazos y Caballero. 1903. Del exterior al interior del mosquito. Apuntes sobre la anatomía y morfología. E printed from Rev.de med.trop., Havana 4:209-218, 1903.

García, I et al. Manual de laboratorio de parasitología. 2009. Serie parasitología, ISSN 1989-3620

Peters, W. y Gilles, H. M. 1989. A Colour Atlas of Tropical Medicine and Parasitology.

Wolfe Medical Publications, London.

Ash, L. R. y Oriel, T. C. 1987. Parasites: A Guide to Laboratory Procedures and Identification. ASCP Press, Chicago.

Botero. Parasitosis humanas. 2001 4a edicion corporacion para investigaciones biologicas.