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# Larval habitats of Mosquitoes in Ein-Me and Wakema Townships, Ayeyarwady Region in Myanmar

Maung Maung Mya[1]*, Sein Thaung[1] & Than Tun[2]

[1]*Department of Medical Research, Ministry of Health, Myanmar.*
[2]*Vector Borne Diseases Control Programme, Ministry of Health, Myanmar.*
*Corresponding Author Email: dr.mgmgmya@gmail.com**

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ABSTRACT

Larval breeding sides or larval habitats of mosquito survey was conducted in ThaPhan Pinseit, ThaPyu Pinseit, PaukGone and SarPhyusu villages in Ein-Me and Pake-Tar-Gyi, Moe-Kaung, Au-Kyun and Yay-Lein villages in Wakema Townships in Ayeyarwady Region. A total of 4102(47.97%) larvae from Wakema and 4450(52.03%) larvae from Ein-me Townships consist of 11 species of mosquito larvae were collected. Three species of *Culex* as *Cx. tritaeniorhynchus, Cx. vishnui,* and *Cx. quinquefqsciatus*, one species each of *Mansonia* and *Armigerese* and four species of *Anopheles* as *An. hyrcanus, An. barbirostris, An. vagus* and *An. tesselatus*, and two species of *Ae. aegypti* and *Ae. albopictus* larvae were collected from 15 kinds of larval habitats as ponds, rice fields, slowly running water, streams, creeks, foot prints, metal drums, concrete drum, concrete jars, Bago jars, spirit bowls, toilets water, hyacinth vegetation and polluted water pools. Of these habitats the highest density of larvae was collected from rice fields water (23.45% and 26.11%) followed by polluted water pools (19.79 and 21.16%) and lowest density was observed from foot prints (1.73% and 0.1%) in both Wakhinma and Ein-me Townships. *Cx. tritaeniorhynchus, Cx. vishnui* and *Anopheles* larvae were collected from all water sources except water storage containers as metal drums, concrete drum, concrete jars, Bago jars, spirit bowls were only *Ae. aegypti* and *Ae. albopictus* larvae positive. In both Townships, will be suffer high risk of vector borne diseases transmission due to high density of JE, Filariasis, and Dengue vectors are availed in these areas. There is a need to control mosquito density and also need to prevent man vector contact in both Townships.

**Keywords:** Larva; Habitats; Mosquitoes; Density; *Anopheles*; *Culex*; *Aedes*; Metal Drum; Concrete Tank; Vectors; *Ae. aegypti*; *Ae. albopictus*; *Cx. tritaeniorhynchus*; *Cx. Quinquefasciatus*.

## 1. Introduction

Several species of mosquitoes are distributed throughout the world, especially in tropical climate zone. However, the most important mosquito vectors belong mainly to three genera: *Aedes*, *Anopheles*, and *Culex*. *Aedes* transmits Dengue fever and Dengue hemorrhage fever, yellow fever, Zika, Chikungunya, *Culex* transmits Filariasis, Japanese Encephalitic, and *Anopheles* transmits malaria [1]. Mosquito is prevalent world over especially between latitude 45° north and latitude 40° south and the tropic regions [2]. Especially in recent years, the distribution space of both mosquitoes and mosquito-borne disease has been changing and expanding for reasons such as increasing rates of environmental corruption, climatic changes, vector and pathogen resistance to insecticides and drugs, progressive urbanization and population movement [3]. The tropical climate of Myanmar is one of the important environmental factors as swampy areas, water pools, water pocket, pond and plenty of rivers, streams, creeks, gutters and natural and men made containers that promotes high densities of mosquitoes and is ideal for the transmission of mosquito-borne diseases. These arboviruses pose increasing global public health concerns because of their rapid geographical spread and increasing disease burden. In particular, dengue is the most important arboviral disease, and is widely distributed in the tropical and sub-tropical regions of the world [4].

The reported cases of mosquito-borne diseases have increased continuously over the last ten decades. Dengue was first reported in Yangon in 1964 with the first major outbreak occurring in 1970 and spreading to all other States and Regions. Yangon Region continues to have the highest incidence reported in the country. Over time, dengue cases have spread to more townships and outbreak frequency has increased [5]. Among the vector borne diseases,

dengue is the most substantial in Myanmar. According to the Ministry of Health in Myanmar malaria epidemic is declining although dengue is increasing in many parts of Myanmar especially in Yangon and small number of Filariasis and Encephalitic [6]. With increasing occurrence of such diseases, control methods are needed to protect mosquito borne diseases transmission to human populations in Myanmar. Most mosquito-borne diseases have mainly affected the hilly and delta region of Myanmar with a long transmission duration from rainy to cold season [7].

Ayeyarwady Region, also known as the Delta region, is a coastal region between the Bay of Bengal to the west, and the Andaman Sea to the east. The capital city is Pathein. Sharing a border with Rakhine, Bago, and Yangon, Ayeyarwady Region consists of 26 townships, covering a total of 35,964 $km^2$. Ayeyarwady is Myanmar's most populated state with an estimated. The Irrawaddy River is the largest river in Myanmar. Originating from the confluence of the N'mai and Mali rivers, it flows from north to south before emptying through the Irrawaddy Delta in the Ayeyarwady Region into the Andaman Sea. Its drainage basin of about 404,000 square kilo meters (156,000 sq mi) covers 61% of the land area of Myanmar, and contains five of its largest cities. As early as the sixth century, the river was used for trade and transport, and an extensive network of irrigation canals was developed to support agriculture. The river is still of great importance as the largest commercial waterway of Myanmar. It also provides important ecosystem services to different communities and economic sectors, including agriculture, fisheries, and tourisms, Ayeyarwady region is a delta area of Myanmar plenty of river, streams, creeks, ponds, water pools, gutters, swampy areas and rice fields are available in the areas. Therefore, high density of different species of mosquito vectors and mosquito borne diseases as Dengue Fever, Dengue hemorrhage fever, Japanese Encephalitic and Malaria are serious health problems in Ayeyarwady. *Aedes* mosquito larvae favorite to clean water and they were abundantly present in artificial and manmade water storage containers as bamboo holes, concrete tanks, concrete jars, metal drums, plastic drums, earthen pots, bowls, discarded car tyers, tin cans, bottles and coconut shells etc. and they are vector of Dengue Fever, Dengue hemorrhage fever, Zika, Chikungunya and yellow fever. Mostly, *Anopheles* larvae were found in clean water as water wells, slowly running water, ponds, creeks, water pools, sand pools, rock pools, dams and irrigation and sometime they were found in footprint of man and cattle's. *An. dirus* and *An. minimus* are main vectors of malaria in Myanmar [8,9].

*Culex tritaeniorhynchus, Cx. vishnui, Cx. gelitus* are main vector of Japanese Encephalitic disease. Although vectors observation study in India by Indian researchers they also revealed that Japanese encephalitis virus isolation has been made from a variety of mosquito species. Culicine mosquitoes mainly *Cx. vishnui* group (*Cx. tritaeniorhynchus, Cx. vishnui and Cx. seudovishnui*) are the major vectors of JE in different parts of India. In Anopheles group *as An. barbirostris An. paeditaeniatus* and *An. subpictus* isolates and *Mansonia* group as *Ma. Annulifera, Ma. indiana* and *Ma. uniformis* isolates were found JE virus positive [10].

*Culex quinquefasciatus* transmit filariasis in men Avian malaria in birds and *Culex tritaeniorhynchus* transmitted Japanese encephalitis. *Anopheles dirus* and *An. minimus* transmit malaria [8,11]. World Health Organization revealed that 7.6 million dengue cases were reported in 2023, including 3.4 million confirmed cases, over 16000 severe cases, and over 3000 deaths. While a substantial increase in dengue cases has been reported globally in the last five years [12]. In India, dengue fever and Chikungunya are main Public Health Problem [13]. DHF, malaria,

filariasis are harmful to human and they are a public health problem in Myanmar. These will prevent by the control of mosquito in the immature stage in larva habitats. To control mosquito borne diseases, there is a need to know the species of mosquitoes and their breeding habitats in study areas. Therefore, attempt has be made to determine the species of mosquitoes and their natural breeding habitats in Ein-me and Wakema Townships in Ayeyarwady Region in Myanmar.

### 1.1. Objectives of the study

To access the larval habitats of mosquitoes in Ein-Me and Wakema Townships, Ayeyarwady Region in Myanmar.

#### 1.1.1. Specific objectives

(1) To determine the different types of larva habitats.

(2) To access the different species of mosquito larvae in larva habitats.

(3) To determine the vector of mosquito larvae in different types of habitats.

(4) To calculate the larval density and percentage of larval density per village.

## 2. Materials and Methods

### 2.1. Study Design

Field descriptive study design will be done.

### 2.2. Study Period

The study period was 1 year, from April 2023 to March 2024.

### 2.3. Study Areas

The study was conducted in Ein-me Township, ThaPhan Pinseit and ThaPyu Pinseit villages in ThaPhan Pinseit RHC and PaukGone and SarPhyusu villages in PaukGone village in PaukGone RHC and in Wakema Township, Pake-Tar-Gyi and Moe-Kaung villages from Pake-Tar-Lay RHC, and Au-Kyun and Yay-Lein villages from Au-Kyun RHC, were selected to collect the mosquito larvae in different types of breeding habitats. In both areas high numbers of DHF and Japanese Encephalitic cases were reported.

### 2.4. Larval Collection

For identification of breeding sites, larval surveys were conducted in all water sources in and around three kilo-meters radius from the study site, such as ponds, rice fields, slowly running water, streams, creeks, foot prints, metal drums, concrete tanks, concrete jars, Bago jars, sprit bowls, toilet water, Marshes around irrigation ditches, hyacinth vegetation, water pools, and all different types of water holding places were examined for larvae by 3 Dips /water holding place with WHO dipper [14] .The captured larvae and pupae were put in labeled plastic bags and brought back to the laboratory for species identification and colonization.

Map of the location of mosquito breeding habitats in the study villages were drawn by using Global Positioning System GPS device (GPSMap16 Garman, 18x-5HZ) software interface application method by expert person.

### 2.5. Identification of Mosquitoes

Collected adult mosquitoes and adult emerged from larva survey were identified by species according to different identification keys [15-18].

### 2.6. Data Analysis

Data from various sources were triangulated for meaningful interpretation. Larval density was calculated by larvae/dip and percentage was computed for larval density per village by Excel software. Map of the study areas were drowning by GPS device (GPSMap16 Garman, 18x-5HZ) software interface application method by expert person.

## 3. Results

**Table 1.** Breeding habitats of mosquitoes in Wakhinma and Ein-me Townships in Ayeyarwady Region

| S. No. | Type of habitats | Species of mosquito larvae | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | No. of collected | Total | Density (%) | No. of collected | Total | Density (%) |
| 1 | Ponds | *Cx. tritaeniorhynchus* | 48 | 130 | 3.3 | 11 | 20 | 0.49 |
| | | *Cx. vishnui* | 45 | | | 3 | | |
| | | *Cx. quinquefasciatus* | 18 | | | | | |
| | | *Mansonia* | 8 | | | | | |
| | | *An. Hyrcanus* | 11 | | | 4 | | |
| | | *An. barbirostris* | 0 | | | 2 | | |
| | | *An. vagus* | 5 | | | | | |
| 2 | Rice fields | *Cx. tritaeniorhynchus* | 478 | 962 | 23.45 | 367 | 1071 | 26.11 |
| | | *Cx. vishnui* | 345 | | | 222 | | |
| | | *Cx. quinquefasciatus* | 48 | | | 153 | | |
| | | *An. hyrcanus* | 55 | | | 123 | | |
| | | *An. barbirostris* | | | | 143 | | |
| | | *An. vagus* | 24 | | | 63 | | |
| | | *An. tesselatus* | 12 | | | 0 | | |
| 3 | Slowly running water | *Cx. quinquefasciatus* | 64 | 218 | 5.31 | 3 | 16 | 0.39 |
| | | *Cx.vishnui* | 35 | | | 3 | | |
| | | *An. hyrcanus* | 51 | | | 6 | | |
| | | *An. barbirostris* | | | | 4 | | |
| | | *An. vagus* | 27 | | | | | |
| | | *An. tesselatus* | 41 | | | | | |
| 4 | Stream | *Cx. tritaeniorhynchus* | 87 | 111 | 2.71 | 0 | 0 | 0 |
| | | *Cx. vishnui5* | 1 | | | 0 | | |
| | | *An. tesselatus* | 6 | | | | | |
| | | *An. hyrcanus* | 17 | | | 0 | | |
| | | *An. barbirostris* | | | | 0 | | |
| 5 | Creeks | *Cx. tritaeniorhynchus* | 68 | 139 | 3.39 | 7 | 19 | 0.46 |
| | | *Cx. vishnui* | 56 | | | 2 | | |
| | | *Cx. quinquefasciatus* | | | | 1 | | |
| | | *An. hyrcanus* | 11 | | | 5 | | |
| | | *An. barbirostris* | | | | 4 | | |
| | | *An. vagus* | 4 | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | Foot prints | *Cx. tritaeniorhynchus* | 56 | 71 | 1.73 | 0 | 4 | 0.1 |
| | | *An. hyrcanus* | 15 | | | 2 | | |
| | | *An. vagus* | | | | 2 | | |
| 7 | Metal drums | *Ae. aegypti* | 246 | 246 | 6.0 | 186 | 186 | 4.53 |
| | Concrete tanks | *Ae. aegypti* | 118 | 118 | 2.88 | 153 | 153 | 3.73 |
| | Concrete Jars | *Ae. aegypti* | 232 | 232 | 5.66 | 175 | 175 | 4.27 |
| | Bago Jars | *Ae. aegypti* | 138 | 217 | 5.3 | 124 | 124 | 3.63 |
| | | *Ae. albopictus* | 79 | | | 25 | | |
| 8 | Spirit bows | *Ae. aegypti* | 153 | 265 | 6.47 | 74 | 130 | 3.17 |
| | | *Ae. albopictus* | 112 | | | 56 | | |
| 9 | Toilet water | *Cx. tritaeniorhynchus* | 14 | 116 | 2.83 | 56 | 116 | 2.83 |
| | | *Cx. vishnui* | 32, | | | 27 | | |
| | | *Cx. quinquefasciatus* | 13 | | | 7 | | |
| | | *Armigeres* | 21 | | | 13 | | |
| | | *Ae. aegypti* | 36 | | | 13 | | |
| 10 | Marshes around irrigation ditches | *Cx. tritaeniorhynchus* | 87 | 252 | 6.15 | 231 | 652 | 15.89 |
| | | *Cx. vishnui* | 68 | | | 147 | | |
| | | *Cx. quinquefasciatus* | 43 | | | 56 | | |
| | | *Mansonia* | 11 | | | | | |
| | | *An. hyrcanus* | 34 | | | 96 | | |
| | | *An. barbirostris* | | | | 46 | | |
| | | *An. vagus* | 9 | | | 76 | | |
| 11 | Hyacinth vegetation | *Cx. tritaeniorhynchus* | 66 | 209 | 5.1 | 453 | 891 | 21.72 |
| | | *Cx. vishnui* | 42 | | | 143 | | |
| | | *Cx. quinquefasciatus* | | | | 93 | | |
| | | *Mansonia* | 34 | | | 0 | | |
| | | *An. hyrcanus* | 31 | | | 126 | | |
| | | *An. vagus* | 13 | | | 46 | | |
| | | *An. tesselatus* | 23 | | | 30 | | |
| | | | | | | | | |
| 12 | Polluted water pools | *Cx. tritaeniorhynchus* | 286 | 811 | 19.79 | 364 | 868 | 21.16 |
| | | *Cx. vishnui* | 299 | | | 261 | | |
| | | *Cx. quinquefasciatus* | 75 | | | 98 | | |
| | | *An. hyrcanus* | 63 | | | 56 | | |
| | | *An. barbirostris* | 55 | | | 87 | | |
| | | *Mansonia* | 33 | | | 2 | | |
| 13 | Total collected Larvae | | 4102 | 4102 | 100 | 4450 | 4450 | 100 |
| 14 | Larval density/ village | | 4102 47.97% | | 4450 52.03% | 8552 100% | | |

Table 1 shows that detail of the collected larval species and larval habitats in Wakema and Ein-me Townships. Higher number of larvae were collected in Ein-me (4450,52.03%) than Wakema (4102,47.97%). A total of 14 types of mosquito breeding habitats were found in both Einme and Wakema Townships. Of these, the highest density of Mosquito larvae was collected in Rice field water (26.11%) followed by Hyacinth vegetation (21.72%) and

Polluted water pools (21.16%) and lowest density was observed in Foot prints water (0.1%) in Ein-Me Township. In Wakema Township, the highest density of larvae was collected from Rice field water 23.45% followed by Polluted water pools (19.79) and lowest density was observed in Foot print water (1.73%).

JE main vector *Cx. tritaeniorhynchus* larvae were found highest number in all the habitats expect water storage containers as Metal drums, Concrete tanks, Concrete Jars, Bago Jars and Spirit bows followed by *Cx. vishnui*. *Cx. tritaeniorhynchus* and suspected vector *Cx. vishnui* were collected in same habitats of both Wakema and Ein-me Townships. Both *Cx. quinquefasciatus* and *Cx. vishnui*. larvae were collected from ponds, rice fields, slowly running water, creeks, toilet water, marshes around irrigation ditches, hyacinth vegetation and polluted water pools. Four different species of *Anopheles* mosquito larvae as *An. hyrcanus, An, barbirostris, An. vagus, An. tesselatus*, larvae were collected in rice fields and slowly running water and *An. hyrcanus, An, barbirostris, An. vagus*, were collected in ponds, creeks, marshes around the ditches and hyacinth vegetations of larval habitats.

Highest number of *Anopheles* larvae were collected from rice field water followed by marshes around irrigation ditches and hyacinth vegetation and lowest number of *Anopheles* were collected in foot print water in Ein-Me. *An. hyrcanus* and *An, barbirostris* were collected in all larval habitats except domestic water storage containers. *Anopheles* mosquito larvae were found higher in Ein-me Township than in Wakema Township in rice field followed by hyacinth vegetation.

Dengue main vectors *Aedes aegypti* and *Ae. albopictus* were collected mostly in water storage containers such as Metal drums, Concrete tanks, Concrete Jars, Bago Jars, Spirit bows and in unmovable Toilet water containers (as small concreted tanks, Bago jars and earthen pots).

## 4. Discussion

Adult mosquitoes are the deadly insects alive because they transmitted different kinds of pathogens that cause different diseases. Disease transmission is depending on the breeding sources, vectors and condition of mosquitoes. Mosquitoes are insects that have a high diversity of species. Approximately 3,490 species of mosquitoes to date have been officially recognized [19]. Different species of mosquitoes and mosquito larval habitats were available in tropical and subtropical regions including Southeast ASION countries. Present study was conducted to determine the larval habitats of different species of mosquitoes in Wakhinma and Ein-me Townships in Ayeyarwady Region due to JE suspected cases were reported from their Township Hospital [20].

In the present study, a total of 4102(47.97%) larvae from Wakema and 4450(52.03%) larvae from Ein-me Townships consist of 11 species of mosquito larvae were collected. In *Culex* group (3 species) as *Cx. tritaeniorhynchus, Cx. vishnui,* and *Cx. quinquefqsciatus*, Mansonia group as *Mansonia, spp.* (1 species). *Armigerese* species (1 species) and *Anopheles* Group (4 species) *An. hyrcanus, An, barbirostris, An. vagus and An. tesselatus*, larvae were collected from 15 kinds of larval habitats as ponds, rice fields, slowly running water, Streams, creeks, foot prints, metal drums, concrete drum, concrete jars, Bago jars, spirit bowls, toilets water, hyacinth vegetation and Polluted water pools. Of these habitats the highest density of larvae was collected from rice fields water followed by polluted water pools and lowest density was observed from both Wakema and Ein-me Townships. *Cx. tritaeniorhynchus* and *Cx. vishnui* were collected from all water sources (as ponds, rice fields,

slowly running water, Streams, creeks, toilets water, hyacinth vegetation and Polluted water pools) except water storage containers (metal drums, concrete drum, concrete jars, Bago jars, spirit bowls). In these water storage containers were found high number of *Aedes* larvae. Same result has been found in Chaung Sone and Yee Townships Mon State, Hinthada Township Ayeyarwady Region [21, 22].

Other researcher from Indonesia revealed that there were seven types of larval habitats as containers, ditches, creeks, ponds, artificial ponds, groundwater puddles, and rice fields for the larval mosquitoes were observed and Mosquito larvae that were successfully collected consisted of 11 species; *Aedes albopictus, Ae. aegypti, Armigeres subalbatus, Anopheles aconitus, An. kochi, An. vagus, Culex fuscocephala, Cx. pseudovishnui, Cx. tritaeniorhynchus, Cx. quinquefasciatus*, and *Cx. vishnui*. Co-occurrence in mosquito larvae as many as 13 compositions, with the highest co-occurrence in *Ae. albopictus* and *Cx. quinquefasciatus* that was 11 times. He concluded that the existence of mosquito larvae and the availability of their breeding site in *M. fascicularis* captivity area can be a potential transmission of pathogens between mosquitoes and hosts [23]. In the present study, 11 species of mosquito larvae were collected from 15 types of habitats and high range of JE vector *Cx. tritaeniorhynchus, Filarial vector Cx. quinquefasciatus* were collected. The larval habitat greatly influences the distribution and abundance of species involved in the transmission of pathogens [24]. In the present study Dengue fever (DF) and Dengue hemorrhagic fever (DHF) vectors *Ae. aegypti* and *Ae. albopictus* were collected in domestic water storage containers as metal drums, concrete drum, concrete jars, Bago jars, spirit bowls.

Other researcher found that, *Aedes albopictus* was mainly collected from man-made containers i.e., trash cans and buckets. A larval breeding study in Myanmar found that *Ae. albopictus* a rural breeder and larvae were found in three holes, bamboo stamps, Bago jars and car tires [25]. The result was similar with Chareonviriyaphap et al. [26] who successfully collected *Ae. albopictus* in various containers i.e., jars, cement tanks, plastic tanks, flower vas, animal feed containers, plastic bottles, and unused tires. *Aedes aegypti* was only observed in container habitats surrounding *M. fascicularis* breeding area in Indonesia. Day and his party also reported that the oviposition preference of *Ae. aegypti* in artificial containers [27]. A study of species composition and habitats in semi-urban area of Dhaka Bangladesh revealed that a total of 6088 mosquito larvae belonging to 12 species (*Aedes aegypti, Aedes albopictus, Anopheles barbirostris, Anopheles peditaeniatus, Anopheles vagus, Culex gelidus, Culex hutchinsoni, Culex quinquefasciatus, Culex tritaeniorhynchus, Mansonia annulifera, Mansonia uniformis*, and *Toxorhynchites splendens*) under 5 genera were collected from 14 different types of habitats. *Culex quinquefasciatus* was the dominant species (21.7/500 ml) followed by *Cx. tritaeniorhynchus* (10.53/500 ml) [28]. Although in present study JE vector *Cx. tritaeniorhynchus* was the dominant species followed by JE suspected vector *Cx. vishnui* in the study areas. It may be due to the fact that present study was done in rural areas where rice growing areas and paddy fields are abundantly presented and most of the water sources were polluted with rice straw.

In the present study *Ae. aegypti* and *Ae. albopictus* larvae were collected from metal drums, concrete drum, concrete jars, Bago jars, spirit bowls and only *Ae. aegypti* larvae was collected from Toilet water with *Culex* and *Armigerese* larvae. It may be due to the fact that *Ae. aegypti* female lay their eggs when the water is clean after the water become polluted, *Culex* and *Armigerese* may be laid their eggs. And *Ae. albopictus* larvae were collected

from Bago jars and spirit bowls. Although another researcher observed that *Ae. aegypti* is found most abundant in tires and less in cemented tanks, while *Ae. albopictus* was dominant in earthen jars and less density was observed in cemented tanks is agreed with the present study [28]. The data evaluate that *Ae. albopictus* prefer black colour container Bago Jars which made by mud (Glassed earthen pots) and close vicinity of the house for oviposition. however, WHO reported that *Aedes* mosquitoes prefer to live in human dwelling. *Ae. albopictus* typically breeds in tree holes and others small, restricted and shaded water collections surrounded by vegetation but also in peri-domestic containers filled with water [29]. An Ethiopia study mention that discarded tires (57.5%) were the most common *Aedes* mosquito breeding habitats, and mud pots were found second most common breeding habitats (30.0%). After rearing of collected larvae, *Aedes aegypti* (49.3%), *Ae. vittatus* (6.5%), and *Culex* species (44.2%) were identified [30].

In the present study there were 4 species of Anopheles mosquitoes as *An. Hyrcanus, An. barbirostris, An. vagus* and *An. tesselatus* larvae were collected from ponds, rice field, slowly running water, streams, creeks, foot prints, Marshes around irrigation ditches, Hyacinth vegetation and polluted water sources. *An. hyrcanus, An. barbirostris* and *An. vagus* were found very common *Anopheline* mosquitoes and they were found in all kinds of water sources except domestic water storage containers. Other researcher revealed that *An. culicifacies* larvae were abundantly observed from sand pools from Gonminsoe village in Paukkaung Township in Bago Region and near the Son Dem, Myothit Township in Magwe Region [9,31]. Previously, *An. dirus* larvae were collected in rock pools and *An. minimus* larvae were collected in slowly running water and sand pools but now *An. dirus, An. minimus* and *An. maculatus* larvae were found in domestic water wells in coastal areas of Mon and Taninthayi Region, Banmauk Township Sagaing Region [32-34,25].

## 5. Conclusion

Larval habitats of mosquito survey were conducted in 4 villages each of Ein-Me and Wakema Township Ayeyarwady Region. A total of 4102(47.97%) larvae from Wakhinma and 4450(52.03%) larvae from Ein-me Townships consist of 11 species of mosquito larvae were collected. Three species of *Culex* mosquito larvae, as *Cx. tritaeniorhynchus, Cx. vishnui,* and *Cx. quinquefqsciatus,* one species of Mansonia spp.one species of *Armigerese* and four species of *Anopheles* as *An. hyrcanus, An, barbirostris, An. vagus* and *An. tesselatus,* and Two species of *Aedes* as *Ae aegypti* and *Ae. albopictus* larvae were collected from 15 kinds of larval habitats as ponds, rice fields, slowly running water, streams, creeks, foot prints, metal drums, concrete drum, concrete jars, Bago jars, spirit bowls, toilets water, hyacinth vegetation and polluted water pools were observed. Of these habitats the highest density of larvae was collected from rice fields water followed by polluted water pools and lowest density was observed from foot prints in both Wakhinma and Ein-me Townships. *Cx. tritaeniorhynchus* and *Cx. vishnui* and Anopheles larvae were collected from all water sources except domestic water storage containers (metal drums, concrete drum, concrete jars, Bago jars, spirit bowls) were only *Ae. aegypti* and *Ae. albopictus* larvae were collected. In both area, high risk of vector borne diseases transmission will be occurred due to high density of JE, Filariasis, and Dengue vectors are availed in these areas. There is urgently need to control mosquito density and also need to control man vector contact to avoid transmission of mosquito borne diseases in both Townships. Present study suggest that: (1) vector control study should be made in both mosquito prone areas and (2) also

should be made in other vector borne disease endemic areas. (3) Vector and breeding sources were should be searched in other mosquito borne diseases prone areas. (4) The efficacy of ITN and IITNs nets against adult mosquitoes should be done in endemic areas. (5) Alternative methods as traditional insecticides should be used to control adult and larval control. (6) And also should be done as community base control of mosquito by biological control method as larvivorous fish in all breeding sources.

**Declarations**

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**Competing Interests Statement**

All the contributing authors declare no conflicts of interest.

**Consent for publication**

The authors declare that they consented to the publication of this study.

**Authors' contributions**

All the authors took part in literature review, analysis, and manuscript writing equally.

**Informed Consent**

Not applicable.

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