Data Article

Data on biology and demographic parameters of the *Aedes albopictus* from dengue outbreaks in Klang Valley, Malaysia

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ABSTRACT

In this article, data on the demographic parameters of the *Aedes albopictus* were collected from those areas in Shah Alam, Malaysia that had experienced a dengue outbreak. The surveys were conducted from March to December 2017. The eggs of the *Ae. albopictus* were collected using ovitraps, and were analysed based on the demographic parameters in a controlled environment in an insectarium. The data were comprised of four types of biological information on the life demographic parameters of the *Ae. albopictus* that were monitored based on specific localities. The data were inferred information regarding egg productivity (\(n\)), egg development (%), immature development (days), and survivorship (days).

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Table of Specifications

| Subject                      | Biology                                                                 |
|------------------------------|--------------------------------------------------------------------------|
| Specific subject area        | Bioscience and Biodiversity, Entomology                                 |
| Type of data                 | Tables                                                                   |
|                              | GIS maps                                                                 |
| How data were acquired       | This study was performed using a field strain of the Ae. albopictus that was originally collected from twenty residential areas in the central zone of Shah Alam. This research applied fieldwork with a cross-sectional design to investigate the demographic parameters of the Ae. albopictus. The evaluation of the Aedes albopictus was conducted in a controlled environment in an insectarium. |
| Data format                  | Raw                                                                     |
|                              | Semi-analysed                                                           |
| Parameters for data collection| Biological information was obtained on life demographic parameters, namely, (i) immature development, (ii) adult survival, (iii) gonotrophic cycle, and (iv) fecundity of the adult Ae. albopictus. The adult mosquitoes were monitored according to the set localities. |
| Description of data collection| Descriptive demographic parameters were used to describe the field strain of the Ae. albopictus collected from residential areas in Shah Alam. The eggs of the Ae. albopictus that had been collected were colonised in the Vector Control Research Laboratory (at a temperature of 28 ± 2 °C with 75% to 85% relative humidity) using standard protocols adopted from the “Manual for Mosquito Rearing and Experimental Techniques” [1, 2]. |
| Data source location         | The entomological survey was conducted in twenty localities in the central zone of Shah Alam, Malaysia. The GPS coordinates used to collect the field strains were as follows: |
| Data accessibility           | All the raw data are available in the article.                          |

Value of the Data

- Data on the life parameters of the Ae. albopictus mosquito are beneficial for the scientific community to understand the population dynamics of a species within their habitat. This is important for interpreting the life demographics, which include the survival, development and reproductive system of a population under various conditions.
- Data on the development rate of the Ae. albopictus in dengue outbreak areas are necessary for the scientific community to estimate the ability of the vector in transmitting the disease.
- Other scientists can benefit from the data when dealing with studies related to mosquito ecology. Furthermore, the survival of mosquitoes plays a pivotal role in disease transmission.
- The data can be used to understand the demographic parameters of the mosquito to strengthen existing vector control programmes. The data from the research that was conducted in dengue outbreak areas in Malaysia in 2017 offer information on the demographic parameters of the Ae. albopictus.

1. Data description

The present study was undertaken in twenty districts in the central zone of Shah Alam. Out of a total of 60 ovitraps that were placed in the field during the study period, 371 positive ovitraps (66.21%) were collected, while a total of 10,606 eggs were obtained (Table 1). To summarize the population parameter of the Ae. albopictus in the central zone of Shah Alam, the following factors were analysed: (i) egg development, (ii) immature development, (iii) adult survivorships, (iv) female fecundity, and (v) gonotrophic cycle. The study was developed under controlled laboratory conditions (at a temperature of 28 ± 2 °C with 75% to 85% relative humidity). Tables 2 and 3 show the descriptive population parameters of the Ae. albopictus at the immature and adult stages, respectively, while the biological data on the gonotrophic cycle and fecundity are tabulated in Table 4. Based on the outcome, 18 localities (78.2%) in the central zone showed a
### Table 1
Positive ovitraps index (POI) and mean eggs per trap (MET) collected from twenty localities in the central zone of Shah Alam, Malaysia.

| Locality | Ovitraps placement (a) | Number of recovered ovitraps (b) | Number of positive ovitraps (c) | Positive ovitraps index (POI) (%) (d) | Number of eggs (MET±SD) |
|----------|------------------------|----------------------------------|---------------------------------|----------------------------------------|------------------------|
| S2       | 30                     | 28                               | 21                              | 75.00                                  | 482 ±7.64               |
| S3       | 30                     | 27                               | 18                              | 66.70                                  | 477 ±7.00               |
| S4       | 30                     | 23                               | 20                              | 86.95                                  | 407 ±9.60               |
| S5       | 30                     | 29                               | 18                              | 62.07                                  | 523 ±10.00              |
| S6       | 30                     | 29                               | 25                              | 86.21                                  | 1023 ±11.92             |
| S7       | 30                     | 27                               | 15                              | 55.56                                  | 321 ±7.00               |
| S8       | 30                     | 30                               | 19                              | 63.33                                  | 487 ±9.56               |
| S9       | 30                     | 23                               | 15                              | 51.72                                  | 457 ±8.18               |
| S10      | 30                     | 29                               | 16                              | 55.17                                  | 317 ±14.21              |
| S11      | 30                     | 29                               | 13                              | 44.83                                  | 260 ±5.15               |
| S12      | 30                     | 26                               | 20                              | 76.92                                  | 716 ±8.03               |
| S13      | 30                     | 29                               | 17                              | 58.62                                  | 366 ±8.01               |
| S14      | 30                     | 28                               | 21                              | 75.00                                  | 974 ±17.18              |
| S15      | 30                     | 30                               | 22                              | 73.33                                  | 764 ±6.08               |
| S16      | 30                     | 30                               | 20                              | 66.67                                  | 740 ±6.94               |
| S17      | 30                     | 30                               | 21                              | 70.00                                  | 840 ±8.72               |
| S18      | 30                     | 29                               | 17                              | 58.62                                  | 301 ±8.21               |
| S19      | 30                     | 24                               | 14                              | 58.33                                  | 170 ±5.67               |
| S20      | 30                     | 27                               | 20                              | 74.07                                  | 568 ±9.14               |
| Total    | 600                    | 556                              | 371                             | 66.21                                  | 10,606 ±28.58           |

Note: The positive ovitraps index (POI) was calculated by dividing the number of positive ovitraps (c) with the total number of recovered ovitraps (b) and multiplying with 100. The mean eggs per trap were calculated by dividing the total number of eggs collected (d) with the number of positive ovitraps (c).

### Table 2
Descriptive population parameters of the *Ae. albopictus* (immature stage) at study sites within residential areas in the central zone of Shah Alam, Malaysia.

| Locality | Development rate, (n) | Developmental day of immature, F₀ (Mean, days) | Population performance |
|----------|-----------------------|-------------------------------------------------|------------------------|
| Eggs     | Larvae | Pupae | Adult | Eggs | Larvae | Pupae | Adult | Hatching rate (%) | Mortality rate (%) |
| S2       | 482    | 420   | 307   | 297  | 2      | 4     | 1     | 7     | 87.14              | 29.28               |
| S3       | 477    | 350   | 320   | 314  | 1      | 5     | 2     | 8     | 73.37              | 10.28               |
| S4       | 407    | 341   | 227   | 208  | 3      | 4     | 2     | 9     | 83.78              | 39.00               |
| S5       | 523    | 476   | 381   | 355  | 3      | 5     | 1     | 9     | 91.01              | 25.42               |
| S6       | 1023   | 701   | 587   | 507  | 2      | 4     | 1     | 7     | 68.52              | 27.67               |
| S7       | 321    | 283   | 192   | 183  | 4      | 5     | 2     | 11    | 88.16              | 35.33               |
| S8       | 413    | 300   | 270   | 257  | 1      | 5     | 2     | 8     | 72.64              | 14.33               |
| S9       | 487    | 421   | 327   | 302  | 1      | 5     | 2     | 8     | 86.45              | 28.27               |
| S10      | 457    | 399   | 313   | 284  | 3      | 4     | 1     | 8     | 87.31              | 28.82               |
| S11      | 317    | 210   | 151   | 139  | 2      | 6     | 2     | 10    | 66.24              | 33.81               |
| S12      | 260    | 215   | 137   | 128  | 3      | 6     | 1     | 10    | 82.69              | 40.47               |
| S13      | 716    | 579   | 404   | 385  | 2      | 5     | 2     | 9     | 80.86              | 33.51               |
| S14      | 366    | 247   | 210   | 201  | 2      | 5     | 2     | 9     | 67.49              | 18.62               |
| S15      | 974    | 866   | 723   | 704  | 1      | 5     | 1     | 7     | 88.91              | 18.71               |
| S16      | 764    | 749   | 603   | 586  | 3      | 5     | 2     | 10    | 98.04              | 21.76               |
| S17      | 740    | 687   | 555   | 516  | 2      | 4     | 2     | 8     | 92.84              | 24.89               |
| S18      | 840    | 750   | 616   | 566  | 4      | 4     | 1     | 9     | 89.29              | 24.53               |
| S19      | 301    | 283   | 199   | 175  | 2      | 4     | 1     | 7     | 94.01              | 38.16               |
| S20      | 170    | 147   | 92    | 85   | 3      | 7     | 1     | 11    | 86.47              | 42.17               |
| S21      | 568    | 412   | 324   | 295  | 4      | 5     | 2     | 11    | 72.53              | 28.40               |

Note: The sites are described as S = Section in residential areas in the central zone of Shah Alam, Malaysia. The annotation, (n), represents the number of eggs, larvae, pupae and adults of the *Ae. albopictus*.
Table 3
Descriptive population parameters of the *Ae. albopictus* (adult stage) at study sites within residential areas in the central zone of Shah Alam, Malaysia.

| Locality | Emerged adult, F0, (n) | Survivorship of adult, lx (days) |
|----------|------------------------|--------------------------------|
|          | Total | Male | Female | ratio | Male | Female | Average |
| S2       | 297   | 106  | 191    | 1.0:1.8 | 57   | 67    | 62     |
| S3       | 314   | 235  | 79     | 3.0:10  | 61   | 74    | 67.5   |
| S4       | 208   | 83   | 125    | 1.0:1.5 | 38   | 43    | 40.5   |
| S6       | 355   | 213  | 142    | 1.5:1.0 | 65   | 79    | 72     |
| S7       | 507   | 195  | 312    | 1.0:1.6 | 64   | 73    | 68.5   |
| S8       | 183   | 96   | 87     | 1.1:10  | 41   | 57    | 49     |
| S9       | 257   | 122  | 135    | 1.0:1.1 | 48   | 66    | 57     |
| S10      | 302   | 100  | 202    | 1.0:2.0 | 33   | 45    | 39     |
| S11      | 284   | 86   | 198    | 1.0:2.3 | 39   | 45    | 42     |
| S12      | 139   | 76   | 63     | 1.1:0.9 | 29   | 41    | 35     |
| S13      | 128   | 76   | 52     | 1.5:1.0 | 29   | 43    | 36     |
| S15      | 385   | 148  | 237    | 1.0:1.6 | 46   | 68    | 57     |
| S16      | 201   | 74   | 127    | 1.0:1.7 | 50   | 57    | 53.5   |
| S17      | 704   | 287  | 417    | 1.1:1.6 | 70   | 77    | 73.5   |
| S18      | 586   | 320  | 266    | 1.2:1.0 | 37   | 49    | 43     |
| S19      | 516   | 297  | 219    | 1.5:1.1 | 50   | 59    | 54.5   |
| S20      | 566   | 271  | 295    | 1.1:1.2 | 47   | 51    | 49     |
| S21      | 175   | 87   | 88     | 1.0:1.0 | 55   | 70    | 62.5   |
| S23      | 85    | 46   | 39     | 1.2:1.0 | 52   | 68    | 60     |
| S24      | 295   | 134  | 161    | 1.0:1.2 | 60   | 69    | 64.5   |

Note: Identification and status of the *Ae. albopictus* follow the descriptions listed by the CDC, whereby the F0 (field strain) was subjected to mass rearing. The process was conducted in a controlled environment in an insectarium at a temperature of 28 ± 2°C with 75 ± 10% humidity and a photoperiod of 14:10 h of dark:light cycles. The annotation in brackets (n) represents the number of adult *Ae. albopictus* that were utilised to obtain the desired measurements. Additionally, the survivorship of the adults (lx) was monitored and recorded daily (days).

Table 4
The unprocessed data on the fecundity, gonotrophic cycle, and generation of offspring of the *Ae. albopictus* strain collected from study sites (25 males: 25 females).

| Locality | Gonotrophic cycle of F0 (Total eggs produced) | Total eggs (n) | No. eggs per ♀ | Total cycle | Mean eggs per cycle |
|----------|---------------------------------------------|----------------|----------------|-------------|--------------------|
| G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 |
| S2  | 125 | 368 | 214 | 117 | 32 | 14 | 0 | 0 | 0 |
| S3  | 43 | 186 | 100 | 332 | 147 | 123 | 50 | 39 | 25 |
| S4  | 127 | 350 | 317 | 108 | 30 | 21 | 0 | 0 | 0 |
| S5  | 56 | 437 | 625 | 546 | 324 | 89 | 39 | 21 | 29 |
| S7  | 71 | 1050 | 813 | 651 | 318 | 95 | 77 | 45 | 0 |
| S8  | 108 | 435 | 516 | 238 | 94 | 31 | 19 | 0 | 0 |
| S9  | 388 | 547 | 101 | 63 | 58 | 21 | 0 | 0 | 0 |
| S10 | 100 | 174 | 235 | 214 | 157 | 42 | 18 | 0 | 0 |
| S11 | 200 | 325 | 204 | 175 | 87 | 32 | 0 | 0 | 0 |
| S12 | 97 | 201 | 189 | 116 | 25 | 39 | 0 | 0 | 0 |
| S13 | 108 | 186 | 201 | 219 | 133 | 56 | 18 | 0 | 0 |
| S15 | 100 | 432 | 475 | 387 | 358 | 104 | 109 | 32 | 25 |
| S16 | 70 | 300 | 357 | 270 | 210 | 199 | 40 | 0 | 0 |
| S17 | 71 | 1250 | 854 | 600 | 318 | 187 | 77 | 45 | 0 |
| S18 | 10 | 87 | 332 | 368 | 120 | 88 | 25 | 0 | 0 |
| S19 | 64 | 142 | 589 | 432 | 129 | 78 | 63 | 25 | 0 |
| S20 | 200 | 430 | 515 | 226 | 80 | 32 | 24 | 0 | 0 |
| S21 | 100 | 175 | 265 | 217 | 125 | 36 | 12 | 0 | 0 |
| S22 | 114 | 1007 | 108 | 116 | 30 | 15 | 0 | 0 | 0 |
| S23 | 207 | 289 | 299 | 346 | 265 | 104 | 150 | 35 | 0 |

Notes: A gonotrophic cycle is the period of time from the blood supply to the oviposition. The gonotrophic cycle, which is represented by the total number of eggs produced per cycle, is denoted by G. Descriptions of the measurements are abbreviated as follows: n = total number of eggs produced, and ♀ = No. of eggs produced by a single female mosquito.
developmental time of between 6 and 9 days. In terms of adult longevity, 11 localities (47.8%) were observed to have a longer longevity period, where the adult was able to survive for more than 54 days. The fecundity, gonotrophic cycle, and generations produced were also observed in order to determine the biology and demographic parameters of DF. The highest fecundity was recorded in Section 17, with a total of 3402 eggs and seven gonotrophic cycles until the adult mosquitoes died. The locality with the lowest fecundity was Section 12, with a total of 667 eggs and only 6 gonotrophic cycles. On average, a female *Ae. albopictus* in these areas laid between 26.68 to 136.08 eggs (Fig. 1).

The incidence rate (IR) was used to compare the biological parameters of the *Ae. albopictus* in high and low-risk localities in the central zone of Shah Alam. This IR data for residential areas were categorized into two groups; namely (i) high-IR (>20 cases in a population of 1000), and (ii) low-IR (<20 cases in a population of 1000) areas. An independent t-test analysis was used to determine if there was a significant difference between the biological parameters of the *Ae. albopictus* in high and low-IR areas. Generally, most of the data recorded was greater in the high-IR areas compared to the low-IR areas, except for the immature development time (larvae to pupae, and the total development time) (Table 5). There was a significant difference ($p=0.03$) in terms of the number of eggs produced by the females in high-IR ($M=73.27\pm15.69$ eggs) and in low-IR ($M=45.75\pm11.43$ eggs) areas.

![Eggs produced per female](image)

**Fig. 1.** Average number of eggs laid by female *Ae. albopictus* at twenty localities in the central zone of Shah Alam.
Table 5
Table of life attributes of the *Ae. albopictus* mosquito in Shah Alam based on the incidence rate (IR).

| Attribute                          | High IR            | Low IR             | p-value |
|------------------------------------|--------------------|--------------------|---------|
|                                    | Mean ± SD          | Range              | Mean ± SD          | Range              |         |
| Female fecundity (egg productivity)| 73.27±15.69        | 36.84–136.08       | 45.75±11.43        | 26.68–60.88        | 0.03     |
| Egg development (%)                |                    |                    |                    |                    |         |
| Hatchability                       | 83.49±17.00        | 68.52–94.01        | 82.39±17.94        | 66.24–98.04        | 0.80     |
| Mortality                          | 31.42±7.40         | 18.71–42.17        | 25.51±7.63         | 10.28–39          | 0.14     |
| Immature development (days)        |                    |                    |                    |                    |         |
| Eggs to Larvae                     | 5.11±1.42          | 4–7                | 4.64±1.53          | 4–6               | 0.20     |
| Larvae to Pupae                    | 1.33±2.15          | 1–2                | 1.73±1.98          | 1–2               | 0.09     |
| Development time                   | 8.78±1.35          | 7–11               | 8.82±1.42          | 7–11              | 0.95     |
| Adult survivorships (days)         |                    |                    |                    |                    |         |
| Male                               | 52.67±7.44         | 29–70              | 45.18±8.69         | 29–61             | 0.18     |
| Female                             | 65.78±9.64         | 43–79              | 55.36±12.23        | 41–74             | 0.06     |
| Average                            | 59.22±8.45         | 36–73.5            | 50.27±10.43        | 35–67.5           | 0.10     |

Note: The descriptive analysis of the life attributes of the *Ae. albopictus* is based on the incidence rate (IR) of DF cases in 2017, which were categorized into high IR (>20 cases in a population of 1000) and low IR (<20 cases in a population of 1000). The p-values generated from the t-test analysis represent the significant difference between the attributes of the *Ae. albopictus* in high and low-IR areas.

2. Experimental design, materials, and methods

2.1. Study site

The entomological survey was conducted in localities in the central zone of Shah Alam located approximately 25 km from the city of Kuala Lumpur at 3°05’48.74” N 101°33’02.39” E to 2°58’22.93” N 101°44’39.69” E altitude (Fig. 2). Based on the dengue surveillance data, this area experiences a large dengue outbreak every year. In this study, twenty residential localities were explored for the surveillance activities, and their surrounding environment was observed. The ecological conditions in the studied localities are summarized in Fig. 2. It was generally observed that this area had an intensely green landscape and vegetation.

2.2. Sampling and laboratory evaluation

The study was performed using a strain of the *Ae. albopictus* originally collected in Shah Alam from March to December 2017. The eggs were collected using ovitraps, which were essentially plastic containers filled with 150 ml distilled water, and with a paddle made of wooden hardboard (8 cm x 2 cm) for oviposition. A total of 20 ovitraps were deployed to each locality, and these were placed in habitats suitable for the breeding of mosquitoes, such as (i) near adult resting sites; (ii) in complete shade, protected from the weather and human interference; (iii) in direct line of sight; (iv) near to other breeding containers; and (v) close to the ground (24). After four consecutive days of export, the ovitraps were collected back [3] (Fig. 3A). At this stage, the paddles inside the ovitraps were transferred into airtight plastic containers (13 cm x 6 cm). Meanwhile, the ovitraps were tightly covered with lids and brought back to the laboratory for the colonization of the mosquitoes and enumeration of the eggs. All the collected ovitraps were labelled according to their prescribed localities. During the pre-experimental work, the paddles were first dried at a temperature of 28°C to facilitate the egg-counting process.

In order to produce the F1 generation, the F0 (field strain) underwent mass rearing. The process was conducted in a controlled environment in an insectarium at a temperature of 28 ± 2°C with 75 ± 10% humidity, and a photoperiod of 14:10 h of dark:light cycles. The eggs collected from each locality were hosted separately by placing them in water for one hour. First, the larval instars were transferred to plastic traps (29 x 23 x 6 cm) filled with dechlorinated tap water,
and were monitored until adulthood. The larvae were fed daily with pupal larval food. The rate of development (days) of the eggs to the larval stage, and from the larval to the pupal stage, and finally, to immature mosquitoes, was observed and recorded accordingly [4].

The pupae that emerged were separated from the rest of the larvae and placed in a new container, which was put inside a standard rearing cage (30 cm x 30 cm x 30 cm) until the emergence of the adult mosquitoes. At the adult stage, the mosquitoes were separated according to their sex. Then, 25 male and 25 female mosquitoes (ratio 1:1) were transferred into a container that was placed in a smaller cage (15 cm x 15 cm x 15 cm) using an insect separator, and this was inspected for the emergence of adult mosquitoes. A universal bottle was stuffed with cotton wool and filled with 10% sucrose solution to feed the mosquitoes. The universal bottle was placed in the cage and was refilled from time to time. After day 5 of the emergence of the adult mosquitoes, a blood meal was given by placing a lab rat in a confined cage for the development of the eggs in the female mosquitoes [5]. Following this, a round black plastic container was filled with dechlorinated water, and folded filter paper was placed on top to serve as an oviposition substrate. The moistened folded filter paper cone was changed daily until no eggs were deposited on it (Fig. 3B). The eggs, which had been placed in the containers with filter paper, were air-dried and the number of eggs was enumerated. The fecundity, gonotrophic cycle, and survival of the adult *Ae. albopictus* mosquitoes were monitored and recorded daily.
A. Collection of Aedes mosquitoes using ovitraps

B. Colonization of Aedes mosquito

Fig. 3. Sampling and laboratory evaluation: (A) Placement of ovitraps based on several factors: (i) near adult resting sites, (ii) in complete shade, away from the weather and human interference, (iii) in direct line of sight, (iv) near to other breeding containers, and (v) close to the ground. (B) Schematic representation of mass rearing activity in a 12:12 light:dark photoperiod.

2.3. Data analysis and management

The present study was undertaken in twenty districts in the central zone of Shah Alam. In order to summarize the demographic parameters of the *Ae. albopictus*, a table analysis was conducted. The incidence rate (IR) of DF cases in 2017 was used to compare the demographic parameters in high and low-risk areas in the central zone of Shah Alam. For a descriptive analysis of the IR based on the number of DF cases in 2017, eleven sections (*n* = 11) were categorized as high-IR (>20 cases in a population of 1000) and nine sections (*n* = 9) were categorized as low-IR (<20 cases in a population of 1000) areas. Since the mode number for the incidence rate was 20.42, therefore, areas that recorded more than 20 cases were considered as high-incidence rate areas, while those that recorded less than 20 cases were considered as low-incidence rate areas. An independent *t*-test analysis was used to determine if there was a significant difference between the attributes of the *Ae. albopictus* in terms of the demographic parameters in the high and low-IR areas.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships, which have, or could be perceived to have, influenced the work reported in this article.
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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2020.105882.

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