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LARVICIDAL ACTIVITIES OF *CARICA PAPAYA* LINN (CARICACEAE) LATEX GEL ON LARVAE OF *CULEX QUINQUEFASCIATUS* IN LYMPHATIC FILARIASIS VECTOR CONTROL IN LOKOSSA DISTRICT IN SOUTH-WESTERN REPUBLIC OF BENIN, WEST AFRICA

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ABSTRACT

Mosquito control programs are now threatened by the selection of mosquito populations resistant to the chemical insecticides. Thus, alternative vector control methods are necessary. This study was aimed at investigating on the larvicidal activities of *Carica papaya* Linn latex gel on larvae of *Culex quinquefasciatus* in lymphatic filariasis vector control in Lokossa district in south-western Republic of Benin, West Africa. Larvae of *Culex quinquefasciatus* mosquitoes were collected from breeding sites using the dipping method from September to November 2024 during the small rainy season in Lokossa district. A batch of 25 larvae of fourth instar were exposed to a mixture of *Carica papaya* Linn latex gel containing in each of five glass jars or test cups of same dimensions with different concentrations of 1mg/l, 2mg/l, 3mg/l, 4mg/l and 5mg/l and one control jar for each serial concentrations containing no trace of *Carica papaya* Linn latex gel. Larval mortality was recorded after 24 hours, 48 hours and 72hours exposure. The results showed that *Carica papaya* Linn latex gel had acted by poisoning the larvae of four instars which could not breathe and pupate. The use of *Carica papaya* Linn latex gel disallows mosquito larvae to acquire tolerance.

KEYWORDS

Carica papaya latex gel, *Culex quinquefasciatus* and Republic of benin.

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INTRODUCTION

Culex quinquefasciatus, a member of *Culex pipiens* is vector of lymphatic filariasis and this disease is a problem of public health. Due to lack of novel insecticides, high cost of synthetic insecticides, concern for environmental sustainability, harmful effect on human health and other non-target populations, high rate of biodegradable nature, high

rate of biological magnification through ecosystem, and increasing insecticides resistances on a global scale (Brown AW, Russell TL, *et al*)[1,2]. An effective alternative approaches is to explore the floral biodiversity and enter the field of using safer insecticides of botanical origin as a simple and suitable method of mosquito control, unlike synthetic insecticides which are based on a single active ingredient. (Shaalan EAS, *et al)*[3] reviewed the current state of knowledge on larvicidal plant species extraction process, growth and reproduction inhibiting phytochemicals, botanical ovicides, synergistic, additive and antogonistic joint action effects of mixture, residual capacity, effects on non-target organisms, resistance and screening methologises and discussed some promising advances made in phytochemical research.

Latex was a fluid secreted by laticifer cells in plants. The biological role of latex secretion in plants remains unknown, but several types of research proved that it has insecticidal propert (Rajkuberan C, *et al*)[4]. Latex contains highly active chemicals such as aromatics, terpenoids, alkaloids, phenols, glycosides, carbohydrates and proteins (Konno K)[5]. Further, in ancient time, latex was practiced in traditional and folk medicine for treating ailments and diseases.

Very few researches were published on the use of essential oils in *Culex quinquefasciatus* larvae tolerance in Benin. Therefore, there is a need to carry out new researches for this purpose.

The goal of this study was to investigate on the larvicidal activities of *Carica papaya* Linn (Caricaceae) latex gel on larvae of *Culex quinquefasciatus* in lymphatic filariasis vector control in Lokossa district in south-western Republic of Benin, West Africa.

MATERIAL AND METHODS

Study area

The study area concerned mono department more precisely Lokossa district in the south-western Republic of Benin (Figure No.1). The economic activities of populations, their usual protection practices against mosquito bites and peasant practices to control farming pests were taken into account in the choice of the study sites. These factors were taken into account more precisely to study the larvicidal activities of *Carica papaya* Linn (Caricaceae) latex gel on larvae of *Culex quinquefasciatus* in lymphatic filariasis vector control in Lokossa district in south-western Republic of Benin, West Africa. A climate with four seasons, two rainy seasons (March-July and August-November) and two dry seasons (November-March and July-August) characterizes Lokossa district. The temperature ranged from 25 to 32°C with the annual mean rainfall, which is between 900 et1100mm.

Mosquito sampling

We collected *Culex quinquefasciatus* larvae from September to November 2024 during the small rainy season in Lokossa district. Thus, we collected larvae from breeding sites using the dipping method and kept them in labeled bottles (Figure No.2). Then, we carried out the samples to the Laboratory of Pluridisciplinary Researches of Technical Teaching (LaRPET).

Latex collection

We collected latex gel in sterile bottles from unripe mature fruits on paw paw (Figure No.3) in Lokossa district. Thus, unripe mature fruits were pierced with needles and latex gel was taken in the sterile bottles. Then, we carried out these bottles to Laboratory for bioassays.

Bioassays

A batch of twenty five (25) larvae of four instars reared in the insectary of the Department of Sciences and Agricultural Techniques was added to each of five glass jars or test cups of same dimensions containing the dilutions of 1.0mg/liter, 2.0mg/liter, 3.0mg/liter, 4.0mg/liter and 5.0mg/liter respectively of *Carica papaya* Linn latex gel. These tests cup were covered with small cutting untreated net. At each range of dilutions, there is a corresponding control. The control jars contained no trace of *Carica papaya* Linn latex gel.

Four replicates were set up and an equal number of controls were set up simultaneously with distilled water. The test containers were held at 25-28°C.

Larval mortality was recorded after 24hours, 48hours and 72hours exposure. Dead larvae were those that could not be induced to move when they were probed with a needle in the siphon or the cervical region. Moribund larvae were those

incapable of rising to the surface or not showing the characteristic diving reaction when the water was disturbed.

Statistical analysis

Analysis using t-test was performed with 95% confidence interval in SPSS version 16.0 (SPSS Inc., Chicago, IL). The p-value acquired by t-test for all cases of this study is less than 5%.

RESULTS AND DISCUSSION

Evaluation of larvicidal effect of *Carica papaya* latex gel on larvae of *Culex quinquefasciatus* from Lokossa district

The analysis of Figure No.4 showed that after the exposure of *Culex quinquefasciatus* larvae of four instars (L4) to *Carica papaya* latex gel, no dead and moribund larvae were registered in the control plastic cups after 24 hours, 48 hours and 72hours recording, they were all alive. The analysis of the same figure showed that very few dead larvae were registered after 24 hours exposure with all tested concentrations of 1mg/l, 2mg/l, 3 mg/l, 4mg/l and 5mg/l ($P>0,05$). The recording of 48 hours exposure showed that dead larvae were registered in the all test plastic cups with all tested concentrations of 1mg/l, 2mg/l, 3 mg/l, 4mg/l and 5mg/l ($P <0,05$). The number of dead larvae recorded after 48hours exposure was higher than that registered after 24 hours exposure. The recording of 72 hours exposure showed that more dead larvae were registered in the all test plastic cups with all tested concentrations of 1mg/l, 2mg/l, 3 mg/l, 4mg/l and 5mg/l ($P <0,05$). Otherwise, the number of dead larvae recorded after 72 hours exposure was higher than that registered after 48 hours exposure. Finally, the highest mortality rate was recorded with the concentration of 4 mg/l (70 dead larvae on a total of 125 tested larvae).

Advantages and disadvantages of the use of *Carica papaya* latex gel against *Culex quinquefasciatus* larvae

The analysis of Table No.1 shows that there are many advantages in the use of *Carica papaya* latex gel to control mosquito larvae. But, also there are very few disadvantages.

Discussion

In the current study, after the exposure of *Culex quinquefasciatus* larvae of four instars (L4) to *Carica papaya* latex gel, no dead and moribund larvae were registered in the control plastic cups after 24 hours, 48 hours and 72hours recording, they were all alive. Very few dead larvae were registered after 24 hours exposure with all tested concentrations of 1mg/l, 2mg/l, 3mg/l, 4mg/l and 5mg/l. The 48 hours exposure showed that dead larvae were registered in the all test plastic cups with all tested concentrations of 1mg/l, 2mg/l, 3mg/l, 4mg/l and 5mg/l. The number of dead larvae recorded after 48hours exposure was higher than that registered after 24 hours exposure. The recording of 72 hours exposure showed that more dead larvae were registered in the all test plastic cups with all tested concentrations of 1mg/l, 2mg/l, 3 mg/l, 4mg/l and 5mg/l. Otherwise, the number of dead larvae recorded after 72 hours exposure was higher than that registered after 48 hours exposure. Finally, the highest mortality rate was recorded with the concentration of 4mg/l. The results showed that the use of *Carica papaya* latex gel causes full-grown *Culex quinquefasciatus* larvae to die by suffocation. After the application of *Carica papaya* latex gel, the larvae of fourth instar cannot breathe. Our results corroborated with those obtained by (Kuberan R, *et al*)[6] who had studied the larvicidal efficacy of *Carica papaya* latex extract and silver nanoparticles (CPAgNPs) synthesized using latex, against developing immature juveniles of *Culex quinquefasciatus*. Briefly, the latex was collected and fractioned with different solvents such as chloroform, methanol and aqueously. The obtained crude extracts were subjected to larvicidal activity in the dose-dependent method. After 24 hours, the mortality rate was calculated and statistically analyzed. From their results, it was demonstrated that the chloroform extract displayed prominent activity in IInd and IIIrd instar larvae of *Culex quinquefasciatus* with better LC50 values followed by methanol and aqueous extract. Subsequently, they profiled the qualitative analysis of a chloroform extract through biochemical tests; Fourier transform infrared spectroscopy and gas chromatography-mass spectrometry. Moreover, they authenticated the major secondary metabolites and activated larvicidal compound present in the extract. Further, they synthesized CPAgNPs using aqueous latex extract and challenged with IInd and

IIIrd instar larvae of *Culex quinquefasciatus*. Noticeably, the synthesized nanoproducts were showed 100% mortality in a 24 hours treatment with significant LC50 values. Hence, this study has opened up new vistas in the field of parasitological research to develop *Carica papaya* latex as a new stratagem in the insect vector management program. Another research carried out by (Okolie NJC)[7] had studied the larvicidal effects of paw paw (*Carica papaya*) aqueous extract on mosqiuto vectors including *Culex* species in Nigeria. For that, the larvicidal effect of *Carica papaya* extract against larvae of *Anopheles* and *Culex* mosquitoes and the rate of decay of the extract in aqueous solution was investigated.

The leaf extract was found to achieve a 100% mortality rate of the *Anopheles* mosquito larvae at the concentration of 0.06 mg/ml. A much higher concentration (0.10mg/ml) was required to achieve the same mortality rate for *Culex* larvae. The lethal strength of the solution decreased with time of storage, loosing its larvicidal property on the 18th day of storage. The study suggests that *Carica papaya* extract could act as effective larvicide if appropriate bio-degradation controlled system capable of maintaining the release of the active ingredients for a longer period is developed.

Table No.1: Advantages and disadvantages of the use of *Carica papaya* latex gel

S.No	Advantages	Disadvantages
1	*Carica papaya* tree (paw paw) is cultivated in many regions in Benin country	Limited effectiveness of *Carica papaya* latex gel in the presence of vegetation and floating debris (is the main disadvantage)
2	*Carica papaya* latex gel is a cheap and easy method of larval control for some breeding sites such as borrow-pits, pools and so on	
3	Mosquitoes may not develop resistance to *Carica papaya* latex gel	
4	*Carica papaya* latex gel is not toxic to most non-target organisms including mammals and fish.	
5	*Carica papaya* latex gel cannot soil the earth after its action or effect where it has been applied	-

Figure No.1: Map of Lokossa district surveyed in republic of Benin

Figure No.2: A breeding site of *Culex quinquefasciatus* larvae surveyed in the district of Lokossa

Figure No.3: A tree of *Carica papaya*

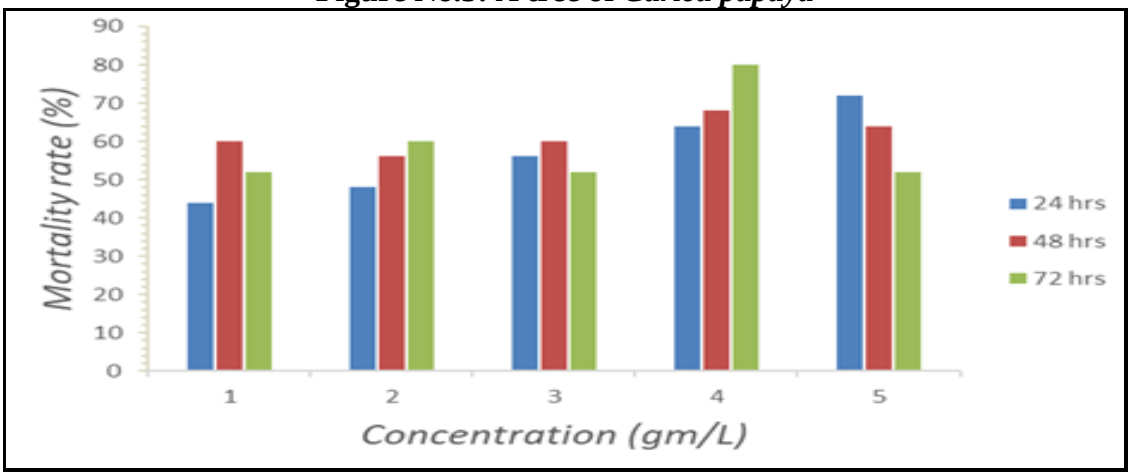

Figure No.4: Larvicidal activity of *Carica papaya* latex gel against *Culex quinquefasciatus* larvae

CONCLUSION

The use of *Carica papaya* latex gel is effective on larvae of fourth instar of *Culex quinquefasciatus* in the current study. *Carica papaya* latex gel can help for new stratagem in the control of mosquito larvae in vector management program. However, this study was conducted in laboratory conditions and there is also a need to carry it out in field conditions for better conclusions. Also, the bio-active molecules responsible of larvae mortality or lethality and their mode of actions remain indistinct and imprecise, and this calls for further pharmacological and clinical research on them.

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CONFLICTS OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this article.

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