Analysis Of *Aedes Aegypti* Larvae Population Density, Kasturian Village, South Ternate, Ternate City, Indonesia

Amalan Tomia[1]*, Sumiati Tomia[2]

[1]Public Health study program, Faculty of Health Sciences, Muhammadoyah University, North Maluku, Jl. KH. Ahmad Dahlan, No. 100. Sasa Village, South Ternate District. Ternate City, Indoinesia
[2]Environmental Health, Poltekes Kesehatan KEMENKES Ternate, Indoinesia
*Corresponding Author:
Email. algaternate@gmil.com

Abstract.

Introduction. This study aims to determine the level of population density of Aedes aegypti mosquito larvae as an effort to control dengue fever in Kasturian Village. Ternate City. Method. The sample of this study was larvae taken from 100 houses in Kasturian Village, North Ternate District, Ternate City that have containers both inside and outside the house. The data obtained were analyzed for larval index using the House Index (HI), Container Index (CI), and Breteau Index (BI) formulas. The relationship between habitat characteristics and population density of Aedes sp mosquito larvae was analyzed using the SPSS program.Results And Discussion . The survey results found that the characteristics of the Ae. aegypti mosquito larvae habitat consisted (TPA)container types including bathtubs, toilet tubs, drums, jugs, ablution water, cergen and buckets, and non containers including used cans (non0TPA), used tires, used glasses or bottles, flower vases, aquariums, dispenser containers, washbasins, gutters, and used drums. The type of container that is predominantly positive for larvae is the TPA container type, dark in color, found in the house and does not use a cover. The results of the analysis of the density index of Ae. aegypti mosquito larvae are in the moderate category for CI and BI, while HI is in the high category. Conclusion. This can be explained that Kasturian Village has the potential for dengue virus infection (DBD) which needs to be watched out for.

Keywords: *Kasturian; Kasturian Village and Density of Aedes aegypti*.

I. INTRODUCTION

Indonesia is an archipelago with a tropical climate and is more influenced by climate factors. The high rainy season and humidity affect the existence of mosquito populations. The high mosquito population has caused an increase in dengue fever cases. Data on dengue fever cases in 2024 reported 210,644 cases with 1,239 deaths due to dengue fever that occurred in 259 districts/cities in 32 provinces. Meanwhile, data on dengue fever in North Maluku in 2024 showed 236 cases of dengue fever spread across 7 districts/cities [1].*Ae. aegypti* mosquito larvae in an area can be an indicator of the cause of dengue fever cases in that area [2][3]. The density of the larval population is influenced by weather factors such as high rainfall, creating new habitats for mosquito larvae to breed [4] [5] . The rainy season also creates puddles and uncontrolled water reservoirs [6] [7][8].

Ternate City is an endemic area for dengue fever, data from the Ternate City Health Office in 2024 showed 210 cases of dengue fever [9] . The results of a study by Tomia et al, showed that in Ternate City there are 27 sub-districts that are endemic to dengue fever [10]. Kasturian Sub-district is one of the sub-districts in Ternate City that has the potential to become endemic to dengue fever, this is because there are still many potential breeding places used by mosquitoes to breed. The method used to limit the density of *Ae. aegypti* mosquitoes is the entomological surveillance method. The purpose of implementing the surveillance method is to monitor the abundance and spread of vector-borne diseases through monitoring container habitats in urban and suburban areas [11]. The indicators used to measure the density of Ae. aegypti mosquito larvae are by measuring the container index, including the Container Index (CI), House Index (HI), Breteau Index (BI) [2][12]. This study was conducted to determine the population density of *Aedes* spp mosquito larvae. as a vector of dengue fever in Kasturian sub-district, North Ternate, Ternate City.

II. METHODS

Method is a descriptive type of research with a *cross-sectional method* that aims to determine the density level of *Aedes* spp *mosquito larvae* . The research was conducted in Kasturian Village, North Ternate City, from September to December 2024 (Figure 1).

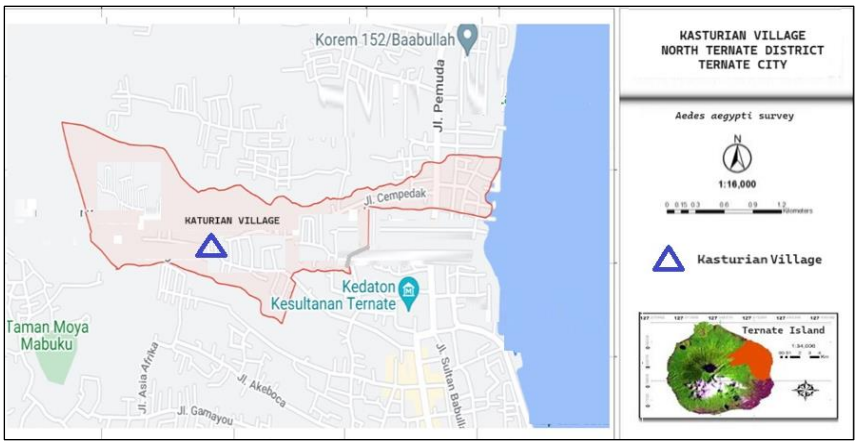


Fig 1. Research Location

The population in this study were larvae found in containers found at the research location in Kasturian Village, North Ternate, Ternate City. The research sample based on the Indonesian Ministry of Health in 2017 was larvae taken from 100 houses in Kasturian Village, North Ternate, Ternate City [13]. Container observations were carried out both inside and outside the house . The selection of 100 houses was determined by the *simple random sampling method* . The larvae obtained were then identified using the *single larva* method [13]. The data obtained will be analyzed to determine the larval index using the *House Index* (HI), *Container Index* (CI), and *Breteau Index* (BI) formulas. The data obtained from the calculation of the larval index are then compared with the larval index table to obtain the level of larval density (Table 1) [14]. Data analysis using SPSS Statistics.

Table 1. Larva Index Aedes sp.

Density Figure (DF)	*House Index (HI)*	*Container Index (CI)*	*Breteau index (BI_*	***Category Density***
1	1- 3	1- 2	1- 4	*Low*
2	4- 7	3- 5	5- 9	
3	8- 17	6- 9	10- 19	
4	18- 28	10- 14	20- 34	*Light*
5	29 – 37	15- 20	35 – 49	
6	38 – 49	21 – 27	50 – 74	
7	50 – 59	28 – 31	75 – 99	
8	60 – 76	32 – 40	100 – 199	*Heavy*
9	>77	>41	> 200	

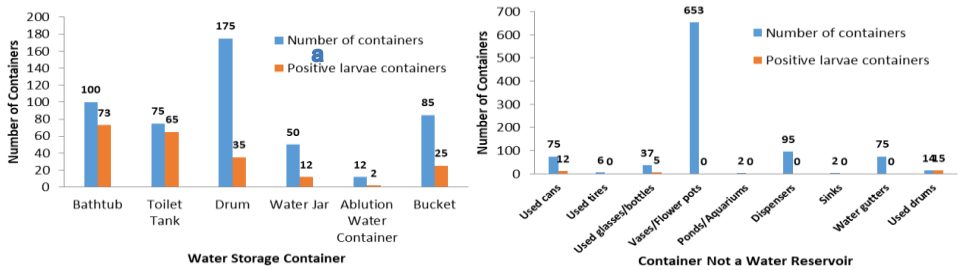
Source ; WHO (14)

III. RESULTS AND DISCUSSION

Result

Habitat Characteristics of *Aedes aegypti Larvae*

The results of a larval survey of 100 houses in Kasturian sub-district found 1613 (84.87%) containers positive for larvae, 244 containers (15.13%), as can be seen in Figure 2:



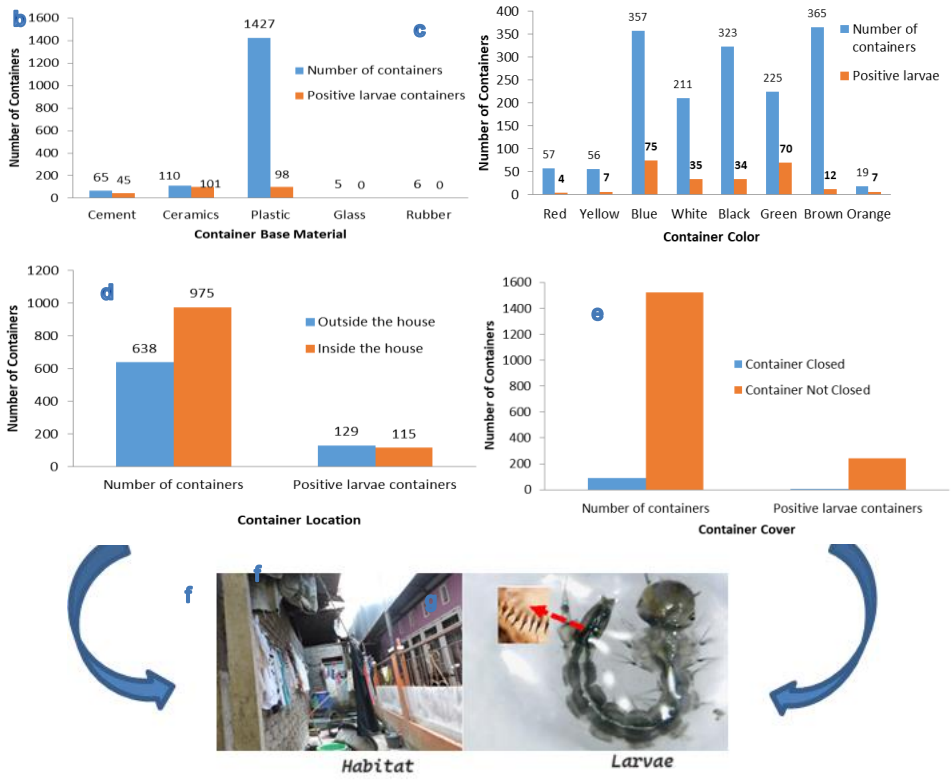


Fig 2. Characteristics of Aedes aegypti Larvae Habitat based on container type, water storage (TPA and Non-TPA) (a), Basic Material (b), Color (c), Place (d), Container Cover (e), Habitat (f) and Larvae Type (g).

Population Density of *Aedes aegypti Larvae*

Population density of *Ae.aegypti mosquito larvae* can be seen in Table 2 below.

Table 2. The density level of *Ae.aegypti* larvae in the sub -district Kasturian , North Ternate District

Checked	*Aedes* larvae spp				Jlh	CI/DF	HI/DF	BI/DF
	Positive	%	Negative	%				
House	55	55	45	45	100	15.39 /5	55 /7	31.83 /5
Container	244	15.13	1369	84.87	1613			

Relationship between Habitat Characteristics and Larvae Population Density

The results of the statistical analysis of the relationship between habitat characteristics and the density level of *Ae. aegypti larvae* can be seen in Table 3 below.

Table 3. Results analysis connection characteristics h abitat larva *Aedes* aegypti based on type of habitat, location container , color container , and closed container

Container Types	Container characteristics	Number of containers	Positive container of larvae	*P=value*	OR
Water Cover Place	Bathtub	100	73		
	WC Tank	75	65		
	Drum	175	35		
	Water Jug	50	12		
	Place of Ablution	12	2		
	Bucket	85	25		
	Jerry can	157	0		
		654	**212**		
Not a Water Reservoir	Used cans	75	12		
	Used tires	6	0		
	Used Glasses/Bottles	37	5		
	Vase/Flower pot	653	0	0.211	-
	Pool/Aquarium	2	0		
	Dispenser	95	0		
	Sink	2	0		
	Gutter	75	0		
	Used drums	14	15		

		959	**32**		
		1613	**244**		
Container Base Materials	Red	147	4		
	Brown	244	12		
	Blue	357	75		
	Black	323	34		
	Green	225	70		
	Yellow	75	7	0.101	-
	White	211	35		
	Glass	12	0		
	Orange	19	7		
		1613	**244**		
Container Location	Outside the house	638	129		
	Inside the house	975	115	0,000	2.42
		1613	**244**		
Container Cover	Closed	90	4		
	Not closed	1523	240	0,000	2.23
		1613	**244**		

Discussion

Characteristics of the habitat of *Aedes aegypti larvae* .

Ae. aegypti mosquito larvae consist of the types of TPA (bathtubs, toilets, drums, water jugs, ablution places, ceregen and buckets), and the types of non-TPA containers (used cans, used tires, used glasses/bottles, flower vases, aquariums, dispenser containers, washbasins, gutters, and used drums). *Ae. aegypti* mosquitoes like more water that does not touch the ground like a tub bath , bucket, can used , bottles , drums , or used jars And leaf stalk tree bananas [15][16][17]. Same result Also found in ward Gambesi [6] And ward Tabona [10].

Population Density of *Aedes a egypti Mosquito Larvae* .

Density population mosquito is indicator will the occurrence infection disease measured vector transmission by using *House Index (HI), Container Index (CI), Breteau Index (BI)* and Figure *Density (DF)* . All three entomological indicators are very effective to use in monitoring area frequent prone happen DHF cases , so that they can anticipate the emergence of new cases [18] .*Ae* . *aegypti* mosquito larvae in Kasturian sub-district, there is a potential risk of dengue fever transmission because the index value is in the moderate category (CI and BI = 5%), and the high category (HI = 7%). WHO provisions indicate a risk of transmission if HI exceeds 35 % , and C I exceeds 20 % and BI exceeds 50 % (19)(20). Research Previously in Ternate City had risk tall the occurrence transmission of dengue virus (DBD), with n CI value and HI value >5%, and BI value >50 % [17]. Badriah and Hidayah explained that BI and HI values are generally used to determine priority areas for controlling dengue fever. If the I value is ≥20 and HI >5%, then the area is categorized as sensitive to dengue fever and has a high larval infestation, so control is needed [21].

Connection Habitat Characteristics Against Density Larvae Population .

Results analysis relationship between habitat characteristics and population density of *Ae.aegypti larvae* show that type container , material base container And color container No influential significant to level mosquito larvae density *Ae* . *aegypti* (p = 0.211, p = 0.101, p = 0. 110). Meanwhile, the location of the container and the use of container covers significantly affected the density of *Ae. mosquito larvae. Egypt* (p = 0. 0 ,00), with OR value = *2.42* And *OR* 2.23 . It means location container And closing container give contribution to improvement density mosquito larvae population *Ae. aegypt* by 2.42 and 2.23 times . *The* same condition also occurred in West Bangka Regency with the risk of dengue fever is 2.7 times [22]. Wanti et al in their research explained in their research that the most influential variable on larval density is the presence of a container lid with an OR of 19.6 or an open or semi-closed container gives the possibility of a positive container for larvae and pupae 19.6 times greater than a closed container [23]. *Ae. aegypti* larvae are more commonly found in containers as breeding grounds that are inside the house and do not use covers [24]. To reduce the density of *Ae. aegypti* mosquito larvae in containers that do not use covers because of their large size, the container can be drained and the air can be replaced periodically once a week.

Large containers that are no longer used cannot be buried but drain the air or reuse the used containers [23].The Draining is the process of cleaning the container walls by brushing the inside of the container so that the attached mosquito eggs can be removed and disposed of along with the water discharge [24[. If draining and changing the water periodically cannot be done due to limited water, then it is necessary to sprinkle temephos into the container and close the container to reduce the risk of mosquito breeding in the container [23[. The Vector control can be done by conducting PSN activities involving related agencies and the community. The density index can be controlled by conducting waste management, increasing PSN activities. This activity must be carried out together across sectors and community empowerment by optimizing health promotion activities to the community and collaborating with regional stakeholders (mayors, sub-district heads, village heads) so that control activities are sustainable [25][17]. This study recommends conducting further research in the field using containers as a substitute for ovitraps to trap Aedes aegypti mosquitoes in the phase of reducing adult mosquitoes that develop in residential environments.

IV. CONCLUSION

The survey results on the characteristics of the habitat of *Ae. aegypti* mosquito larvae consist of TPA and non-TPA types. The dominant positive containers are TPA containers, dark in color and found in houses and do not use covers. The results of the analysis of the density index of *Ae. aegypti* mosquito larvae in Kasturian Village are in the moderate category (CI and BI), HI (high category). This shows that Kasturian Village has the potential to be infected by the dengue virus (DBD) and needs to be watched out for.

V. ACKNOWLEDGEMENTS

Thanks to the Ternate City Health Service and the Head of Kasturian Village, as well as the entire community for their assistance and cooperation during the research.

REFERENCES

[1] Ministry of Health of the Republic of Indonesia Beware , increase DBD cases not yet reach peak. 2024. [Citation January 2025] https://sehatnegeriku.kemkes.go.id/baca/umum/ 20240402/0045224/ waspada-kenaikan-kasus-dbd-belum-mencapai-puncak /

[2] Tomia S, Hadi UK, Soviana S, Retnani EB, Density Of Eggs and Larvae of Aedes Spp and the Characteristics of their Larvae Habitat in Endemic Dengue Area of Ternate City. 2022. ***Mal J Med Health Sci 19***(1): 40-45. doi:10.47836/mjmhs18.5.19

[3] Nasifah , SL & Sukendra , DMm, Condition Environment and Behavior with DHF incidents in the region Work health center Kedungmundu . ***Indonesian Journal of Public Health and Nutrition***. 2021. 1 , 62-72. http://journal.unnes.ac.id/sju/index.php/IJPHN

[4] Putri , DF, Triwahyuni , T., Husna , I. & Sandrawati , S. Relationship factor temperature And humidity with case Fever Dengue Hemorrhagic Fever (DHF) in Bandar Lampung City. ***Journal Analyst Health*** , ***2020***. 9 , 17-23. DOI : 10.26630/jak.v9i1.2112.

[5] Rozilawati H, Tanaselvi K, Nazni WA, Mohd MS, Zairi J, Adanan CR, Lee HL.. Surveillance of *Aedes albopictus* Skuse breeding preference in selected dengue outbreak localities, Peninsular Malaysia. Trop Biomed. 2015 32: 49-64. https://pubmed.ncbi.nlm.nih.gov/25801254/

[6] Tomia A, Relationship Habitat Characteristics of The presence of Aedes larvae Sp as Vector Potential Fever Dengue Hemorrhagic Fever in Kelurahan Gambesi , South Ternate District . ***Journal of Science and Technology.*** 2022. *2(2), 2022. 112-122.*

[7] Yuliani DM, Hadi UK, Soviana S, Retnani EB., Habitat characteristic and density of larva *Aedes aEB, lbopictus* in Curug, Tangerang District, Banten Province, Indonesia 2018. Biodiversitas. 2021. 22, (12): 5350-5357. DOI: 10.13057/biodiv/d221216

[8] Washliyah S, Tarore D, Salaki Ch ,. Relationship of the Breeding Place with the Density of *Aedes aegypti* Larvae as a Dengue Haemorhagic Fever Disease Vector in the Working Area of Kalumata Ternate City Health Center . ***Bioslogos Journal***. 2019.9 (2). https://ejournal.unsrat.ac.id/v2/index.php/bioslogos/ article/view/24174

[9] Sutriyawan , A., Darmawan , W., Akbar, H., Habibi , J. & Fibrianti , FFactor affecting Eradication Nest Mosquitoes (PSN) Through 3M Plus in Effort Prevention Fever Dengue Hemorrhagic Fever (DF). ***Journal Knowledge Health Society***. . 2022. 11 , 23-32. D OI: https://doi.org/10.33221/jikm.v11i01.936

[10] Rau MJ, Nurhayati S , Faktor yang Berhubungan dengan Keberadaan Jentik Nyamuk Aedes Aegepty di Wilayah Kerja Puskesmas Sangurara (Cross Sectional Study di Sulawesi Tengah, Kota Palu). DOI: *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, 2021. *4*(2), 215-225. https://doi.org/10.56338/mppki.v4i2.1498

[11] Ternate City Health Office , Beware of Dengue Fever. 2024. [Citation January 10 , 2025] https://haliyora.id/2024/10/09/dbd-di-kota-ternate-mencapai-210-kasus/

[12] Tomia A, Tuharea R, Djafar MA, Density of Mosquito Larvae *Aedes aegypti* based on House Index as Indicator Surveillance Vector Fever Dengue Hemorrhagic Fever in Kelurahan Tabona , South Ternate District . ***Biosainstek Journal*** . 2022. 4 (2), 42–45.

[13] Ministry of Health of the Republic of Indonesia. *Guidelines Prevention And Control Fever Dengue Hemorrhagic Fever In Indonesia* .2017.

[14] World Health Organization. A review of entomological sampling methods and indicators for dengue vector s. 2013. Available from: http://www.who.intl/tdr/publicatiobs/ documents/dengue

[15] Tomia S, Hadi UK, Soviana S, Retnani EB., Effectiveness of Ovitrap as a Population Control Tool for Aedes Spp. In Areas Endemic to Dengue Fever Ternate City . IJSRM). 2023. 11(12):307-313, DOI : 10.18535/ ijsrm /v11i12.fe03

[16] Saleh , M., Aeni , S., Gafur , A. Basri , S. Relationship Eradication Nest Mosquitoes (PSN) with Existence Flick Mosquito Aedes aegypti in the Work Area Health Center Five District . Barru . ***HYGIENE: Journal Health Environment*** , 2018. 4 **,** 93-98.

[17] Tomia A, Hadi UK, Soviana S, Retnani EB. Maya Index and Density of Aedes aegypti Larvae in Ternate City, North Maluku . BALABA. 2019. 15(2), 133-142. https://doi.org/10.22435/blb.v15i2.1936

[18] Kinansi RRV, Prihatin MT, Garjito TA, Hidajat MCh,. The presence of Aedes sp. larvae at Controllable Sites and Disposable Sites in Indonesia (Case Study in 15 Provinces). Aspirator. 2019. 11(1), 2019, pp. 1–12. DOI: 10.22435/asp.v11i1.540

[19] Pahlepi RI, Soviana S, Elok Budi Retnani EB.. Density and characteristics of *Aedes* spp. larvae habitat in elementary schools in dengue fever endemic areas of Palembang City. Spirakel. 2017 9(2): 68-78. DOI: 10.22435/spirakel.v8i2.8085: 68-78

[20] Go´mez-Vargas W, Rı´os-tapias PA, Marin-Vela´squez K, Giraldo-Gallo E, Segura-Cardona A, ArboledaM. Density of *Aedes aegypti* and dengue virus transmission risk in two municipalities of Northwestern Antioquia ,Colombia. PLoS ONE. 2024. 19(1): e0295317. https://doi.org/10.1371/journal.pone.0295317

[21] Badriah S, Hidayah N. Relationship between place brood mosquito *Aedes aegypti* with case fever bloody *dengue* in Kelurahan Sharpener Subdistrict Sharpener Regency Sharpener North Paser . ***J. Trop Pharm Chem*** . (Indonesia). 2011. 1(2):153-60. DOI : 10.25026/jtpc.v1i2.23

[22] Nurjanah S, Atmowidi T, Hadi UK, Solihin DD, Priawandiputra W. Habitat Preference of *Aedes aegypti* and *Aedes albopictus* : a Case Study on Dengue Endemic Areas of Sumatra, Indonesia. ***Philippine Journal of Science.*** 2021.152 (3): 1007–1014, D oi:10.1088/1755-1315/886/1/012065

[23] Wanti , Yudhastuti R, Yotopranoto S, Notobroto HB, Subekti S, Umniati SR,. Container Positivity and Larva Distribution Based on the Container Characteristics. International . ***Journal of Public Health Science (IJPHS).*** 2017.6, (3) , pp . 237~242. DOI: http://doi.org/10.11591/ijphs.v6i3.9290

[24] Daswito R, Samosir K. Physical environments of water containers and Aedes sp larvae in dengue-endemic areas of Tanjungpinang Riau. News Medical Society. 2021. 37 (1): 13-19.

[25] Astuti EP, Prasetyowati H, Ginanjar A. Transmission Risk of Dengue Hemorrhagic Fever based on Maya and Entomological Indexes in South Tangerang , Banten . Media Litbangkes.2016 .l26 (4):211-8. https://lib.fkm.ui.ac.id/detail?id=127071.