

Density and Dominance of Mosquitoes' Larvae that Inhabit Phytotelmata in Residential and Plantation Areas in Pesawaran District, Lampung Province, Indonesia

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Abstract Phytotelmata is one of the natural breeding places of mosquitoes found in nature. The density of mosquito larvae inhabiting phytotelmata is closely related to the volume of puddles present in the phytotelmata. The research was conducted in residential and plantation area at Pesawaran district, Lampung Province, which aims to find out the type of mosquito larvae, density, and dominance of mosquito larvae that inhabit phytotelmata. The results of this study indicate that in the area of *Culex quinquefasciatus* larvae have the highest density of 62.76%, and the lowest larvae of *Aedes albopictus* and *Toxorynchites sp.* respectively 10,7%. In the highest density plantation area was found in *Aedes albopictus* larvae of 20.64%. The dominant index of mosquito larvae in the settlement area was 0.4 and the dominant index of mosquito larvae in the plantation was 0.611.

Keywords: *phytotelmata, density, larvae, dominant index*

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1. Introduction

The mosquito is one of the insects belonging to the phylum of Arthropoda, where most of the members are vectors of some types of diseases. Mosquito breeding is strongly associated with the type and number of breeding places, because the breeding place is very important for mosquitoes for survival [1].

The mosquito breeding place is very diverse both inside and outside the house, natural and unnatural. Natural breeding place that is on outside the home is water puddle in the plant which is called phytotelmata [2]. These plants can be found anywhere with different types, especially in humid places such as in the tropics [3]. Types of phytotelmata i.e pitcher plant, tree hole, petals, petals, fruit holes, and the root hole [4].

Phytotelmata is one of the natural breeding places of mosquitoes, where mosquitoes can complete their life cycle until they become adults [5]. Research on phytotelmata as a place of insect misery has been done by several researchers in several research topics such as: Water Insects that Inhabit Phytotelmata [3]; Diptera Fluctuation Diptera on Phytotelmata and Its Relation to Climate Variation in West Sumatra Indonesia [6]; Some Chemical Factors and Water Physics Determination of Diptera Density on Phytotelmata in Endemic Areas of Dengue Fever [7]; Diptera density of larvae that inhabit phytotelmata in several locations in West Sumatra,

Indonesia [8]. However, information on the density and dominance of mosquito larvae that inhabit phytotelmata especially in residential and plantation areas in Lampung Province, Indonesia, has not been obtained the information, for this study to find out what type of mosquitoes' larvae, density, and dominance of mosquito larvae that inhabit phytotelmata.

2. Materials and Methods

The research was conducted in Taman Sari Village, Gedong Tataan Sub-district, Pesawaran Regency of Lampung Province. Sampling by siphoning water puddle on the part of Phytotelmata plant found at the study site, using a pipette that matches the surface diameter of phytotelmata type to be taken. Water that has been siphoned inserted into the sample bottle, labeled, and then the sample was taken to the laboratory.

The sample water originating from the puddle in phytotelmata is separated from the dirt and garbage that was carried along at the time of siphoning, and then measured the volume of water. Separate the mosquito larvae between the living and the dead. The surviving mosquito larvae were kept to adulthood to ensure identification results, while the dead larvae were inserted into bottles containing 70% alcohol for further identification referring to [9] identification book [10], and [11].

To determine the value of mosquito larvae density refers to the formula of Michael [12] that is by dividing

the number of species of each individual larvae with the amount of water volume in the occupied Phytotelmata (ml)

$$(K) = \frac{\text{Number of species of each individual larvae}}{\text{water volume in phytotelmata (ml)}} \quad (1)$$

And to determine the dominance of mosquito larvae, the researchers calculate using Simpson Index formulas [13] with the following formula:

$$Ds = \sum (Pi)^2, \text{ where } Pi = ni / N$$

Note : Ds : Simpsons' Index

ni: The number of individuals of the-i species

N: The totals of individual

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3. Result and Discussion

The identification results showed that in the residential area, there were three species of mosquito larvae, *Aedes albopictus*, *Culex. Quinquefasciatus*, *Toxorhynchites sp.*, And in plantation area also found three species of mosquito larvae namely *Ae.albopictus*, *Ae. Chrysolineatus*, and *Cx. Quinquefasciatus*. Total species of mosquitoes found for both areas were five species of mosquito larvae. At least the type of mosquitoes found may be due to environmental factors in the breeding places such as, the volume of water puddle in phytotelmata, the source of food in the breeding place supports the life of mosquito larvae.

The result of mosquito larvae density analysis on phytotelmata in residential area and plantation area can be seen in Table 1 and Table 2.

Table 1 shows that the density of each species of mosquito larvae inhabiting phytotelmata varies. The highest relative density (RD) in the residential area was found in *Culex quinquefasciatus* larvae that inhabited the *Nephelium lappaceum* tree hole at 62.76%. The results of

the study of Rosa, et. Al. (2016b) on the density of *Diptera larvae* in phytotelmata in some dengue endemic areas in West Sumatera indicates that *Culex sp* larvae were found to inhabit phytotelmata in several phytotelmata species ie, pandanus, taro, bamboo and pineapple in West Sumatra.

The lowest relative density was found in *Aedes albopictus* and *Toxorhynchites sp.* larvae in the *Nephelium lappaceum* tree with a RD value of 10.7% each.

The relative density of mosquito larvae in the highest plantation area of *Aedes albopictus* larvae that inhabits the fruit hole at *Cocos nucifera* is 20.64%. The lowest relative density of *Cx.Quinquefasciatus* mosquito larvae of 2.24 on Bamboo stumps. (see Table 2)

From both tables above shows that the relative value and density of mosquito larvae is higher in plantation area than in residential area. This is probably due to the fact that the plantation area is further away from the settlements, so the disruption due to human activity against mosquitoes is less than the disruption to mosquitoes in residential areas with higher human activity.

The kinds and types of phytotelmata can also affect the amount of water that is accommodated which will indirectly affect the density of the mosquito larvae that inhabit it. In plantation type phytotelmata found is type of tree hole and fruit hole that morphology and its construction can accommodate the volume of water more, whereas in phytotelmata residential more dominated by type of leaf petals that ability in accommodating fewer puddles. Differences in the ability to accommodate puddles are thought to be due to the morphological and constructional differences of the phytotelmata that include the diameter and depth of the puddle, as well as the environmental factors of phytotelmata.

Plant morphology as a place of puddles greatly affects the volume of puddles. This is in accordance with [14] research, which states that tree-hole phytotelmata can hold more water than other types of phytotelmata. [5] states that in phytotelmata type of leaf petals have a more open morphological form of the leaves so that more easily exposed to the sun, consequently a larger evaporation process, which can lead to reduced volume of water that is accommodated. [7], reported that phytotelmata type leaf petal type will have warmer puddles compared with pipe-like tree type holes, indicating that plant morphology also affects the temperature in puddles.

Table 1. Density and Relative density of mosquito larvae that inhabit phytotelmata in residential areas, Pesawaran district, Lampung province

Kinds of phytotelmata	Kinds of mosquito and Density (ind/ml)							
	<i>Ae. albopictus</i>		<i>Ae. chrysolineatus</i>		<i>Cx. quinquefasciatus</i>		<i>Toxorhynchites sp.</i>	
	D	RD(%)	D	RD(%)	D	RD(%)	D	RD(%)
<i>A. macrorhiza</i>	0	0	0	0	0	0	0	0
<i>C. esculenta</i>	0	0	0	0	0	0	0	0
<i>D. fragrans</i>	0	0	0	0	0	0	0	0
<i>G. sanguine</i>	0	0	0	0	0	0	0	0
<i>M. paradisiaca</i>	0	0	0	0	0	0	0	0
<i>N. lappaceum</i>	0,0103	10,7	0	0	0,06	62,76	0,0103	10,7
<i>P. angustifolia</i>	0	0	0	0	0	0	0	0
<i>T. cacao</i>	0,015	15,69	0	0	0	0	0	0

Note : D : Density
RD: Relative Density.

Table 2. Density and Relative density of mosquito larvae inhabiting phytotelmata in the Pesawaran Plantation area of Pesawaran, Lampung province

Kinds of phytotelmata	Density (Ind/ml)							
	<i>Ae. albopictus</i>		<i>Ae. chrysolineatus</i>		<i>Cx. quinquefasciatus</i>		<i>Toxorhynchites</i> sp.	
	D	RD(%)	D	RD(%)	D	RD(%)	D	RD(%)
<i>A. comosus</i>	0,09	6,63	0	0	0	0	0	0
<i>Bambusa</i> sp.	0,102	7,62	0,16	11,96	0,03	2,24	0	0
<i>C. nucifera</i>	0,276	20,64	0,064	4,78	0,207	15,48	0	0
<i>D.fragrans</i>	0	0	0	0	0	0	0	0
<i>M.paradisiaca</i>	0,11	8,22	0	0	0	0	0	0
<i>P.amaryllifolius</i>	0	0	0	0	0	0	0	0
<i>T.cacao</i>	0,06	4,48	0,068	4,48	0,17	12,71	0	0

Note: D: Density
RD: Relative Density.

Environmental factors that can also affect the volume of water in phytotelmata is rainfall. In the high rainfall range, of course, the volume of puddles contained in phytotelmata will increase, and vice versa.

Other factors that affect the density of mosquito larvae in phytotelmata are the availability of mosquito larvae foods, such as microorganisms and parasitic bacteria available in puddles in phytotelmata. The mosquito larvae act as primary consumers and filter feeders that will feed on particle suspensions from litter as in *Aedes* and *Anopheles* [15].

Physical factors such as temperature and humidity also affect the process of mosquito breeding. Optimal temperatures in the mosquito breeding process range from 20-28°C, although at higher temperatures it is known to speed up the mosquito breeding process with a maximum temperature limit of 30°C [16,17]. In this study the temperature in residential areas and plantations ranged from 25°C to 28.5°C which is included in the optimal temperature for mosquito breeding.

Temperatures in puddles are influenced by the vegetation where the plants grow. Plants that grow in the shade will have a lower temperature than plants that are directly exposed to sunlight.

(Table 3) The dominant index value of mosquito larvae inhabiting phytotelmata in the residential is 0.4 which is included in the dominance category, while the index value ranges from 0.31 to 0.60, while the dominance value in the plantation area is 0.611 which is included in the category of high level dominance because Index values ranged from 0.61-1.

Table 3. The dominant index of mosquito larvae in residential and plantations of Pesawaran District, Lampung Province

Types of area	Index of Dominance
Residential	0,4
Plantation	0,611

4. Conclusion

1. The highest mosquito larvae density in residential area is *Culex quinquefasciatus* which inhabit type of phytotelmata *Nepheleium lappaceum* type of tree hole of 62,76%, and lowest larva of *Aedes albopictus* and

Toxorhynchites sp. Which inhabit the type of phytotelmata *Nepheleium lappaceum* tree-hole type in rambutan of 10.7% each. The highest density in the plantation area is *Aedes albopictus* larvae that inhabit *Cocos nucifera* type of fruit hole by 20.64%.

2. The dominant index of mosquito larvae inhabiting phytotelmata in residential is 0.4 and the dominant index of mosquito larvae on phytotelmata in plantation is 0.611.

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