FUDMA Journal of Sciences (FJS)
ISSN: 2616-1370
Vol. 2 No. 1, April, 2018, pp 178-182

LARVICIDAL EFFECTS OF *LUFFA AEGYPTIACA* (MILL, 1638) ON *CULEX QUINQUEFASCIATUS* (SAY, 1823)

Mainako, M.D. and Sow, G.J.

Department of Zoology, Faculty of Life Sciences, Ahmadu Bello University, Zaria, Nigeria
*Corresponding Author: mainakomd@gmail.com 0803 647 8562

ABSTRACT:
Larvicidal effects of *Luffa aegyptiaca* was investigated on laboratory bred *Culex quinquefasciatus* from Zaria. Pulverized seed, stem, sponge and leaves of *Luffa aegyptiaca,* were extracted with methanol in a Soxhlet extractor. Extracts were diluted in borehole water and tested for larvicidal effects on medically important *Culex quinquefasciatus* mosquito under laboratory conditions. Hundred mosquito larvae (in four replicates of twenty-five each), in small white plastic disposable cups were exposed to concentrations of 0.0 mlL^{-1} [Control], 0.8mlL^{-1}, 0.4mlL^{-1}, 0.2mlL^{-1} and 0.1m1L^{-1} of seed, stem, sponge and leaves of *Luffa aegyptiaca* extracts for 24 hours to determine larval mortality. At 0.8mlL^{-1}, 0.4mlL^{-1}, 0.2mlL^{-1} and 0.1m1L^{-1} concentration of the seed extract, percentage larval mortality recorded were 95%, 77%, 61% and 48% respectively. At 0.8mlL^{-1}, 0.4mlL^{-1}, 0.2mlL^{-1} and 0.1m1L^{-1} concentration of the stem extract, percentage larval mortality recorded were 20%, 4%, 0% and 0% respectively. At 0.8mlL^{-1}, 0.4mlL^{-1}, 0.2mlL^{-1} and 0.1m1L^{-1} concentration of the sponge extract, 76%, 59%, 42% and 30% larval mortality were recorded respectively. Zero mortality (0%) was recorded in groups exposed to different concentrations of leaf extract. Probit analyses of the larval mortality data gave LC_{50} values of 0.13mlL^{-1}, 1.13mlL^{-1} and 0.26m1L^{-1} for the seed, stem and sponge extracts of the plant respectively. Our data suggests that leaf extract of *Luffa aegyptiaca* is not a good candidate for vector control, however, the seed, stem and sponge could be harnessed in vector control of noxious mosquito species of *Culex quinquefasciatus* to stem their disease transmission roles.

Keywords: *Culex quinquefasciatus, leaf, larvae, Luffa aegyptiaca, seed, sponge.*

INTRODUCTION

Vector borne diseases remain the major source of illness and death worldwide. Mosquitoes alone transmit disease to more than 700 million people annually (Shivakumar and Kataria, 2011). *Culex quinquefasciatus* (Say, 1823) is a medically important species of mosquito that has been implicated in the transmission of diseases such as filariasis and denque amongst animals and man (Adebote *et al*., 2011). Mosquitoes undergo complete metamorphosis (egg, larva, pupa and adult) during its life-cycle, with the larval stage as easiest stage in checking its population. The most effective method of controlling transmission in most vector-borne infections is through control of the vectors (Obamanu *et al*., 2006). Today, environmental safety is considered to be of paramount importance. An insecticide does not need to cause high mortality on target organisms in order to be acceptable but should be eco-friendly in nature (Ghosh *et al*., 2012). Extensive use of synthetic and chemical insecticides has resulted in environmental hazards and also in development of physiological resistance among vector mosquito species. Plant products are considered to be potential alternatives as they are environmentally safe, target-specific and biodegradable (Eugeni, 2014). Larvicides, if applied in mosquito breeding area can kill or inhibit the growth of mosquito larvae from developing into the adult form.

The Nigerian climate favours a wide variety of plants with vast antimicrobial and medicinal potentials (Aboh *et al*., 2011). *Luffa aegyptiaca*, commonly known as sponge gourd, belongs to the Curcubitaceace family. It is a vigorous climbing annual vine with several lobed cucumber-like leaves. The fruits develop at maturity, with a network of fibers surrounding a large number of flat blackial seeds (Nirmal *et al*., 2009). *Luffa aegyptiaca* is a fast growing annual vine which grows ubiquitously and matures within four months. It is called 'soso' in Hausa, 'kankan' in Yoruba and 'asisa' in Ibo (Abayeh *et al*., 2013). *Luffa aegyptiaca* grows in almost all parts of Nigeria as weed; and it has been reported to possess both medicinal and nutritional potentials (Mhya *et al*., 2014). The present investigation was undertaken to determine the efficacy of sponge, seed, stem and leaf extract of *Luffa aegyptiaca* against *Culex quinquefasciatus* larvae.

MATERIALS AND METHODS

The study was carried out in Zaria, Nigeria (longitude 11°3' N and latitude 7°42'E). Fully developed fruit, seed, stem and leaves of *Luffa aegyptiaca* were harvested from the walls fencing school of aviation quarters Zango, Zaria, Nigeria. The authentication of the plant was carried out at the Herbarium unit, Department of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria and was assigned a voucher number 693. Blood-fed *Culex quinquefasciatus* were collected using aspirator from various indoor resting sites within Samaru Campus, Ahmadu Bello University, Zaria, Nigeria. They were introduced into mosquito rearing cage (30cm × 30cm × 30cm) containing two transparent plastic containers each half filled with borehole water, for egg laying. The eggs laid, were allowed to hatch to larvae (first instar larvae).

Fresh leaves, stem, sponge and seed of *Luffa aegyptiaca* were air dried at room temperature on a wooden table at the Biology Laboratory of the Department of Biological Sciences, Ahmadu Bello University, Zaria, for 2 weeks. The fully dried plant samples were then pulverized using a mortar and pestle. Each of the pulverized samples was sieved with a sieve of mesh size 40µm. Twenty grams (20g) of fully pulverized stem, leave,

sponge and seed of *Luffa aegyptiaca* were each mixed with 250 ml of methanol (as a solvent) and extracted with Soxhlet apparatus for Six (6) hours, at Hydrobiology Laboratory, Department of Biological Sciences, Ahmadu Bello University, Zaria. The solvent from the extract was evaporated using water bath maintained at 60 ± 5 °C. For each of the extracts, a concentration of 0.8 mlL^{-1}, 0.4 mlL^{-1}, 0.2 mlL^{-1} and 0.1 mlL^{-1} were made and used for the bioassay.

Twenty-five first instar larvae were introduced into a white disposable cup containing 100 ml of a known concentration of *Luffa aegyptiaca* stem, leaf, sponge and seed. Four replicates were set up for each concentration. The control was also ran simultaneously. Larval mortality for each was recorded after 24 hours. Mortality values of exposed *Culex quinquefasciatus* larvae in the various test concentrations of methanolic extract of seed, stem, sponge and leaves of *Luffa aegyptiaca* were subjected to Probit analysis to determine the median lethal concentration (LC_{50}) and Analysis of Variance (ANOVA) was used to test for significant differences in larval mortality amongst the various concentrations and across the seed, stem, sponge and leaves of *Luffa aegyptiaca*.

RESULTS

The larvicidal activity of *Luffa aegyptiaca* on *Culex quinquefasciatus* larvae is presented in Table 1 and 2, below. It is evident that all concentrations of methanolic extract of seed, stem and sponge of *Luffa aegyptiaca* used during the research showed moderate to high larvicidal effect.

The percentage mortality of *Culex quinquefasciatus* larvae when exposed to seed extract was between 48% and 95%, stem extract was between 0% and 20%, and sponge extract was between 30% to 76% at concentrations of 0.1mlL^{-1} to 0.8mlL^{-1} in each case. While leaf extract did not yield any mortality, even at the concentration of 0.8mlL^{-1} which yielded 0%.

Table 1: Mortality of *Culex quinquefasciatus* larvae on exposure for 24hours to various concentrations of methanol extract of *Luffa aegyptiaca* seed, stem and sponge

***Luffa aegyptiaca* Part**	**Concentration (mlL^{-1})**	**Larvae Exposed**	**Larval Mortality (%)**
Seed	0.8	100	95^{a}
	0.4	100	77^{b}
	0.2	100	61^{c}
	0.1	100	48^{d}
Stem	0.8	100	20^{a}
	0.4	100	4^{b}
	0.2	100	0^{c}
	0.1	100	0^{c}
Sponge	0.8	100	76^{a}
	0.4	100	59^{b}
	0.2	100	42^{c}
	0.1	100	30^{d}

Percentage mortality with the same superscript within the same part of *Luffa aegyptiaca* (seed, stem and sponge) are not significantly different (P> 0.05).

Probit analyses gave median lethal concentration (LC_{50}) values of 0.13 mlL^{-1}, 1.13mlL^{-1} and 0.26 mlL^{-1} for methanolic extract of *Luffa aegyptiaca* seed, stem and sponge respectively (Table 2).

Table 2: Determination of median lethal concentration of methanolic extract of *Luffa aegyptiaca* against the larvae of *Culex quinquefasciatus*

Luffa aegyptiaca Part	Concentration (mlL^{-1})	Log. of Concentration	Larval Mortality (%)	Probit of Mortality	Regression Equation	LC_{50} (mlL^{-1})
Seed	0.8	-0.097	95[a]	6.64	Y=1.8372x + 6.6602	0.13
	0.4	-0.398	77[b]	5.74		
	0.2	-0.699	61[c]	5.28		
	0.1	-0.000	48[d]	4.95		
Stem	0.8	-0.097	20[a]	4.16	Y=5.2259x + 4.7189	1.13
	0.4	-0.398	4[b]	3.25		
	0.2	-0.699	0[c]	0.00		
	0.1	-0.000	0[c]	0.00		
Sponge	0.8	-0.097	76[a]	5.71	Y=1.3688x + 5.8058	0.26
	0.4	-0.398	59[b]	5.23		
	0.2	-0.699	42[c]	4.80		
	0.1	-0.000	30[d]	4.48		

DISCUSSION

Control of vectors is a common approach for disease control. The present study showed that methanolic extract of *Luffa aegyptiaca* seed, sponge and stem were potential agents for the control of larvae of *Culex quinquefasciatus*. There is a growing interest in investigating the potentials of plant extracts to control mosquito populations. For instance, Vatandoost and Vaziri (2004) investigated the larvicidal properties of *Azadirachta indica*, Singh (2003) of *Ocimum canum* oil on *Culex quinquefasciatus* and *Anopheles stephensi*.

It was clearly proved that crude or partially purified plant extracts are less expensive and highly efficacious for control of mosquitoes. The plant extracts are eco-friendly (Ramanibai *et. al*. 2014) In this study, the result showed that the seed, stem and sponge of *Luffa aegyptiaca* could be harnessed in vector control of noxious mosquito species of *Culex quinquefasciatus* to stem their disease transmission roles. The larvae of *Culex quinquefasciatus* responded to the methanolic extract in a concentration dependent manner, thus, concentration of $0.8mlL^{-1}$ caused more mortality (95%) than $0.1m1L^{-1}$ concentration (48%) of the seed extract. This similar trend also was observed in the stem and sponge extract of *Luffa aegyptiaca*. It is evident that concentrations have significance in causing mortality, thus, this is key when control strategy using a particular extract is employed. Similar observations were made by researchers like Adebote *et al.* (2011), when working on *Bobgunnia madagascariensis* where $0.8mlL^{-1}$ of the seed extract produced the highest mortality (95 %) and $0.1\ mlL^{-1}$ produced the least mortality (48%); this similar trend was observed with the stem that was examined. The larvicidal activities of *Luffa aegyptiaca* could be attributed to the presence of saponins; though the phytochemicals were not investigated in this study, but the work of Abayeh *et* al. (2013). The presence of saponins which interact with the cuticle membrane of the larvae, ultimately kill the larvae Chapagain and Wiesman *et al.* (2005). Methanolic seed, stem and sponge extracts of *Luffa aegyptiaca* has proven efficacy in causing significant mortality in the larvae of *Culex quinquefasciatus*. Thus we recommend it to the growing list of botanicals with anti-mosquito properties that could be harnessed for the control of noxious mosquito species and as alternative for synthetic pesticides.

REFERENCES

Abayeh, O. M., Garba, I. H., Adamu, H. M. and Abayeh, O. J. (2013). Quality Characteristics of *Luffa aegyptiaca* seed oil. *International Journal of Scientific & Engineering Research*, **4(4)**: 11-16

Aboh, M. I., Okhale, S. E. and Ibrahim, K. (2012). Preliminary studies on *Luffa cylindrica*: Comparative phytochemical and antimicrobial screening of the fresh and dried aerial parts. *African Journal of Microbiology Research*, **6(13)**: 3088-3091

Adebote, D., Adeyemi, M. H. and Atsukwei, T. (2011). Larvicidal Efficacy of Solvent-Extrcted Stem Bark of *Bobgunnia madagascariensis,* **1(7)**: 101-106

Chapagain, B. and Wiesman, Z. (2005). Larvicidal effects of aqueous extracts of *Balanites aegyptiaca* (desert date) against the larvae of *Culex pipiens* mosquito *African Journal of Biotechnology*, **4(11)**: 1351 -1354

Eugeni, A.P.G., Raveen, R., Arivoli, S., Samuel, T. and Madhanagopal, R. (2014). Larvicidal Efficacy of *Jasminum* sp. (Oleaceae) Flower Extracts against the Dengue and Chikungunya Vector *Aedes aegypti* L. (Diptera: Culicidae). Medicinal Chemistry, 4: 672-675.

Ghosh, A., Chowdhury, N., and Chandra, G. (2012). Plant extracts as potential mosquito larvicides *Indian Journal of medical reserch, **13(5):** 581-598*

Mhya, H. D. and Mankilik, M. (2014). Phytochemical Screening of Aqueous Extract of *Luffa aegyptiaca* (Sponge gourd) Leave Sample from Northern Nigeria. *International Journal of Pharma Sciences and Research,* **5(7)**: 344-345

Nirmal, S., Kothawade, P., Datir, S. and Pal, S. C. (2009). Nonpolar compounds from *Luffa aegyptiaca* fruit. *Facta universitatis series: Physics, Chemistry and Technology **7(1)**:, 69 - 72*.

Obamanu, F. G., Ogbalu, O. K., Gabriel, U. U., Fekarurhobo, G. K. and Adediran, B. I. (2006). Larvicidal properties of *Lepidagathis alopecuroides* and *Azadirachta indica* on *Anopheles gambiae* and *Culex quinquefasciatus. African Journal of Biotechnology*, **5(9):** 761-765

Ramanibai R., Deepika T. and Madhavarani A. (2014) Antimosquito acitvity of leaf extract of *Melia azedarach* and *Carica papaya* detected against the larvae *Culex quinquefasciatus*. International Journal of Innovative Research in Science, Engineering and Technology, **4(3):** 11928-11935

Shivakumar, M. S. and Kataria, R. (2011). Comparative efficacy of Azadirachtin on the larval population of *Culex quinquefasciatus, Anopheles stephensi,* and *Aedes aegypti* (Diptera*:* Culicidae) *International Journal of Pharma and Bio Sciences in Gujarat, India*, **2**: 41-47

Singh N.P., Kumar V, and Vhauhan D. (2003). Mosquito larvicidal proberties of the leaf extract of a herbaceous plant *Ocimum canum* (Family: labiatae). *Journal of Communicable Disease*, **35(1)**: 43-45.

Vatandoost, H. and Vaziri, V.M. (2004). Larvicidal activities of a neem tree extract (Neemarin) against mosquito larvae in the Islamic Republic of Iran*. Journal of African Common diseases,* **38(1):** 104-107.