

CHAPTER 3

STUDYING THE EFFECT OF THE INSECTICIDE USED IN AGRICULTURE (RUSTILE) ON THE LARVAE OF THE DOMESTIC MOSQUITO (*CULEX PIPPIENS*)

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ABSTRACT: Mosquitoes are the first cause of transmission of viral diseases for both humans and animals, as they can transmit some viral diseases. These insects have attracted the attention of specialists, especially in the field of control. Extensive

use of pesticides in agriculture and public health programs leads to numerous environmental problems and toxic effects on aquatic animals, especially non-target organisms. Thus, this method has many negative effects. Our study aims to know the effect of the insecticide used in agriculture Rustile to eliminate four stages of the life cycle of mosquitoes without causing damage to the ecosystem. So that we concluded through our work that the effect of these pesticides varies according to the concentration used, as shown by the sharp differences in the proportion and rate of mosquito mortality. The use of a 2.5 ml dose of rustic ide had a greater effect compared to both the 0.5 ml and 4.5 ml doses on the third day. If it turns out that using a dose of 4.5 ml of the pesticide was more effective in the third and fourth stages (L_3 , L_4) compared to doses of 0.5 ml and 2.5 ml of the same pesticide. However, this concentration is not recommended as it is not effective in the first larval instars (I and II) and thus allows them to develop into later instars (III and IV) which require a higher concentration in order to eliminate them. In addition to causing a lot of pollution, especially water pollution and its accumulation, thus affecting the balance of the water environment used there. Therefore, the use of a rusticide with the active substance ACETAMIPRID 20% at a specific concentration can be considered very effective in eliminating mosquito larvae and thus getting rid of harmful mosquitoes without harming the environment or non-target organisms.

KEYWORDS: Acetamiprid, *Culex pipiens*, Ecotoxicity, Rustile.

ESTUDAR O EFEITO DO INSETICIDA UTILIZADO NA AGRICULTURA (RUSTILE) SOBRE AS LARVAE DO MOSQUITO DOMÉSTICO (*CULEX PAPIENS*)

RESUMO: Os mosquitos são a primeira causa de transmissão de doenças virais tanto para humanos quanto para animais, pois podem transmitir algumas doenças virais. Esses insetos têm atraído a atenção de especialistas, principalmente na área de controle. O uso extensivo de pesticidas na agricultura e em programas de saúde pública leva a numerosos problemas ambientais e efeitos tóxicos em animais aquáticos, especialmente organismos não-alvo. Assim, este método tem muitos efeitos negativos. Nosso estudo tem como objetivo conhecer o efeito do inseticida utilizado na agricultura Rustile em eliminar quatro etapas do ciclo de vida dos mosquitos sem causar danos ao ecossistema. De modo que concluímos através do nosso trabalho que o efeito desses pesticidas varia de acordo com a concentração utilizada, como mostram as diferenças acentuadas na proporção e taxa de mortalidade dos mosquitos. O uso da dose de 2,5 ml de ide rústico teve efeito maior em comparação às doses de 0,5 ml e 4,5 ml no terceiro dia. Acontece que o uso de uma dose de 4,5 ml do pesticida foi mais eficaz na terceira e quarta etapas (L_3 , L_4) em comparação com doses de 0,5 ml e 2,5 ml do mesmo pesticida. No entanto, esta concentração não é recomendada porque não é eficaz nos primeiros instares larvais (I e II) e assim permite que evoluam para instares posteriores (III e IV) que requerem uma concentração mais elevada para serem eliminados. Além de causar muita poluição, principalmente a poluição das águas e seu acúmulo, afetando assim o equilíbrio do meio hídrico ali utilizado. Portanto, o uso de um rusticida com a substância ativa ACETAMIPRID 20% em concentração específica pode ser considerado muito eficaz na eliminação de larvas de mosquitos e, assim, livrar-se dos mosquitos nocivos sem agredir o meio ambiente ou organismos não-alvo.

PALAVRAS-CHAVE: Acetamipride, *Culex pipiens*, Ecotoxicidade, Rustile.

INTRODUCTION

Concerned experts and specialists agree that environmental sciences currently occupy an important space between basic, applied and human sciences. And people have started to view these developments as global problems that countries can only bring together, put in place appropriate frameworks and solutions. It emerged as an objective need to research living organisms and their environmental habitats (Hanoush, 2004) and to study the relationships between living and non-living elements. Insects are among the living organisms that have aroused great interest among environmental scientists, as they are among the most important classes of the arthropod phylum, both in terms of number and biological diversity, and in terms of economic importance. Among the insects that have been the subject of much scientific research are the mosquito families, because they are the first enemy of humans and animals. They are vectors of the pathogenic agents of many diseases, including malaria, yellow fever, elephantiasis, filariasis or filariasis, etc. Biodiversity can be understood as the study of difference, that is, what distinguishes and makes at the same time two neighboring entities in space or time. Conservation of biodiversity necessarily requires a complete knowledge of the distribution of fauna and flora (Couturier et al. 1985). Arthropods are abundant in all habitats from deserts to tropical forests. Insecticides are insecticides intended to kill insects. Pesticides are widely used in agriculture and community health and are also present in the local environment and are mostly responsible for health effects (Morsli et al. 2015) affecting insects as well as their toxic effects on humans (Lechekhab. 2018). Mosquitoes are considered harmful insects because they are the main vector of viral diseases to humans and animals. We conducted a comparative chemical study using the chemical pesticide «Rustile» used in agriculture on the larvae of domestic mosquitoes.

MATERIALS AND METHODS

Presentation of the study area Garaate Djamel

Garaate Djamel is located in the commune of El Chat, daira of Ben Mhidi on the left side of the wilaya road number 109 connect the wilaya of Annaba with El- Kala (Gacem, 2013).

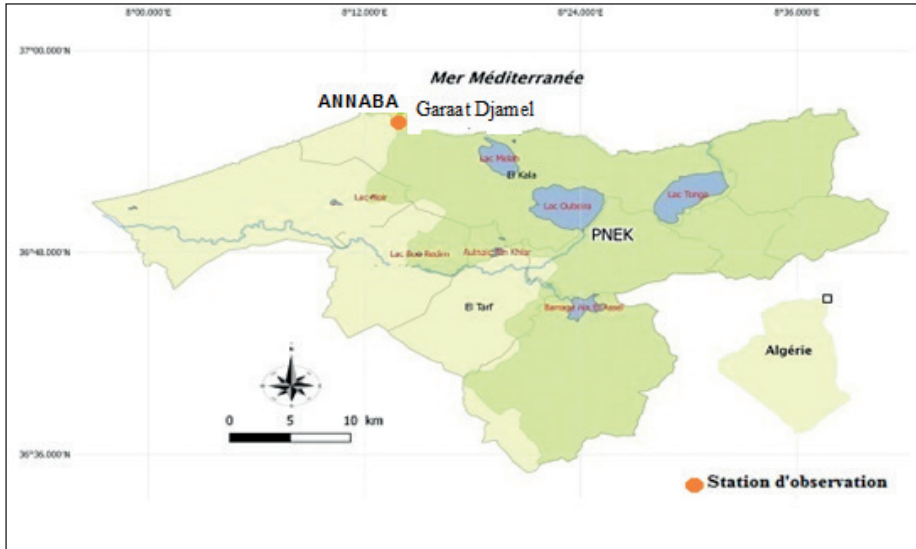


Figure 1: Location of observation station (Garaat Djamel) (Gacem *et al.*, 2023).

Insecticide Rustile

They are active substances or phytosanitary preparations that have the property of killing insects and/or their larvae and/or eggs. They are part of the family of pesticides, themselves included in the family of chemical pesticides, subject to regulation in Europe through specific directives. The generic term “insecticide” also includes pesticides intended to control arthropods that are not insects (such as spiders or mites such as ticks) as well as sometimes repellents. A distinction is made between contact products. Insecticides are chemical pesticides intended to destroy insects: widely used in agriculture and community health (disease vector control), they are also present in the home environment, although interesting from the point of view of operator safety, they have been subject to significant limitations in use due to Presumed adverse effects on non-target groups (Habiba, 2022). Both of these are great. The insecticide families are reviewed respectively, toxicokinetics, mode of action at the biochemical level and described toxic effects in humans in the main exposure contexts: household accidents, suicidal poisoning by high doses (Gacem, 2023).

Les Culicidae *Culex pipiens* Linnaeus, 1758

Mosquitoes are Arthropods. They are grouped in the Culicidae family, presenting sucker-biting type mouthparts. The duration of larval stages is closely linked to certain components of the environment, in particular temperature, humidity and photoperiod (Himmi, 1998). The life cycle of mosquitoes shows many variations depending on the species. The egg, larva and nymph stages are aquatic, while the adult is aerial.

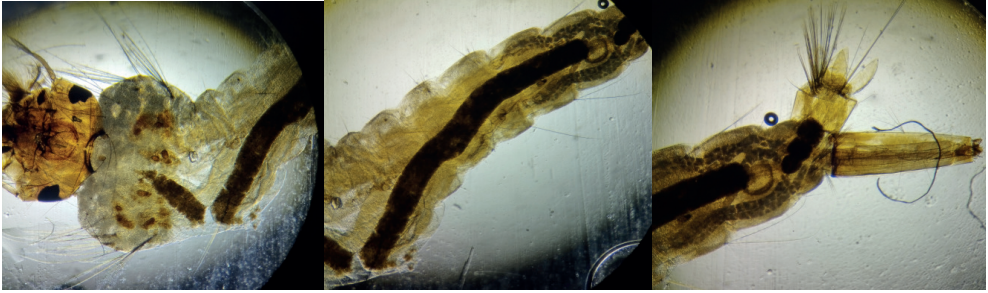


Figure 2: The anterior parts of the *Culex pipiens* larva Gr. x150 (Personal photos).

ANALYSIS AND STATISTICS

The results obtained are represented by the mean, the standard deviation and the percentage of mortality; we used the EXEL 2007 and EXEL 2010.

RESULTS

Figure (3) shows us the effect of the insecticide when placed with the larvae of the mosquito, *Culex pipiens pipiens*. A significant value of the death rate of the larvae of the first stage was estimated at 40%, followed by the death rate of the larvae of the second stage, which was estimated at 26.66%, to decrease the death rate. The larvae of the third instar compared to the death rate of the larvae of the first and second instars, which is 20%, to record the lowest mortality rate in the box containing the larvae of the fourth instar, which was estimated at 6.66%. These results are due to the small size of the larvae of the first and second instars and their effect on the pesticide and the inability to resist, while the larvae of the third and fourth instars are larger and more resistant to the insecticide.

Through figure (4) it is clear to us that when mosquito larvae, *Culex pipiens pipiens*, were placed with a little insecticide and left after 48 hours. The same death rate was recorded for each of the first, second and fourth instar larvae, except that it decreased by a large percentage compared to the first day, when we recorded 6.66%. As for the mortality rate for the third stage, it was completely absent.

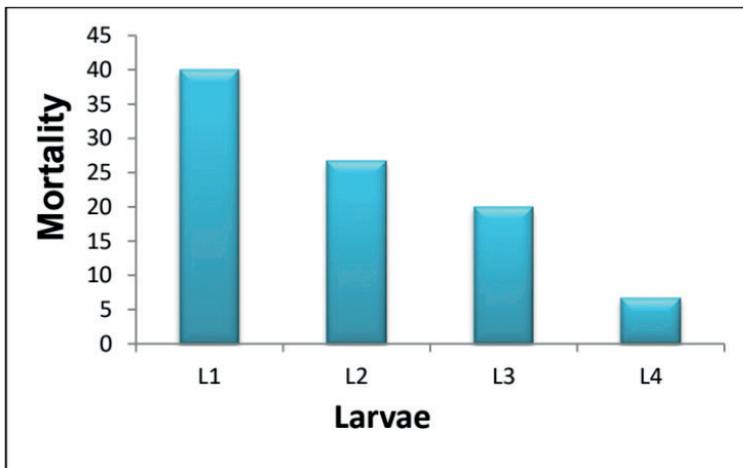


Figure 3 : Effect of the insecticide on *Culex pipiens pipiens* mosquito larvae within 24 hours.

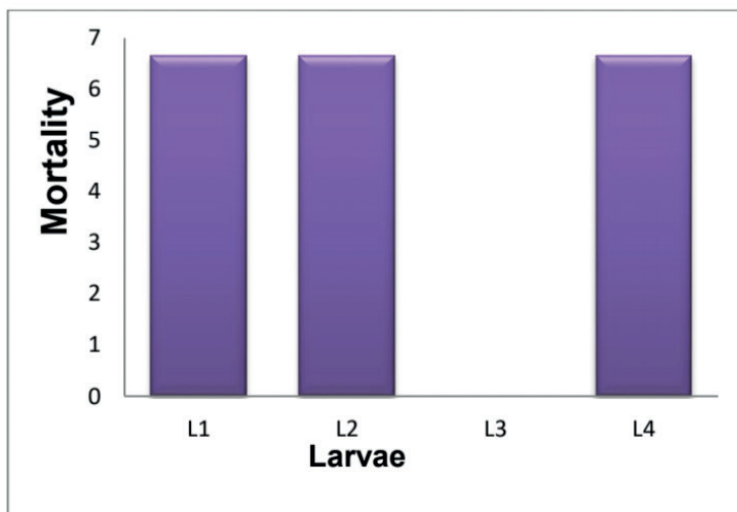


Figure 4: The ratio of the death rate of the four instars of the *Culex pipiens pipiens* larva within 48 hours.

DISCUSSION

Insects are among the most widespread arthropods on earth. In terms of epidemiological significance and human nuisance, mosquitoes are the first pathogen vectors, followed by Acariens mites, ticks, ticks, and finally Puces fleas (Lecointre, 2001). In order to combat these vector factors, chemical control was the main method for controlling disease vectors, but it has many disadvantages with regard to the high cost of pesticides, and it negatively affects the environment and the health of non-target groups such as humans, in addition to the emergence of resistance to some pesticides (Zaidi & Soltani, 2011). These

species are highly responsive to pesticides in the world and Algeria (Bendali-Saoudi *et al*, 2013). It has succeeded in developing systems that are resistant to conventional insecticide. As a result, the use of biological control has become a necessary alternative, thanks to its effectiveness against a wide range of pests (Soltani, 2010). Biological control is a traditional and alternative method to chemical control, non-selective and specific (Chaouch, 2024).

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CONCLUSION

Our experiments dealt with a study of the mortality rate of *Culex pipiens pipiens* mosquito larvae treated with an insecticide Rustile during four stages of its life cycle. Through our research, we concluded that this pesticide has a toxic effect on mosquito larvae, *Culex pipiens pipiens*, where the effect is on the first small larval instars, the first larval instar L₁, then the second larval instar L₂, compared to the third instar L₃ and the fourth L₄. Hence, farmers must use this insecticide used in agriculture, and this confirms the toxicity of the insecticide, that is, the chemical control of mosquito larvae L₁, L₂, L₃ and L₄, and therefore biological control has more effectiveness in eliminating predators without environmental or health damage, which made it more effective. Widely used of chemical control.

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