

# PRESENCE OF *AEDES ALBOPICTUS* in Palestine – West Bank

Shadi Hilmi Abd Allah Adawi1

Ministry of Health, Salfit Primary Health Care, Environmental Health Department,  
Palestinian Territory.

## ABSTRACT

**Aim:** This study ~~was conducted in order to~~ confirmed the ~~presence and~~ establishment of *Aedes (Stegomyia) albopictus* (Skuse, 1894) and provided information about its distribution during the period of July to October 2012 in Salfit district (Northwestern West Bank).

**Study Design:** A cross- sectional study.

**Methods:** A cross- sectional survey was conducted in West Bank - Salfit district to collect larvae and adults of the *Aedes albopictus* ~~mosquito~~ from two localities in Salfit district during the period of July to October 2012.

**Results:** ~~A adult mosquitoes of~~ *Aedes albopictus* were ~~found and~~ collected from outdoor sites of different habitats in two localities in Salfit district ~~for the first time~~ (Mas-ha and AZ-Zawia locality) and different immature stages (larvae and pupae) ~~of mosquito~~ were found in ~~one locality in~~ Salfit district ( Mas-ha locality)

**Limitations of Study:** This study discusses the presence and distribution of *Aedes albopictus* in Salfit district during the period of July to October 2012.

Comment [Rev1]: These are not limitations?

**Conclusion:** The results show that the dense populations of adults and larvae were found in the subsequent survey, confirming the establishment of the species in the area. More studies are needed to understand the ecology and biology of *Aedes albopictus* and its distribution in Salfit district and its possibility of transmitting viral diseases.

**Keywords:** *Aedes albopictus*; Salfit district; presence; distribution.  
Shd\_adawi@yahoo.com

## 1. Introduction:

The mosquito *Aedes* (*Stegomyia*) *albopictus* (Skuse, 1894), known notoriously as the Asian Tiger Mosquito, has been spreading worldwide during the past two decades and has been reported in more than 25 countries on the five continents outside its natural region since the end of 1970 {1, 2}. It was originally widespread in South Asia and on the Islands of the Western Pacific and Indian oceans {3}. In recent decades it has also spread to North and South America, Australia, Newzealand, Africa and European countries such as France, Italy and Spain{4-6} It can also be found in Mediterranean region countries such as Lebanon, Syria and Israel, which is ~~nearest to the West Bank~~ within few kilometers distance of the West Bank {7,8}.

*Ae. Albopictus* are easily recognized by the bold black shiny scales and distinct silver white scales on the palpus and tarsi {9}. The scutum (back) is black with a distinguishing white stripe down the center beginning at the dorsal surface of the head and continuing along the thorax {9}. It is a highly invasive mosquito species and difficult to control, ~~it is also an~~ aggressive ~~in the~~ day-time biter, and considered a container breeder, preferring to oviposition in small quantities of water such as drums, tires, buckets, flower saucers, tarpaulins and manholes and tree holes { 4, 5,10}.

In addition to the nuisance of biting, ~~and according to the existing literature~~ *Ae. a/Albopictus* poses ~~possesses~~ a potential threat to human health, because ~~it~~ has been experimentally infected with more than 20 arboviruses {11, 12}. It is known to be a vector of several arboviruses in Africa, Asia and Europe. Many studies have proved that the *Ae. a/Albopictus* is the main vector for dengue, cChikungunya (CHIK) and Encephalitis viruses {1, 11, 12}, and was recently found naturally infected with West Nile virus in the U.S.A {13}.

In the Mediterranean region ~~many~~ studies have discussed the presence of *Ae. a/Albopictus* in ~~different~~ countries such as Lebanon, Syria, and Israel, including ~~studies in~~ its ecology, biology and ~~its~~ medical importance in transmitting diseases {7, 8, 14}. In Palestine- West Bank Ministry of Health reports signs that a new species of mosquito (*Ae. a/Albopictus*) spread in a few sporadic foci in different districts of the West Bank without any details {15} and there are no studies discussing the presence of *Ae. a/Albopictus*, its biology, ecology, distribution and its medical importance before because this species had not been recorded in Palestine – West Bank before the year of 2012.

~~The current survey was conducted to So in order to~~ confirm the ~~presence and the~~ establishment of this species in West Bank and to provide information about its distribution and ~~its~~ breeding sites, this study was conducted.

**Comment [Rev2]:** Not really – albopictus outbreaks have faultered shortly – e.g., Hawaii?

**Comment [Rev3]:** Not really – just because a mosquito is occasionally infected doesn't make it a main vector.

## 2. Material and Methods:

### 2.1. Study area:

Salfit district located at 32° 7' 5.5" N, 35° 5' 25" E (figure. 1) with total area is almost 202 sq km, is one of 17 districts of the Palestinian National Authority. It is located in the northwestern West Bank, bordered by the district of Ramallah and Al-Bireh to the South, Nablus to the East, and Qalqilya to the North as well as Israel to the West. According to the Palestinian Central Bureau of Statistics (PCBS), 2007 the governorate has a population of 59,570 inhabitants. Mas-ha and AZ-Zawia localities located in the Western part of Salfit district and have total population 5200 inhabitants, most of whom work in agriculture and trade. Economic activity depends on agriculture, where olives, almonds, figs, grapes, and apples are the main crops. ~~ClimateIt has a hot climateis hot with,~~ dry summers and rainy winters, ~~and haswith an the~~ average maximum ~~and minimum~~ temperatures of 29 and 6 °C, ~~respectively, while the average minimum temperature amounts to 6 °C.~~ The average humidity in the region is 62% that may rise up to 67%. Rainfall is concentrated in the winter and the average rainfall is 660 mm per year.

### 2.2. Sampling sites:

~~The study was conducted to collect larvae and adults of suspected Ae. Albopictus Mosquitoes from two localities in Salfit district namely Mas-ha locality and Az-Zawia locality.~~

Comment [Rev4]: Redundant to below

### 2.3. Study design:

This study was conducted as a cross sectional survey to collect larvae and adults of suspected Ae. ~~aAlbopictus Mosquito~~ from two localities ~~in Salfit district namely~~ Mas-ha ~~locality~~ and Az-Zawia ~~localities in Salfit District~~ from July 2012 ~~until~~ to October 2012. The two sites were selected based on the continuous complaints from the residents who suffer from an aggressive ~~mosquito~~ biting during the day ~~by a mosquito with that has colors (black and white) colors that and~~ were not noticed before this year, ~~in these localities.~~ Every study site at first was divided into sectors of different habitats using the simple random technique (vegetation areas, animal areas and waterside areas), then larvae and adult mosquitoes were collected from outdoor sites ~~of the two localities~~ using different collection methods. Dipping technique was used in the collection of larvae and landing catches during the day using aspirator tool for adults {16}.

Comment [Rev5]: Unclear? How randomized?

#### 2.3.1. Adults and larvae collecting:

#### 2.3.2. Larvae collection:

Mosquito larvae were collected from all available potential breeding sites. (Tin cans, discarded tires, plastic and metal container waters, etc.). Dipping technique was used in the collection {16}. Larvae were transported to the laboratory, ~~and washed, and~~ killed with hot water and kept in 70% alcohol then mounted on slides using Euparal {16}.

Comment [Rev6]: How can you dip in small containers like tin cans?

#### 2.2.3. Adults collection:

Only adult mosquitoes ~~of suspected Ae. Albopictus~~ were collected ~~from the positive localities of different habitats~~ by using landing catches on volunteers during the day using an aspirator tool and conserved with funnel test tube until identification in the laboratory. Other species of mosquito were neglected.

#### 2.2.4. Adults and larvae identification:

~~Collecting of a~~Adults and ~~L~~Larvae mosquito~~s~~ were sent to the ~~lab at~~ Salfit Primary healthcare center for identification ~~and identified by~~ using morphological keys {17-19}.

### 2.4. Distribution of Ae. ~~aAlbopictus~~ adults and larvae in different habitats of the study areas

To investigate the presence of Ae. *Albopictus* adults and larvae in different habitats, each study site is divided into three sectors, where each sector represents a different habitat (1- animal and poultry farm, or any areas using for rearing animal, 2- vegetation cover such as house gardens, plant farms and nurseries, etc. 3- waterside such as outside artificial wells irrigation canals, artificial pools and any other

source of water), then *Ae. Albopictus* adults and larvae were collected from these habitats during the study period and numbers of *Ae. Albopictus* adults and larvae collected from each sector of the sites were recorded and analyzed.

### 2.2.5 Data management and analysis

Data were entered in SPSS software 16 and analyzed using- **S**Simple descriptive statistics.

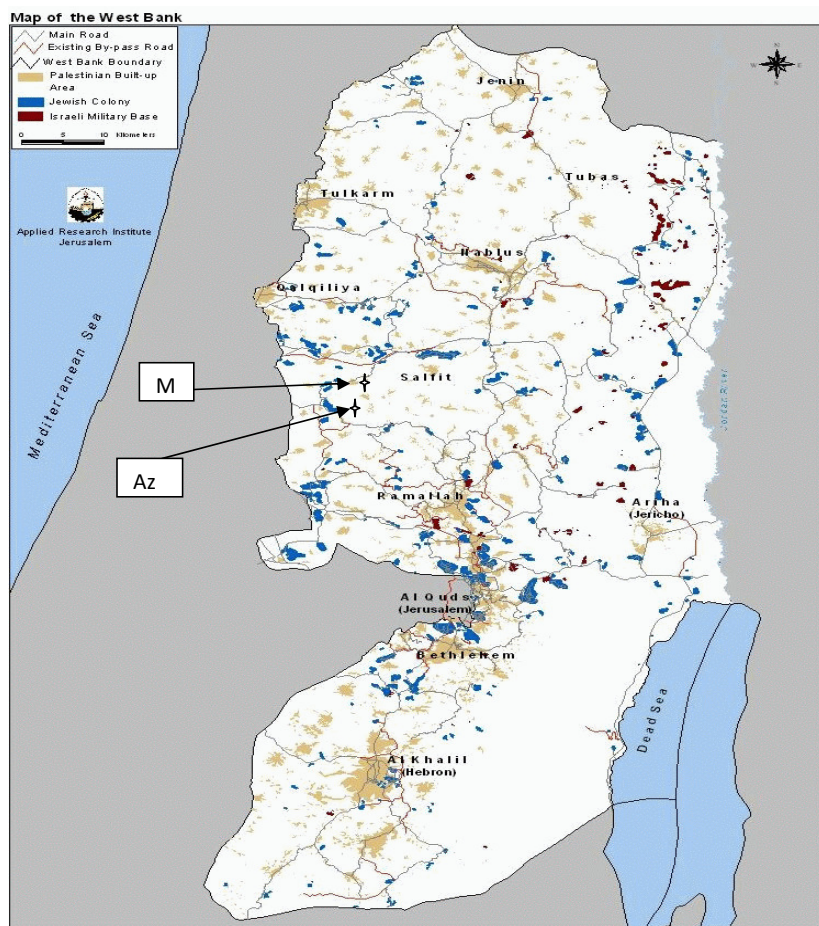


**Figure 1. Shows the located of Mas-ha (M) and Az-Zawia (Az) localities in Salfit district in the West Bank (Palestine Central Bureau of statistic, 2007)**

### 3. RESULTS:

#### 3.1. Collecting Adults and larvae of *Ae. Albopictus* from outdoor sites in Mas-ha and Az-Zawia localities during the year 2012.

Only suspected *Aedes albopictus* adults were collected and other mosquitos were neglected. 200 adult mosquitos of *Aedes albopictus* were collected from outdoor sites in two localities in the Salfit district (150 adults from Mas-ha locality and 50 adults from Az-Zawia locality). All adults were identified as *Aedes albopictus* as shown in table 1. The result shows that 590 different immature stages (550 larvae and 40 pupae) of mosquitos were collected. Only larvae were identified. The results show that (300;0.6%) of larvae were *Ae. Albopictus* and found in one locality in the Salfit district (Mas-ha locality) as shown in table 1.

Comment [Rev7]: 300 of 550? What is 0.6%???

#### 3.2. Distribution of *Ae. Albopictus* Adults and larvae in different habitats in Mas-ha and Az-Zawia localities in Salfit district during the year 2012

During the period of entomological survey, 120 outdoor sites of vegetated area in Mas-ha and AZ-Zawia localities were inspected for suspected adults and larvae of *Ae. Albopictus* mosquito. The results show that (31;0.26%) of positive sites had have adults or larvae of *Ae. Albopictus*, The results show (17; 0.48%) of inspecting outdoor sites of water areas in Mas - ha localities have positive adults and larvae of *Ae. Albopictus* mosquito. No positive sites for larvae and adults *Ae. Albopictus* were recorded in the animal area in two localities as shown in table 2.

#### 3.3. Breeding sites of *Ae. Albopictus* in Mas-ha and Az-Zawia localities in Salfit district during the year 2012

The total number of possible breeding sites inspected for *Ae. Albopictus* larvae were 511 of different breeding sites, the results show that the breeding sites for immature stages were only one (0.004%) plastic containers of water (200L) used for plant irrigation in nursery as shown in table 3.

**Table 1.**Number of adults and larvae of *Ae. Albopictus* collected outdoor sites from Mas-ha and AZ-Zawia localities in Salfit district for the year 2012

| Localities | NO of adults <i>Aedes albopictus</i> collected | NO of Larvae collected | NO of positive Larvae <i>Aedes albopictus</i> collected | % of positive Larvae <i>Aedes albopictus</i> collected | NO of pupae collected |
|------------|------------------------------------------------|------------------------|---------------------------------------------------------|--------------------------------------------------------|-----------------------|
| Mas-ha     | 150                                            | 500                    | 300                                                     | 0.6                                                    | 27                    |
| AZ-Zawia   | 50                                             | 50                     | 0                                                       | 0                                                      | 13                    |
| Total      | 150                                            | 550                    | 300                                                     | 0.55                                                   | 40                    |

**Comment [Rev8]:** How can this be in light of Table 3 below????

**Comment [Rev9]:** These numbers are strange in that they are in lots of 50? My collections never come out this exacting?

**Table 2.** Numbers and percentages of positive inspected outdoor sites for immature stages and adults of *Ae. Albopictus* in Mas-ha and AZ-Zawia localities in Salfit district for the year 2012

| Localities | No of inspecting outdoor sites of vegetated area | No of positive inspection outdoor sites of vegetated area | % of positive inspection outdoor sites of vegetated area | No of inspecting outdoor sites of animal area | No of positive inspected outdoor sites of animal area | % of positive inspected outdoor sites of animal area | No of inspecting outdoor sites of water area | No of positive inspected outdoor sites of water area | % of positive inspected outdoor sites of water area |
|------------|--------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------|------------------------------------------------------|----------------------------------------------|------------------------------------------------------|-----------------------------------------------------|
| Mas-ha     | 100                                              | 30                                                        | (30;100) (0.3)                                           | 30                                            | 0                                                     | 0                                                    | 35                                           | 17                                                   | (17;35) (0.48)                                      |
| AZ-Zawia   | 20                                               | 1                                                         | (1;20) (0.05)                                            | 10                                            | 0                                                     | 0                                                    | 8                                            | 0                                                    | 0                                                   |
| Total      | 120                                              | 31                                                        | (31;120) 0.26                                            | 40                                            | 0                                                     | 0                                                    | 43                                           | 17                                                   | (17;43) (0.4)                                       |

**Comment [Rev10]:** Re-organize to account for the different habitats sampled. This is confusing as presented. So most of these were adult collections because larvae were only found once [see Table 3????].

**Comment [Rev11]:** These are not percentages?

Table 3. Shows the most types of inspecting breeding sites of *Ae. Albopictus* and the percentage of positive breeding sites in Mas-ha and AZ-Zawia localities in Salfit district

| Type of possible breeding sites inspected | No of possible breeding site inspected | No of positive possible breeding site inspected | % of positive breeding site inspected |
|-------------------------------------------|----------------------------------------|-------------------------------------------------|---------------------------------------|
| Discarded tires                           | 30                                     | 0                                               | 0                                     |
| Tree holes                                | 45                                     | 0                                               | 0                                     |
| Tin cans                                  | 55                                     | 0                                               | 0                                     |
| Plastic containers                        | 227                                    | 1                                               | (1;227)<br>(0.004)                    |
| Metal containers                          | 23                                     | 0                                               | 0                                     |
| Flower saucers                            | 8                                      | 0                                               | 0                                     |
| Pot of plants                             | 43                                     | 0                                               | 0                                     |
| Artificial wells                          | 50                                     | 0                                               | 0                                     |
| Others                                    | 30                                     | 0                                               | 0                                     |
| Total                                     | 511                                    | 1                                               | (1;551)<br>(0.002)                    |

Other :Any container possible to collect water outdoor site

#### 4. Discussion:

*Ae. Albopictus* is a widespread mosquito and it plays a role in transmitting diseases in neighboring countries such as Syria, Lebanon, and Israel {7, 8, 14}. Many studies discussed the presence, distribution, biology, ecology and medical importance of this species especially in Israel that is a country close to Palestine which shares borders in all districts, so the transmission of *Ae. Albopictus* to Palestine - West Bank is possible by different ways. It can be transported in vehicles, trading ornamental plants, trees (fruits, citrus, etc.) or other methods. These means are suitable habitat for breeding and resting of *Ae. Albopictus*. This hypothesis agrees with different studies like {7, 20 }, which suggests that the *Aedes Albopictus* was transmitted by vehicle transportation. Mardon et al.2002, 2004 found that the immature stages of mosquito were transmitted by ornamental plant and trees sent to California and the Netherlands.

In Salfit district especially in Mas-ha and Az-Zawi locality it is expected that the presence of *Ae. Albopictus* is due to the previous methods, but the transporting or trading of ornamental plants is thought to be the more likely way. Through the entomological survey the results showed that all places having positive *Ae. Albopictus* Adults mosquitos have ornamental plants (flowers) brought from the nurseries located in the neighboring country (Israel) which endemic with *Ae. Albopictus*. The results also showed the presence of immature stages of mosquito in one place (nursery) in Mas-ha locality from salfit district, Through the investigations with the owner of this nursery, the results showed that all plants (ornamental plants, trees plant) were coming from endemic areas in Israel. This result agrees with other studies as {21-23}, which proved that immature stages of mosquito transmitted through the trading of ornamental plants coming from an endemic country with *Ae. Albopictus*.

## 5. Conclusion:

The results show that the dense populations of adults and larvae were found in the subsequent survey, confirming the establishment of the species in the area. More studies are needed to understand the ecology and biology of *Aedes albopictus* and its distribution in Salfit district and its possibility of transmitting viral diseases.

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## COMPETING INTERESTS

Author has declared that no competing interests exist.

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