



Entomology Survey Based on Lymphatic Filariasis Locus in the District of Pekalongan City Indonesia

Nurjazuli*

Faculty of Public Health, Diponegoro University

Email: nurjzl_fkmundip@yahoo.co.id

Abstract

World Health Organization classified Lymphatic Filariasis (LF) into Neglected Tropical Diseases (NTDs). It was an endemic vector related disease in Indonesia. The district of Pekalongan City was still endemic area for years till now. This condition was supposed related to the existence of cases and mosquito vectors. This study aimed to prove if the mosquitoes spread in this area was positive filarial worm. It was an observational research using survey method. Population of this research were mosquitoes that breed around the cases locus. Fifty loci were sampled purposively. Data collection was conducted by catching mosquitoes resting in the houses of cases early in the morning. It was done by professional entomologist. Laboratory testing of filarial worm was examined in B2P2VRP Salatiga. The collected data would be analyzed descriptively and spatially. Results of this study found that 50 loci surveyed, it had been successfully collected for 988 mosquitoes and 524 of them were female. This research got 4 loci which the mosquitoes caught were L3 filarial worm positive. Mosquito positive rate was 16.33% (8 of the 49 female mosquitoes examined). Three species of mosquitoes had been identified namely *Cx. quinquefasciatus*, *Ae. aegypti*, and *Ar. subalbatus*. The laboratory testing confirmed that *Cx. quinquefasciatus* was the only one vector which was filarial worm positive. In conclusion; *Cx. quinquefasciatus* was the only one mosquito as the vector of Lymphatic Filariasis. This research suggested that entomological surveillance should be done for effective programme in the future.

Keywords: Lymphatic Filariasis; Confirmed Vector; Pekalongan City.

* Corresponding author. Mobile: +62 082133023107

E-mail address: nurjzl_fkmundip@yahoo.co.id.

1. Introduction

Lymphatic Filariasis (LF) is one of the most debilitating and disfiguring scourges among all diseases. It is the second leading cause of disability worldwide. Globally, 1.3 billion people are estimated to be at risk of infection and some 120 million people are infected in 83 countries. It is one of the major public health problems in South-East Asia. The Region accounts for the highest burden of the disease among WHO Regions, with nine out of the 11 member countries in the Region being endemic [1].

Lymphatic Filariasis (LF) is one of the two important vector-borne diseases, and the other one is malaria. Malaria and lymphatic filariasis are the two vector-borne diseases that account for the largest global burdens of mortality and morbidity, respectively. More than half the world's population is at risk of at least one of these diseases. Historically, there is evidence that efforts to control malaria have inadvertently resulted in the interruption of transmission of lymphatic filariasis in some areas. *Anopheles* mosquitoes transmit both malaria and lymphatic filariasis and many other types of mosquitoes also transmit lymphatic filariasis. Vector-control methods can effectively reduce transmission of these infections. The domestic *Culex* mosquito is the most widespread and important vector of lymphatic filariasis in Asia, eastern Africa and the Americas [2].

The nine LF endemic countries in the Region of South East Asia are: Bangladesh, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste. The two non-endemic countries are Bhutan and DPR Korea. Filariasis elimination programmes are in operation in all the nine endemic countries and national plans of action are being implemented in all the countries [1].

Lymphatic filariasis (LF) is transmitted by many species of mosquitoes in four principal genera: *Anopheles*, *Culex*, *Aedes* and *Mansoni* [3]. LF was almost spread in all area of Indonesia, but It was in low level in Central Java (Mf rate is 0.8%). Pekalongan City is one of the area in Central Java which is endemic of filariasis till now [4]. The number of filariasis cases in Pekalongan City is still uncertain. But It indicated positive trend (increasing) and spread over all area. Based on annual report, It had been registered 77 cases (MF+) in Pekalongan City along the year of 2012 [5]. The other aspect that contribute the existence of LF is mosquitoes which has a big role in disease transmission. Filariasis control programs in Pekalongan is only focused on finger blood surveys and mass treatment. While efforts aimed at vector control has not been the focus of prevention. There is still less information of data on the species and the distribution of mosquito vectors of filariasis in this city. Therefore, it is necessary to do research which can provide information about the condition of vector as the basis for the integrated control to decrease the incidence of filariasis.

2. Material and Method

It was an observational study using survey method. The population in this study was the mosquitoes that breed around the home of filariasis patients. Samples taken were 50 cases from houses in which the incident happened. Data was collected by catching inactive mosquitoes in the house, in the morning (before sunrise). The catching of the mosquitoes is carried by 5 entomologists and 1 supervisor. Laboratory tests is done to determine the presence of filarial worms by performing dissection to mosquitoes that were caught in B2P2VRP Salatiga. The

data were then analyzed descriptively and spatially.

3. Result

3.1 The Stages of research

Mosquito Catching. Mosquito catching activities conducted in 50 homes in the area of chronic filariasis cases in Pekalongan. Catching is conducted for inactive mosquitoes in the house. The time of the catching is in the morning before sunrise. A total of 5 professional entomologists had done the catching under supervision. In this research, entomologists are using aspirator to catch mosquitoes. Mosquitoes caught at any point of the house were collected in paper cup covered by gauze and sealed by rubbers trap. Gauze cover torn at the top of the screen, then cotton hat has been given sugar water solution is placed as mosquitoes's food.

Mosquitoes Shipment. Some mosquito caught in paper cup were then put in a container box. Paper cup placement is done in layers/stacked. At the bottom, edge, between layers and between the paper cup as well as the top of the container box was given a stem of banana trees. Midrib serves to maintain the stability of temperature and humidity during shipment from the capture site to laboratory which distance around 150 km (4 hours mile). One container box contains 20 paper cup. At the top of the container box placed a towel soaked in water to maintain the temperature inside the box.

Mosquitoes Holding. After the samples are received in the laboratory B2P2VRP Salatiga, then we performed a holding for 12 days. This is to provide the opportunity for microfilaria to experience the development from phase L1 to L3. It also facilitates the examination as filarial worms has grown to become bigger so it's easily be observed with a microscope. Holding is done by placing a paper cup in a box container on a tray filled with water and given buffer. This is intended to ensure that there are no ants come into paper cups, while humidity in container box will be at stable state. After 12 days, the mosquitoes are ready for dissection to identify the presence of filarial worms.

3.2 Mosquitoes Dissection

Laboratory tests conducted for the mosquito body dissection after suffering a holding for 12 days. Mosquitoes that were dissected are only the female one. Dissection is performed by placing a mosquito body over the preparation previously given liquid of HCl. Observations dissection performed directly under a dissecting microscope.

In this study the mosquitoes that has been collected is as many as 988 (of 50 point dwelling case) consist of 464 males and 524 female mosquitoes. The identification result of mosquito species consisted of three species which are *Culex quinquefasciatus*, *Aedes aegypti*, and *Armigeress subalbatus*. Entomology survey results in detail can be seen in Table 1.

Based on Table 1 it can be seen that the species of *Cx. quinquefasciatus* is the most widely caught in Pekalongan with the proportion of 98.88%. Other species caught are *Ae. aegypti* and *Ar. subalbatus* with a very small

proportion (1.12%).

Table 1: Result of mosquitoes species identification

No.	Species of Mosquito	Number of Arrested Mosquitoes (tail)		Total
		Male	Female	
1	<i>Cx. quinquefasciatus</i>	461	516	977
2	<i>Ae. Aegypti</i>	3	7	10
3	<i>Ar. subalbatus</i>	0	1	1
	Total	464	524	988

Table 1 shows that the mosquitoes were caught consisted of males and females. Furthermore, dissection is performed only on female mosquitoes (524 tail) to determine whether there is filarial worms in the body of the mosquito. Out of the 50 mosquitoes capture points, we found 4 points which the results of dissection found filarial worms. This study found that *Cx. quinquefasciatus* is the only mosquito on which we can found filarial worms in the body of the mosquito. Results of mosquitoes dissection as in table 2.

Table 2: Result of mosquito dissection in laboratory

No.	Site of entomological survey (village)	No. Of female mosquitoes examined	No. of mosquitoes filarial positive	Worm density
1	Bumirejo Coordinate (UTM): X = 350917 ; Y = 9236192	16	1	1 worm L3
2	Kertoharjo Coordinate (UTM): X = 353723 ; Y = 9239943	8	1	1 worm L3
3	Jenggot Coordinate (UTM): X = 353231 ; Y = 9235207	6	1	12 worms L3
4	Jenggot Coordinate (UTM): X = 353445 ; Y = 9234800	19	5	25 worms: 4 worms L2 and 21 worms L3.
	Total	49	8	39 worms

Table 2 shows there are 4 capture points (8%) where mosquitoes found to be positive for containing filarial

worms from 50 capture points that has been done. The total number of female mosquitoes were captured from 4 point is 49 tail. As many as 49 mosquitoes were performed dissection, 8 mosquitoes (16.33%) containing positive filarial worms. There is something quite interesting to note. The number of positive mosquito catching worms at point 4 in Jenggot Village RT.02 Rw.02 with coordinates: $x = 353\ 445$ $y = 9234800$. At that point, mosquitoes were pretty much caught (19 mosquitoes) and 5 of them positively containing filarial worms (26.32%). Whereas the other three capture points are only found 1 mosquitoes positive worms among mosquitoes captured at each point.

Results of mosquitoes dissection indicate density variations number of worms per tail with a range of 1 to 12 worms. The mean density of worms in the body of the mosquito is 4.9 worms per mosquito. However, there are things that need to be considered also in the 3-point in Jenggot Village RT.01 Rw.11 with coordinates: $x = 353\ 231$ and $y = 9235207$. At the capture point, we found 1 mosquito (between 6 tails were caught) containing filarial worms with sufficiently high density (12 worms per mosquito). Figure 1 shows a picture of filarial worms dissection outcome that were caught in Pekalongan City. Image (a) is a filarial worm L3 with low density and (b) L3 filarial worms with high density.



(a). L3 worm in low density

b. L3 worm in high density

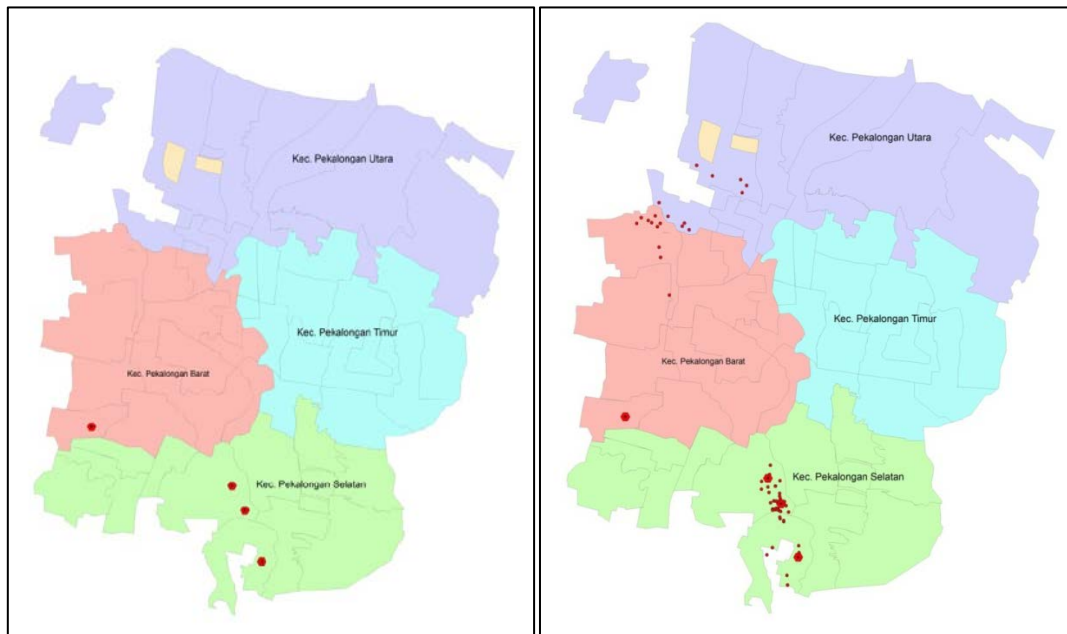
Figure 1: Description of low and high density worm in the body of *Cx. quinquefascitatus*.

3.3 Spatial Analysis of the worm positive mosquito

In this study, dissection of filariasis vector were performed in suspected mosquitoes from the catching. As stated previously, there are 4 capture points found positive mosquitoes containing filarial worms. These points were then analyzed spatially to show where the mosquitoes containing filarial worm positive distributed as figure 2.

To see the relationship between the incidence of filariasis with potential mosquito vectors that were caught, mapping were held based on the distribution of cases of filariasis and location of positive mosquito worms. Based on the fig.2 appears that cases of filariasis is spread and gathered around the location where it was found mosquitoes positively containing filarial worms (the circle with a dot in the middle). This condition indicated

that around the house of these patients there are mosquitoes positively containing filarial worms.



(a) Spatial distribution of confirmed vector (b) Spatial distribution of confirmed vector and filariasis cases

Figure 2: Spatial distribution of lymphatic filariasis cases and filarial worm positive mosquitoes

4. Discussion

Based on table 1, the species of *Cx. quinquefasciatus* is the most widely caught in Pekalongan with the proportion of 98.88%. Other species caught are *Ae. aegypti* and *Ar. subalbatus* with a very small proportion (1.12%). Why *Cx. quinquefasciatus* was the most widely caught. Species from genus *Culex* lay their eggs in stagnant water bodies ranging from artificial water reservoirs and water catchment areas to large permanent water bodies. *Culex quinquefasciatus* usually lay their eggs in contaminated water containing organic materials such as garbage, human waste, and branches of trees. Type of habitats are water infiltration pit, septic tanks, latrines, canal, and the unused wells [6] The breeding places are common in urban areas with improper drainage and sanitary conditions [3]. Environmental conditions that already mentioned before are commonly found in Pekalongan City. Habitats that are found in this study site was a puddle of water from household waste and part of industrial waste.

Environmental factors is a vehicle where the vector mosquitoes breed. This study found that some habitats become mosquito breeding sites. Habitats that are found are Sewers Waste (SPAL) and public ditch/ trench. This habitat is suitable for *Culex* mosquitoes. This condition is in accordance to the species of mosquitoes caught in this study, namely *Culex quinquefasciatus*. This species is the only species positively tested containing filarial worms. This results are consistent with research conducted by Ike Ani Windiastuti stating that the species of mosquitoes that confirmed as a vector of filariasis in Pekalongan is *Culex quinquefasciatus* [7]

Based on review literature, *Culex* mosquitoes breed in association with human habitations and are the domestic pest mosquitoes. They preferred to breed in polluted waters, such as sewage and sullage water collections including cess pools, cess pits drains and septic tanks etc. Their egg-raft found on the surface of water in rain barrels, neglected bird baths, swimming pools, clogged rain gutter, tin cans, old tires, car bodies, cisterns, roof gutters and any other containers which hold water. They can also breed in comparatively clean water collections if such types of polluted water collections are absent [8].

Table 2 shows that there are 4 capture points (8%) where mosquitoes found to be positive for containing filarial worms from 50 capture points that has been done. The total number of female mosquitoes were captured from 4 point is 49 tails. As many as 49 mosquitoes were performed dissection, 8 mosquitoes containing positive filarial worms (infection rate=16.33%). At the capture point, we found 1 mosquito (between 6 tails were caught) containing filarial worms with sufficiently high density (worm load=12 larvae). This research also caught 5 filarial worm positive mosquitoes (of the 19 mosquitoes) at one capture point with total worm load=25 larvae (average worm load=5 larvae). It was quite high compared to other research. The previous research in Colombo Sri Lanka indicated that of the 178 *Cx. quinquefasciatus* female mosquitoes that were dissected, 2 mosquitoes were identified with *W.bancrofti* larvae with worm loads of 3 and 1. The infection rate was hence calculated to $2/178=0.0112$ (1.12%) [9].

Based on the fig.2 appears that cases of filariasis was spread and gathered around the location where it was found mosquitoes positively containing filarial worms. This condition indicated that around the house of these patients there are mosquitoes positively containing filarial worms. It was a potential condition for high transmission of filariasis. It means that all communities living around the site of worm positive mosquitoes to have risk for infection. Moreover, *Cx. quinquefasciatus* was the domestic mosquito and having flight range till 200 meters [3]. So, people living around those sites were at risk of filariasis infection. The existence of worm positive mosquitoes possibly transmit filarial worm from home to home continuously. So, control program especially entomology surveillance was recommended to conduct in the future for effective interrupting filariasis transmission.

5. Conclusion

This research concluded that there were 3 species of mosquito caught in Pekalongan City (*Culexquinquefasciatus*, *Aedesaegypti*, and *Armigeressubalbatus*) and *Cx. quinquefasciatus* was the biggest number of mosquito species among them. Of the mosquitoes dissection, *Culexquinquefasciatus* was the only one mosquito which confirmed as the filariasis vector in Pekalongan City. This research recommended that surveillance activity should be conducted for the effective filariasis control program in the future.

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dissection till It was completed.

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