



LARVICIDAL ACTIVITY OF MEDICINAL PLANTS AND DETERGENT AGAINST DENGUE VECTOR (*Aedes aegypti*)

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ABSTRACT

Dengue mosquitoes, primarily *Aedes aegypti* and *Aedes albopictus* species, are vectors of dengue virus. The mosquito can be recognize by white markings on legs and a marking in the form of a lyre on the thorax. *Aedes aegypti* is a vector for transferring various tropical fevers. Dengue fever also well known as break bone fever. Dengue is transferring by various species of mosquito under the genus *Aedes*, principally *A. aegypti*

Larvicidal activity of three plant extracts and detergent against *Ae. Aegypti* mosquitoes. The study found. That among the plant extracts tested (Garlic bulb extract, Neem leaves extract, and Tulsi leaves extract) and detergent, *Allium sativum* (Garlic) showed the highest efficacy against the larvae of *Ae. Aegypti*, while *Ocimum sanctum* (Tulsi) exhibited the least larvicidal effect. This suggests that Garlic extract could be a promising for controlling the population of these mosquitoes

Key words: Mosquito larvae, plant abstracts and detergent, larvicidal activity, Eco-friendly tool.

Introduction

The mosquitoes are a serious threat to public health, since they are known vector of many life-threatening diseases like malaria, filariasis, Japanese encephalitis, Chikungunea and dengue fever, which are transmitted by the species of three mosquito genera: *Anopheles*, *Culex* and *Aedes*. Eradication of *Aedes aegypti* is the main way to eradicate DHF (Williams and Pinto 2012) Repellency is an important way of preventing vector-borne diseases by reducing man-vector contact by using a natural medicinal value neem. (Bounias M.,2003) Neem has been used as insecticides even before the advent of synthetic organic insecticides (Casida et al., 1998)

Many efforts have been made to suppress the density of vector populations of *Aedes* sp. mosquito, namely chemical control by using insecticide. Chemical control is one of the very highly recommended ways to control mosquitoes in a short time, for a large population. But during the process it should be remembered that these controls have considerable side effects and can damage the environment. To minimize the side effects of the use of chemical insecticide in vector

control, utilization of natural insecticide that can eradicate the vectors is suggested to reduce the disease cases caused by *Aedes* sp. In addition, as these substances are made from natural materials, so it is expected that this type of insecticide will be easier to decompose (biodegradable) in nature. So, it will not pollute the environment and is relatively safe for humans and livestock (Maciel-de-Feritas R et. Al 2014)

Garlic plants can be one natural alternative option of vector control disease caused by *Aedes* sp mosquitoes. The compounds present in garlic include Allicin and Sulfur Ammonia acid Allin. The Allicin Lyase Enzyme converts sulfuric ammonia acid Alin to Pyruvic Acid, Ammonia, and Allicin Anti Microbes. Next, Allicin changes to Diallyl disulfide. Allicin and Diallyl Sulphide compounds have many benefits and are effective as drugs. Allicin and its derivatives also have a larvicidal effect(Hanani S J, et.al 2013)

Based on studies on the genus *Ocimum*, this plant contains alkaloids(Abdurrahman et al 2019) flavonoids, tannins, saponins, triterpenoids, and essential oils (Narulita W et al 2019) . So, this research was held to see the ability of the extract of the basil leaves of the (*Ocimum sanctum*) as larvaside against fourth instar larvae of the *Aedes aegypti* mosquito (Kurniawan A et al 2019)

Ocimum sanctum of family Lamiaceae have been tried for the phytoecdysis like compounds and their effect on second and fourth instar larvae of *Culex quinquefasciatus*.(krishan et al 2007)

Practically, control measures focus on species of mosquito that are vectors of livestock or human disease, or that are seriously irritant pests (Sarwar M. 2020)

The prevention of DHF is aimed to control the vector (Nathan et al 2009) *Aedes aegypti* is known to prefer breeding places mainly in man- made containers with clear water inside such as rainwater (Anonim and Anonim 2007) Detergent is one of cleansing agents used in households that is available and has the potential as larvicide for *Aedes aegypti*. Some studies showed that detergent could prevent oviposition and killed the larvae of *Aedes aegypti* in various concentrations.(Prasantong R.1989), (Sudarmaja M. 2008), However, water that contains detergent can still be used as breeding place of *Aedes aegypti* (Hadi et al 2006) The mechanisms of action of plant extracts on mosquito larvae include neurotoxic effects, inhibition of detoxifying enzymes, disruption of larval growth, and/or injury to the midgut (Pavela et al., 2019). According to (Pavela et al., 2019), 29 of 400 examined plant species showed outstanding larvicidal activity against *Aedes* species. Use of insecticidal soaps, are being revisited. The insecticidal soaps remain effective against pest insects and relatively safe (Szumlas 2002).

Materials and Methods



Azadirachta Indica



Ocimum sanctum



Garlic Plant



Detergent



Collection of leaves and Garlic

Collection of leaves of *Azadirachta Indica*, *Ocimum sanctum* from the department of Zoology Isabella thoburn college India. *A.sativum* were collected from the near market and household detergent were used.

The purpose of this study was to determine mosquito larvicidal activity of medicinal plants and commercially available detergent.

The information from these studies could benefit the screening and selection of new larvicides for the vector mosquito management.

Leaves of neem, tulsi and garlic were dried for one week and then grinded through grinder mixer and powder were obtained, and then powder soaked in water for one night and 100% natural extract obtained with no chemical/synthetic.

20 *Aedes* larvae were transferred into the glass bowls and five replicas were made for each with one control group. Within 10 minutes larvae get stable and adjust into the bowl. Then in each bowl 1g, 1.5g, 2g, 2.5g, and 3g/l extract were added with the help of dropper, and the deaths of larvae were counted and the effectiveness of the extract was noted.

Prepared extracts



Before exposure



Experiment set-up



Mortality of larvae after exposure



Results

The results clearly indicated that highest mortality of larvae were observed in garlic. Garlic has great potential to kill larvae due to presence of allicin and diallyl sulphide which plays an important role as anti-microbial and anti-parasitic, and the *Ocimum* has least effective in compare to two medicinal plants and detergent. Mean mortality of *Aedes* larvae after exposure were expressed in terms of number in Table -1 After that values were allowed to make a comparison with control to find out the correct mortality of the *Aedes* larvae. In Table-2, result for %mean mortality is expressed which is highest in garlic. All the tables were done using excel spreadsheet. Data were submitted to one way analysis using excel spreadsheet. When the ANOVA statistics were significant ($p < .005$) Garlic extract mortality rate of *Aedes* larvae at a conc. of 3g/l was observed to be 100% (Table-2). This indicates that garlic has a potent larvicidal effect on *Aedes* larvae, achieving complete eradication. Detergent exposure on *Aedes* larvae at a concentration of 3g/l resulted in mortality rate 95% highly effective (Table-2). Extract of Neem, at a conc. of neem led to mortality rate of 20% (Table-2) among *Aedes* larvae. Neem demonstrated moderate larvicidal activity against the larvae. While tulsi at concentration of 3g/l exhibited a mortality rate 15% on *Aedes* larvae (Table-2)

TABLE- Aedes larva mortality after exposure to leaf extract

Mortality (Mean± S.E) after exposure to plant extract

Co nc.	N	GARLIC			DETERGENT			NEEM			TULSI		
		DA Y 1	DA Y 2	DA Y3	DA Y 1	DA Y 2	DA Y3	DA Y 1	DA Y2	DAY 3	DA Y 1	DA Y 2	DA Y 3
1g	20	8.33 ±0.57	8.66 ±0.57	8.66± 0.57	7.33± 0.57	7.66± 0.57	7.66± 0.57	11.33 ±0.57	1.6 6± 0.5 7	1.33± 0.57	1.66 ± 0.57	1.66 ± 0.57	1.33 ± 0.57
1.5 g	20	11.33 ±0.57	11.66 ±0.57	11.66 ±0.57	0.33± 0.57	10.00 ±1.00	10.00 ±1.00	11.66 ±0.57	2.0 0± 1.0 0	2.33± 0.57	1.33 ± 0.57	1.66 ± 0.57	2.00 ± 1.00
2g	20	15.33 ±0.57	15.66 ±0.57	15.66 ±0.57	13.33 ±0.57	14.00 ±1.00	14.00 ±1.00	12.00 ±1.00	2.0 0± 1.0 0	3.00 ±1.00	1.66 ± 0.57	2.66 ± 0.57	2.00 ± 1.00
2.5 g	20	17.66 ±0.57	19.33 ±0.57	19.33 ±0.57	16.66 ±0.57	16.00 ±1.00	18.00 ±1.00	2.66± 0.57	2.0 0± 1.0 0	3.00± 1.00	2.00 ± 1.00	2.66 ± 0.57	2.00 ± 1.00
3g	20	19.66 ±0.57	19.33 ±0.57	19.33 ±0.57	19.66 ±0.57	19.00 ±1.00	19.00 ±1.00	14.33 ±0.57	3.6 6± 0.5 7	4.00± 1.00	2.66 ± 0.57	2.66 ± 0.57	3.66 ± 0.57
C O N.	20	1.00± 00	1.00± 00	1.00± 00	1.00± 00	1.00± 00	1.00± 00	1.00± 00	1.0 0± 00	1.00± 00	1.00 ±00	1.00 ±00	1.00 ±00

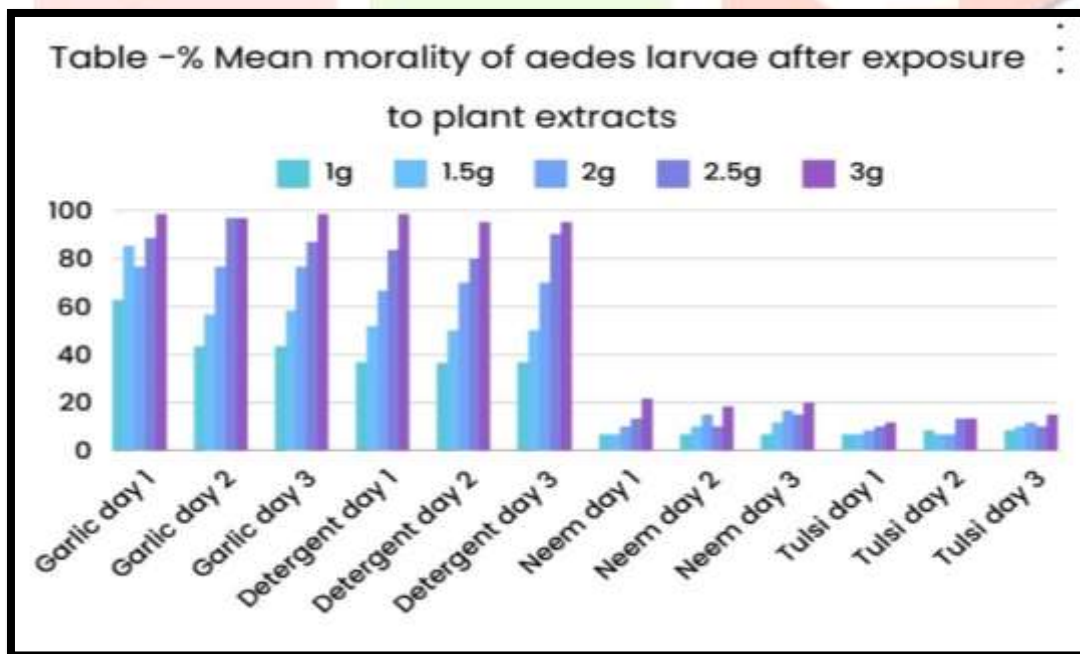


Table -1 shows the % mean mortality of larvae after exposure to leaf extract and detergent

TABLE- %Mean mortality of Aedes larvae after exposure to plant extracts

Co nc.	GARLIC			DETERGENT			NEEM			TULSI		
	DA Y1	DA Y2	DA Y3	DA Y1	DA Y2	DA Y3	DA Y1	DA Y2	DA Y3	DA Y1	DA Y2	DA Y3
1g	62.5 %	43.3 3%	43.3 3%	36.6 6%	36.3 3%	36.6 6%	6.66 %	6.66 %	6.66 %	6.66 %	8.33 %	8.33 %
1.5g	85%	56.6 6%	58.3 3%	51.6 6%	50.0 0%	50.0 0%	6.66 %	10.0 0%	11.6 6%	6.66 %	6.66 %	10.0 0%
2g	76.6 6%	76.6 6%	76.6 6%	66.6 6%	70.0 0%	70.0 0%	10.0 0%	15.0 0%	16.6 6%	8.33 %	6.66 %	11.6 6%
2.5g	88.3 3%	96.6 6%	86.6 6%	83.3 3%	80.0 0%	90.0 0%	13.3 3%	10.0 0%	15.0 0%	10.0 0%	13.3 3%	10.0 0%
3g	98.3 3%	96.6 6%	98.3 3%	98.3 3%	95.0 0%	95.0 0%	21.6 6%	18.3 3%	20.0 0%	11.6 6%	13.3 3%	15.0 0%

The graph shows the survival of larvae after exposure to leaf extract and detergent



Discussion

The average number of dead mosquito larvae was highest in garlic . One of the ways to control mosquito larvae is through the use of natural products like garlic as it holds the chemical composition like allicin sulfur ammonia and acid allin which act as larvicide. When the larvae were exposed to 2mg/ml concentration, a mortality rate of 3.33 and 5.33 was recorded after 1st and 2nd hours respectively which there were no significant different but after 3 and 4 hours of exposure

there was a significant difference which has the mean mortality of 7.66 and 10.00 respectively after exposure to the extract. (Kasim et al 2019)

Solution with 0% garlic concentration as a control showed 0% mortality of larvae. This proves that the water solution without additional garlic solution does not affect the larvae. Solution with garlic concentration of 10% and 15% is not effective in killing *Aedes aegypti* larvae in 12 hours. Solution with garlic concentration of 20% began to effectively kill *Aedes aegypti* larvae at 9 hours of observation and still killed more *Aedes aegypti* larvae until 12 hours observation. A solution with garlic concentration of 25% and 30% began to effectively kill *Aedes aegypti* larvae at 6 hours of observation and kill more larvae until observation for 12 hours. (Rahmah et al., 2018)

Detergent has larvicide potential because it contains surfactants which consist of non-ionic surfactants ionic surfactants and cationic surfactants which obstruct the oxygen supply at the water surface and kill the larvae. Detergent solution with 1, 1.5, 2, 2.5, 3, 3.5 and 4 g/l concentration is able to kill larvae as high as 37.2%, 42.4%, 74.4%, 85.6%, 89.6%, 95.2% and 100%, respectively. Higher concentration of detergent was capable to kill more larvae. The test showed that the average death of larvae differed significantly between all the treatment groups and also with the control group. (Madavi et al., 2020)

Neem is also well liked genuine product which contains insecticidal characteristics like Azadirachtin which is noxious to mosquito. Azadirachtin indica has been reported to be eco- friendly and non-toxic to vertebrates. The plant crude or botanical extracts are less expensive and highly effective for the control of mosquitoes that contributes too many serious vectors borne diseases rather than purified compounds or extracts of the plant (Alouani et al, 2009; Khalafalla et al., 2007; Bhagavan and Rahuman, 2011)

The larviciding effect of *A. indica* oil extract on total of 400 *Anopheles* larvae were exposed to different concentration of neem seed extract (1%, 4%, 8% and 10%) for 24h, 48h and 72h. The percentage mortality of neem seed extract to larvae showed 86.5%, 98.8% and 100% mortality. While 2(1%) mortality in the control was also recorded. (Lama et al 2024)

The results clearly indicated that highest of 93.3% larval mortality was observed at 400 ppm concentration of the neem oil formulation. Whereas the lowest mortality of 50% was recorded at the 25 ppm concentration. The larval mortality of 70.8%, 75% and 85% were observed at 50,100 and 200 ppm concentration respectively. As the concentration of the neem plant oil formulation increases the total mortality of *Aedes aegypti* also was found to be increased. (Vikramsivasakthi et al 2017)

Ocimum contains methyl eugenol which has insect repelling properties result of the effect of dry *Ocimum sanctum* leaves on the larval stage of mosquitoes and the mortality rates were (47, 72, and 80%), respectively (P = 0.008, F=29.9027). (Abashi et al 2021)

Conclusion

The results of this study indicate that garlic possesses remarkable larvicidal activity against *Aedes* larvae, with a mortality rate of suggests that garlic could be a valuable natural agent for controlling *Aedes* larvae. Detergent, neem and tulsi also exhibited significant larvicidal effects, albeit with lower mortality rates compared to garlic. These findings highlight the potential of these substances as alternative larvicidal agents in larvae control strategies.

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