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MONOGRAPH

"THE AEDES AEGYPTI, A GUEST OF HONOUR DURING THE RAINY SEASON IN ECUADOR"

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Gratitude

Through the pages of this work I want to express my gratitude to all those who in one way or another have contributed to the completion of this stage of mine as a student, especially to:

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My teachers, who have given me their knowledge selflessly and patiently.

My family, especially my parents, who have always given me their support and love and pushed me forward, encouraging me to fulfill my dreams.

Summary

It is common to hear that, during the winter months in Ecuador, the risks of contracting diseases increase. The greatest victims are diseases caused by insects such as the Aedes Aegypti mosquito, which mainly affect the most vulnerable population like children and the elderly. This work seeks to make people know more about this small enemy of human health, its characteristics, the diseases it causes and the way they can be fought.

This document will first contain a description of the Aedes Aegypti mosquito, its habitat and factors that influence its proliferation. Then, the main diseases caused by this insect will be listed and a brief description of its symptoms will be made. Finally, general recommendations will be made to avoid breeding of these mosquitoes and to create a culture of prevention.

It is expected that at the conclusion of the reading of this work, there will be a greater knowledge of the threat that constitutes the Aedes Aegypti mosquito for the health of the population and that it is made aware that with prevention methods it is possible to prevent the proliferation of diseases that cause, thus improving the standard of living in our country.

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Introduction

This monograph is a research work about ***The Aedes Aegypti, a guest of honour during the rainy season in Ecuador.*** The Aedes Aegypti mosquito is an insect that proliferates during the winter season in our country because both the climatic conditions and the hygiene conditions in our cities favor its proliferation.

In the world, there is no one free from the experience of a mosquito bite, the same in London, Kuala Lumpur or Caracas, in Egypt or Australia and even Alaska. The attack of this fragile insect, approximately half a centimeter long, is very common when it invades a human room and injects its fine sting into the skin of mammals; although some attack other groups of animals such as reptiles. It is a true vampire since it requires blood to reproduce.

At the beginning of chapters 1 and 2 we have tried to make a brief and simple description of the Aedes Aegypti, and then enumerate and detail the main diseases it causes as well as its symptoms. Finally, in chapter 3, simple forms of prevention, both at the family and institutional levels, are enunciated that can be implemented to diminish the presence of the focus that generates winter diseases.

The topic was chosen due to the concern for the great impact on the health of the most vulnerable population, such as children and the elderly so that with the knowledge of possible prevention methods, these can be implemented and improve the quality of life of our society.

(250 words)

Chapter I

Knowing your enemy

1.1 Description

The Aedes Aegypti mosquito belongs to the Aedes family; it is black with a white lyre shape and stripes on its legs. It mostly bites humans and usually stings in closed places.

The Aedes Aegypti places its eggs in natural places such as trees or in artificial places such as a water container. This species lays its eggs during the day if in the water container it has organic matter such as decomposing leaves, algae, etc.

The eggs are not capable of surviving under abrupt environmental conditions i.e. they cannot survive in a very cold climate, in the winter although this species develops and originates from it, it's very cold conditions can make the eggs do not last as it is in the United States more frequent in the south as well as in Latin America.

Many eggs for survival adhere to the side walls and, if the water is emptied, can last alive for a maximum period of one year.

The Aedes Aegypti for breeding around homes and egg production sites are often found inside or very close to homes, due to the presence of places that facilitate their breeding activity, most where they are found are in water containers in homes. They rest indoors (in closets and other darks places) and in cool, shaded open spaces.

If the book is read one can see the meaning of the word "Aedes". (Richard).(1960). “Should the wording of the original description indicate, as Mattingly maintains(...).(p.23).

Aedes Aegypti also transmits dengue, chikungunya and yellow fever, unlike the female mosquito (anopheles) which in this case is the particular type of species that causes malaria.

Unicef (2016) affirms:

> Zika disease usually causes mild fever, rashes, headache, conjunctivitis and muscle and joint pain a few days after the bite of the mosquito, most infected people do not have symptoms, as long as they are not infected. That in those who do, the disease is usually moderate, with a high prevalence of symptoms that can last from two to seven days. (Unicef, 2016, p.3).

1.1.1 Morphology.

The Aedes Aegypti consists of a small body and measures about 5-10 millimeters. For the reason of being family of the Aedes we are going to observe in him characteristics that link him with this one, like for example the palpos (that are the sensorial appendices that possess the arthropods); nevertheless, they do not get to be equal since this one consists of palpos much shorter than the proboscis.

They usually bite at dusk and dawn, times when females move to look for hosts, although if the host gets into breeding grounds can be attacked by females at any time of day.

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Larval brood stocks are usually small water spots, both natural: holes in trees or rock cracks, and artificial: jugs, vases, ashtrays, pot plates or fountain drains, usually related to open spaces with vegetation.

This means that the eggs of this group of insects resist dehydration perfectly (it is even a necessary condition to continue their life cycle), which has allowed them, together with other factors, such as globalized trade, to disperse to other geographical areas, including Europe. The sting of the Aedinos is usually quite painful with a great local affectation.

1.1.2 Reproduction.

Male reproductive gland proteins impact the physiology and/or behavior of mated females in a broad range of organisms. We sought to identify mRGPs of the yellow fever mosquito, Aedes aegypti, the primary vector of dengue and yellow fever viruses.

Earlier studies with Aedes aegypti demonstrated that “matrone” (a partially purified male reproductive accessory gland substance) or male accessory gland fluid injected into virgin female Ae. aegypti affect female sexual refractoriness, blood feeding and digestion, flight, ovarian development, and oviposition. Using bioinformatic comparisons to Drosophila melanogaster accessory gland proteins and mass spectrometry of proteins from Ae. aegypti male accessory glands and ejaculatory ducts (AG/ED) and female reproductive tracts, we identified 63 new putative Ae. aegypti mRGPs. Twenty-one of these proteins were found in the reproductive tract of mated females but not of virgin females suggesting that they are transferred from males to females during mating. Most of the putative mRGPs fall into the same protein classes as mRGPs in other organisms, although some appear to be evolving rapidly and lack identifiable homologs in Culex pipiens, Anopheles gambiae, and D. melanogaster. Our results identify candidate male-derived molecules that may have an

important influence on behavior, survival, and reproduction of female mosquitoes. (Craig). (1967). "Mosquitoes: female monogamy induced by male accessory gland substance." (p.156).

1.2 Geographical Location

Originally species of Afrotropical distribution (A. aegypti), thanks to human action and their great capacity to adapt to new habitats, have been described in large biogeographic zones: Palearctic, Nearctic and Neotropical.

Mosquitoes are found in immature stages in water, especially in artificial containers very close to homes and often indoors.

Flight radius studies indicate that most Aedes aegypti females can spend their entire lives in or around the houses in which they have become adults, and that they usually fly about 400 meters on average.

This means that it is people, rather than mosquitoes, who rapidly spread the virus in the communities or places where they live or from one community or place to another.

During the rainy season of 2001, the incidence of the dengue vectors Aedes aegypti and Ae. albopictus was examined in different habitats of two cities (Rio de Janeiro and Nova Iguaçu) in Rio de Janeiro State, Brazil, and in two cities (Palm Beach and Boca Raton) in Florida.

Oviposition trap collections were performed in urban, suburban, and rural habitats in both areas.

The plenitudes and frequencies of event of Aedes aegypti is influenced in inverse manners by expanding urbanization were just halfway bolstered. City, territory, and their collaboration altogether influenced the bounty of the two species. Urban communities with high bounty of Aedes aegypti likewise had a high wealth of Aedes albopictus.

The two species were generally plenteous in the urban areas of Rio de Janeiro state and the most minimal in Boca Raton. Natural surroundings had a huge yet inverse impact on the bounties of Ae. aegypti and Ae. albopictus. When all is said in done, Aedes aegypti was generally predominant in profoundly urbanized zones and Ae. albopictus in rustic, rural, and vegetated urban territories in Rio de Janeiro state and Florida. Be that as it may, plenitudes of the two species were comparative in most rural zones.

Analyses of frequencies of occurrence showed an unexpected high level of co-occurrence of both species in the same oviposition trap.

Despite the different geographical origins of Aedes albopictus in Brazil and the United States, the habitats used by this recent invader are remarkably similar in the two countries.

(1.138 words)

Chapter II

Small but very dangerous

2.1 Diseases caused by Aedes Aegypti

The bite of the Aedes Aegypti mosquito may be unimportant in individuals who are affected by it, but it has a very high death rate Figure 1(2019) Pan American Health Organization. The country has suffered 4 deaths due to its current sting in 2019. The diseases that occur in Ecuador produced by the Aedes Aegypti do not originate from it but as a kind of transport for some diseases such as Zika, Dengue, Chikungunya, and Malaria.

2.1.1 Zika.

Zika is a viral disease originating in Africa and widespread in many countries in America and Asia. It is the last discovered disease, considered especially dangerous for pregnant women because it can lead to microcephaly. It is transmitted by the Aedes mosquito species. The symptoms disappear on their own, without any treatment. They may even go unnoticed. As mentioned in the newspaper El Universo (2019). Nationally, Manabi is the province with the most affected. It has 85% of the total cases, this is 2,507 infected. They are followed by Esmeraldas, Guayas and Santo Domingo, according to the statistical gazette of the MSP.

2.1.1.1 *Symptoms.*

The symptoms that people present are high fever, rash on the skin, joint pain and conjunctivitis, muscle pain.

Zika virus illness is usually mild with symptoms lasting a few days to a week. People who become infected with Zika usually do not feel sick enough to go to the hospital, and it is very rare for them to die from the virus.

2.1.1.2 *Characteristics.*

When Zika occurs in a woman who is pregnant, there is a high risk that the baby will develop microcephaly at birth. Microcephaly is a neurological disorder that occurs in fetuses that do not develop enough cephalic fluid, resulting in the brain is abnormally formed having a much smaller than normal size.

The Zika virus usually remains in the blood of the infected person for about a week. Consult your doctor or other health care provider if you have symptoms and live in an area at risk for Zika or recently traveled to an affected area. Once a person has been infected, they are very likely to be immune to future infections.

2.1.2 Dengue.

It is a virus that is similarly transmitted by the Aedes Aegypti, but it is also produced by the tiger mosquito.

In 2019, 23 deaths occurred in Ecuador. In Ecuador, there were 16,544 people with this disease and a case fatality rate of approximately 0.73%.

2.1.2.1 *Symptoms.*

Side effects incorporate serious stomach torment or palpation torment, constant regurgitating, clinical amassing of mucosal draining liquids, laziness or peevishness, postural

hypotension (lipotimia), hepatomegaly more prominent than 2 centimeters, dynamic increment in hematocrit.

There is no drug to treat dengue contamination, you can take analgesics with acetaminophen. It is imperative to rest and drink a lot of liquids. It very well may be lethal if not appropriately overseen clinically, particularly when there is a disease by various serotypes.

2.1.2.2 *Characteristics.*

Ecuador has confirmed recent cases of dengue fever. The risk is present throughout the year, with a maximum transmission during the rainy season, from January to September, because at those times there is often rainfall to produce pits and pools with water through it, the mosquito lays eggs and thus prolific the same.

It is estimated that 70% of the territorial extension of the country has environmental conditions conducive to the reproduction of the vector transmitter of Dengue Aedes aegypti, and therefore all populations settled in these geographical areas have the possibility of suffering this disease. Therefore, Dengue is a public health problem especially in the rainy season due to the great proliferation of the vector.

2.1.3 Chikungunya.

It is a disease that is transmitted by an infected mosquito that bites the human being, it can be either the Aedes Aegypti or the Tiger Mosquito.

The disease emerged in 2013, and cases began to be reported in South America in the same year. The first symptoms usually appear between 3 and 7 days after the bite of an infected mosquito. To date, 2 fatal cases of chikungunya have been reported: one in Esmeraldas district and one in San Lorenzo district.

2.1.3.1 *Symptoms.*

Most people who are infected have symptoms, which can be severe.

According to the World Health Organization (2015) the majority of those infected have high fevers, along with severe joint pain, headaches, nausea, fatigue and skin rashes.

2.1.3.2 *Characteristics.*

Its death rate is impossible and there is no fix so its treatment incorporates analgesics or non-steroidal mitigating medications to lessen torment and aggravation. There is an antibody in the trial stage made appropriating of infections that lone influence bugs and that has created a quick invulnerability in non-human mice and primates; nonetheless, its utilization isn't yet approved for individuals.

The Minister of Public Health highlighted: “On Tuesday, 230 cases of chikungunya were reported in Guayas (68 in Guayaquil), due to a notification error by the Infectious Hospital, since only laboratory-confirmed cases were reported, not including 1,569 with clinical diagnosis, reason for which there was an increase to 1,799 cases”

2.1.4 Malaria.

Jungle fever is a genuine ailment brought about by a parasite. An individual can be tainted whenever chomped by an Aedes mosquito or a tiger mosquito. Intestinal sickness assumes a significant job despite death worldwide yet is practically killed in the US. The sickness is equitably an issue in underdeveloped nations with warm atmospheres. On the off chance that you travel to those nations, you are in danger of getting this infection. There are four unique kinds of intestinal sickness brought about by four related parasites. The deadliest sort happens in Africa, south of the Sahara Desert.

2.1.4.1 *Symptoms.*

It is a parasitic disease that involves high fevers, chills, flu-like symptoms and anemia, bloody stools, in severe cases can end in a coma the infected, jaundice. Muscle pain and convulsions.

2.1.4.2 *Characteristics.*

Malaria is caused by a parasite that is passed on to humans through the bite of infected Aedes family mosquitoes. After infection, the parasites travel through the bloodstream to the liver, where they mature and produce another form of parasites, called merozoites. The parasites enter the bloodstream and infect the red blood cells. The parasites grow inside the red blood cells. The red blood cells break down within 48-72 hours, infecting more red blood cells. The first symptoms usually occur 10 days to 4 weeks after infection, although they may appear as early as 8 days or as late as a year after infection. Symptoms occur in cycles of 48 to 72 hours. (Montero, 2015; Acosta, 2016).

(1.097 words)

Chapter III

Fighting the enemy

3.1 Mosquito Control Strategy

According to the WHO (2002, p.2), "two-fifths of the world's population lives at risk of being infected by dengue and more than 100 countries have been affected by epidemics of dengue or hemorrhagic dengue". It can be said that annually there are more than 50,000,000 cases of dengue, approximately 95%.

3.1.1 Characteristics of a control strategy.

There are two types of strategies: control and eradication, both with different methodologies and goals.

3.1.1.1 *Control strategy.*

Discard containers where water accumulates; if it cannot be discarded, just put upside down, place a mosquito net on all windows and the front door to the home, keep the grass mowed to avoid the growth of bushes and clean patios to avoid puddles of water, change the water in the vases, dishes under flowerpots and pet drinkers daily, cover the tanks and containers to collect water, empty the drains of air conditioning or rain drains, uncover the drains of rain and gutters, use repellent and renew it every 3 hours; in children should be applied by an adult and should not be used in children under 2 months, use spirals or repellent tablets in the rooms, place tulle in cribs and strollers.

3.1.1.2 *Eradication strategies.*

This strategy implies universal coverage of all mosquito breeding sites in all infested localities in the country, for the total elimination of the vector and subsequent permanent surveillance against reinfestation. The initial cost of this strategy is high, but once the mosquito is eliminated, the cost of reinfestation surveillance is much lower, and the transmission of dengue and urban yellow fever is avoided altogether.

3.1.1.3 *Promotion, community participation, legislation.*

Promotion of these principles in the development policies of all relevant agencies and organizations and civil society; establishment or strengthening of normative and legislative controls for public health, and empowerment of communities.

3.1.1.4 *Collaboration of the health sector.*

The climate science community can play an important role in addressing public health challenges. Many human diseases and health conditions are sensitive to changes in temperature, precipitation, humidity, wind and other environmental variables such as air or water quality. Therefore, climate information can be used as a risk indicator and to inform disease monitoring and health research. In some cases, it can be used to predict the time and place of a disease outbreak, depending on expected weather conditions.

According to El Telégrafo (2015), "a mosquito of the species Aedes aegypti can travel 400 meters around in any sector". The minister of health said it because with a bottle in collected a sample of embedded water that was located about 400 meters and observed larvae of mosquitoes that proliferated in it.

3.1.1.5 *Disease control.*

Some mosquitoes are vectors of disease. This means that they can transmit diseases from one human or animal to another. Normally, diseases are caused by viruses or tiny parasites. For example, a mosquito that bites an infected human or animal can pick up a virus along with the blood it sucks. Vargas Javier (2003) says that the mosquito and the virus do not harm each other, but the virus reproduces inside the mosquito. Later, the mosquito can transmit the virus to other human beings by biting them. Some control can be achieved in the diseases it causes.

Preventing the mosquito bite, mosquito diseases can be transmitted from the pregnant mother to the fetus and this can present difficulties in the birth of the same, some diseases of the mosquito can also be transmitted sexually, however, it can reduce the possibility if in sexual relations both use condoms. There is currently no vaccine to cure diseases.

3.1.1.6 *Infrastructure and resource development.*

It has been reported that WHO was active for the mosquito action week and more than 12 Caribbean countries were implementing activities related to this week, serving as an example of the model to be adapted and implemented throughout the Americas region. Many countries in South America want to integrate and carry out campaigns and within health where they specialize in the state of the sick and others can provide help for some sick people who need it for their welfare.

3.1.2 Strategy implementation.

Integrated management for dengue prevention and control is a model for planning, organizing, conducting, executing, evaluating and monitoring structures as well as oriented processes and results.

3.1.3 Control methods.

The Aedes aegypti mosquito uses a multitude of reduced spaces, both artificial and natural, as breeding grounds.

In some artificial containers, large numbers of adult mosquitoes proliferate, while others are less productive. Efforts to control vectors should, therefore, be directed at those habitats that are most productive and therefore epidemiologically important, rather than at all types of receptacles, especially where there are significant resource constraints.

3.1.3.1 *Environmental management.*

Eliminate mosquito habitats around homes, make sure the mosquito doesn't have a place to lay its eggs. Because mosquitoes need water for two stages of their life cycle, it is important to control that there are no water sources. use structural barriers since Aedes mosquito bites frequently occur indoors and is an important way to reduce the incidence of bites, control the mosquito in the larval stage, control the adult mosquito, and so on.

3.1.3.2 *Chemical control.*

A way to have control between the mosquito is the larvicides, this is a product composed of a set of substances whose purpose is to eliminate the larvae where they are. It is usually

impractical to use it in places where the Aedes aegypti proliferates as containers where water is stored.

3.1.3.3 *Biological.*

Biological control is based on the introduction of organisms that depredate or parasitize the populations of the species to be controlled, compete with them or otherwise reduce them. In the case of Aedes aegypti, there are larval fish and predatory copepods that are effective against vector mosquitoes in immature larval stages. Several species of fish have been used to eliminate mosquitoes from large containers used to store drinking water in many countries, as well as in open freshwater wells, ditches, and industrial reservoirs. Guppies are generally well-suited to these types of closed aquatic environments and have been used on many occasions.

(1.022 words)

Conclusions

Once the investigation and collection of data that make up this monographic work has been completed, it can be concluded that:

• Mosquitoes, like other small insects, can greatly affect the development of a society, obviously their affectation is negative. In every society, one of the main objectives is to keep its members healthy, especially the members of the most vulnerable groups such as children and the elderly, who if affected by any of the diseases we have studied caused by Aedes aegypti, they seriously affect and even, unfortunately, die. For this reason, we should not underestimate it and through informative methods try, first of all, to know Aedes aepypti and its weaknesses in order to combat it efficiently.

• Aedes Aegypti can proliferate under certain conditions that allow its larvae to reproduce more easily. Knowing these conditions gives us an advantage that we can use against it by creating strategic plans that can be applied both at the household level by adults and children, and at the sector level by the respective authorities. Eliminating outbreaks of infection where epidemics often originate can become the main strategy in the fight against Aedes Aegipti and its lethal diseases.

• We should not fear the Aedes Aegypti mosquito, it is now known that it is possible to cut off the presence of the diseases that this insect causes. Applying prevention above all will give us excellent results in the short and long term. Then, as it has been investigated, the fact of being able to identify the diseases that it causes based on its symptoms, allows an adequate and timely diagnosis and an efficient treatment that will allow us to lower population mortality rates.

Although the motto may seem somewhat worn out, I think that in order to achieve an efficient way to combat this small and dangerous enemy we must join efforts at all levels without belittling the contribution that children, adults, civil society and authorities can give; and together support with our grain of sand, without forgetting that "Unity is strength."

(343 words)

Recommendations

At the end of this monographic work it is recommended:

1. That because of the situation that societies present before the bites and diseases caused by the Aedes Aegypti mosquito, to take the necessary measures to avoid the massive continuity of patients and to prevent deaths before the vector.

2. Promote people's awareness to take this case seriously to prevent deaths, carrying out talks, campaigns or recreational activities to achieve a better understanding of the situation in the face of what the vector can cause in health.

3. To make the population aware of the importance of disease prevention, specifically those caused by the Aedes Aegypti, and the protagonist that their actions can have in the actions to combat this insect.

(122 words)

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