

EFFECTIVENESS OF PAPAYA SEED SOLUTION AND AVOCADO SEED AS LARVICIDE OF MOSQUITOES *Aedes sp.*

Laila Safitri, Muhammad Irfa'i, Syarifudin A, Arifin

Poltekkes Kemenkes Banjarmasin Department of Environmental Health

Jl. H. Mistar Cokrokusumo No. 1A, Banjarbaru, South Kalimantan 70714

E-mail: lailasafitri185@gmail.com

Article Info

Article history:

Received August 15, 2022

Revised August 16, 2022

Accepted January 01, 2023

Keywords:

Seed Fruit Papaya

Seed Fruit Avocado

Effectiveness

Aedes sp.

ABSTRACT

Effectiveness of Papaya Seed Solution and Avocado Seed As Larvicide of Mosquitoes *Aedes sp.* Mosquito *Aedes sp.* is a species of mosquito in tropical and subtropical regions that are vectors for transmitting the dengue virus to man through the bite; with that, there is a need for existence, effort prevention, and a control-friendly alternative environment using larvicide vegetables that are solution seed fruit papaya (*Carica papaya L.*) and seeds fruit avocado (*Persea americana*). The study aims to determine the effectiveness of seed fruit papaya (*Carica papaya L.*) and seed fruit avocado (*Persea americana*) on the larval mortality of *Aedes sp.* Type study This is a post-test-only group design. The population is the third instar larva of *Aedes sp.* The sample used 1,200 larvae of *Aedes sp.* on each solution of seed fruit papaya and seed fruit avocado, with variations of 6 doses that are 0%, 2%, 4%, 6%, 8%, and 10%. Concentration variation of mosquito larvicide from papaya seeds (*Carica papaya L.*) and avocado seeds (*Persea americana*), with the highest concentration of 10% resulting in the death of mosquito larvae as high as 72% and 88%, respectively. The effective concentration at Lc50 found is 6% for papaya seed solution (*Carica papaya L.*) and 4% for avocado seed solution (*Persea americana*).

This is an open access article under the [CC BY-SA](#) license.



INTRODUCTION

The number of puddles caused by the rainy season can be a breeding ground for mosquitoes, causing many cases of disease spread from the role of mosquitoes. Dengue Hemorrhagic Fever (DHF) is a disease transmitted through mosquito bites from the species *Aedes sp.* DHF sufferers will experience symptoms of sudden fever, bleeding in the skin and other parts of the body, and if not treated immediately, can cause shock and death ^[1]. Vector control is the main way to reduce dengue transmission that adapts well to urban areas especially human habitation.

Plant-based larvicide control can serve as a deterrent to the emergence of resistance in target organisms. Types of natural larvicides that are easily decomposed (bio larvicide) in nature include papaya fruit seeds (*Carica papaya L.*) and avocado seeds (*Persea americana*). Papaya seeds contain papain which has the function of inhibition of various proteins in the intestine of larvae so that they can interfere with the growth and development of larvae so that they cannot breathe and eventually die. While avocado seeds contain active ingredients including alkaloids, saponins and triterpenoids. Avocado seed extract granules

are a poison inhibitor of metamorphosis of *Aedes sp. mosquitoes* and are also contact poisons, as well as stomach poisons.

Research on the use of papaya fruit seeds (*Carica papaya L.*) as natural larvicide has been conducted by Yuliana [2], Najib [3], Emma et al [4], while the use of avocado seeds (*Persea americana*) as natural larvicide has also been carried out by Marlinda et al [5], Zuhrotun [6], and Adesina et al [7]. Seeing this, the study to determine the comparison of the effectiveness of papaya seed solution (*Carica papaya L.*) and avocado seed (*Persea americana*) as larvicide of *Aedes sp. mosquitoes* with variations in concentration is expected to be able to provide alternative solutions for vegetable larvicide that can be used by the community.

MATERIALS AND RESEARCH METHODS

Research conducted using *True Experimental Design*. Natural ingredients, namely papaya seed solution (*Carica papaya L.*) and avocado seeds (*Persea americana*) are used as larvicide with *Aedes sp.* samples with varying concentrations for each treatment. To determine the effectiveness of natural larvicide in killing *Aedes sp.* larvae, this study used a research design in the form of an experimental approach with intervention or treatment from researchers.

The research materials used are papaya seeds (*Carica papaya L.*), avocado seeds (*Persea americana*), and water. Observations were carried out for 24 hours to see the mortality rate of *Aedes sp. instar III* larvae for each treatment. Then pH and temperature measurements were carried out for each solution during the observation and also probit tests for the calculation of LC₅₀ solution of papaya fruit seeds (*Carica papaya L.*) and avocado seeds (*Persea americana*).

RESULTS OF RESEARCH AND DISCUSSION

The activity began on April 2, 2021, and 1, 200 larvae were obtained in treatment using larvicide solution of papaya fruit seeds (*Carica papaya L.*) and avocado seeds (*Persea americana*) at concentrations of 0% (control), 2%, 4%, 6%, 8% and 10% carried out 4 repetitions with an observation time of 24 hours. The type of larvicide used is a solution of papaya seeds (*Carica papaya L.*) and avocado seeds (*Persea americana*).

Table 1. Toxicity Test Results of Variation of Concentration Effectiveness of Papaya Fruit Seed Solution (*Carica papaya L.*) against larval death *Aedes sp.*

Types of larvicides	Solution concentration	Number of larvae	Larval death				Average death of larvae
			R1 (tail)	R2 (tail)	R3 (tail)	R4 (tail)	
Papaya Fruit Seed Solution	0%	25	0	0	0	0	0
	2%	25	4	5	5	6	5
	4%	25	8	9	8	9	9
	6%	25	11	12	13	13	12
	8%	25	15	14	14	15	15
	10%	25	18	19	16	18	18

Based on Table 1, the lowest mortality rate is 0% concentration (where this concentration is a control concentration containing 100 ml of aquadest) with a percentage of 0% meaning that the solution is not capable of being used for mortality of *Aedes sp. larvae*. The highest larval mortality rate was at a concentration of 10% with 18 deaths (72%). The optimum concentration of the solution is 6% with the number of deaths of 12 heads (48%) because the concentration has been able to kill half of the larvae.

Table 2. Toxicity Test Results Variation of Concentration Effectiveness of Avocado Seed Solution (*Persea americana*) against Larval Death *Aedes sp.*

Types of larvicides	Solution concentration	Number of larvae	Larval death				Average death of larvae
			R1 (tail)	R2 (tail)	R3 (tail)	R4 (tail)	
Avocado Seed Solution	0%	25	0	0	0	0	0
	2%	25	10	12	8	12	11
	4%	25	12	14	13	14	13
	6%	25	15	16	16	16	16
	8%	25	17	18	17	18	18
	10%	25	24	21	20	24	22

Based on Table 2, the lowest mortality rate is 0% concentration (where this concentration is a control concentration containing 100 ml of well water) with a percentage of 0%, meaning that the solution is not capable of being used for mortality of *Aedes sp. larvae*. The highest mortality rate was at a concentration of 10% with 22 deaths and 88%. The optimum concentration of solution was obtained at a concentration of 4% with a number of deaths of 13 and a percentage of 52% because the concentration was able to kill half of the number of larvae in each treatment.

Table 3. Results of temperature measurement of concentration variations in the effectiveness of papaya fruit seed solution (*Carica papaya L.*) against larval death *Aedes sp.*

Papaya Seed Solution Concentration	Mouth (°C)				Temperature Range (°C)
	R1	R2	R3	R4	
0%	29,9	29,8	29,8	29,9	29,8 – 29,9
2%	29,6	29,6	29,6	29,6	29,6
4%	29,5	29,5	29,4	29,4	29,4 – 29,5
6%	29,3	29,4	29,3	29,5	29,3 – 29,5
8%	29,3	29,2	29,3	29,2	29,2 – 29,3
10%	29,1	29,1	29,0	29,0	29,0 – 29,1

Table 4. Results of temperature measurement of concentration variations in the effectiveness of avocado seed solution (*Persea americana*) against larval death *Aedes sp.*

Avocado Seed Solution Concentration	Mouth (°C)				Temperature Range (°C)
	R1	R2	R3	R4	
0%	29,9	29,9	29,9	29,9	29,8 – 29,9
2%	29,6	29,6	29,6	29,6	29,6
4%	29,5	29,5	29,4	29,4	29,4 – 29,5
6%	29,4	29,4	29,3	29,3	29,3 – 29,4
8%	29,3	29,2	29,3	29,2	29,2 – 29,3
10%	29,1	29,0	29,0	29,0	29,0 – 29,1

Table 3 and Table 4 show the temperature range of death of *Aedes sp. larvae* is 29.0 °C – 29.6 °C with 24 hours observation for both Papaya fruit seed solution (*Carica papaya L.*) and

avocado fruit seeds (*Persea americana*). The temperature at the time of testing was 28°C. The optimum temperature of the test is in the range of <27°C or >30°C. Where in this temperature range there was no presence of *Aedes sp. larvae* [8]. The temperature of 20 - 30 ° C is the temperature range where larval growth occurs, so tests carried out with a temperature range of 29.0 ° C - 29.6 ° C do not interfere with larval growth [9].

Table 5. Test of Probit Seeds of Papaya Fruit Seeds (*Carica papaya L.*)

LC	Estimate	Lower	Upper
50	6,755	6,222	7,351
90	12,767	11,628	14,328

Table 6. Test of Probit Seeds of Avocado Fruit Seeds (*Persea americana*)

LC	Estimate	Lower	Upper
50	4,644	3,886	5,367
90	10,203	9,015	11,995

Table 5 shows that the LC50 value of papaya seed solution (*Carica papaya L.*) is 6.755% with an LC90 value of 12.767%. While in Table 6 it is shown that the LC50 value of avocado seed solution (*Persea americana*) is 4.644% with an LC90 value of 10.203%. The results of the analysis showed that the optimum concentration for papaya seed solution was 6% while for avocado seeds was 4%. This is because at a concentration of 6%, papaya seed solution has been able to kill almost 50% of the total larval population (48% larval death rate) while for avocado seed solution, at a concentration of 4% it has been able to kill more than half of the total larval population (52% mortality rate).

The results of research conducted on the death of *Aedes sp. larvae* can be seen in all treatment groups. In papaya fruit seed solution (*Carica papaya L.*) larval death is caused by active compounds, namely alkaloids, caprine, nicotine, tannins, and chymopapain enzymes [10]. Another active compound contained in papaya fruit seeds is the enzyme papain. The enzyme papain inhibits digestion through inhibition of various proteins in the larval intestine so that the larvae cannot breathe and eventually die from nerve paralysis [11]. While in the avocado seed solution (*Persea americana*) the death of *Aedes sp. larvae* is caused by the active ingredients contained in it including alkaloids, triterpenoids, tannins, flavonoids, and saponins which have a stronger intensity compared to other secondary metabolite compounds [5][6]. The main active compounds in vegetable larvicide of avocado seed solution (*Persea americana*) are polyphenols. Polyphenols can bind to various proteins so that they can cause denaturation of proteins (proteolysis) that make up the cell wall. This will cause cells to experience metabolic disorders so that there is a process of cell damage in larvae [11]. Based on the observations, *Aedes sp. larvae* that have been given a solution of papaya seeds (*Carica papaya L.*) and avocado seeds (*Persea americana*) will experience the same behavioral changes where the larval movements become sluggish, and then show symptoms of death. *Aedes sp. larvae* can be said to die when the larvae are no longer able to move when given impulses such as touch. The larvae will also sink and be deposited at the bottom of the *test cup*, and will no longer appear to the surface of the water. The dead larvae appear pale white. The results of the probit test show that the LC50 value of papaya fruit seed solution (*Carica papaya L.*) is 6.755, meaning that the papaya fruit seed solution (*Carica papaya L.*) that can

kill 50% of larvae is at a concentration of 6.755% with an upper limit of 7.351 and a lower limit of 6.222. The LC90 value of papaya fruit seed solution (*Carica papaya* L.) is 12.767 which means papaya fruit seed solution (*Carica papaya* L.) which can kill 90% of larvae is at a concentration of 12.767% with an upper limit of 14.328 and a lower limit of 11.628. While the probit test results LC50 value of avocado seed solution (*Persea americana* mil) of 4.644 means that avocado seed solution (*Persea americana* mil) which can kill 50% of larvae is at a concentration of 4.644% with an upper limit of 5.367 and a lower limit of 3.886. The LC90 value of avocado seed solution (*Persea americana* mil) is 10.203, which means that the avocado seed solution (*Persea americana* mil) that can kill 90% of larvae is at a concentration of 10.203% with an upper limit of 11.995 and a lower limit of 9.015.

CONCLUSIONS AND RECOMMENDATIONS

The highest concentration of vegetable larvicide of papaya fruit seeds (*Carica papaya* L.) and avocado fruit seeds (*Persea americana*) was 10% with average larval mortality rates of 72% and 88% respectively. The effective concentration is 6% for papaya seed solution (*Carica papaya* L.), and 4% for avocado seed solution (*Persea americana*). LC50 for papaya seed solution (*Carica papaya* L.) is at a concentration of 6% and for avocado seed solution (*Persea americana*) at a concentration of 4%.

Researchers can then conduct further research to eliminate the color formed by the active ingredients in the vegetable larvicide content, papaya seed solution and avocado seeds.

REFERENCES

1. Kemenkes RI (2020) 'Profil Kesehatan Indonesia'.
2. Yuliana, C. L. (2016). *Efek Infusa Biji Buah Pepaya (Carica papaya L.) Terhadap Kematian Larva Aedes aegypti*. Skripsi.
3. Najib, Rizqa. 2017. *Penggunaan Ekstark Biji Buah Pepaya (Carica Papaya) dan Biji Alpukat (Persea americana) Sebagai Larvasida Aedes Aegypti*. Digital Repository Universitas Jember.
4. Emma Mardiyah, Muhammad Fakhri Nur, Lia Siti Halimah. 2018. *(COMPARISON OF THE EFFECTIVENESS OF PAPAYA SEEDS ETHANOL EXTRACTS (Carica papaya L) AS LARVASIDE ON Aedes aegypti LARVA AND Aedes albopictus INSTAR III-IV)*. Mardiyah E. Medika Kartika : Jurnal Kedokteran dan Kesehatan
5. Marlinda, M., Sangia, M. S & Wuntu, A. D. 2012. *Analisis Senyawa Metabolit Sekunder dan Uji Toksisitas Ekstrak Etanol Biji Buah Alpukat (Persea americana)*, Jurnal MIPA UNSRAT.
6. Zuhrotun, A. 2007. *Aktivitas Anti Diabetes Ekstrak Etanol Biji Buah Alpukat (Persea americana)*. Bentuk Bulat. Karya Ilmiah. Jatinangor: Universitas Padjadjaran.
7. Adesina JM, Jose AR, Rajashekar Y, Ileke KD. 2016. *Persea americana (Mill.) seed extracts: Potential herbal larvicide control measure against Anopheles gambiae Giles, 1902 (Diptera: Culicidae) Malaria vector*. International Journal of Mosquito Research.
8. Ridha, M Rasyid., dkk. 2013. *Hubungan Kondisi Lingkungan dan Kontainer dengan Keberadaan Jentik Nyamuk Aedes aegypti di Daerah Endemis Demam Berdarah Dengue di Kota Banjarbaru*. Jurnal Buski.
9. Costa, E.A.P.A., Eloína Maria de Mendonça Santos, Juliana Cavalcanti Correia, dan Cleide Maria Ribeiro de Albuquerque, 2010, *Impact of Small Variations in Suhue and Humidity on The Reproductive Activity and Survival of Aedes aegypti (Diptera, Culicidae)*, Rev. Bras. entomol.. São Paulo

10. Adeneye, AA., Olagunju, JA. 2009. *Preliminary hypoglycemic and hypolipidemic activities of the aqueous seed extract of Carica papaya L.n. in Wistar rats. Biology and Medicine.*
11. Wibawa, R.R. 2012. *"Potensi Ekstrak Biji Mahkota Dewa (Phaleria macrocarpa) Sebagai Insektisida Terhadap Nyamuk Aedes aegypti Dengan Metode Semprot".* Tidak Diterbitkan. Skripsi. Jember: Universitas Jember.
12. Yogiraj, V., Goyal, P.K., Chauhan, C.S., Goyal, A., Vyas, Bhupendra. 2014. *Carica papaya L.n. International Journal of Herbal Medicine.*
13. Wahyuni Dwi (2016) *'Formulasi LC50 Bioinsektisida Baru Ekstrak Biji Pepaya (Carica papaya L) Biji Srikaya (Annona squamosa L) dan Biji Alpukat (Persea americana) Terhadap Mortalitas Larva Nyamuk Aedes aegypti).*
14. Under, L. (2017) 'Larvicidal efficacy of ethanolic leaf extracts of four selected local plants from hail region, northern Saudi Arabia, against the dengue fever vector, Aedes aegypti (L.) Under laboratory conditions', *International Journal of Mosquito Research*, 4(3).
15. Utomo, Margo. 2010. *Daya Bunuh Bahan Nabati Serbuk Biji Papaya Terhadap Kematian Larva Aedes aegypti Isolate Laboratorium B2P2VRP Salatiga.* Jurnal Universitas Muhammadiyah Semarang.
16. Taufiq, S., Yuniarni, U & Hazar, S. 2015. *Penggunnan Ekstrak Biji Pepaya (Carica Papaya L) Sebagai Larvasida Nabati Terhadap Kematian Larva Nyamuk Anopheles Dan Aedes Aegypti Instar III. Prosiding Penelitian Spesia Unisba.* ISSN 2460-6472.
17. Prastiwi, R. *Penggunaan Larutan Daun Pepaya (Carica papaya) sebagai Larvasida Terhadap Kematian Larva Nyamuk Aedes aegypti* (Doctoral dissertation, Fakultas Kesehatan Masyarakat Universitas Jember).
18. P. Malathi, S. V. (2015). *Evaluation of mosquito larvicidal effect of Carica Papaya against Aedes Aegypti.*
19. Leite, J.J.G. 2009. *Chemical Composition, Toxicity and Larvacidal and Antifungal Activities of Persea americana (Avocado) Seed Extract.* *Revista da Brasileira de Mediciana Tropical.*
20. Dwi Wahyuni, Dyah Prajnaparamita Dewi, Suratno. (2014). *Toksisitas Granula Ekstrak Biji Alpukat (Persea americana.) Terhadap Mortalitas Larva Nyamuk Aedes aegypti L. (Toxicity of Avocado Seed Extract Granules against The Mortality of Aedes aegypti L. Larvae).* Artikel Ilmiah Hasil Penelitian Mahasiwa
21. Chavez, Pedro. 2011. *Antifungal Activity in Ethanolic Extracts of Carica papaya L. cv. Maradol Leaves and Seeds.* *Indian J Microbiol.*
22. Chandra, A., Hie M.I. & Verawati. 2013. *Pengaruh pH dan Jenis Pelarut pada Perolehan dan Karakterisasi Pati dari Biji Alpukat.* Bandung: Lembaga Penelitian dan Pengabdian kepada Masyarakat Universitas Katolik Parahyangan.
23. Arukwe, U., Amadi, B.A. & Duru, M. 2012. *Chemical Composition Of Persea americana Leaf, Fruit and Seed. IJRRAS.*
24. W S Adayani, R. S. (2018). *Effect of treatment using Carica papaya seed extract with Ag-TiO2 nanocomposite on the mortality of Aedes aegypti larvae.*
25. Fayzal Ramadhan, M. R. *Toksisitas campuran ekstrak biji pepaya (Carica papaya L.) dan biji srikaya (Annona squamosa L.) terhadap mortalitas larva nyamuk Aedes aegypti L.*