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## Iraq's swamps and surrounding pests

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**Abstract.** According to the results of a study conducted on the types of mosquitoes prevalent in certain parts of the Al-Qadisiyah Governorate, the following types of mosquitoes exist: There are *Culiseta longiareolata*, *Obadiah* spp., *Aedes detritus*, *Cx. molestus*, and the Asian tiger mosquito. The presence of mosquitoes reached *molestus*, where the highest concentrations of *Cx. molestus* were recorded in the neighbourhoods of Al-Hakim, Al-Orouba, Al-Tali'a, and Al-Hamza Al-Sharqi, 84%, 76%, 72%, and 50%, respectively. To mimic mosquito infestation and control, this study will create a mathematical model considers environmental factors, including wind, temperature, and terrain features. We paid special attention to the Asian tiger mosquito, which is now known to be a significant carrier of human illnesses such as dengue, yellow fever, and chikungunya. The management of disease vectors is one method for preventing such epidemics. As an alternative to chemical control methods that are extremely detrimental to the environment, biological control methods such as the insect technique (SIT) are of great interest. The success of SIT depends on accurate modelling of insect dispersion as well as solid knowledge of insect biology. To predict mosquito dispersal, we take into account a piecemeal approach and build temporal, spatial, and temporal models employing susceptibility, diffusion, and interaction equations. A propulsive differential equation is used to represent the release of infertile males on a regular basis. Finally, we offer numerical simulations of mosquito dispersal and assess several vector control scenarios utilizing a split factor approach and numerical approaches that are ideally suited to each operator. We demonstrate how the environment can have a significant impact on mosquito dispersal as well as the effectiveness of vector control techniques such as SIT.

**Keywords.** Iraqi environment (Al-Qadisiyah governorate), Asian tiger mosquito, D D T, *Bacillus thuringiensis*, Human diseases, Insect biology, Sterile insect technique

**I.Introduction :** Because they are carriers of several virulent infections, mosquitoes are crucial insects for both human and veterinary medicine. It is one of the greatest threats to public health and economic prosperity for both humans and animals in many nations. As Aldo performs the bio transfusion of three groups of pathogens—aphids, viruses, and nematodes—that cause numerous diseases such as blood loss, itching, sensitivity and edema, and it was found that the

threatened regions have significantly expanded. With increasing temperature rising, diseases are being transmitted and eradicated because of vector bugs. To address this issue it, special initiatives have been established throughout the world using a variety of disruptive techniques, such as filling in ponds. Additionally, mosquito breeding grounds, dry swamps, and cut weeds that sprout and drift in sewers were removed. Water and mineral oil were sprinkling on the flats to suppress the aquatic phases of insects. [1]

Using insect growth regulators to stop development and excretion, watering to stop the emergence of larvae and pupae, using natural adversaries such as Gambaya fish, water bugs, and other indexes, adults such as Hassid utilize electric traps that stun bugs when they are drawn to them or sterilize male mosquitoes with X-rays or gamma rays before releasing them in the area where mosquitoes need to be controlled. Chemical pesticides are used to combat the insects that spread these diseases. effective in lowering the prevalence of certain diseases, particularly where vector insects breed Beginning in the 1950s, relatively large volumes of chemical pesticides were applied, which resulted in the establishment of resistance to these pesticides as well as unintended poisoning in nontarget organisms. substances that are comparatively safe for the environment and utilized against . [2]

Abate is a substance that is currently widely used to inhibit mosquito larvae and pupae. Mosquito pupae were obtained from the Iraqi Ministry of Health, and it is one of the most significant insecticides because of its numerous desirable features. It is better to employ organic insecticides because they can operate under astronomical settings and have low toxicity . [3] Abate, which is currently being used extensively to reduce mosquito larvae, is a chemical that is generally harmless to the environment and effective against mosquito larvae and pupae. Mosquito pupae were obtained from the Iraqi Ministry of Health, and it is one of the most significant insecticides because of its numerous desirable features. The use of organic pesticides is recommended because of their ease of use and low toxicity, which can cause heavy metals to survive in stormy situations. As a result, experts have turned to creating the biological control principle, which is their concern. A single pest, it is regarded as bacterium since it lacks the ability to harm the environment or develop resistance to the key adversary . Due to its rapid growth and reproduction as well as its capacity to employ a variety of nutritional sources for growth, it is one of the most significant biological control components. Therefore, in the fight against mosquitoes, biological pesticides are ideal substitutes for chemical pesticides since their toxins are less harmful. For both human health and nontarget species, this form of bacteria is safe.

## II.The aim of the research :

1. The relationship of mosquitoes to medicine.
2. The impact of these types of mosquitoes on the environment was identified.
3. The types of mosquitoes in the various water basins and sites were determined for the purpose of determining the dominant species in Al-Qadisiyah Governorate.
- 4 . Knowledge of the effect of *B. Bacillus thuringiensis* strains: *Bacillus thuringiensis israelensis* on the environment

## III.The medical importance of mosquitoes:

From a medical and economic standpoint, mosquitoes are one of the most significant types of insects. They are major disease vectors that are present on all continents except Antarctica. Mosquitoes have long been linked to illnesses that can afflict both people and animals Before

the late 1800s, it was unknown whether mosquitoes served as intermediate hosts for vertebrate parasites. Since that time, mosquitoes have been cited as the arthropod that is most dangerous to people's health. According to reports the culicine mosquito a known disease carrier in Iraq, bites both people and animals making it a nuisance in both urban and rural areas. [4]

However, more recent research has revealed that some culicines are vectors for the viruses Japanese encephalitis virus (JEV) and Rift Valley fever in the eastern Mediterranean region, which includes Iraq.



Figure No. (1): Image of the *Culicine Mosquito* [25]

Post Mosquito Cx.p. This species was identified as a mechanical vector of the hepatitis C virus in Iraq. and other pathogens of this type, from samples collected locally, were isolated from Cx.m, including encephalitis viruses in the Murray Valley, the viruses virus Murray Valley, Parma Forest virus, BFV (virus), and Ross River virus (RRV). The first blood meal is necessary for the transition. Therefore, the egg ion plays an important role in the spread of epidemic-causing diseases to thrive in an environment around humans to live within a phenomenon called autogenesis: which is the phenomenon of mosquitoes postponing blood feeding.. [4] [1]

#### **IV.Environment and mosquitoes :**

In the hot tropics the majority of the species of the genus Culex can be found in humid and arid regions; the insect is found in ponds during its immature stage, therefore its environment is wet open locations where precipitation and standing water accumulate. The mosquito (Cxp.m.) is widespread in northern Iraq, particularly in the region around Mosul, where it is found. Additionally, it was noted in Iran's frigid regions, particularly in Tehran's northern regions. The Cx.m . mosquitoes are more prevalent in subsurface sites than at surface sites. As one of the species that enjoys interactions with people Cx.p.m. is located in Najaf Governorate in Iraq, and it is one of the species that adapts to surroundings around human habitations. Cx.m. favour low locations that collect rainwater and sewage in metropolitan environments, such as tunnels and metros. [5]

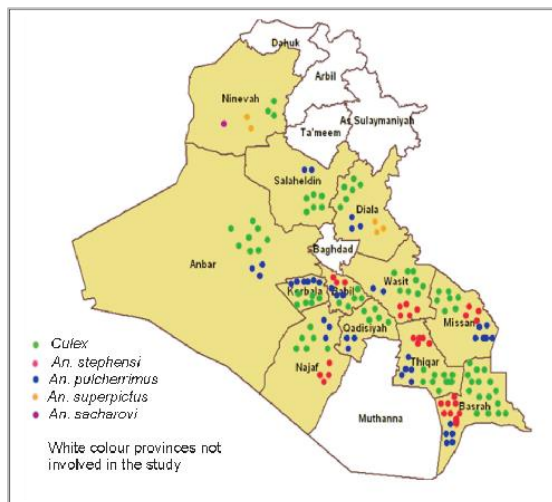


Figure No. (2): Map showing distribution of mosquito species in Iraq, 2009 [26]

**Al-Qadisiyah Governorate (geographical nature / climatic conditions):**

One of the cities in southern Iraq and the Middle Euphrates region is Diwaniyah. All administrative and governmental institutions are housed there, making it the political, economic, and administrative hub of the Diwaniyah Governorate. It is located approximately 180 kilometers from Baghdad and is traversed by the Shatt al-Diwaniya branch of the Euphrates River.

Within the governorates of the Middle Euphrates, the Al-Qadisiyah Governorate represents the center of the sedimentary plain. It has borders on all of its sides. Babel Governorate, to the north, and Al-Muthanna Governorate, to the south, form its borders. The governorates of Wasit and Dhi Qar are bordered from the east and the eastern north, respectively, and from the west by the governorate of Al-Najaf. [6]

The Al-Qadisiyah Governorate is a Middle Euphrates Governorate, and as such, its geographic location is regarded as a significant component of the Iraqi Sedimentary Plain, which is the most significant Quaternary period and the most recent geological formation. This plain was formed by sedimentation processes that gradually filled the large shortened torsion, and as such, it made up nearly one-fifth of the area of Iraq, or roughly equivalent territory. The research region was distinguished by its flat surface, which generally dips from the northwest to the south and east due to precipitation, and is approximately 93,000 km<sup>2</sup>. There are three different levels of elevation

- The first is represented in the northwest and has a height between (18 and 22 meters).
- The second is located in the center of the governorate's surface and has a height range of (14–18).
- The third is found in the southeast and has a height range of 10 to 14.

**climate elements:**

The Al-Qadisiyah Governorate temperature data show that the region's average daily height is 25.1 degrees Celsius, its average daily temperature is -6 degrees Celsius, and its annual temperature ranges from 44.5 degrees Celsius in July to -6 degrees Celsius in January.

In terms of the rain that fell into the Al-Qadisiyah Governorate, the average rainfall (was 97.5) m.

In January and February, it grows until it drops to (20.2) m and (13.2) m, respectively, and then drops to (3-4) m in March.

One of the governorate's most significant sources of water is surface water. It primarily consists of the Euphrates River and its tributaries within the governorate, as the Euphrates River divides into two branches at the Hindiyah Dam (Shatt Al-Hillah and Shatt Al-Hindia), with Shatt Al-Hillah being one of the most significant streams branching from the front of the dam, and into three branches at the administrative borders of the provinces of Babylon and Al-Qadisiyah, specifically to the north of The Euphrates River's main course is Shatt Al-Hindia. After the Al-Hindiya Dam, it divides into two main branches, Shatt Al-Kufa and Shatt Al-Shamiyya, to the south of the city of Al-Kifl, at a distance of no more than five kilometers. In the Salahiyah neighborhood, he enters the Al-Qadisiyah Governorate's territory. [6] [7]

## **V. Mosquito control and its environmental dimensions:**

### **I. Mechanical control :**

Preventant measures are used to battle mosquito larvae by removing their breeding and housing areas.

By tapping, drying, backfilling, or other methods water that would be good for mosquito breeding disposal can be removed, stored rainwater can be drained, and old tires, covers, and tin cans that collect water can be removed so that the area is suitable. The water in public park fountains and ponds should be changed at least once a week to minimize mosquito reproduction and survival. [2] The windows should also be covered with gauze to keep mosquitoes out. Moreover, to protect the ecosystem, mosquito control measures include enhancing the area's cleanliness, putting in contemporary sewage systems, rationalizing water use, and eradicating weeds that are growing next to the water.

The quantity of mosquito pupae is reduced when rice fields are managed with water, which involves flooding the field with water for one week, letting it dry for three days, and then flooding it again. [2]

### **II. Chemical control :**

Moreover all chemical pesticides, regardless of how they work, will cause the target species to develop resistance, necessitating the development of new insecticides. Diphenyl- dichloroethane (DDT) an insecticide was one of the first pesticides applied to eradicate disease-causing arthropods during World War II. It was initially employed to fight malaria and typhus. Globally, the number of DDT malaria cases in 1955 drastically decreased. [2] [8] [9]

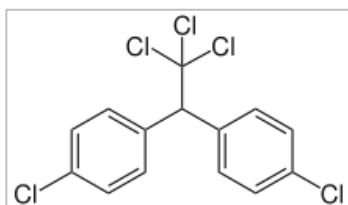


Figure No. (3) shows the chemical structure of Diphenyl-Dichloro insecticide [27]

Pesticide residues in the environment disintegrate:

Numerous factors can influence how quickly pesticide residues in the environment break down. The chemical makeup of pesticides, which is thought to be responsible for the majority of pesticide pollution issues, is one of the most crucial factors. In this section, we will try to explain how long pesticide residues decompose in the environment.

It does not necessarily follow that its impact will be diminished; rather, it is possible that these byproducts of decomposition may be more hazardous and poisonous to the environment than the initial molecule. [9]

Factors influencing pesticide residues

Any pesticide residue may be impacted by a variety of factors, such as the following:

- 1) Adsorption of the pesticide by soil components.
- 2) Use rainwater to remove the pesticide.
- 3) Pesticides are taken up by plants and animals. [2]
- 4) Direct or indirect evaporation.
- 5) Use the wind to carry and transport chemicals.

The aforementioned elements might lessen the quantity of residues at the location where they were found, but when we consider the environment as a whole, we see that these procedures did not lessen the quantity of pesticide residues. The mechanisms that actually diminish and eliminate these residues, nevertheless, [10] are those that involve microorganisms, soil, sunlight, pH, heat, and auxiliary variables in the soil and its enzymes, since these elements work to degrade it and lower its concentration in the environment. Environmental pesticides include:

Decomposition in the soil caused by microorganisms Fungi and bacteria, which are among the most significant types of microorganisms found in soil, can break down pesticide residues through a variety of chemical processes. [2]

Pesticide.

Organochlorine insecticides were used first.

1- pesticide DDT

DDT is destroyed and broken down by soil microorganisms into a variety of chemicals by a number of processes, including:

A) Reductive dechlorination reaction: In this reaction, a chlorine atom is reduced and removed, converting DDT into a number of compounds. TDE (Tichloro Diphenyl Ethane), DDMS (Dichloro Diphenyl Mono Chlorinated Saturated Ethane), and DDNS (Dichloro Diphenyl Non Chlorinated Saturated Ethane) are a few of these substances. [9]:

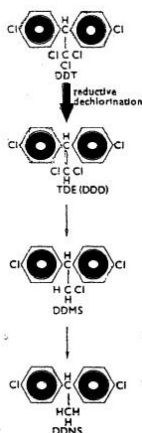


Figure No. (4): Explains DDTA chemical equations [28]

B) In the oxidative stress response, DDT is transformed into Dicofol.

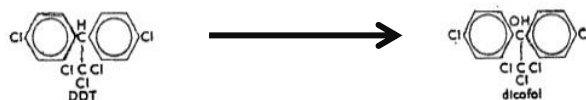


Figure No. (5): Transformation process DDT into Dicofol [29]

C) Dehydrochlorination process: In this reaction, chlorine and an atom of hydrogen are removed from some of the compounds produced in the first reaction. TDE and DDMS are transformed into DDMU and DDNU, respectively. [9]

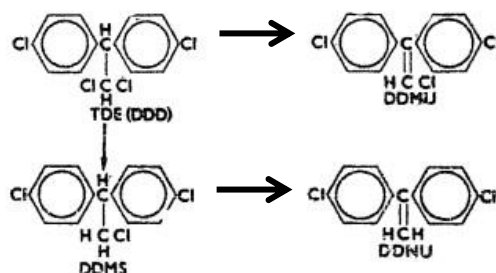


Figure No. (6): Transformation process TDE and DDMS are transformed into DDMU and DDNU [27]

BHC, or benzene hexachloride

In contrast to the other pesticides in the organic chlorine group, the BHC pesticide is known to quickly disappear from the soil. [10] Microorganisms and soil alkalinity are key factors in pesticide degradation by dehydrochlorination. Some studies have revealed that the process of



BHC disintegration and decomposition is faster anaerobic conditions, therefore it disappears quickly in stagnant or soggy soils. This is due to the activity of microbes on the PCCH molecule.

2- Insecticides using cyclodiene

3- Numerous significant pesticides, including chlordane, dieldrin, and aldrin, are part of this category. These pesticides are characterized by a high level of stability, few microorganisms can break them down. According to the findings of one study, only 10 of the 600 soil microbe isolates were able to act on the dieldrin pesticide. [9]

### III. Genetic control :

The prevention of insect reproduction, sometimes known as sterility, is one effective method controlling insects, which is to render them sterile. This can be done through genetic approaches, such as the use of gamma rays, or chemical sterilizers; there are approximately 400 compounds that render an insect sterile when applied to it. These substances, which come from several chemical families, are either used directly to treat insects or combined with food to be used as baits. All of these chemicals are exceedingly harmful agents that cause sterility. They also have negative consequences on people and other animals, including cancer, dystocia, and numerous genetic abnormalities. These compounds cannot therefore be dispersed across the environment. Although there is much interest in identifying chemical sterilizers with limited impacts on insects, their manufacture has not yet been achieved; thus, they must be employed in controlled laboratory settings. [11] However, detractors worry that if released into the wild, genetically engineered creatures using gene drive technology could cause havoc on the environment. [12] [11]

According to Dana Perl's of Friends of the Earth, "This is an experimental technology that could have devastating effects." According to critics, the decline in bug populations could cause the introduction of new mosquitoes carrying more diseases.

The experiment is a significant development in the Bill & Melinda Gates Foundation-funded anti-malaria initiative. Years of additional research are planned as part of the project to evaluate the insects and any potential environmental effects, as well as societal and political consultations to reach an agreement on the best time to permit the release of genetically modified mosquitoes. [12]

### VI. Bacillus thuringiensis bacteria: VI.

At the end of the nineteenth century, a number of scientists originally suggested using entomopathogenic bacteria to manage insect pests. A vast collection of microbes, including bacteria, viruses, fungi, and protozoa, are filters that can be utilized in biological pest control methods.

Biopesticides have few environmental consequences in comparison to the harmful effects of chemical pesticides and their harmful effects on human health. Approximately 90% of microbial pesticides are geared toward the application of biopesticides mostly built upon B.t. It was later discovered in 1911 by the German scientist Berliner, who isolated it from the White Sea Flour Moth. *S* (Ishiwata, 0910 and Van, 0992) , which was initially isolated from *Bombyx silkworm mori* by the Japanese scientist Ishiwata. [13] [14]

The medium, known as B.t. was obtained from a mill in Thuringe, Germany (Berliner, 1915). This bacterium did not receive the necessary attention until it was researched by researchers Hannay (1953), Angus and Heimpel (1956), and then this was followed by the discovery of

New strains of bacteria B.t. The US Environmental Protection Agency received the first registration of bacteria in the year 1961. [14]

After this study, the effectiveness of the bacterium B.t.i against mosquitoes and some dicotyledonous insects was demonstrated, which represented a major turning point in research and studies on bacteria (Tokcaer, 2003) by the two researchers, Krieg and Langenhruch (1981). This bacterium is effective against insects with coleoptera, and research and studies continued until the discovery of another B.t. tenebrionis strain. [13]

As a contender for this kind of job, VI. *Bacillus thuringiensis* is one of the environment's closest friends. It is a bacterium that forms spores and makes crystalline proteins poisonous to many different kinds of insects. Bt bacteria are almost universally distributed. Surveys have shown that they can be found in deserts and beaches as well as other types of terrain. There are thousands of different Bt strains, and they all produce more than 200 crystalline proteins that are highly effective against a variety of insects, including mosquito larvae, butterfly and moth larvae, and other invertebrates. Many agricultural practices, especially organic farming, use bt bacteria. Additionally, it is utilized in genetically modified crops and urban aerial spraying programs

## VII.How do the Bt bacteria function?

The toxins in the insect's extremely basal gut are degraded and made active by the insect's consumption of bacteria. The toxin's own receptors cause the insect to stop feeding. [15]

The intestinal wall is damaged by crystals, allowing spores and bacteria in their vegetative state to enter the body. The insect quickly perishes as a result of bacterial growth. Even if the insect takes several hours to days to pass away after being exposed to the bacteria's toxin, the fact that it stops eating within hours is sufficient assurance that the plant will not sustain further harm during the interim period between exposure to the poison and death. [15]



Figure No. (7): A picture of the elm leaf beetle [30]

### 1. **Bt kurstaki (Bt-k) :**

These bacteria are excellent for controlling caterpillars that eat tree leaves, shrubs, tomatoes, and other vegetables, such as tent caterpillars, gypsy moths, and tomato hornworms. When Bt-k bacteria are introduced to and applied to early larvae, before they become adults, their effectiveness is most apparent. It may be necessary to apply Bt-k bacteria again to insects because they decay quickly in sunlight. For the best results, wait until the late afternoon. [13] [16]

**2. Bt (Bt-i) :**

Bt (Bt-i) is a very specific biocide against mosquitoes and black flies. It can be used safely in rainfall collection channels, pastures, marshes, ponds, water gardens, and flower pots. It can therefore be used anywhere there is standing water. Within 24 hours, Bt-i bacteria may can destroy 95–100% of mosquito larvae, making them extremely effective. It must be used on young larvae to guarantee this effectiveness. The appropriate authorities are employing a comparable bacterium that was discovered and used in the Gaza Strip of Palestine several years ago to control mosquitoes. [13] [17]

**3. Bt tenebrionis (Bt-t) and Bt san diego (Bt-sd) :**

The bacteria Bt-sd and Bt-t were able to eradicate the Colorado potato beetle, which is resistant to several chemical insecticides. These bacteria can also be used to control the elm leaf beetle and can be used on potatoes, eggplant, and tomatoes. Since these biocides have no effect on adult beetles, they should only be used on immature larvae [13] [18]

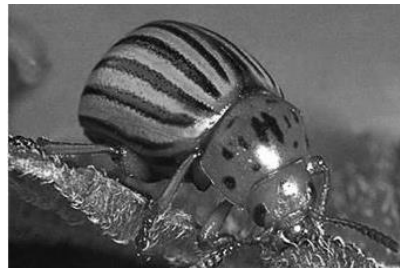


Figure No. (8): Colorado potato beetle [30]

**VIII. Life cycle of a mosquito :**

There are nearly three thousand mosquito species, divided into thirty-five basic species. The mosquito is thought to be a family of insects with two wings, and its main food in general is blood; thus, it is nicknamed Vampire. [19] The mosquito does not open its jaws; instead, it inserts needles through which it sucks blood. The impact of mosquitoes on the environment varies according to their type, some of which are thought to have evolved from their origin. The female mosquito deposits 100 to 200 eggs at a time to start the mosquito's life cycle. The egg cycle occurs practically weekly, and the eggs hatch between a week and a month depending on the type and environmental factors. Most mosquito eggs are destroyed by other insects before they hatch, and some mosquito species do not lay eggs unless there is water nearby. The larva takes approximately one week to develop into a pupa, the stage before becoming a full mosquito, and it lasts for two to three days in that stage before it matures into a mosquito. Male mosquitoes have a shorter lifespan than females, with females only remaining in heat for up to two weeks at a time [19]

**IX. Insect bite injury :**

X. As a carrier of numerous harmful diseases, including some of the most dangerous diseases spread by the mosquito insects, the harm caused by mosquitoes to the environment is clear in terms of the number of deaths. Back pain and encephalitis This disease is spread by black-tailed mosquitoes, which are usually found in swampy areas with standing water. [20] Because this mosquito does not feed on mammals, it is unknown how it spreads to birds of prey, particularly humans, and there is a concern that another kind may exist. The carrier is the person who has a mosquito. Animal worms: worms that affect dogs and other pets in general. If it spreads to all of the dog's systems, it can be dangerous. [19]

All blood illnesses may be spread by mosquitoes. Studies have demonstrated that mosquitoes may also transmit plastic components dissolved in water into blood. the principal carrier of the dangerous Zika virus. Certain mosquito species can spread dengue and yellow fever. Approximately 200 million cases of malaria are transmitted each year by mosquitoes, making them one of the most harmful agents contributing to the spread of this deadly disease. [20]

#### **XI. The effect of mosquitoes on the surrounding environment and its relationship with different water sites in the province of Qadisiyah.**

An invasive species that has recently started to develop in Iraq, particularly around water sources, is the Asian tiger mosquito, which is active both day and night. Even through a thin garment, a female mosquito may bite multiple times quickly, and each bite hurts.

The Asian tiger mosquito is harmful, similar to all other mosquitoes in the environment of Iraq. When quickly moving, extremely aggressive, and active during the day to feed, this species of mosquito can carry and spread a number of deadly illnesses, such as the encephalomyelitis, West Nile, and Chikungunya viruses. Although mosquitoes are known to spread illnesses such as Zika, malaria, and the West Nile virus, there is no evidence that they can also spread the coronavirus. [6] Thus far, it appears that this new virus is transmitted from person to person through coughing, sneezing, and exhaling respiratory droplets created by a sick person's body, much like the typical cold does. Sadly, there is still much for us to discover about COVID-19 and how it may impact us in the future.

How can we prevent harm?

Standing water is a breeding ground for mosquitoes.

- 1- It is necessary to drain any stagnant water from the house and yard.
- 2- The lawn was removed once a week, and drain any water sources were removed.
- 3- Drain pipes were filled with any standing water.
- 4- Every water source that cannot be drained should be covered.
- 5- Drill holes in the tires and other containers after draining the water in them, fill them with sand, or both.
- 6- Garden irrigation should not be overdone.
- 7- The mosquito that bites is drawn to excess wetness.
- 8- Fish ingested by mosquitoes can be added to containers that cannot be emptied.
- 9- People in charge of public health should be informed about the existence of stagnant water in public squares and parks by local authorities.



Figure No. (9): A picture Asian tiger mosquito [25]

You are likely to have mosquitoes if your home has areas for them to breed and eat. Blood is only consumed by the female Asian tiger mosquito. For her to make eggs, she needs protein. Males eat nectar from plants. [21] Asian tiger mosquitoes may flock to homes with extensive flower gardens and landscaping. A source of water is also necessary for Asian tiger mosquitoes

to lay their eggs. [21] They favour using water from either natural or man-made vessels. They may use low ditches, garbage piles, old tires, clogged gutters, and other similar locations to deposit their eggs. In contrast to other mosquito species, they do not favour laying their eggs in sizable open bodies of water, such as swamps and ponds.

## **XII. The fluorescence diffusion reaction equation is:**

Currently, binding interactions in living cells are frequently studied using FRAP, or fluorescence recovery after photo bleaching. There has not been a thorough investigation or systematic method for obtaining binding information from an arbitrary FRAP curve, despite the identification of a number of idealized solutions for the reaction–diffusion equations that control FRAP. Here, we provide a comprehensive answer to the FRAP reaction–diffusion equations for either a single or a set of independent binding contacts, and we compare it to several hypothetical situations. As a result, we are left with a methodical method for deriving binding information from FRAP data, which we then used to address the issue of transcription factor mobility in the nucleus. We demonstrated that the GR is momentarily tethered to a single state within the nucleus, with each molecule interacting at an average of 65 locations each second. This quick sampling is likely crucial for identifying a particular promoter target sequence. We further demonstrated that, contrary to what several investigations have suggested, the nuclear matrix is not the main binding state. We give examples of the various self-consistency checks that our analysis performs on a FRAP fit. We also outline limitations on what can be inferred from FRAP data, demonstrate how diffusion should be a significant factor in many FRAP recoveries, and offer techniques for evaluating this contribution. Overall, our method creates a broader framework for evaluating the importance of diffusion, the quantity of binding states, and the binding strength. [22]

The estimation of diffusion and reaction rates is frequently performed using fluorescence correlation spectroscopy (FCS). In FCS, the autocorrelation function (ACF) of the fluorescence fluctuations is computed while the fluorescence emanating from a tiny volume is monitored. This ACF can be connected to the ACF of the oscillations in the number of detected fluorescent molecules by scaling down the fluctuations caused by the emission process. For a reaction-diffusion system in which the fluorescence changes with binding and without binding, the ACF of the fluctuations in the number of molecules is theoretically examined in this study, with no approximations. [22] Theoretical ACFs are typically created on the assumption that fluctuations in a species' molecular number are instantly unrelated to those of the other species and follow the Poisson distribution. According to these presumptions, the ACF developed in this study is solely distinguished by the diffusion timescale of the fluorescent species, and its total weight is the inverse of the average number of fluorescent molecules. After that, the theory is examined in light of earlier experimental findings that, for a related system, provided a different total weight and accurate estimates of other diffusive timescales. By assuming that, as in the variance decomposition formula, the variance of the particle counts of the other species depends on the variation in the number of fluorescent molecules, the overall weight mismatch is adjusted. It is demonstrated that the ACF depends on several timescales of the system and that its overall weight coincides with the finite acquisition time used in its computation. According to this approach, FCS experiments carried out in reaction-diffusion systems can be used to determine the diffusion coefficients of no observable species. Future experimentation strategies are also explored. [22]

### **Bacillus thuringiensis israelensis and the surrounding environment:**

It is common practice to use a natural pathogen of certain invertebrates, particularly insects, as a biological control agent. Due to the extreme host specificity of these bacteria, Bt-based preparations are harmless to nontarget organisms, but mounting evidence shows that their use can have far-reaching effects on natural populations. [23] For example, after being introduced to soil habitats, Bt strains can influence local microbes such as bacteria and fungi and further develop complicated connections with local plants, ranging from a largely favourable approach to pathogenesis-like plant invasion.

Bt can indirectly affect other organisms in the food chain by having a direct impact on its target insects.

Additionally, they have the ability to produce off-target effects on a variety of terrestrial and soil invertebrates, and the regular acquisition of virulence components unrelated to the main insecticidal toxins can expand the Bt host range to include vertebrates such as humans. Even in the absence of direct negative impacts, exposure to Bt may have an impact on species that are not intended targets by decreasing their prey base and nutritional value, which may eventually improve their survival. [23] The enormous phenotypic plasticity of Bt strains and the complexity of their ecological interactions suggest that further evaluation of the safety of Bt-based pesticides should consider multiple levels of ecosystem organization and a wide range of inhabitants.

### **Bacillus thuringiensis israelensis :**

A group of bacteria known as *Bacillus thuringiensis* serotype israelensis (Bti) is utilized as a biological control agent for some dipteran larval stages. While having essentially no impact on other creatures, Bti produces poisons that are effective at killing several species of mosquitoes, fungus gnats, and blackflies. The fact that *B. thuringiensis* products are believed to only affect a small number of non-target species is their main benefit. Although Bti might not have much of an impact directly on non-target creatures, it might have an impact indirectly on food webs and other ecosystem attributes including biodiversity and ecosystem functioning. [17]

The pBtoxis plasmid, which is present in Bti strains, encodes for a variety of Cry (a -endotoxin) and Cyt toxins, including Cry4, Cry10, Cry11, Cyt1, and Cyt2. There are at least four key hazardous components in the crystal aggregation that these toxins produce, although it is unknown how much of each Cry and Cyt protein is present and it is such as ly to vary depending on the strain and formulation. The pore-forming toxins Cry and Cyt proteins lyse midgut epithelial cells by penetrating the target cell membrane and creating pores. [17]

"Mosquito Dunks" and "Mosquito Bits" are commercial formulations. It is also offered in bulk liquid or granular forms for usage by businesses and government organizations.

In one of the laboratory environments of Al-Qadisiyah University - College of Biotechnology, *Bacillus thuringiensis israelensis* (Antrol) was tested to determine how it would affect adults and larvae of *Musca domestica* L. by processing their food. The percentage of accumulated deaths after five days of treatment ranged from 77.78 to 89% , The results showed that treating adult meals with concentrations ranging from 50 to 1000 ppm resulted in mortality rates dependent on concentration and time, and the treatment of *M. domestica* larvae with the mentioned concentrations resulted Above are cumulative mortality ranging from 53.53 to 77% in addition to many malformations such as shrinkage and blackening of the body. Compared

with those in the control treatment, a decrease in pupal weight, female fertility, and hatchability was observed the larval feeding treatment group . [4]

### **XIII. Conclusions:**

“Because of the difficulty of obtaining information, I never intended to conduct this kind of research, but when I joined the Iraqi educational system and specifically at the University of Al-Qadisiyah, it became clear that I had a duty to use all my resources useful to my city, and the training I received on environmental health topics for a period of time.” A week convinced me to make a change.

I started my study on the effect of microbes on the environment in this way. This was the topic of this research. However, when I started research in July, the weather started to become cooler and wetter in September, and by November, when the rainy season was in full swing, there was a large amount of standing water.

Even now, he still has to deal with bugs, which are especially annoying when he is running around the track or lounging outside his home while smoking a cigarette or talking.

“I worked with the Diwaniyah health department (there were only two of us at the time in a place with approximately 400 people); we set up light traps next to a hole filled with water where we could observe many mosquitoes; however, compared to the trap, I had there were fewer in the trap than in the next day I was using it away from our lodgings. “At first, we thought a light trap would work best when it was completely dark outside. However, despite being near a source with many mosquitoes, few were caught. To ensure control of the mosquitoes around the camp, I teamed up with Contractors. To prevent the larvae from developing into adults, Bt (*Bacillus thuringiensis* israelensis) was used in standing water. I also put up signs advising locals to contact the help desks of pest control companies if they noticed any new areas . Although I was in a place One and I did not leave Diwaniyah, I only had control of seven other sites. Building relationships everywhere was one of the hardest hurdles, but in the end, it was one of the most rewarding elements.

#### **Risks associated with employing this kind of bacterium for live control**

- Using Bt bacteria does not provide any dangers to human health, according to the US Environmental Protection Agency (USEPA).
- Bt bacteria showed mild irritation in the eyes of the test rabbits, which may be due to the physical rather than the biological characteristics of the tested bacterial form. Bt bacteria did not appear to have any chronic toxicity or carcinogenic effects.
- Bt bacteria are frequently used near lakes, rivers, and dwellings, and have no known adverse impact on wildlife such as mammals, birds, and fish. There is no proof that it results in mammalian birth abnormalities.
- Because they break down quickly in the presence of sunlight and ultraviolet rays, bt bacteria are known for their rapid environmental decomposition and don't harm groundwater.

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### Authors' contributions.

The author: Mustafa Ali Al-Sharoot wrote, analysed and derived the results through comparison between the data obtained in the analysis results. There is no other researcher participating in this scientific report.

### Competing interests

The authors declare that they have no competing interests.

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