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El Colegio de la Frontera Sur

Demografía de *Aedes aegypti* (Diptera: Culicidae): Comparación de poblaciones silvestres y de laboratorio

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Presentada como requisito parcial para obtener el grado de
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Por

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para obtener el grado de **Maestro (a) en Ciencias en Recursos Naturales y Desarrollo Rural**

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Dedicatoria

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Tabla de contenido

Resumen

Objetivo: Comparar las funciones y parámetros demográficos de poblaciones de *Aedes aegypi* de poblaciones silvestres y de laboratorio y determinar el efecto de la irradiación en la sobrevivencia de mosquitos estériles.

Metodología: El estudio consistió en tres tratamientos: 1) cepa silvestre, 2) cepa de laboratorio (Mex CGD) fértil y 3) cepa estéril (obtenida a partir de la irradiación de pupas de la cepa fértil de laboratorio Mex CGD). Por cada tratamiento se realizaron tres replicas. Se determinó el tiempo de desarrollo y sobrevivencia de los estados inmaduros, y la sobrevivencia y fecundidad de los adultos. Con los datos obtenidos, se elaboraron tablas de vida y se estimaron las funciones y parámetros poblacionales.

Resultados: El periodo de incubación de los huevos silvestres de *Ae. aegypti* fue de 14 días, registrándose 68.8% de eclosión, mientras que para la cepa de laboratorio fértil fue de 25 días con 65.7% de eclosión. El desarrollo de larva hasta la emergencia del adulto fue de 11 días para la cepa de laboratorio fértil y 13 días para la cepa silvestre. No hubo diferencia significativa en la sobrevivencia de los machos de los diferentes tratamientos. En las hembras, solo las estériles tuvieron una menor sobrevivencia con respecto a las silvestres y fértiles. Además, se observó que las hembras de laboratorio registraron mayores tasas de fecundidad y de crecimiento poblacional con respecto a las hembras silvestres.

Conclusiones: Las comparaciones realizadas demostraron que existen diferencias en las funciones y parámetros demográficos de la población de *Ae. aegypti* adaptada a laboratorio con respecto a la silvestre. La cepa de laboratorio mostró mayores tasas de reproducción y crecimiento poblacional, lo cual indica que esta cepa ha tenido un proceso de adaptación a las condiciones de cría masiva. Se determinó que la irradiación reduce la sobrevivencia de las hembras estériles.

Palabras clave: Mosquito, cría masiva, técnica del insecto estéril, parámetros poblacionales, tablas de vida.

Capítulo I

Introducción

Aedes aegypti, Linnaeus 1762, es el principal vector de la transmisión de una variedad de virus que provocan enfermedades como el dengue, fiebre amarilla, Zika y chikungunya (Reinert et al. 2009, Fernández-Salas et al. 2015). Su amplia distribución y su adaptación al modo de vida humano urbanizado (Scott et al. 1993), hacen que esta especie de mosquito sea un grave problema de salud pública para más de la mitad de la población a nivel mundial (OMS 2017).

Una alternativa de control para esta especie de mosquito es la técnica del insecto estéril (TIE). Este es un método de control que se basa en la cría masiva, la esterilización y la liberación de machos estériles (Knipling 1955). La TIE requiere el uso de grandes cantidades de individuos de la especie que se desea controlar, por lo que se deben producir masivamente en ambientes controlados, buscando que los insectos estériles sean de calidad, ya que de esto dependerá el éxito del método de control (Knipling 1955, Lee et al. 2013).

Actualmente se está llevando a cabo un proyecto piloto con la TIE para la supresión de poblaciones de *Ae. aegypti* en el sur del estado de Chiapas, México. La implementación de esta técnica está apoyada por la división conjunta FAO-IAEA bajo el proyecto MEX 5031, el cual inició en el año 2016. Para establecer la cría masiva de los mosquitos, se recolectaron huevos de esta especie en 12 localidades de la costa de Chiapas. A partir de los huevos recolectados se realizaron las cruzas de mosquitos y se estableció una cepa genéticamente diversa (Mex CGD) en el insectario del Centro Regional de Investigación de Salud Pública del Instituto Nacional de Salud Pública (CRISP-INSP); que actualmente es la colonia que prevalece en cría masiva (Bond et al. 2017, 2019). La irradiación para inducir esterilidad en adultos se realiza en estado de pupa (Bond et al. 2019). Cuando se inició esta investigación esta cepa tenía 56 generaciones en condiciones de cría masiva.

Cuando se inicia la colonización en laboratorio a partir de una o varias poblaciones silvestres, hay un proceso de adaptación que puede afectar negativamente a los insectos (Hoffmann y Ross 2018). Esto se debe a que la transferencia de especies silvestres a un medio diseñado por humanos, implica un cambio radical de condiciones, limitación de espacio y el contacto con nuevos elementos que no existen en el medio natural. Dichos cambios pueden provocar adaptaciones en atributos importantes para su sobrevivencia en el medio silvestre, como la reproducción, búsqueda de alimento y la evasión de depredadores (Kohane y Parsons 1988).

En el ciclo de vida de *Ae. aegypti*, se ha demostrado que los huevos silvestres tienden adaptarse a los ambientes de laboratorio, presentando una disminución en su porcentaje de eclosión en función del tiempo que llevan almacenados (Manorenjitha y Zairi 2015). Las condiciones de cría tienen un efecto fundamental en el tiempo de desarrollo y sobrevivencia de las etapas larvales, de los cuales dependerán los rasgos de los estados siguientes del mosquito (Mohammed y Chadee 2011, Couret et al. 2014). Las adaptaciones en la vida adulta, por lo general, se observan en el grado de sobrevivencia y fecundidad (Costero et al. 1998, Manorenjitha y Zairi 2015, Rozilawati et al. 2017).

Se ha reportado que en un medio artificial, los factores que influyen en el desarrollo de *Ae. aegypti* son la dieta (Styer et al. 2007, Sowilem et al. 2013, Couret et al. 2014), la densidad a la que se crían las larvas (Gilles et al. 2011, Couret et al. 2014), la humedad relativa (Schmidt et al. 2018) y el fotoperiodo (Costanzo et al. 2015). Se ha demostrado que la capacidad de reproducción y las fluctuaciones de los parámetros poblacionales se deben al grado de adaptación de los mosquitos a los medios silvestres o artificiales en los cuales se han establecido (Crovello y Hacker 1972, Rozilawati et al. 2017).

Para comprender y caracterizar las variaciones en la dinámica poblacional que ocurren bajo condiciones de laboratorio, es necesario elaborar tablas de vida. En estas se hace un registro de la mortalidad y la fecundidad con respecto a la edad de los individuos (Carey 1993, Peterson et al. 2009). Dependiendo del tipo de población a investigar, puede ser una tabla de vida de cohorte, que da una perspectiva longitudinal, es decir el seguimiento de un grupo de insectos que nace al mismo tiempo hasta el deceso del último individuo. Otra opción es una tabla de vida actual, que da una perspectiva transversal, en la cual se registran los tiempos de vida de los individuos de una población y se asume una cohorte hipotética (Carey1993). De esta manera se han realizado diversas investigaciones de *Ae. aegypti*, que han aportado información sobre el efecto del hábitat, ciclo de vida, dinámica de población, adaptaciones a laboratorio y potencial de colonización (Costero et al. 1998, Beserra y Castro Jr 2008, Tejerina et al. 2008, Sowilem et al. 2013, Manorenjitha y Zairi 2015, Maimusa et al. 2016, Chadee et al. 2017).

Considerando la importancia que ha tomado el control de *Ae. aegypti* mediante la TIE en los últimos años, surge la necesidad de conocer los parámetros de población de colonias adaptadas a las condiciones de cría masiva. Por lo tanto, el objetivo de este estudio fue comparar las funciones y parámetros demográficos de la cepa de *Ae. aegypti* de laboratorio (Mex CGD) con poblaciones silvestres y determinar el efecto de la irradiación en la sobrevivencia de los insectos estériles. Las funciones y los parámetros demográficos se obtuvieron a partir de la determinación del tiempo de desarrollo y sobrevivencia de los estados de huevo, larva, y pupa. En el caso de los adultos, se determinó su sobrevivencia y reproducción en condiciones controladas de laboratorio. Se aplicaron los métodos demográficos descritos por Carey (1993) y se obtuvieron los datos de sobrevivencia, tasas de reproducción y de crecimiento poblacional. Con esto se identificaron las diferencias entre las distintas cepas de mosquitos y se obtuvo información sobre las repercusiones en las dinámicas poblacionales de los mosquitos debido a los procesos de cría e irradiación.

En el capítulo II, se presentan los resultados de la investigación a través de un manuscrito, que fue sometido a Journal of Medical Entomology. En el capítulo III, se presentan las conclusiones generales. Finalmente, se incluyen las referencias citadas en esta introducción y en las conclusiones. En anexos se incluyen las tablas de vida obtenidas para la población silvestre, cepa adaptada a laboratorio y para la población de mosquitos estériles.

Capítulo II

Demografía de mosquitos *Aedes aegypti* (Diptera: Culicidae): Comparación de poblaciones silvestre y adaptada a laboratorio

Demography of *Aedes aegypti* (Diptera: Culicidae) mosquitoes: Comparison of wild and laboratory adapted populations

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Running head: Demography of wild and laboratory *Aedes aegypti*

Demography of *Aedes aegypti* (Diptera: Culicidae) mosquitoes: Comparison of wild and laboratory adapted populations

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Abstract

Demographic parameters of wild and laboratory adapted *Aedes aegypti* populations were compared and the effect of irradiation on adult survival was assessed. The incubation period was 25 days for eggs of the laboratory strain, with 65.6% hatching, and 14 days with 68.78% hatching for the wild one. Development time of the immature stages was shorter for the laboratory strain, with 11 days from larvae to adult, compared to 13 days for the wild ones, with approximately 99% survival from larvae to adults for both strains. No significant differences were observed in male survival among wild, laboratory non-irradiated and irradiated treatments. For females, irradiation produced a significant reduction in survival compared to wild and non-irradiated laboratory individuals. Population parameters indicated that the laboratory strain develops faster, has higher reproduction rates and higher population growth rates than the wild strain. The intrinsic rate of increase (*r*) was 0.068 for the laboratory strain and 0.059 for the wild strain. These differences demonstrate that the laboratory strain is adapted to mass rearing conditions.

Keys Words: Mosquito vectors, dengue, survival, population parameters, mass-rearing rearing, colonization, sterile insect technique.

Introduction

Aedes aegypti, Linnaeus 1762, is recognized as the most important vector in the transmission of a wide range of viruses that affect humans, causing diseases such as dengue, Zika and chikungunya (Fernández-Salas et al. 2015, Rey and Lounibos 2015). Currently, there are no vaccines against these viruses, and in recent years there has been an alarming increase in these diseases, so new control methods are sought (Baldacchino et al. 2015, Fernández-Salas et al. 2015). One option is the Sterile Insect Technique (SIT). This control method is mainly based on mass rearing, sterilization and release of sterile males, suppressing populations by inducing sterility in the wild populations and the consequent reduction of their birth rates (Knipling 1955). In the implementation of such control method, it is necessary to know and characterize the biology of the insect in question, to ensure quality and efficiency at the time of release (Chambers 1977).

A SIT pilot project is currently under way in Chiapas, Mexico, supported by the Joint FAO-IAEA Division (MEX-5031). This project aims is to validate the SIT as an element of integrated vector management to suppress mosquito populations in two small rural communities. For the implementation of this pilot project, a collection of *Ae. aegypti* eggs was previously made in 12 locations on the Chiapas coast. A Genetically Diverse Strain (GDS-Mex) was produced and this has been reared at the insectarium of the Regional Center for Public Health Research of the National Institute of Public Health for 56 generations (CRISP-INSP) (Bond et al. 2017, 2019). Male pupae are sterilized through irradiation at a 50 Gy dose (Bond et al. 2019).

Mosquitoes, as many other insect species, are subject to selection processes that determine their adaptations to the environment. When subjected to mass rearing under artificial conditions, different selective pressures, not present in the natural environment, can produce changes in their biological traits (Benedict et al. 2009, Hoffmann and Ross 2018). *Ae. aegypti* has proven to be a mosquito that has the ability to easily adapt and establish under artificial laboratory conditions. These adaptations have been reflected in traits such as egg incubation periods, larvae developmental time on artificial diets, and adult survival and fecundity under confined conditions (Manorenjitha and Zairi 2015).

Life tables are demographic tools with which population functions and parameters are quantitatively obtained, such as life expectancy, reproductive rates and population growth rates (Carey 1993, Sowilem et al. 2013). In other insect species, there is evidence that adaptations to laboratory mass rearing conditions affect or modify the biological attributes of insects and that some of these changes can be observed in their demographic parameters (Vargas and Carey 1989, Huho et al. 2007, Hernández et al. 2009, Quintero-Fong et al. 2018). Our goals in of this research was to compare the functions and demographic parameters of wild and the laboratory-adapted *Ae. aegypti* population (GDS-Mex) and to determine the effect of irradiation on the survival of sterile laboratory mosquitoes.

Materials and methods

This research was carried out at the CRISP-INSP insectarium, located in Tapachula city, Chiapas, Mexico. To determine and compare the demographic functions and parameters of *Ae. aegypti*, three treatments were considered: 1) wild strain, 2) no irradiated laboratory strain and 3) irradiated laboratory strain. Three replicates, with three different cohorts, were done. For each treatment, an initial batch of 5,000 eggs was randomly selected. From this batch, both immature and adult individuals were taken for the different experiments. The temperature at the laboratory for the development of immatures was 27°C±1°C and for adults it was 26±1°C. Relative humidity was 75±5%, and a 12:12 h L: D photoperiod was maintained for all life stages.

Laboratory adapted strain

Egg batches of the laboratory strain were provided by CRISP-INSP. As stated above, this laboratory adapted strain was initiated with egg collections at 12 different locations in the coast of Chiapas. These eggs were mixed and this is the Genetically Diverse Strain of *Ae. aegypti* (GDS-Mex) that has been reared at the insectarium and currently it is mass-reared at the CRISP-INSP facility in Rio Florido (Bond et al. 2017). This laboratory strain was approximately three years old and at the time this research project started it had 56 generations (Bond et al. 2017, 2019).

Irradiated laboratory-reared mosquitoes

Our aim with this treatment was to evaluate the effect of irradiation, used to sterilize males, on the survival of males and females under laboratory conditions. No other demographic functions or parameters were estimated because these were the same as the laboratory strain and because irradiated mosquitoes do not reproduce. Mosquitoes of the laboratory strain (GDS-Mex) were irradiated as pupae, 24 to 36 hours before adult emergence, at the fruit fly facility, MOSCAFRUT (SENASICA – IICA), located in Metapa, Chiapas. A Gamma Bean GB-127 irradiator, with dry storage chamber, with a Cobalt-60 source, was used. The mean irradiation dose was 50 Gy, which was obtained over a period of 5 min exposure at a distance of 66 cm from the source (Bond et al. 2019).

Wild strain

Wild *Ae. aegypti* mosquitoes were obtained from egg collections in the town of Raymundo Enríquez (14 ° 52 'N, 92 ° 19' W; altitude of 80 masl), located in the Municipality of Tapachula, Chiapas. Fifteen houses were selected in which the inhabitants were visited, explaining the study and asking for their permission to set up traps at their houses. After approval, two ovitraps constructed with local materials using black plastic containers (10 cm diameter, 20 cm height) (Marina et al. 2018) were placed in each house, one outdoor and the other indoor. Ovitraps were inspected every 7 days for a month. At each inspection, the filter paper strip used as oviposition substrate was removed and placed in a zip lock plastic bag to take them to the laboratory, the water was changed and the paper strip was replaced with a new one. The collections were carried out during the months of January, May and September 2019. Eggs hatched in the CRISP-INSP insectary and within 11 days adults emerged. Once adults emerged, they were identified to discard *Ae. albopictus* mosquitoes. All *Ae. aegypti* mosquitoes (parental) were placed in a breeding cage (29.5 cm x 29.5 cm x 29.5 cm). Since emergence, they were fed a 10% sucrose diet. At 72 h sheep blood was provided for females through artificial Hemotek membrane feeders (PS6B, Hemotek Ltd., Great Harwood, UK) for 1 h. After 48 h, ovitraps were placed inside the cage. The eggs laid were considered as the F1 generation of the wild strain and were used in the following experiments.

Embryonic development and egg hatch

To obtain the incubation time and egg hatching percentage, 300 eggs were randomly selected from the initial batch of 5,000 eggs, and were placed in groups of 100 eggs in plastic (polypropylene) 300 ml cups. Subsequently, 100 ml of filtered water at 27°C were added to each glass. Every 24 h the hatched eggs were collected and recorded. This activity was considered completed when the daily hatching was null.

Immatures development and survival

The development time and survival of the larval to pupal stages was estimated from an initial batch of 5,000 eggs. Five hundred eggs were hatched by the hypoxia method (FAO-IAEA 2017), so 100 larvae of the same age were obtained. These larvae were placed in 300 ml plastic cups and 100 ml of filtered water at 27°C were added. Diet was provided daily. It consisted of ground mouse diet pellets (LabDiet ® 5001) in water at 4% w/w. The amount of diet was according to the density of larvae (6µl / larva) (Bond et al. 2017). The cups were checked every 24 h to observe and record the number of living larvae, pupae and adults. Adults were removed. This activity ended when the emergence of the last adult was observed.

Adult survival and reproduction

Adult mosquitoes of the same age (within a 24 h range) were obtained from the batch of 5,000 eggs. At the time of emergence, they were sorted by sex based on antenna type dimorphism, and 100 males and 100 females were transferred to a breeding cage (29.5 cm x 29.5 cm x 29.5 cm). Feeders with 10% sucrose solution were placed inside the cage, and changed every 7 days. After introducing the mosquitoes into the cage, sheep blood was provided for 1 h through artificial feeders (PS6B, Hemotek Ltd., Great Harwood, UK). This food was provided every 3 days until the death of the last female.

To estimate daily fecundity (number of eggs laid per female per day), an ovitrap was placed inside the cage after the first blood feeding. This ovitrap was replaced every 24 h, and the number of eggs was recorded.

To determine fertility (egg hatch), the collected eggs were placed on pieces of filter paper and placed into trays with damp cotton substrates for 48 h to complete the embryo process. Then, they were dried for 72 h on trays with dry paper. Egg hatching was promoted using the fermented diet method, which is a variant of the method described by FAO-IAEA (2017). The method is based on the fermentation of the mouse diet in an airtight container, adding 1 ml of diet (4%) and 41 ml of water and letting stand 24 hours before use. The eggs were added to the container with the fermented liquid and after 45 min the number of hatched eggs was recorded.

To obtain survival data of males and females, the cages were inspected every 24 h, removing the dead mosquitoes and recording their number and sex, until the death of the last one.

Demographic and statistical analyses

For the demographic and statistical analysis, the data from the three cohorts was added and analyzed as follows.

For the egg stage, the daily hatching percentage was determined according to the number of eggs hatched every 24 h and was compared with the initial batch of 100 eggs placed in the cups. To obtain the total hatching percentage, the total number of hatched eggs was divided by the sum of hatched and non-hatched eggs for the entire period. The incubation period was considered as the number of days from when water was added to the eggs batches until the day that no more hatching was observed. The percentage of immatures per day was determined according to the number of larvae, pupae and adults present every 24 h and was compared with the initial 100 larvae placed in the cup.

To obtain the functions and demographic parameters we followed the methods described by Carey (1993). Life tables were constructed using the data collected from the different states of *Ae. aegypti*. For immature stages, the number of hatched eggs, development time and mortality of the larvae and pupae were considered. In the case of adults, daily mortality by sex and the number of eggs laid per day were considered. The functions used were: a) age (x) expressed in days from emergence to the death of the last individual; b) number of live mosquitoes at age x (N_x); c) fraction of survivors at age x (l_x); d) probability of survival in each age interval (p_x); e) fraction that dies in each interval (d_x); f) probability of dying in the following age interval (q_x); and g) life expectancy at age x (e_x). Survival curves for both sexes of wild, non-irradiated laboratory and irradiated laboratory treatments were made.

Fecundity functions and parameters were calculated from the number of eggs laid per day and the number of living female. The calculated functions were: a) gross fecundity (M_x), which is the number of eggs per female at age x, for female offspring (m_x) the total number of eggs was divided by 2; b) net fecundity ($l_x m_x$), which is the number of daughters produced at age x multiplied by the fraction alive at that same age. The reproductive parameters were: c) gross fecundity rate (GFR), which is the sum of female offspring per female produced during the entire life period ($\sum m_x$); d) net fecundity rate (R_0) which is the gross rate weighted by survival ($\sum l_x m_x$); and e) mean age of reproduction (MAR), which is the sum of age times net fecundity divided by net fecundity and represents the time from adult emergence to midpoint reproduction. Fertility was determined as the fraction of eggs that hatched and was expressed as percentage (%).

Population parameters were calculated by integrating the mortality and development time data of eggs, larvae, pupae and adults. The parameters calculated were: a) net fecundity or replacement rate (R_0), which is the number of female progeny that replaced the initial female cohort; b) generational time (T), which is the average time form egg to mean age of reproduction; c) intrinsic growth rate (r), that indicates the increase capacity of the population per unit time; d) finite growth rate (λ), which is the number of new individuals added to the cohort per unit time; and e) doubling time (DT), which is the time in which the population size duplicate.

The differences in survival among treatments was analyzed by the Cox proportional hazards model and Tukey's tests for means multiple comparisons. Statistical analysis software “R” was used (R Core Team, 2019).

Results

Embryonic development and egg hatch

The incubation period and the percentage of egg hatch for wild and laboratory strains are shown in Figure 1. Hatching for both treatments started on the same day, showing a higher percentage of hatching for the wild strain on day 1 with 18.9%, compared to 5.0% for the laboratory strain. In the case of the wild ones, the highest hatching percentages were obtained on days 1 to 4, and thereafter hatching decreased, remaining below 3% per day. Those of the laboratory strain presented greater variability. The highest percentages were observed on day 6 with 9.1%, and on day 12 with 5.7%. The rest of the days hatching remained below 5%. In general, the percentage of hatched eggs for the wild treatment was 68.8% with incubation duration of 14 days. For the laboratory treatment the hatching percentage was 65.7% with an incubation period of 25 days.

Immatures development and survival

In general, the laboratory strain showed shorter immature development time than the wild one. The wild strain had a maximum of 13 days with 98.7% survival (Figure 2A). In the laboratory stain, the maximum development time was 11 days with 99% survival (Figure 2B). Pupation of both treatments began on day 4, reaching the highest pupation percentage on day 6, and ended on day 12 for the wild and on day 10 for the laboratory strain. Adult emergence of the wild strain began on day 6 and ended on day 13, and for the laboratory strain, it began on day 6 and ended on day 11.

Adult survival and reproduction

Survival of wild, laboratory and irradiated laboratory males is shown in figure 3A. Irradiated laboratory (sterile) males showed the lowest survival, while the survival of the wild and non-irradiated laboratory (fertile) males were similar. However, the maximum observed longevity was 71, 67 and 60 days for irradiated laboratory, wild and non-irradiated laboratory males, respectively. According to the Cox proportional hazards model and using the log rank test with $p > 0.05$, it was found that the difference in the survival of males of the 3 treatments was not significant (log-rank = 0.6, 2 df, $p = 0.7$).

Female survival is shown in Figure 3 B. Irradiated laboratory females showed the lowest survival, while the survival of the wild and the non-irradiated laboratory females were similar. Maximum longevity was 84 days for irradiated laboratory females, 109 days for non-irradiated laboratory females, and 125 days for wild females. According to the Cox proportional hazards model and using the log-rank test, the differences among the treatments was significant (log-rank = 27.69 2 df, p = 0.000001). Tukey's test indicated a highly significant difference between irradiated and non-irradiated laboratory females (Pr | z | = 0.0000155), and between irradiated laboratory and wild females (Pr | z | = 0.0000226). The difference between non-irradiated laboratory and wild females was not significant (Pr | z | = 0.986).

Net fertility schedules were similar for both strains (Figure 4). Laboratory females start laying eggs on day 7, following a variable and increasing trend, reaching its maximum on day 45.Then, they showed a gradual decrease until fertility became null on day 96. Wild females took longer to mature, laying their first eggs on day 9, and reaching its highest peak on day 40, then gradually decreased and the last oviposition was recorded on day 87. Throughout the reproductive period, the net fecundity of the wild females remained below those of the laboratory females.

The reproductive parameters obtained are presented in Table 1. It is observed that the mean age of reproduction was similar for both treatments, with 36.1and 36.7 days for wild and laboratory females, respectively. In the rest of the reproductive parameters, laboratory females showed greater values than wild females.

Population parameters

Male life expectancy at emergence (e_0) was lower than females, both in wild and laboratory adapted strains. Comparing treatments, life expectancy of irradiated mosquitoes was lower than the other two treatments. Laboratory mosquitoes presented higher fecundity and population growth rates, and shorter generation and doubling times than wild mosquitoes (Table 2).

Life tables of wild and laboratory strains, with all demographic functions are shown as supplementary material. Table S1 for wild strain and Table S2 for the laboratory strain.

Discussion

Our results showed that the process of adaptation to laboratory mass rearing conditions causes demographic changes in *Ae. aegypti*. Mosquitoes adapted to laboratory conditions presented higher population growth rates than wild ones and these are explained by the shorter development times and the higher reproductive rates. These types of demographic changes coincide with what has been found for other species of insects adapted to mass-rearing conditions and are explained by the inadvertent selection that seeks to optimize processes (Vargas and Carey 1989, Miyatake and Yamagishi 1999, Liedo et al. 2010, Sánchez-Rosario et al. 2017, Quintero-Fong et al. 2018). From a production approach, these adaptations are desirable. However, from the perspective of its use for the application of the SIT, it is important to ensure that together with these adaptations, attributes that are important for the performance of sterile mosquitoes in the field are not lost, such as their dispersal capacity, their ability to evade predators, and their sexual competitiveness (McInnis et al. 1996, Calkins and Parker 2005, Hendrichs et al. 2007, Pereira et al. 2013, Dor et al. 2020).

A variable that did not adjust to this trend was egg incubation period. In our study, incubation periods for the laboratory adapted strain were 11 days longer than those in the wild. The incubation periods and the hatching percentages that we observed are within the range observed by Silva et al. (1993) who report a hatching rate of 68% and an incubation period that varied from 4 to 18 days at an average temperature of 25.3°C. Manorenjitha and Zairi (2015) reported a hatching percentage of 49.1% for eggs laid by wild *Ae. aegypti* females.

Regarding daily hatching, the gradual pattern observed in the wild strain agrees with that described by Soares-Pinheiro et al. (2017) who evaluated the daily hatching rates of *Ae. aegypti* stored at different periods, obtaining a higher hatching percentage in the first 4 days and then a gradual decrease. The incubation period ended on day 7, being shorter than our results. These differences may be attributed to the medium in which the eggs were incubated. They added larval diet to their medium, that has been reported as a hatching inducer, whereas we use only filtered water. Christophers (1960) pointed out that hatching can vary according to the quality of the incubation medium, hatching is less feasible in distilled or clean water, compared to incubation in water with organic matter, and/or microorganisms. In general, egg hatching success can be influenced by changes in the environment. These changes tend to activate a state of diapause in mosquito embryos, preparing them to be able to survive for a long time until they can find favorable conditions to emerge (Denlinger and Armbruster 2014, Diniz et al. 2017).

Survival of immatures, up to the end of the pupal stage was 99% for both treatments. These results are similar to those reported by Tejerina et al. (2009) and Padmanabha et al. (2011). For mass rearing purposes, immature survival is a key factor in the efficiency of the process to produce adequate quantities of quality sterile insects (Chambers 1977).

Development time of immatures was similar among the treatments at the beginning of pupation and adult emergence, but it differed in the end of the larval period and adult emergence, with the laboratory strain ending two days earlier than the wild strain. These differences have been reported in laboratory adapted strains that tend to have shorter development periods compared to their wild conspecifics (Miyatake and Yamagishi 1999, Allgod and Yee 2014). These differences are attributed to the selective pressures under artificial laboratory conditions (Hoffmann and Ross 2018). This implies factors such as temperature, diet and larval density, which have been shown to be the main factors affecting immatures development and survival (Couret et al. 2014). It is important to highlight that the development time of laboratory immatures was shorter than wild ones, this represents a desirable attribute for mass-rearing production (Christophers 1960).

Ae. aegypti females lived longer life spans than males. This is in agreement with other reports in the literature (Christophers 1960, Harrington et al. 2001, Styer et al. 2007, Tejerina et al. 2009, Reiskind et al. 2010, Brady et al. 2013). In our case, both males and females were confined in the same cage in which they had the opportunity to copulate from day 1 until their death. These differences between the sexes can be attributed to the cost of mating and reproduction that resulted in a decrease in males longevity (Liles and Delong 1960). Mosquito survival can also be influenced by the type of diet. In the wild, females feed more frequently and preferably on human blood (Scott et al. 1993), and in a laboratory environment a diet is imposed to which they have to adapt to complete their development (Styer et al. 2007). It has been observed that old females have to divide the energy resources of the diet for egg production, and reserves for survival (Styer et al. 2007, Chadee et al. 2017). In this case, laboratory mosquitoes still maintain similar survival traits as their wild conspecifics, since no differences were observed between them. Sterile (irradiated) females, was the only treatment where significant differences in survival was observed. This can be attributed to the effects of irradiation. Although irradiation doses have been evaluated with the aim of affecting only the germ cells to induce sterility, this is not entirely specific and might have side effects on the somatic cells of the mosquito, which may have an impact on their survival (Shetty et al. 2016, Bond et al. 2019).

Reproduction rates were higher in laboratory females (GFR = 77.89 eggs / female) than in wild females (GFR = 51.40 eggs / female). Even with this difference, in both treatments, fecundity is considered to be within the range reported by Tejerina et al. (2009), Sowilem et al. (2013), and Chadee et al. (2017), with fecundity values greater than 40 eggs / female. The differences between our treatments can be attributed to the adaptations that occur during the colonization processes. Laboratory-reared insect species have been reported to have higher fecundity rates and lower reproductive ages than their wild conspecifics (Liedo et al. 2010, Sánchez-Rosario et al. 2017, Quintero-Fong et al. 2018).

Regarding population demographic parameters, laboratory mosquitoes had higher growth rates compared to wild ones. The net fertility rate (R_0) of the laboratory treatment indicates that, on average, a female would be replaced by 27.1 females. Laboratory mosquitoes had a shorter generation time, and therefore, the time required for doubling its size was shorter. These are favorable adaptations for mass production. According to Yang et al. (2010), population growth rates tend to be lower in natural environments than under laboratory conditions. These adaptations of wild populations have been demonstrated, since although the same controlled conditions are managed in the laboratory, development variations have been reported according to the region, period and season of mosquito collection (Castro Jr et al. 2013). The higher growth rates of laboratory strains can be explained by the favorable and stable conditions to which they have been exposed for generations (Crovello and Hacker 1972, Vargas and Carey 1989).

In conclusion, adaptations to mass rearing conditions and irradiation cause changes in the functions and demographic parameters of *Ae. aegypti*. The comparisons among different treatments indicate that laboratory mosquitoes were favored with shorter immature development time, higher fecundity and greater population growth rates compared to wild mosquitoes. This suggests that it is possible to achieve desirable attributes in mass-reared insects through direct selection processes in colony management (Quintero-Fong et al. 2016, Sánchez-Rosario et al. 2017). The lower survival rates of sterile mosquitoes, particularly females, can be attributed to the adverse effects of irradiation. These data can be used as baseline for quality standards in mass-rearing. The demographic functions and parameters can also be used to develop optimal mass-rearing harvest models (Liedo and Carey 1994), and for the development of population models for vector suppression strategies.

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References Cited

Allgod, D. W., and D. A. Yee. 2014. Influence of resource levels, organic compounds and laboratory colonization on interspecific competition between the Asian tiger mosquito *Aedes albopictus* (Stegomyia albopicta) and the southern house mosquito *Culex quinquefasciatus*. Med. Vet. Entomol. 28: 273–286.

Baldacchino, F., B. Caputo, F. Chandre, A. Drago, A. della Torre, F. Montarsi, and A. Rizzoli. 2015. Control methods against invasive *Aedes* mosquitoes in Europe: A review. Pest Manag. Sci. 71: 1471–1485

Benedict, M. Q., B. G. J. Knols, H. C. Bossin, P. I. Howell, E. Mialhe, C. Caceres, and A. S. Robinson. 2009. Colonisation and mass rearing: learning from others. Malar. J. 8 (Suppl 2): S4.

Bond, J. G., A. Ramírez-Osorio, C. F. Marina, I. Fernández-Salas, P. Liedo, A. Dor, and T. Williams. 2017. Efficiency of two larval diets for mass-rearing of the mosquito *Aedes aegypti*. PLoS One 12(11): e0187420. doi:10.1371/journal.

Bond, J. G., A. R. Osorio, N. Avila, Y. Gomez-Simuta, P. Liedo, A. Dor, F. Marina, I. Fernández-Salas, O. Carvalho, K. Bourtzis, and W. Trevor. 2019. Optimization of irradiation dose to *Aedes aegypti* and *Ae. albopictus* in a sterile insect technique program. PLoS One. 14: e0212520. https://doi.org/10.1371/journal.pone.0212520.

Brady, O. J., M. a Johansson, C. a Guerra, S. Bhatt, N. Golding, D. M. Pigott, H. Delatte, M. G. Grech, P. T. Leisnham, R. Maciel-de-Freitas, L. M. Styer, D. L. Smith, T. W. Scott, P. W. Gething, and S. I. Hay. 2013. Modelling adult *Aedes aegypti* and *Aedes albopictus* survival at different temperatures in laboratory and field settings. Parasit. Vectors. 6: 351.

Calkins, C. O. and A. G. Parker. 2005. Sterile insect quality. pp. 269–296. In V. A. Dyck, J. Hendrichs and A. S. Robinson (eds.), sterile insect technique: principles and practice in area-wide integrated pest management. Springer, Dordrecht, The Netherlands.

Carey, J. R. 1993. Applied demography for biologists: with special emphasis on insects. Oxford University Press, New York.

Castro Jr, F. P., W. F. S. Martins, M. L. L. Filho, R. P. de Almeida, and E. B. Beserra. 2013. Ciclos de vida comparados de *Aedes aegypti* (Diptera, Culicidae) do semiárido da Paraíba. Iheringia. Série Zool. 103: 118–123.

Chadee, D. D., R. Martinez, and J. M. Sutherland. 2017. *Aedes aegypti* (L.) mosquitoes in Trinidad, West Indies : longevity case studies. Vector Ecol. 42: 130–135.

Chambers, D. L. 1977. Quality control in mass rearing. Annu. Rev. Entomol. 22: 289–308.

Christophers, S. R. 1960. *Aedes aegypti* (L.) the yellow fever mosquito. Its life history, bionomics and structure. Cambridge: Cambridge Univ. Press.

Couret, J., E. Dotson, and M. Q. Benedict. 2014. Temperature, larval diet, and density effects on development rate and survival of *Aedes aegypti* (Diptera: Culicidae). PLoS One. 9: e87468. doi:10.1371/journal.pone.00874689.

Crovello, T. J., and C. S. Hacker. 1972. Evolutionary strategies in life table characteristics among feral and urban strains of *Aedes aegypti* (L). Evolution 26: 185-19.

Denlinger, D. L., and P. A. Armbruster. 2014. Mosquito diapause. Annu. Rev. Entomol. 59: 73–93.

Diniz, A. D. F., R. C. M. Albuquerque, O. L. Oliva, V. M. A. Melo-Santos, and J. C. F. Ayres. 2017. Diapause and quiescence: dormancy mechanisms that contribute to the geographical expansion of mosquitoes and their evolutionary success. Parasit. Vectors. 10: 310.

Dor, A., A. M. Maggiani-Aguilera, J. Valle-Mora, J. G. Bond, C. F. Marina, and P. Liedo. **2020**. Assessment of *Aedes aegypti* (Diptera : Culicidae) males flight ability for SIT application: effect of device design , duration of test , and male age. J. Med. Entomol. 57: 824–829.

(FAO-IAEA) Food and Agriculture Organization of the United Nations/ International Atomic Energy Agency. 2017. Guidelines for routine colony maintenance of *Aedes* mosquito species version 1.0. IAEA, Vienna, Austria. http://www-naweb.iaea.org/nafa/ipc/public/guidelines-for-routine-colony-maintenance-of-Aedes-mosquito-species-v1.0.pdf

Fernández-Salas, I., R. Danis-Lozano, M. Casas-Martínez, A. Ulloa, J. G. Bond, C. F. Marina, T. Lopez-Ordóñez, A. Elizondo-Quiroga, J. A. Torres-Monzón, and E. E. Díaz-González. 2015. Historical inability to control *Aedes aegypti* as a main contributor of fast dispersal of chikungunya outbreaks in Latin America. Antiviral Res. 124: 30-42.

Harrington, L. C., J. D. Edman, and T. W. Scott. 2001. Why do female *Aedes aegypti* (Diptera: Culicidae) feed preferentially and frequently on human blood? J. Med. Entomol. 38: 411–422.

Hendrichs, M. A., V. Wornoayporn, B. Katsoyannos, and J. Hendrichs. 2007. Quality control method to measure predator evasion in wild and mass-reared mediterranean fruit flies (Diptera: Tephritidae). Florida Entomol. 90: 64–70.

Hernández, E., J. Toledo, T. Artiaga-López, and S. Flores. **2009**. Demographic changes in *Anastrepha obliqua* (Diptera: Tephritidae) throughout the laboratory colonization process. J. Econ. Entomol. 102: 542–551.

Hoffmann, A. A., and P. A. Ross. 2018. Rates and patterns of laboratory adaptation in (mostly) insects. J. Econ. Entomol. 111: 501–509.

Huho, B. J., K. R. Ng'habi, G. F. Killeen, G. Nkwengulila, B. G. J. Knols, and H. M. Ferguson. 2007. Nature beats nurture: a case study of the physiological fitness of free-living and laboratory-reared male *Anopheles gambiae* sl. J. Exp. Biol. 210: 2939-2947.

Knipling, E. F. 1955. Possibilities of insect control or eradication through the use of sexually sterile males. J. Econ. Entomol. 48: 459–462.

Liedo, P., and J. R. Carey.1994. Mass rearing of *Anastrepha* (Diptera: Tephritidae) fruit flies: a demographic analysis. J. Econ. Entomol. 87: 176–180.

Liedo, P., A. Oropeza, and J. R. Carey. 2010. Demografía y sus implicaciones en los programas de control. pp. 81–90. In P. Montoya, J. Toledo and E. Hernández. (eds.), Moscas de la fruta fundamentos y procedimientos para su manejo. S y G edit, México, D.F.

Liles, J. N., and D. M. Delong. 1960. The longevity and productivity of adult male and female *Aedes aegypti* when reared separately and together on three different diets. Ann. Entomol. Soc. Am. 53: 277-280.

Manorenjitha, M. S., and J. Zairi. 2015. The adaptation of field collected *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse) in laboratory condition. Int. J. Life Sci. Med. Res. 5: 25–30.

Marina, C. F., J. G. Bond, J. Muñoz, J. Valle, H. Quiroz-Martínez, J. A. Torres-Monzón, and T. Williams. **2018**. Efficacy of larvicides for the control of dengue, Zika, and chikungunya vectors in an urban cemetery in southern Mexico. Parasitol. Res. 117: 1941–1952.

McInnis, D. O., D. R. Lance, and C. G. Jackson. 1996. Behavioral resistance to the sterile insect technique by Mediterranean fruit fly (Diptera: Tephritidae) in Hawaii. Ann. Entomol. Soc. Am. 89: 739–744.

Miyatake, T., and M. Yamagishi. 1999. Rapid evolution of larval development time during mass-rearing in the melon fly, *Bactrocera cucurbitae*. Res. Popul. Ecol. 41: 291–297.

Padmanabha, H., C. C. Lord, and L. P. Lounibos. 2011. Temperature induces trade-offs between development and starvation resistance in *Aedes aegypti* (L.) larvae. Med. Vet. Entomol. 25: 445–453.

Pereira, R., B. Yuval, P. Liedo, P. E. A. Teal, T. E. Shelly, D. O. McInnis, and J. Hendrichs. 2013. Improving sterile male performance in support of programmes integrating the sterile insect technique against fruit flies. J. Appl. Entomol. 137(Suppl 1): 178–190.

Quintero-Fong, L., J. Toledo, L. Ruiz, P. Rendón, D. Orozco-Dávila, L. Cruz, and P. Liedo. 2016. Selection by mating competitiveness improves the performance of *Anastrepha ludens* males of the genetic sexing strain Tapachula-7. Bull. Entomol. Res. 106: 624–632.

Quintero-Fong, L., J. Toledo, L. Ruiz-Montoya, P. Rendón, D. Orozco-Dávila, J. Valle-Mora, and P. Liedo. 2018. Demography of a genetic sexing strain of *Anastrepha ludens* (Diptera: Tephritidae): effects of selection based on mating performance. Agric. For. Entomol. 20: 1-8.

R Core Team. 2019. R: A language and environment for statistical computing. Version 3.6.2. R foundation for statistical computing, Vienna, Austria. https://www.R-project.org/.

Reiskind, M. H., C. J. Westbrook, and L. P. Lounibos. 2010. Exposure to chikungunya virus and adult longevity in *Aedes aegypti* (L.) and *Aedes albopictus*

(Skuse). Vector Ecol. 35: 61–68.

Rey, J. R., and P. Lounibos. 2015. Ecología de *Aedes aegypti* y *Aedes albopictus* en América y la transmisión de enfermedades. Biomédica. 35: 177–185.

Sánchez-Rosario, M., D. Pérez-Staples, J. Toledo, J. Valle-Mora, and P. Liedo.2017. Artificial selection on mating competitiveness of *Anastrepha ludens* for sterile insect technique application. Entomol. Exp. Appl. 162: 133–147.

Scott, T. W., E. Chow, D. Strickman, P. Kittayapong, R. A. Wirtz, L. H. Lorenz, and J. D. Edman. 1993. Blood-feeding patterns of *Aedes aegypti* (Diptera: Culicidae) collected in a rural Thai village. J. Med. Entomol. 30: 922–927.

Shetty, V., N. J. Shetty, B. P. Harini, S. R. Ananthanarayana, S. K. Jha, and R. C. Chaubey. 2016. Effect of gamma radiation on life history traits of *Aedes aegypti* (L.). Parasite Epidemiol. Control. 1: 26–35.

Silva, I. G., M. F. Camargo, M. Elias, and C. N. Elias. 1993. Ciclo evolutivo de *Aedes* (stegomyia) *aegypti* (Linnaeus, 1762) (Diptera, culicidae). Rev. Patol. Trop. 22: 43–48.

Soares-Pinheiro, V. C., W. Dasso-Pinheiro, J. M. Trindade-Bezerra, and W. P. Tadei. 2017. Eggs viability of *Aedes aegypti* Linnaeus (Diptera, Culicidae) under different environmental and storage conditions in Manaus, Amazonas, Brazil. Braz. J. Biol. 77: 396–401.

Sowilem, M. M., H. A. Kamal, and E. I. Khater. 2013. Life table characteristics of *Aedes aegypti* (Diptera: Culicidae) from Saudi Arabia. Trop. Biomed. 30: 301–314.

Styer, L. M., S. L. Minnick, A. K. Sun, and T. W. Scott. 2007. Mortality and reproductive dynamics of *Aedes aegypti* (Diptera: Culicidae) fed human blood. Vector Borne Zoonotic Dis. 7: 86–98.

Tejerina, E. F., F. F. L. Almeida, and W. R. Almirón. 2009. Bionomics of *Aedes aegypti* subpopulations (Diptera: Culicidae) from Misiones province, northeastern Argentina. Acta Trop. 109: 45–49.

Vargas, R. I., and J. R. Carey. 1989. Comparison of demographic parameters for wild and laboratory-adapted Mediterranean fruit fly (Diptera: Tephritidae). Ann. Entomol. Soc. Am. 82: 55-59.

Yang, A. X., Y. Zhang, L. Hua, T. Liu, X. Yang, Y. Zhang, and L. E. I. Hua. 2010. Life history and life tables of *Bactericera cockerelli* (Hemiptera: Psyllidae) on potato under laboratory and field conditions in the lower Rio Grande Valley of Texas. J. Econ. Entomol. 103: 1729–1734.

Figures legends

Fig. 1. Daily egg hatch of wild and laboratory adapted *Aedes aegypti* eggs under laboratory conditions.

Fig. 2. Development time and relative distribution of *Aedes aegypti* immature stages: Larvae, Pupae and Adults under laboratory conditions. A: Wild strain, B: Laboratory adapted strain.

Fig. 3. Survival curves of wild, laboratory and irradiated-laboratory *Aedes aegypti* males (A) and females (B) under laboratory conditions.

Fig. 4. Daily net fecundity expressed in eggs/female for wild and laboratory *Aedes aegypti* strains under laboratory conditions

Figure 1

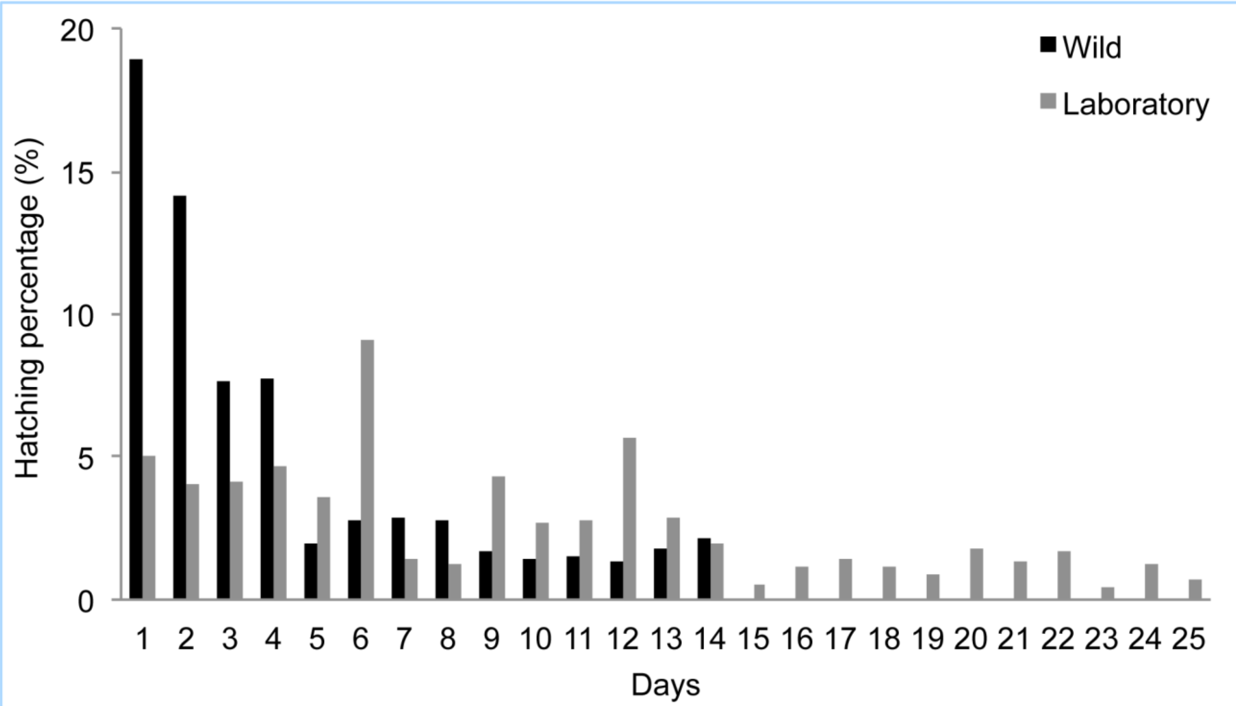
Wild
Laboratory
Hatching percentage (%)
0
5
10
15
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Days

Figure 2

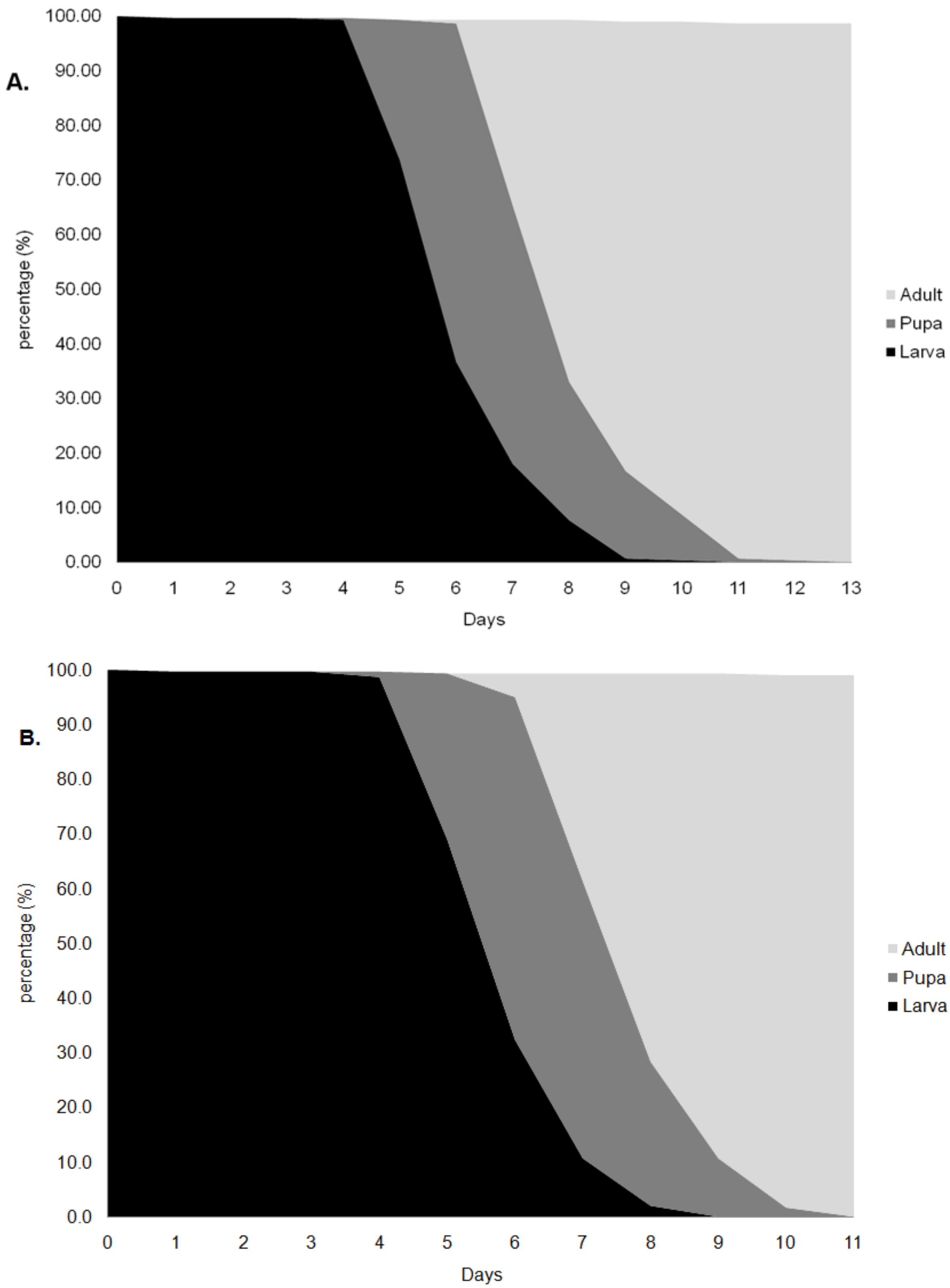
A.
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
percentage (%)
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Days
Adult
Pupa
Larva
B.
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
percentage (%)
0 1 2 3 4 5 6 7 8 9 10 11
Days
Adult
Pupa
Larva

Figure 3

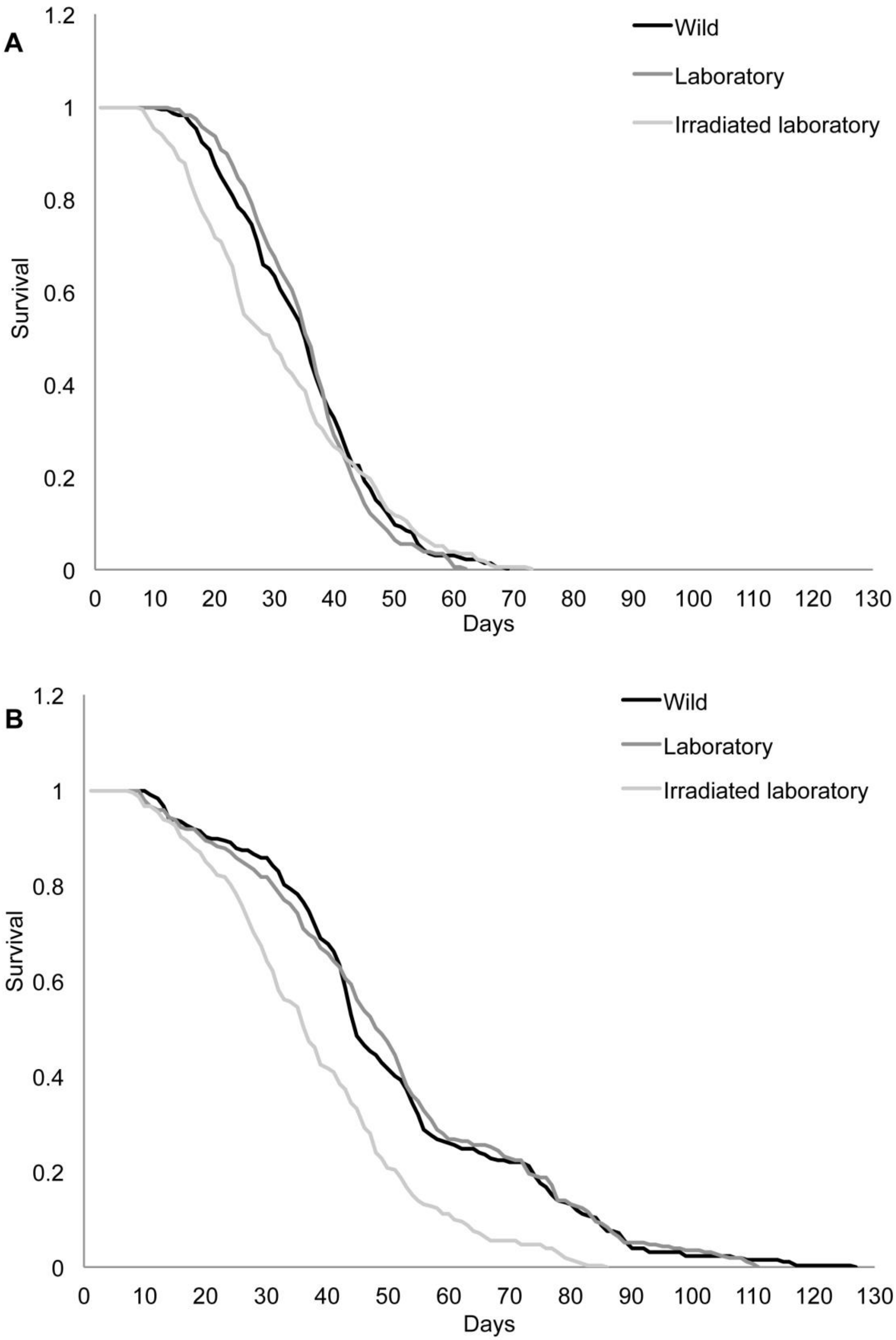
A
B
Wild
Laboratory
Irradiated laboratory
Survival
Days
1.2
1
0.8
0.6
0.4
0.2
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130

Figure 4

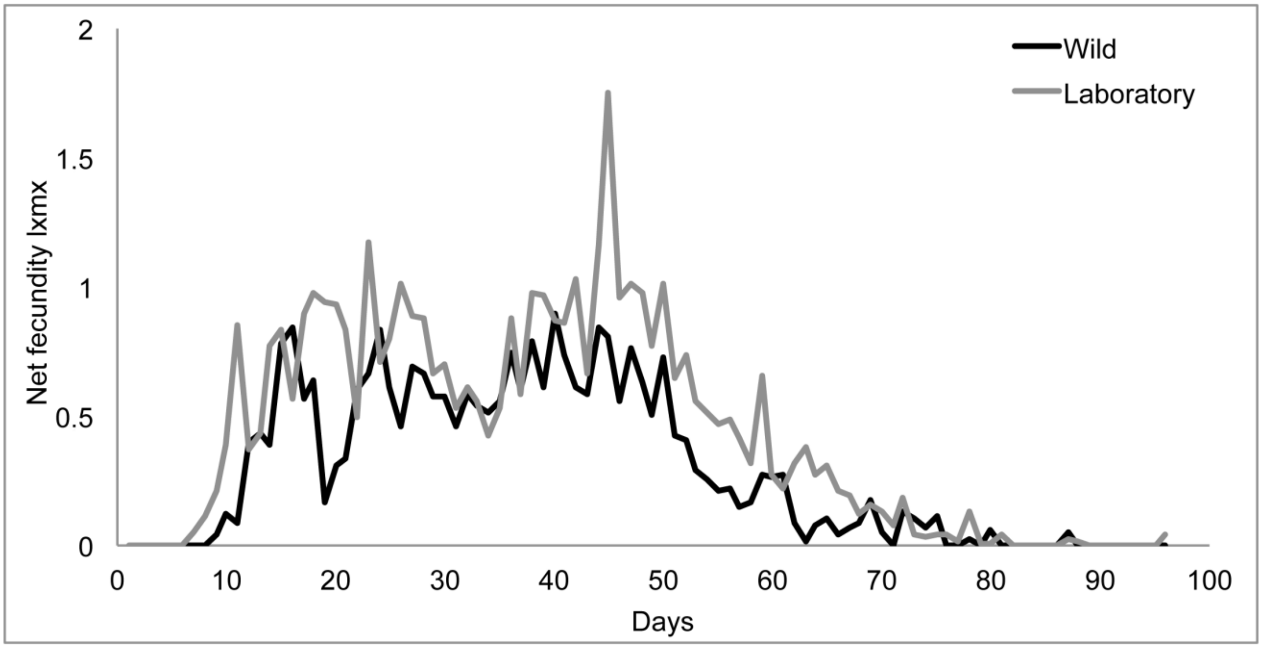
Wild
Laboratory
Net fecundity lxmx
2
1.5
1
0.5
0
0
10
20
30
40
50
60
70
80
90
100
Days

Table 1

Table. 1. Reproductive parameters of wild and laboratory adapted *Ae. aegypti* strains under laboratory conditions (26°C ± 1°C, 75±5% RH, and 12:12 h L:D).

Parameters	**Wild**	**Laboratory**
Gross fecundity (eggs/female)	51.4	77.9
Net fecundity (eggs/female)	28.1	41.7
Fertility (% egg hatch)	67.9	76.9
Mean Age of Reproduction (days)	36.2	36.7

Table 2

Table. 2. Population demographic parameters of wild and laboratory adapted *Ae. aegypti* strains under laboratory conditions (26°C ± 1°C, 75±5% RH, and 12:12 h L:D).

Parameters	**Wild**	**Laboratory non-irradiated**	**Laboratory irradiated**
Adult life expectancy Males (e_0) (days)	33.7	33.9	29.9
Adult life expectancy Females (e_0) (days)	49.2	49.5	36.9
Population life expectancy Females (e_0)	43.0	40.1	32.0
Net reproductive rate (R_0) (females eggs / female)	19.0366	27.1	–
Generation Time (T) (days)	50.1508	48.7220	–
Intrinsic rate of increase (r)	0.0588	0.0677	–
Finite rate of increase (λ)	1.0605	1.0701	–
Doubling Time (DT) (days)	11.7982	10.2314	–

Capítulo III

Conclusiones

Se construyeron tablas de vida y se generó información sobre las siguientes funciones y parámetros demográficos: sobrevivencia, esperanza de vida, fecundidad y tasas de crecimiento poblacional.

En el estado de huevo la cepa silvestre tuvo un menor tiempo de incubación y un mayor porcentaje de eclosión en comparación con la cepa de laboratorio.

Las etapas de larvas y pupas de la cepa de laboratorio tuvieron un menor tiempo de desarrollo para llegar a la etapa de adulto con una sobrevivencia del 99 %. Esto se puede considerar un dato importante para conocer el tiempo y la cantidad de mosquitos que se obtendrán a partir de un lote de larvas a la hora de implementar la producción masiva.

Se determinó que no existen diferencias significativas en la sobrevivencia de machos de los diferentes tratamientos. La sobrevivencia de las hembras estériles fue significativamente menor en comparación con las silvestres y con las de laboratorio fértil (no irradiadas). Asimismo, las hembras tuvieron mayor sobrevivencia que los machos.

Las hembras fértiles de laboratorio tuvieron mayores tasas de fecundidad en comparación con las hembras silvestres. Además, iniciaron la oviposición dos días antes que las silvestres, junto con un mayor porcentaje de eclosión de los huevos, lo que se traduce en una mayor capacidad reproductiva, lo cual concuerda con el proceso de adaptación de los insectos silvestres a condiciones de laboratorio descrito por Hoffmann y Ross (2018). También se determinó que la cepa de laboratorio tiene mayores tasas de crecimiento poblacional que la cepa silvestre, en condiciones de laboratorio.

Se demostró que las condiciones de laboratorio han repercutido de manera favorable en las funciones y parámetros poblacionales de la cepa de laboratorio (Mex CGD). Con esta información se pueden identificar los rasgos de calidad de la colonia con la que se está implementando la cría masiva. Aunque se caracterizaron atributos favorables para la cepa de laboratorio, esto no garantiza su desempeño en ambientes naturales y fluctuantes. Para ello es necesario desarrollar y aplicar diversas pruebas de control de calidad que indiquen la capacidad de sobrevivencia, dispersión y competitividad sexual de los mosquitos estériles.

Literatura citada

Beserra EB, Castro Jr FP. 2008. Biologia comparada de populações de *Aedes* (Stegomyia) *aegypti* (L.)(Diptera: Culicidae) da Paraíba. Neotrop. Entomol. 37(1):81–85. doi:10.1590/S1519-566X2008000100012.

Bond JG, Osorio AR, Avila N, Gomez-Simuta Y, Liedo P, Dor A, Marina F, Fernández-Salas I, Carvalho O, Bourtzis K, et al. 2019. Optimization of irradiation dose to *Aedes aegypti* and *Ae. albopictus* in a sterile insect technique program. PLoS One 14(2): e0212520. https://doi.org/10.1371/journal.pone.0212520.

Bond JG, Ramírez-Osorio A, Marina CF, Fernández-Salas I, Liedo P, Dor A, Williams T. 2017. Efficiency of two larval diets for mass-rearing of the mosquito *Aedes aegypti*. PLoS ONE 12(11): e0187420. https://doi.org/10.1371/journal. pone.0187420.

Carey JR. 1993. Applied demography for biologists: with special emphasis on insects. Oxford University Press, New York.

Chadee DD, Martinez R, Sutherland JM. 2017. *Aedes aegypti* (L.) mosquitoes in Trinidad, West Indies: longevity case studies. J. Vector Ecol. 42(1):130–135. doi:10.1111/jvec.12247.

Costanzo KS, Schelble S, Jerz K, Keenan M. 2015. The effect of photoperiod on life history and blood-feeding activity in *Aedes albopictus* and *Aedes aegypti* (Diptera: Culicidae). J. Vector Ecol. 40(1): 164–171. doi:10.1111/jvec.12146.

Costero A, Edman JD, Clark GG, Scott TW. 1998. Life table study of *Aedes aegypti* (Diptera: Culicidae) in Puerto Rico fed only human blood versus blood plus sugar. Entomol. Soc. Am. 35(5): 809–813.

Couret J, Dotson E, Benedict MQ. 2014. Temperature, larval diet, and density effects on development rate and survival of *Aedes aegypti* (Diptera: Culicidae). PLoS One 9(2): doi:10.1371/journal.pone.0087468.

Crovello TJ, Hacker CS. 1972. Evolutionary strategies in life table characteristics among feral and urban strains of *Aedes aegypti* (L.). Evolution 26(2): 185-196. doi:10.2307/2407030.

Fernández-Salas I, Danis-Lozano R, Casas-Martínez M, Ulloa A, Bond JG, Marina CF, Lopez-Ordóñez T, Elizondo-Quiroga A, Torres-Monzón JA, Díaz-González EE. 2015. Historical inability to control *Aedes aegypti* as a main contributor of fast dispersal of chikungunya outbreaks in Latin America. Antiviral Res. 124: 30–42. doi:10.1016/j.antiviral.2015.10.015.

Gilles JRL, Lees RS, Soliban SM, Benedict MQ. 2011. Density-dependent effects in experimental larval populations of *Anopheles arabiensis* (Diptera: Culicidae) can be negative, neutral, or overcompensatory depending on density and diet levels. J. Med. Entomol. 48(2): 296–304. doi:10.1603/ME09209.

Hoffmann AA, Ross PA. 2018. Rates and patterns of laboratory adaptation in (mostly) insects. J. Econ. Entomol. 111(2): 501–509. doi:10.1093/jee/toy024.

Knipling EF. 1955. Possibilities of insect control or eradication through the use of sexually sterile males1. J. Econ. Entomol. 48: 459–462.

Kohane MJ, Parsons PA. 1988. Domestication: evolutionary change under stress. Evol. Biol. 23: 31–48.

Lee SS, Baker R, Gaffney E, White SM. 2013. Modelling *Aedes aegypti* mosquito control via transgenic and sterile insect techniques: endemics and emerging outbreaks. J. Theor. Biol. 331(1): 78-90. doi:10.1016/j.jtbi.2013.04.014.

Maimusa HA, Ahmad AH, Kassim NFA, Rahim J. 2016. Age-stage, two-sex life table characteristics of *Aedes albopictus* and *Aedes aegypti* in Penang island, Malaysia. J. Am. Mosq. Control Assoc. 32(1):1–11. doi:10.2987/moco-32-01-1-11.1.

Manorenjitha MS, Zairi J. 2015. The adaptation of field collected *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse) in laboratory condition. Int. J. Life Sci. Med. Res. 5(4):

25–30. doi:10.5963/LSMR0504001.

Mohammed A, Chadee DD. 2011. Effects of different temperature regimens on the development of *Aedes aegypti* (L.) (Diptera: Culicidae) mosquitoes. Acta Trop. 119(1): 38–43. doi:10.1016/j.actatropica.2011.04.004.

[OMS] Organización Mundial de la Salud. 2017. Respuesta mundial para el control de vectores 2017–2030. Versión 5.4: 57.

Peterson RKD, Davis RS, Higley LG, Fernandes OA. 2009. Mortality risk in insects. Environ. Entomol. 38(1): 2–10.https://doi.org/10.1603/022.038.0102.

Reinert JF, Harbach RE, Kitching IJ. 2009. Phylogeny and classification of tribe Aedini (Diptera: Culicidae). Zool. J. Linn. Soc. 157(4): 700–794. doi:10.1111/j.1096-3642.2009.00570.x.

Rozilawati H, Mohd MS, Tanaselvi K, Mohd ZT, Zairi J, Nazni W, Lee H. 2017. Life table characteristics of Malaysian strain *Aedes albopictus* (Skuse). Serangga. 22(1): 85–121.

Schmidt CA, Comeau G, Monaghan AJ, Williamson DJ, Ernst KC. 2018. Effects of desiccation stress on adult female longevity in *Aedes aegypti* and *Ae. albopictus* (Diptera: Culicidae): results of a systematic review and pooled survival analysis. Parasit. Vectors. 11(1): 267 https://doi.org/10.1186/s13071-018-2808-6.

Scott TW, Chow E, Strickman D, Kittayapong P, Wirtz RA, Lorenz LH, Edman JD. 1993. Blood-feeding patterns of *Aedes aegypti* (Diptera: Culicidae) collected in a rural Thai village. J. Med. Entomol. 30(5): 922–927. doi:10.1093/jmedent/30.5.922.

Sowilem MM, Kamal HA, Khater EI. 2013. Life table characteristics of *Aedes aegypti* (Diptera: Culicidae) from Saudi Arabia. Trop. Biomed. 30 (2): 301–314.PMID: 23959496

StyerLM, Minnick SL, Sun AK, Scott TW. 2007. Mortality and reproductive dynamics of *Aedes aegypti* (Diptera: Culicidae) fed human blood. Vector Borne Zoonotic Dis.

7(1): 86–98. doi:10.1089/vbz.2007.0216.

Tejerina EF, Luduena AFF, Almirón WR. 2008. Bionomics of *Aedes aegypti* subpopulations (Diptera: Culicidae) from Misiones province, northeastern Argentina. Acta Trop. 109(1):45–49. doi:10.1016/j.actatropica.2008.09.014

Anexos

Tabla de vida de machos *Aedes aegypti* cepa silvestre

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
H	0	300	1.000	0.684	0.316	0.316	0.842	32.538	32.538
L	1	205	0.684	1.000	0.000	0.000	0.684	31.696	46.313
L	2	205	0.684	1.000	0.000	0.000	0.684	31.011	45.313
L	3	205	0.684	1.000	0.000	0.000	0.684	30.327	44.313
L	4	205	0.684	0.997	0.003	0.002	0.683	29.643	43.313
L-P	5	205	0.682	1.000	0.000	0.000	0.682	28.959	42.457
L-P	6	205	0.682	1.000	0.000	0.000	0.682	28.277	41.457
L-P	7	205	0.682	1.000	0.000	0.000	0.682	27.595	40.457
L-P-A	8	205	0.682	0.997	0.003	0.002	0.681	26.913	39.457
L-P-A	9	204	0.680	1.000	0.000	0.000	0.680	26.232	38.588
L-P-A	10	204	0.680	0.997	0.003	0.002	0.679	25.552	37.588
P-A	11	203	0.678	1.000	0.000	0.000	0.678	24.874	36.713
P-A	12	203	0.678	1.000	0.000	0.000	0.678	24.196	35.713
A	13	203	0.678	1.000	0.000	0.000	0.678	23.519	34.713
A	14	203	0.678	1.000	0.000	0.000	0.678	22.841	33.713
A	15	203	0.678	1.000	0.000	0.000	0.678	22.164	32.713
A	16	203	0.678	1.000	0.000	0.000	0.678	21.486	31.713
A	17	203	0.678	1.000	0.000	0.000	0.678	20.809	30.713
A	18	203	0.678	1.000	0.000	0.000	0.678	20.131	29.713
A	19	203	0.678	1.000	0.000	0.000	0.678	19.454	28.713
A	20	203	0.678	1.000	0.000	0.000	0.678	18.776	27.713
A	21	203	0.678	0.997	0.003	0.002	0.676	18.099	26.713
A	22	203	0.675	1.000	0.000	0.000	0.675	17.422	25.801
A	23	203	0.675	0.997	0.003	0.002	0.674	16.747	24.801
A	24	202	0.673	1.000	0.000	0.000	0.673	16.073	23.883
A	25	202	0.673	0.993	0.007	0.005	0.671	15.400	22.883
A	26	201	0.668	0.997	0.003	0.002	0.667	14.729	22.034
A	27	200	0.666	1.000	0.000	0.000	0.666	14.062	21.107
A	28	200	0.666	0.983	0.017	0.011	0.661	13.396	20.107
A	29	196	0.655	0.986	0.014	0.009	0.650	12.735	19.445
A	30	194	0.646	0.969	0.031	0.020	0.636	12.085	18.710
A	31	188	0.626	0.982	0.018	0.011	0.620	11.449	18.301
A	32	184	0.614	0.963	0.037	0.023	0.603	10.829	17.629
A	33	178	0.592	0.973	0.027	0.016	0.584	10.226	17.282
A	34	173	0.576	0.973	0.027	0.016	0.568	9.642	16.743
A	35	168	0.560	0.976	0.024	0.014	0.553	9.074	16.202
A	36	164	0.547	0.971	0.029	0.016	0.539	8.521	15.591
A	37	159	0.531	0.983	0.017	0.009	0.526	7.982	15.040

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
A	38	157	0.522	0.970	0.030	0.016	0.514	7.456	14.292
A	39	152	0.506	0.946	0.054	0.027	0.492	6.942	13.723
A	40	144	0.479	0.934	0.066	0.032	0.463	6.450	13.472
A	41	134	0.447	0.985	0.015	0.007	0.444	5.987	13.389
A	42	132	0.440	0.974	0.026	0.011	0.435	5.543	12.587
A	43	129	0.429	0.958	0.042	0.018	0.420	5.108	11.905
A	44	123	0.411	0.962	0.038	0.016	0.403	4.688	11.407
A	45	119	0.395	0.966	0.034	0.014	0.388	4.285	10.843
A	46	114	0.382	0.953	0.047	0.018	0.373	3.897	10.210
A	47	109	0.364	0.925	0.075	0.027	0.350	3.524	9.693
A	48	101	0.336	0.906	0.094	0.032	0.321	3.174	9.433
A	49	91	0.305	0.911	0.089	0.027	0.291	2.853	9.359
A	50	83	0.278	0.919	0.081	0.023	0.266	2.562	9.224
A	51	77	0.255	0.929	0.071	0.018	0.246	2.296	8.996
A	52	71	0.237	0.943	0.057	0.014	0.230	2.049	8.643
A	53	67	0.224	0.909	0.091	0.020	0.213	1.819	8.136
A	54	61	0.203	0.844	0.156	0.032	0.187	1.606	7.900
A	55	51	0.172	0.895	0.105	0.018	0.163	1.418	8.263
A	56	46	0.154	0.985	0.015	0.002	0.152	1.256	8.176
A	57	45	0.151	0.866	0.134	0.020	0.141	1.103	7.291
A	58	39	0.131	0.897	0.103	0.014	0.124	0.962	7.345
A	59	35	0.117	0.865	0.135	0.016	0.110	0.838	7.135
A	60	30	0.102	0.911	0.089	0.009	0.097	0.728	7.167
A	61	28	0.093	0.902	0.098	0.009	0.088	0.631	6.817
A	62	25	0.084	0.784	0.216	0.018	0.075	0.543	6.500
A	63	20	0.065	0.966	0.034	0.002	0.064	0.469	7.155
A	64	19	0.063	0.893	0.107	0.007	0.060	0.404	6.393
A	65	17	0.056	0.960	0.040	0.002	0.055	0.344	6.100
A	66	16	0.054	0.667	0.333	0.018	0.045	0.289	5.333
A	67	11	0.036	0.813	0.188	0.007	0.033	0.244	6.750
A	68	9	0.029	0.769	0.231	0.007	0.026	0.211	7.192
A	69	7	0.023	0.900	0.100	0.002	0.021	0.185	8.200
A	70	6	0.020	1.000	0.000	0.000	0.020	0.164	8.056
A	71	6	0.020	1.000	0.000	0.000	0.020	0.143	7.056
A	72	6	0.020	1.000	0.000	0.000	0.020	0.123	6.056
A	73	6	0.020	0.889	0.111	0.002	0.019	0.103	5.056
A	74	5	0.018	0.875	0.125	0.002	0.017	0.084	4.625
A	75	5	0.016	1.000	0.000	0.000	0.016	0.067	4.214
A	76	5	0.016	1.000	0.000	0.000	0.016	0.051	3.214
A	77	5	0.016	0.571	0.429	0.007	0.012	0.035	2.214

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
A	78	3	0.009	1.000	0.000	0.000	0.009	0.023	2.500
A	79	3	0.009	0.500	0.500	0.005	0.007	0.014	1.500
A	80	1	0.005	1.000	0.000	0.000	0.005	0.007	1.500
A	81	1	0.005	0.000	1.000	0.005	0.002	0.002	0.500
A	82	0	0.000			0.000	0.000	0.000	0.000

Tabla de vida de hembras *Aedes aegypti* cepa silvestre

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	l_xm_x	c_x
H	0	300	1.000	0.684	0.316	0.316	0.8422	43.004	43.004	0.0000	0.0000	0.0856971
L	1	205	0.684	1.000	0.000	0.000	0.6844	42.162	61.606	0.0000	0.0000	0.0553028
L	2	205	0.684	1.000	0.000	0.000	0.6844	41.478	60.606	0.0000	0.0000	0.0521474
L	3	205	0.684	1.000	0.000	0.000	0.6844	40.793	59.606	0.0000	0.0000	0.0491720
L	4	205	0.684	0.997	0.003	0.002	0.6832	40.109	58.606	0.0000	0.0000	0.0463663
L-P	5	205	0.682	1.000	0.000	0.000	0.6821	39.426	57.801	0.0000	0.0000	0.0435746
L-P	6	205	0.682	1.000	0.000	0.000	0.6821	38.743	56.801	0.0000	0.0000	0.0410883
L-P	7	205	0.682	1.000	0.000	0.000	0.6821	38.061	55.801	0.0000	0.0000	0.0387439
L-P-A	8	205	0.682	0.997	0.003	0.002	0.6809	37.379	54.801	0.0000	0.0000	0.0365333
L-P-A	9	204	0.680	1.000	0.000	0.000	0.6798	36.698	53.984	0.0000	0.0000	0.0343332
L-P-A	10	204	0.680	0.997	0.003	0.002	0.6787	36.019	52.984	0.0000	0.0000	0.0323742
P-A	11	203	0.678	1.000	0.000	0.000	0.6775	35.340	52.161	0.0000	0.0000	0.0304242
P-A	12	203	0.678	1.000	0.000	0.000	0.6775	34.662	51.161	0.0000	0.0000	0.0286883
A	13	203	0.678	0.999	0.001	0.001	0.6771	33.985	50.161	0.0000	0.0000	0.0270514
A	14	203	0.677	1.000	0.000	0.000	0.6767	33.308	49.223	0.0000	0.0000	0.0254761
A	15	203	0.677	1.000	0.000	0.000	0.6767	32.631	48.223	0.0000	0.0000	0.0240225
A	16	203	0.677	1.000	0.000	0.000	0.6767	31.954	47.223	0.0000	0.0000	0.0226519
A	17	203	0.677	1.000	0.000	0.000	0.6767	31.278	46.223	0.0000	0.0000	0.0213594
A	18	203	0.677	1.000	0.000	0.000	0.6767	30.601	45.223	0.0000	0.0000	0.0201407
A	19	203	0.677	1.000	0.000	0.000	0.6767	29.924	44.223	0.0000	0.0000	0.0189915
A	20	203	0.677	1.000	0.000	0.000	0.6767	29.248	43.223	0.0000	0.0000	0.0179079
A	21	203	0.677	1.000	0.000	0.000	0.6767	28.571	42.223	0.0000	0.0000	0.0168861
A	22	203	0.677	1.000	0.000	0.000	0.6767	27.894	41.223	0.0000	0.0000	0.0159226
A	23	203	0.677	0.990	0.010	0.007	0.6733	27.218	40.223	0.0433	0.0294	0.0150141
A	24	201	0.670	0.993	0.007	0.005	0.6676	26.545	39.625	0.1229	0.0824	0.0140159
A	25	200	0.665	0.983	0.017	0.011	0.6598	25.877	38.890	0.0847	0.0565	0.0131272
A	26	196	0.654	0.972	0.028	0.018	0.6451	25.217	38.552	0.4086	0.2676	0.0121684
A	27	191	0.636	0.996	0.004	0.002	0.6349	24.572	38.631	0.4645	0.2958	0.0111576
A	28	190	0.634	0.996	0.004	0.002	0.6327	23.937	37.767	0.4128	0.2620	0.0104836
A	29	189	0.632	0.993	0.007	0.005	0.6293	23.304	36.900	0.8393	0.5307	0.0098503
A	30	188	0.627	0.989	0.011	0.007	0.6237	22.675	36.162	0.9101	0.5714	0.0092219
A	31	186	0.620	0.996	0.004	0.002	0.6192	22.051	35.551	0.6218	0.3862	0.0086019
A	32	185	0.618	0.989	0.011	0.007	0.6146	21.432	34.679	0.6971	0.4313	0.0080816
A	33	183	0.611	0.996	0.004	0.002	0.6101	20.818	34.057	0.1845	0.1129	0.0075370
A	34	183	0.609	0.996	0.004	0.002	0.6079	20.208	33.181	0.3481	0.2123	0.0070808
A	35	182	0.607	0.996	0.004	0.002	0.6056	19.600	32.303	0.3773	0.2292	0.0066520
A	36	181	0.604	0.996	0.004	0.002	0.6034	18.994	31.422	0.6791	0.4110	0.0062492
A	37	181	0.602	0.989	0.011	0.007	0.5989	18.391	30.537	0.7434	0.4483	0.0058706

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	l_xm_x	c_x
A	38	179	0.595	0.992	0.008	0.005	0.5932	17.792	29.879	0.9470	0.5646	0.0054734
A	39	177	0.591	1.000	0.000	0.000	0.5910	17.199	29.103	0.6966	0.4121	0.0051220
A	40	177	0.591	0.992	0.008	0.005	0.5887	16.608	28.103	0.5305	0.3139	0.0048298
A	41	176	0.586	0.992	0.008	0.005	0.5842	16.019	27.315	0.8019	0.4709	0.0045195
A	42	175	0.582	0.996	0.004	0.002	0.5808	15.435	26.523	0.7733	0.4505	0.0042288
A	43	174	0.580	0.984	0.016	0.009	0.5752	14.854	25.625	0.6712	0.3896	0.0039721
A	44	171	0.571	0.984	0.016	0.009	0.5661	14.279	25.022	0.6798	0.3884	0.0036871
A	45	168	0.562	0.968	0.032	0.018	0.5526	13.713	24.416	0.5542	0.3117	0.0034218
A	46	163	0.544	0.988	0.012	0.007	0.5402	13.160	24.210	0.7282	0.3963	0.0031229
A	47	161	0.537	0.983	0.017	0.009	0.5323	12.620	23.508	0.6765	0.3636	0.0029080
A	48	158	0.528	0.983	0.017	0.009	0.5233	12.088	22.902	0.6560	0.3467	0.0026960
A	49	156	0.519	0.974	0.026	0.014	0.5120	11.564	22.291	0.7326	0.3805	0.0024987
A	50	152	0.505	0.960	0.040	0.020	0.4951	11.052	21.875	0.9978	0.5047	0.0022947
A	51	145	0.485	0.963	0.037	0.018	0.4759	10.557	21.770	0.8395	0.4076	0.0020768
A	52	140	0.467	0.981	0.019	0.009	0.4624	10.081	21.592	1.1401	0.5330	0.0018855
A	53	137	0.458	0.980	0.020	0.009	0.4534	9.619	21.007	0.9039	0.4144	0.0017435
A	54	135	0.449	0.955	0.045	0.020	0.4387	9.165	20.420	1.3568	0.6098	0.0016117
A	55	129	0.429	0.926	0.074	0.032	0.4128	8.727	20.363	1.1632	0.4991	0.0014510
A	56	119	0.397	0.903	0.097	0.038	0.3778	8.314	20.943	1.0426	0.4144	0.0012674
A	57	108	0.359	0.918	0.082	0.029	0.3440	7.936	22.129	1.1069	0.3975	0.0010796
A	58	99	0.329	0.952	0.048	0.016	0.3214	7.592	23.055	1.7397	0.5736	0.0009348
A	59	94	0.314	0.978	0.022	0.007	0.3101	7.271	23.191	1.7482	0.5488	0.0008392
A	60	92	0.307	0.978	0.022	0.007	0.3034	6.961	22.691	1.2353	0.3794	0.0007742
A	61	90	0.300	0.970	0.030	0.009	0.2955	6.657	22.192	1.7256	0.5183	0.0007140
A	62	87	0.291	0.969	0.031	0.009	0.2865	6.362	21.864	1.4612	0.4257	0.0006530
A	63	85	0.282	0.960	0.040	0.011	0.2763	6.075	21.548	1.2120	0.3421	0.0005966
A	64	81	0.271	0.983	0.017	0.005	0.2684	5.799	21.425	1.8208	0.4934	0.0005401
A	65	80	0.266	0.949	0.051	0.014	0.2594	5.531	20.780	1.0890	0.2902	0.0005008
A	66	76	0.253	0.920	0.080	0.020	0.2425	5.271	20.866	1.0804	0.2733	0.0004482
A	67	70	0.232	0.932	0.068	0.016	0.2244	5.029	21.646	0.8495	0.1976	0.0003887
A	68	65	0.217	0.906	0.094	0.020	0.2064	4.804	22.188	0.8073	0.1750	0.0003416
A	69	59	0.196	0.954	0.046	0.009	0.1917	4.598	23.431	0.7414	0.1457	0.0002919
A	70	56	0.187	0.976	0.024	0.005	0.1850	4.406	23.536	0.8072	0.1513	0.0002626
A	71	55	0.183	0.975	0.025	0.005	0.1804	4.221	23.105	0.5556	0.1016	0.0002416
A	72	53	0.178	0.987	0.013	0.002	0.1771	4.041	22.677	0.6329	0.1129	0.0002222
A	73	53	0.176	0.987	0.013	0.002	0.1748	3.864	21.962	1.0577	0.1863	0.0002069
A	74	52	0.174	0.961	0.039	0.007	0.1703	3.689	21.240	1.0455	0.1818	0.0001926
A	75	50	0.167	1.000	0.000	0.000	0.1669	3.519	21.081	1.1014	0.1841	0.0001745
A	76	50	0.167	1.000	0.000	0.000	0.1669	3.352	20.081	0.3514	0.0587	0.0001646
A	77	50	0.167	0.973	0.027	0.005	0.1647	3.185	19.081	0.0743	0.0124	0.0001552

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	l_xm_x	c_x
A	78	49	0.162	0.986	0.014	0.002	0.1613	3.020	18.597	0.3333	0.0542	0.0001424
A	79	48	0.160	0.958	0.042	0.007	0.1568	2.859	17.852	0.4437	0.0711	0.0001324
A	80	46	0.153	0.985	0.015	0.002	0.1523	2.702	17.618	0.1765	0.0271	0.0001195
A	81	45	0.151	1.000	0.000	0.000	0.1511	2.550	16.873	0.3209	0.0486	0.0001111
A	82	45	0.151	0.985	0.015	0.002	0.1500	2.399	15.873	0.3955	0.0598	0.0001047
A	83	45	0.149	1.000	0.000	0.000	0.1489	2.249	15.106	0.8030	0.1197	0.0000973
A	84	45	0.149	1.000	0.000	0.000	0.1489	2.100	14.106	0.2197	0.0327	0.0000917
A	85	45	0.149	0.955	0.045	0.007	0.1455	1.951	13.106	0.0076	0.0011	0.0000865
A	86	43	0.142	0.921	0.079	0.011	0.1365	1.806	12.706	0.6111	0.0869	0.0000779
A	87	39	0.131	0.914	0.086	0.011	0.1252	1.669	12.759	0.5431	0.0711	0.0000676
A	88	36	0.120	0.943	0.057	0.007	0.1162	1.544	12.915	0.3679	0.0440	0.0000582
A	89	34	0.113	0.920	0.080	0.009	0.1083	1.428	12.660	0.6900	0.0779	0.0000518
A	90	31	0.104	0.913	0.087	0.009	0.0992	1.320	12.717	0.0000	0.0000	0.0000449
A	91	28	0.095	0.976	0.024	0.002	0.0936	1.220	12.881	0.0000	0.0000	0.0000387
A	92	28	0.092	0.951	0.049	0.005	0.0902	1.127	12.183	0.1829	0.0169	0.0000356
A	93	26	0.088	0.923	0.077	0.007	0.0846	1.036	11.782	0.0128	0.0011	0.0000319
A	94	24	0.081	0.917	0.083	0.007	0.0778	0.952	11.722	0.5278	0.0429	0.0000278
A	95	22	0.074	0.970	0.030	0.002	0.0733	0.874	11.742	0.0000	0.0000	0.0000240
A	96	22	0.072	0.969	0.031	0.002	0.0711	0.801	11.094	0.0000	0.0000	0.0000220
A	97	21	0.070	0.839	0.161	0.011	0.0643	0.730	10.435	0.0000	0.0000	0.0000201
A	98	18	0.059	0.885	0.115	0.007	0.0553	0.665	11.346	0.0000	0.0000	0.0000159
A	99	16	0.052	1.000	0.000	0.000	0.0519	0.610	11.761	0.0000	0.0000	0.0000132
A	100	16	0.052	0.913	0.087	0.005	0.0496	0.558	10.761	0.0000	0.0000	0.0000125
A	101	14	0.047	0.810	0.190	0.009	0.0429	0.509	10.738	0.6905	0.0327	0.0000108
A	102	12	0.038	0.706	0.294	0.011	0.0327	0.466	12.147	0.0000	0.0000	0.0000082
A	103	8	0.027	1.000	0.000	0.000	0.0271	0.433	16.000	0.0000	0.0000	0.0000055
A	104	8	0.027	1.000	0.000	0.000	0.0271	0.406	15.000	0.0000	0.0000	0.0000052
A	105	8	0.027	0.750	0.250	0.007	0.0237	0.379	14.000	0.0000	0.0000	0.0000049
A	106	6	0.020	1.000	0.000	0.000	0.0203	0.355	17.500	0.0000	0.0000	0.0000034
A	107	6	0.020	1.000	0.000	0.000	0.0203	0.335	16.500	0.0000	0.0000	0.0000032
A	108	6	0.020	1.000	0.000	0.000	0.0203	0.315	15.500	0.0000	0.0000	0.0000031
A	109	6	0.020	1.000	0.000	0.000	0.0203	0.294	14.500	0.0000	0.0000	0.0000029
A	110	6	0.020	1.000	0.000	0.000	0.0203	0.274	13.500	0.0000	0.0000	0.0000027
A	111	6	0.020	0.778	0.222	0.005	0.0180	0.254	12.500	0.0000	0.0000	0.0000026
A	112	5	0.016	1.000	0.000	0.000	0.0158	0.236	14.929	0.0000	0.0000	0.0000019
A	113	5	0.016	1.000	0.000	0.000	0.0158	0.220	13.929	0.0000	0.0000	0.0000018
A	114	5	0.016	1.000	0.000	0.000	0.0158	0.204	12.929	0.0000	0.0000	0.0000017
A	115	5	0.016	1.000	0.000	0.000	0.0158	0.188	11.929	0.0000	0.0000	0.0000016
A	116	5	0.016	1.000	0.000	0.000	0.0158	0.173	10.929	0.0000	0.0000	0.0000015
A	117	5	0.016	1.000	0.000	0.000	0.0158	0.157	9.929	0.0000	0.0000	0.0000014

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	$l_x m_x$	c_x
A	118	5	0.016	1.000	0.000	0.000	0.0158	0.141	8.929	0.0000	0.0000	0.0000013
A	119	5	0.016	0.857	0.143	0.002	0.0147	0.125	7.929	0.0000	0.0000	0.0000012
A	120	4	0.014	1.000	0.000	0.000	0.0135	0.111	8.167	0.0000	0.0000	0.0000010
A	121	4	0.014	0.667	0.333	0.005	0.0113	0.097	7.167	0.0000	0.0000	0.0000009
A	122	3	0.009	1.000	0.000	0.000	0.0090	0.086	9.500	0.0000	0.0000	0.0000006
A	123	3	0.009	1.000	0.000	0.000	0.0090	0.077	8.500	0.0000	0.0000	0.0000006
A	124	3	0.009	1.000	0.000	0.000	0.0090	0.068	7.500	0.0000	0.0000	0.0000005
A	125	3	0.009	1.000	0.000	0.000	0.0090	0.059	6.500	0.0000	0.0000	0.0000005
A	126	3	0.009	1.000	0.000	0.000	0.0090	0.050	5.500	0.0000	0.0000	0.0000005
A	127	3	0.009	0.750	0.250	0.002	0.0079	0.041	4.500	0.0000	0.0000	0.0000004
A	128	2	0.007	1.000	0.000	0.000	0.0068	0.033	4.833	0.0000	0.0000	0.0000003
A	129	2	0.007	0.333	0.667	0.005	0.0045	0.026	3.833	0.0000	0.0000	0.0000003
A	130	1	0.002	1.000	0.000	0.000	0.0023	0.021	9.500	0.0000	0.0000	0.0000001
A	131	1	0.002	1.000	0.000	0.000	0.0023	0.019	8.500	0.0000	0.0000	0.0000001
A	132	1	0.002	1.000	0.000	0.000	0.0023	0.017	7.500	0.0000	0.0000	0.0000001
A	133	1	0.002	1.000	0.000	0.000	0.0023	0.015	6.500	0.0000	0.0000	0.0000001
A	134	1	0.002	1.000	0.000	0.000	0.0023	0.012	5.500	0.0000	0.0000	0.0000001
A	135	1	0.002	1.000	0.000	0.000	0.0023	0.010	4.500	0.0000	0.0000	0.0000001
A	136	1	0.002	1.000	0.000	0.000	0.0023	0.008	3.500	0.0000	0.0000	0.0000001
A	137	1	0.002	1.000	0.000	0.000	0.0023	0.006	2.500	0.0000	0.0000	0.0000001
A	138	1	0.002	1.000	0.000	0.000	0.0023	0.003	1.500	0.0000	0.0000	0.0000001
A	139	1	0.002	0.000	1.000	0.002	0.0011	0.001	0.500	0.0000	0.0000	0.0000001
A	140	0	0.000			0.000	0.0000	0.000	0.000	0.0000	0.0000	-
							43.004				19.0366	1.0000000

Parámetros de población	
R_0	19.037
T	50.151
r	0.059
λ	1.061
DT	11.798

Tabla de vida de machos *Aedes aegypti* cepa adaptada a laboratorio

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
H	0	300	1.0000	0.653	0.347	0.347	0.827	30.084	30.084
L	1	196	0.6533	1.000	0.000	0.000	0.653	29.257	44.782
L	2	196	0.6533	1.000	0.000	0.000	0.653	28.604	43.782
L	3	196	0.6533	1.000	0.000	0.000	0.653	27.951	42.782
L-P	4	196	0.6533	0.995	0.005	0.003	0.652	27.297	41.782
L-P	5	195	0.6500	1.000	0.000	0.000	0.650	26.646	40.993
L-P-A	6	195	0.6500	1.000	0.000	0.000	0.650	25.996	39.993
L-P-A	7	195	0.6500	1.000	0.000	0.000	0.650	25.346	38.993
L-P-A	8	195	0.6500	1.000	0.000	0.000	0.650	24.696	37.993
P-A	9	195	0.6500	1.000	0.000	0.000	0.650	24.046	36.993
P-A	10	195	0.6500	1.000	0.000	0.000	0.650	23.396	35.993
A	11	195	0.6500	1.000	0.000	0.000	0.650	22.746	34.993
A	12	195	0.6500	1.000	0.000	0.000	0.650	22.096	33.993
A	13	195	0.6500	1.000	0.000	0.000	0.650	21.446	32.993
A	14	195	0.6500	1.000	0.000	0.000	0.650	20.796	31.993
A	15	195	0.6500	1.000	0.000	0.000	0.650	20.146	30.993
A	16	195	0.6500	1.000	0.000	0.000	0.650	19.496	29.993
A	17	195	0.6500	1.000	0.000	0.000	0.650	18.846	28.993
A	18	195	0.6500	1.000	0.000	0.000	0.650	18.196	27.993
A	19	195	0.6500	1.000	0.000	0.000	0.650	17.546	26.993
A	20	195	0.6500	1.000	0.000	0.000	0.650	16.896	25.993
A	21	195	0.6500	1.000	0.000	0.000	0.650	16.246	24.993
A	22	195	0.6500	1.000	0.000	0.000	0.650	15.596	23.993
A	23	195	0.6500	0.993	0.007	0.004	0.648	14.946	22.993
A	24	194	0.6457	1.000	0.000	0.000	0.646	14.298	22.144
A	25	194	0.6457	0.990	0.010	0.006	0.642	13.652	21.1443
A	26	192	0.6392	0.997	0.003	0.002	0.638	13.010	20.354
A	27	191	0.6370	0.993	0.007	0.004	0.635	12.372	19.422
A	28	190	0.6327	0.983	0.017	0.011	0.627	11.737	18.551
A	29	187	0.6218	0.986	0.014	0.009	0.618	11.110	17.866
A	30	184	0.6132	0.993	0.007	0.004	0.611	10.492	17.111
A	31	183	0.6088	0.968	0.032	0.020	0.599	9.881	16.230
A	32	177	0.5893	0.993	0.007	0.004	0.587	9.282	15.750
A	33	176	0.5850	0.970	0.030	0.017	0.576	8.695	14.863
A	34	170	0.5677	0.969	0.031	0.017	0.559	8.119	14.302
A	35	165	0.5503	0.976	0.024	0.013	0.544	7.560	13.736
A	36	161	0.5373	0.956	0.044	0.024	0.525	7.016	13.056
A	37	154	0.5135	0.954	0.046	0.024	0.502	6.490	12.639

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
A	38	147	0.4897	0.960	0.040	0.020	0.480	5.989	12.230
A	39	141	0.4702	0.963	0.037	0.017	0.462	5.509	11.717
A	40	136	0.4528	0.971	0.029	0.013	0.446	5.047	11.146
A	41	132	0.4398	0.956	0.044	0.020	0.430	4.601	10.461
A	42	126	0.4203	0.969	0.031	0.013	0.414	4.171	9.923
A	43	122	0.4073	0.968	0.032	0.013	0.401	3.757	9.223
A	44	118	0.3943	0.923	0.077	0.030	0.379	3.356	8.511
A	45	109	0.3640	0.911	0.089	0.033	0.348	2.977	8.179
A	46	99	0.3315	0.941	0.059	0.020	0.322	2.629	7.931
A	47	94	0.3120	0.882	0.118	0.037	0.294	2.308	7.396
A	48	83	0.2752	0.913	0.087	0.024	0.263	2.014	7.319
A	49	75	0.2513	0.853	0.147	0.037	0.233	1.751	6.966
A	50	64	0.2145	0.879	0.121	0.026	0.202	1.518	7.076
A	51	57	0.1885	0.920	0.080	0.015	0.181	1.316	6.983
A	52	52	0.1733	0.863	0.138	0.024	0.161	1.135	6.550
A	53	45	0.1495	0.855	0.145	0.022	0.139	0.974	6.514
A	54	38	0.1278	0.864	0.136	0.017	0.119	0.835	6.534
A	55	33	0.1105	0.843	0.157	0.017	0.102	0.716	6.480
A	56	28	0.0932	0.860	0.140	0.013	0.087	0.614	6.593
A	57	24	0.0802	0.892	0.108	0.009	0.076	0.528	6.581
A	58	21	0.0715	0.879	0.121	0.009	0.067	0.452	6.318
A	59	19	0.0628	0.862	0.138	0.009	0.059	0.385	6.121
A	60	16	0.0542	0.760	0.240	0.013	0.048	0.326	6.020
A	61	12	0.0412	0.842	0.158	0.007	0.038	0.278	6.763
A	62	10	0.0347	1.000	0.000	0.000	0.035	0.241	6.938
A	63	10	0.0347	1.000	0.000	0.000	0.035	0.206	5.938
A	64	10	0.0347	0.875	0.125	0.004	0.033	0.171	4.938
A	65	9	0.0303	0.857	0.143	0.004	0.028	0.139	4.571
A	66	8	0.0260	1.000	0.000	0.000	0.026	0.111	4.250
A	67	8	0.0260	0.917	0.083	0.002	0.025	0.085	3.250
A	68	7	0.0238	1.000	0.000	0.000	0.024	0.060	2.500
A	69	7	0.0238	0.636	0.364	0.009	0.020	0.036	1.500
A	70	5	0.0152	0.286	0.714	0.011	0.010	0.016	1.071
A	71	1	0.0043	1.000	0.000	0.000	0.004	0.007	1.500
A	72	1	0.0043	0.000	1.000	0.004	0.002	0.002	0.500
A	73	0	0.0000			0.000	0.000	0.000	0.000

Tabla de vida de hembras *Aedes aegypti* cepa adaptada a laboratorio

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	l_xm_x	c_x
H	0	300	1.000	0.653	0.347	0.347	0.827	40.137	40.137	0.0000	0.0000	0.1011441
L	1	196	0.653	1.000	0.000	0.000	0.653	39.311	60.169	0.0000	0.0000	0.0617523
L	2	196	0.653	1.000	0.000	0.000	0.653	38.657	59.169	0.0000	0.0000	0.0577074
L	3	196	0.653	1.000	0.000	0.000	0.653	38.004	58.169	0.0000	0.0000	0.0539274
L-P	4	196	0.653	0.995	0.005	0.003	0.652	37.351	57.169	0.0000	0.0000	0.0503950
L-P	5	195	0.650	1.000	0.000	0.000	0.650	36.699	56.460	0.0000	0.0000	0.0468537
L-P-A	6	195	0.650	1.000	0.000	0.000	0.650	36.049	55.460	0.0000	0.0000	0.0437846
L-P-A	7	195	0.650	1.000	0.000	0.000	0.650	35.399	54.460	0.0000	0.0000	0.0409166
L-P-A	8	195	0.650	1.000	0.000	0.000	0.650	34.749	53.460	0.0000	0.0000	0.0382365
P-A	9	195	0.650	1.000	0.000	0.000	0.650	34.099	52.460	0.0000	0.0000	0.0357319
P-A	10	195	0.650	1.000	0.000	0.000	0.650	33.449	51.460	0.0000	0.0000	0.0333913
A	11	195	0.650	1.000	0.000	0.000	0.650	32.799	50.460	0.0000	0.0000	0.0312041
A	12	195	0.650	1.000	0.000	0.000	0.650	32.149	49.460	0.0000	0.0000	0.0291601
A	13	195	0.650	1.000	0.000	0.000	0.650	31.499	48.460	0.0000	0.0000	0.0272501
A	14	195	0.650	1.000	0.000	0.000	0.650	30.849	47.460	0.0000	0.0000	0.0254651
A	15	195	0.650	1.000	0.000	0.000	0.650	30.199	46.460	0.0000	0.0000	0.0237971
A	16	195	0.650	1.000	0.000	0.000	0.650	29.549	45.460	0.0000	0.0000	0.0222383
A	17	195	0.650	1.000	0.000	0.000	0.650	28.899	44.460	0.0000	0.0000	0.0207816
A	18	195	0.650	1.000	0.000	0.000	0.650	28.249	43.460	0.0000	0.0000	0.0194204
A	19	195	0.650	1.000	0.000	0.000	0.650	27.599	42.460	0.0500	0.0325	0.0181483
A	20	195	0.650	0.980	0.020	0.013	0.644	26.949	41.460	0.1167	0.0758	0.0169595
A	21	191	0.637	0.986	0.014	0.009	0.633	26.306	41.296	0.2143	0.1365	0.0155316
A	22	189	0.628	0.993	0.007	0.004	0.626	25.673	40.859	0.4034	0.2535	0.0143168
A	23	187	0.624	0.997	0.003	0.002	0.623	25.047	40.139	0.8854	0.5525	0.0132867
A	24	187	0.622	0.986	0.014	0.009	0.618	24.424	39.277	0.3920	0.2438	0.0123733
A	25	184	0.613	0.993	0.007	0.004	0.611	23.806	38.825	0.4594	0.2817	0.0114017
A	26	183	0.609	0.986	0.014	0.009	0.605	23.195	38.098	0.8221	0.5005	0.0105795
A	27	180	0.600	0.993	0.007	0.004	0.598	22.591	37.641	0.9061	0.5438	0.0097458
A	28	179	0.596	1.000	0.000	0.000	0.596	21.993	36.911	0.6182	0.3683	0.0090417
A	29	179	0.596	0.989	0.011	0.006	0.593	21.397	35.911	0.9800	0.5839	0.0084494
A	30	177	0.589	0.985	0.015	0.009	0.585	20.804	35.301	1.0772	0.6348	0.0078098
A	31	174	0.581	0.996	0.004	0.002	0.580	20.219	34.821	1.0560	0.6132	0.0071909
A	32	174	0.579	0.993	0.007	0.004	0.576	19.640	33.949	1.0524	0.6088	0.0066948
A	33	172	0.574	0.992	0.008	0.004	0.572	19.063	33.202	0.9453	0.5428	0.0062094
A	34	171	0.570	0.992	0.008	0.004	0.568	18.491	32.451	0.5627	0.3207	0.0057589
A	35	170	0.566	0.989	0.011	0.006	0.562	17.924	31.695	1.3448	0.7605	0.0053407
A	36	168	0.559	0.988	0.012	0.007	0.556	17.362	31.058	0.8295	0.4637	0.0049335
A	37	166	0.553	0.992	0.008	0.004	0.550	16.806	30.418	0.9412	0.5200	0.0045568

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	l_xm_x	c_x
A	38	164	0.548	0.988	0.012	0.006	0.545	16.255	29.654	1.2055	0.6608	0.0042249
A	39	163	0.542	0.984	0.016	0.009	0.537	15.711	29.004	1.0660	0.5774	0.0039013
A	40	160	0.533	0.996	0.004	0.002	0.532	15.173	28.467	1.0732	0.5720	0.0035875
A	41	159	0.531	0.980	0.020	0.011	0.525	14.641	27.582	0.8184	0.4344	0.0033388
A	42	156	0.520	0.983	0.017	0.009	0.516	14.116	27.146	0.8750	0.4550	0.0030565
A	43	153	0.511	0.979	0.021	0.011	0.506	13.600	26.597	0.6758	0.3456	0.0028086
A	44	150	0.501	0.987	0.013	0.007	0.497	13.094	26.162	0.7944	0.3976	0.0025691
A	45	148	0.494	0.974	0.026	0.013	0.488	12.597	25.500	0.7368	0.3640	0.0023696
A	46	144	0.481	0.959	0.041	0.020	0.471	12.110	25.176	0.5698	0.2741	0.0021561
A	47	138	0.462	0.981	0.019	0.009	0.457	11.638	25.218	0.7441	0.3434	0.0019332
A	48	136	0.453	0.990	0.010	0.004	0.451	11.181	24.691	1.2656	0.5731	0.0017726
A	49	135	0.449	0.971	0.029	0.013	0.442	10.730	23.925	0.8430	0.3781	0.0016407
A	50	131	0.436	0.980	0.020	0.009	0.431	10.288	23.624	1.4552	0.6338	0.0014888
A	51	128	0.427	0.980	0.020	0.009	0.423	9.857	23.094	1.4721	0.6283	0.0013636
A	52	125	0.418	0.979	0.021	0.009	0.414	9.435	22.562	1.3472	0.5633	0.0012484
A	53	123	0.410	0.958	0.042	0.017	0.401	9.021	22.029	1.3730	0.5623	0.0011424
A	54	118	0.392	0.983	0.017	0.007	0.389	8.620	21.981	1.7127	0.6717	0.0010224
A	55	116	0.386	0.944	0.056	0.022	0.375	8.231	21.343	1.1236	0.4333	0.0009396
A	56	109	0.364	0.958	0.042	0.015	0.356	7.856	21.583	2.0804	0.7573	0.0008287
A	57	105	0.349	0.981	0.019	0.007	0.346	7.500	21.500	3.2702	1.1408	0.0007422
A	58	103	0.342	0.949	0.051	0.017	0.334	7.154	20.899	1.8291	0.6262	0.0006806
A	59	98	0.325	0.980	0.020	0.007	0.322	6.821	20.987	2.0167	0.6554	0.0006038
A	60	96	0.319	0.966	0.034	0.011	0.313	6.499	20.405	1.9966	0.6359	0.0005530
A	61	92	0.308	0.937	0.063	0.020	0.298	6.186	20.106	1.6232	0.4994	0.0004992
A	62	86	0.288	0.932	0.068	0.020	0.278	5.888	20.432	2.2782	0.6565	0.0004369
A	63	81	0.269	0.919	0.081	0.022	0.258	5.610	20.879	1.5726	0.4225	0.0003807
A	64	74	0.247	0.947	0.053	0.013	0.241	5.352	21.667	1.9474	0.4810	0.0003271
A	65	70	0.234	0.972	0.028	0.007	0.231	5.111	21.843	1.5463	0.3618	0.0002895
A	66	68	0.228	0.943	0.057	0.013	0.221	4.880	21.452	1.4571	0.3315	0.0002631
A	67	64	0.215	0.939	0.061	0.013	0.208	4.659	21.722	1.4242	0.3055	0.0002318
A	68	60	0.202	0.925	0.075	0.015	0.194	4.451	22.091	1.5753	0.3174	0.0002035
A	69	56	0.186	0.977	0.023	0.004	0.184	4.258	22.849	1.4593	0.2719	0.0001758
A	70	55	0.182	0.964	0.036	0.007	0.179	4.073	22.381	1.1488	0.2091	0.0001605
A	71	53	0.176	0.988	0.012	0.002	0.174	3.895	22.191	2.4321	0.4268	0.0001446
A	72	52	0.173	0.988	0.013	0.002	0.172	3.720	21.463	1.0125	0.1755	0.0001335
A	73	51	0.171	1.000	0.000	0.000	0.171	3.548	20.728	0.8481	0.1452	0.0001232
A	74	51	0.171	0.975	0.025	0.004	0.169	3.377	19.728	1.1962	0.2048	0.0001151
A	75	50	0.167	1.000	0.000	0.000	0.167	3.208	19.227	1.4870	0.2481	0.0001049
A	76	50	0.167	1.000	0.000	0.000	0.167	3.041	18.227	1.0714	0.1788	0.0000980
A	77	50	0.167	0.987	0.013	0.002	0.166	2.874	17.227	1.1883	0.1983	0.0000916

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	l_xm_x	c_x
A	78	49	0.165	0.961	0.039	0.007	0.161	2.708	16.447	0.8487	0.1398	0.0000845
A	79	47	0.158	0.959	0.041	0.007	0.155	2.547	16.103	0.7877	0.1246	0.0000758
A	80	46	0.152	0.986	0.014	0.002	0.151	2.392	15.771	0.5214	0.0791	0.0000679
A	81	45	0.150	0.971	0.029	0.004	0.147	2.241	14.993	0.6957	0.1040	0.0000626
A	82	44	0.145	1.000	0.000	0.000	0.145	2.094	14.425	0.5821	0.0845	0.0000568
A	83	44	0.145	0.881	0.119	0.017	0.137	1.949	13.425	0.3657	0.0531	0.0000531
A	84	38	0.128	0.966	0.034	0.004	0.126	1.812	14.178	0.9237	0.1181	0.0000437
A	85	37	0.124	0.982	0.018	0.002	0.122	1.687	13.658	0.2018	0.0249	0.0000394
A	86	36	0.121	1.000	0.000	0.000	0.121	1.564	12.893	0.1786	0.0217	0.0000362
A	87	36	0.121	0.911	0.089	0.011	0.116	1.443	11.893	0.2321	0.0282	0.0000338
A	88	33	0.111	0.824	0.176	0.020	0.101	1.327	12.010	0.2255	0.0249	0.0000288
A	89	27	0.091	1.000	0.000	0.000	0.091	1.226	13.476	0.0952	0.0087	0.0000222
A	90	27	0.091	0.952	0.048	0.004	0.089	1.135	12.476	0.9286	0.0845	0.0000207
A	91	26	0.087	0.950	0.050	0.004	0.085	1.047	12.075	0.0250	0.0022	0.0000184
A	92	25	0.082	0.974	0.026	0.002	0.081	0.962	11.684	0.0263	0.0022	0.0000164
A	93	24	0.080	0.946	0.054	0.004	0.078	0.881	10.986	0.3514	0.0282	0.0000149
A	94	23	0.076	0.829	0.171	0.013	0.069	0.803	10.586	0.0000	0.0000	0.0000132
A	95	19	0.063	0.966	0.034	0.002	0.062	0.733	11.672	0.0000	0.0000	0.0000102
A	96	18	0.061	0.893	0.107	0.007	0.057	0.672	11.071	0.0000	0.0000	0.0000092
A	97	16	0.054	0.880	0.120	0.007	0.051	0.614	11.340	0.0000	0.0000	0.0000077
A	98	14	0.048	0.864	0.136	0.007	0.044	0.563	11.818	0.0000	0.0000	0.0000063
A	99	12	0.041	0.842	0.158	0.007	0.038	0.519	12.605	0.3421	0.0141	0.0000051
A	100	10	0.035	1.000	0.000	0.000	0.035	0.481	13.875	0.2500	0.0087	0.0000040
A	101	10	0.035	0.938	0.063	0.002	0.034	0.446	12.875	0.0000	0.0000	0.0000037
A	102	10	0.033	1.000	0.000	0.000	0.033	0.413	12.700	0.0000	0.0000	0.0000033
A	103	10	0.033	0.933	0.067	0.002	0.031	0.380	11.700	0.0000	0.0000	0.0000031
A	104	9	0.030	1.000	0.000	0.000	0.030	0.349	11.500	0.0000	0.0000	0.0000027
A	105	9	0.030	0.929	0.071	0.002	0.029	0.319	10.500	0.0000	0.0000	0.0000025
A	106	8	0.028	1.000	0.000	0.000	0.028	0.289	10.269	0.0000	0.0000	0.0000022
A	107	8	0.028	0.923	0.077	0.002	0.027	0.261	9.269	0.0000	0.0000	0.0000020
A	108	8	0.026	1.000	0.000	0.000	0.026	0.234	9.000	1.0417	0.0271	0.0000017
A	109	8	0.026	0.917	0.083	0.002	0.025	0.208	8.000	0.0000	0.0000	0.0000016
A	110	7	0.024	1.000	0.000	0.000	0.024	0.183	7.682	0.0000	0.0000	0.0000014
A	111	7	0.024	1.000	0.000	0.000	0.024	0.159	6.682	0.0000	0.0000	0.0000013
A	112	7	0.024	0.909	0.091	0.002	0.023	0.135	5.682	0.0000	0.0000	0.0000012
A	113	7	0.022	0.900	0.100	0.002	0.021	0.113	5.200	0.0000	0.0000	0.0000010
A	114	6	0.020	0.889	0.111	0.002	0.018	0.092	4.722	0.0000	0.0000	0.0000009
A	115	5	0.017	0.875	0.125	0.002	0.016	0.074	4.250	0.0000	0.0000	0.0000007
A	116	5	0.015	0.857	0.143	0.002	0.014	0.057	3.786	0.0000	0.0000	0.0000006
A	117	4	0.013	1.000	0.000	0.000	0.013	0.043	3.333	0.0000	0.0000	0.0000005

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x	m_x	l_xm_x	c_x
A	118	4	0.013	1.000	0.000	0.000	0.013	0.030	2.333	0.0000	0.0000	0.0000004
A	119	4	0.013	0.500	0.500	0.007	0.010	0.017	1.333	0.0000	0.0000	0.0000004
A	120	2	0.007	0.667	0.333	0.002	0.005	0.008	1.167	0.0000	0.0000	0.0000002
A	121	1	0.004	0.000	1.000	0.004	0.002	0.002	0.500	0.0000	0.0000	0.0000001
A	122	0	0.000			0.000	0.000	0.000	0.000	0.0000	0.0000	-
							40.1373			77.89221	27.1332	1.0000000

Parámetros de población	
R_0	27.133
T	48.722
r	0.068
λ	1.070
DT	10.231

Tabla de vida de machos *Aedes aegypti* cepa estéril

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
H	0	300	1.000	0.653	0.347	0.347	0.827	27.478	27.478
L	1	196	0.653	1.000	0.000	0.000	0.653	26.651	40.792
L	2	196	0.653	1.000	0.000	0.000	0.653	25.998	39.792
L	3	196	0.653	1.000	0.000	0.000	0.653	25.344	38.792
L-P	4	196	0.653	0.995	0.005	0.003	0.652	24.691	37.792
L-P	5	195	0.650	1.000	0.000	0.000	0.650	24.039	36.983
L-P-A	6	195	0.650	1.000	0.000	0.000	0.650	23.389	35.983
L-P-A	7	195	0.650	1.000	0.000	0.000	0.650	22.739	34.983
L-P-A	8	195	0.650	1.000	0.000	0.000	0.650	22.089	33.983
P-A	9	195	0.650	1.000	0.000	0.000	0.650	21.439	32.983
P-A	10	195	0.650	1.000	0.000	0.000	0.650	20.789	31.983
A	11	195	0.650	1.000	0.000	0.000	0.650	20.139	30.983
A	12	195	0.650	1.000	0.000	0.000	0.650	19.489	29.983
A	13	195	0.650	1.000	0.000	0.000	0.650	18.839	28.983
A	14	195	0.650	1.000	0.000	0.000	0.650	18.189	27.983
A	15	195	0.650	1.000	0.000	0.000	0.650	17.539	26.983
A	16	195	0.650	1.000	0.000	0.000	0.650	16.889	25.983
A	17	195	0.650	1.000	0.000	0.000	0.650	16.239	24.983
A	18	195	0.650	0.993	0.007	0.004	0.648	15.589	23.983
A	19	194	0.646	0.980	0.020	0.013	0.639	14.941	23.141
A	20	190	0.633	0.979	0.021	0.013	0.626	14.302	22.606
A	21	186	0.620	0.986	0.014	0.009	0.615	13.676	22.070
A	22	183	0.611	0.982	0.018	0.011	0.606	13.061	21.376
A	23	180	0.600	0.986	0.014	0.009	0.596	12.455	20.753
A	24	177	0.592	0.974	0.026	0.015	0.584	11.859	20.049
A	25	173	0.576	0.989	0.011	0.007	0.573	11.275	19.564
A	26	171	0.570	0.954	0.046	0.026	0.557	10.702	18.781
A	27	163	0.544	0.960	0.040	0.022	0.533	10.145	18.655
A	28	157	0.522	0.963	0.037	0.020	0.512	9.612	18.409
A	29	151	0.503	0.966	0.034	0.017	0.494	9.100	18.103
A	30	146	0.485	0.960	0.040	0.020	0.476	8.606	17.732
A	31	140	0.466	0.986	0.014	0.006	0.463	8.130	17.453
A	32	138	0.459	0.962	0.038	0.017	0.451	7.668	16.693
A	33	133	0.442	0.961	0.039	0.017	0.433	7.217	16.328
A	34	127	0.425	0.913	0.087	0.037	0.406	6.784	15.974
A	35	116	0.388	0.927	0.073	0.028	0.374	6.378	16.444
A	36	108	0.360	0.964	0.036	0.013	0.353	6.004	16.693
A	37	104	0.347	0.981	0.019	0.007	0.343	5.651	16.300

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
A	38	102	0.340	0.975	0.025	0.009	0.336	5.307	15.602
A	39	99	0.332	0.993	0.007	0.002	0.330	4.971	14.997
A	40	99	0.329	0.941	0.059	0.020	0.320	4.641	14.092
A	41	93	0.310	0.972	0.028	0.009	0.306	4.321	13.948
A	42	90	0.301	0.942	0.058	0.017	0.293	4.016	13.335
A	43	85	0.284	0.969	0.031	0.009	0.280	3.723	13.118
A	44	83	0.275	0.945	0.055	0.015	0.268	3.444	12.516
A	45	78	0.260	0.967	0.033	0.009	0.256	3.176	12.217
A	46	75	0.251	0.888	0.112	0.028	0.237	2.921	11.621
A	47	67	0.223	0.922	0.078	0.017	0.215	2.683	12.024
A	48	62	0.206	0.958	0.042	0.009	0.202	2.469	11.995
A	49	59	0.197	0.934	0.066	0.013	0.191	2.267	11.500
A	50	55	0.184	0.941	0.059	0.011	0.179	2.077	11.276
A	51	52	0.173	0.963	0.038	0.007	0.170	1.898	10.950
A	52	50	0.167	0.922	0.078	0.013	0.160	1.728	10.357
A	53	46	0.154	0.972	0.028	0.004	0.152	1.568	10.190
A	54	45	0.150	0.928	0.072	0.011	0.144	1.416	9.471
A	55	42	0.139	0.953	0.047	0.007	0.135	1.272	9.172
A	56	40	0.132	0.967	0.033	0.004	0.130	1.136	8.598
A	57	38	0.128	0.881	0.119	0.015	0.120	1.006	7.873
A	58	34	0.113	0.865	0.135	0.015	0.105	0.886	7.865
A	59	29	0.098	0.867	0.133	0.013	0.091	0.781	8.011
A	60	25	0.085	0.897	0.103	0.009	0.080	0.690	8.167
A	61	23	0.076	0.971	0.029	0.002	0.075	0.610	8.043
A	62	22	0.074	0.941	0.059	0.004	0.072	0.535	7.265
A	63	21	0.069	0.813	0.188	0.013	0.063	0.464	6.688
A	64	17	0.056	0.885	0.115	0.006	0.053	0.401	7.115
A	65	15	0.050	0.870	0.130	0.007	0.047	0.348	6.978
A	66	13	0.043	0.900	0.100	0.004	0.041	0.301	6.950
A	67	12	0.039	0.833	0.167	0.007	0.036	0.260	6.667
A	68	10	0.033	1.000	0.000	0.000	0.033	0.224	6.900
A	69	10	0.033	0.800	0.200	0.007	0.029	0.192	5.900
A	70	8	0.026	1.000	0.000	0.000	0.026	0.163	6.250
A	71	8	0.026	0.833	0.167	0.004	0.024	0.137	5.250
A	72	7	0.022	1.000	0.000	0.000	0.022	0.113	5.200
A	73	7	0.022	1.000	0.000	0.000	0.022	0.091	4.200
A	74	7	0.022	0.700	0.300	0.007	0.018	0.069	3.200
A	75	5	0.015	0.714	0.286	0.004	0.013	0.051	3.357
A	76	3	0.011	0.600	0.400	0.004	0.009	0.038	3.500
A	77	2	0.007	0.667	0.333	0.002	0.005	0.029	4.500

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
A	78	1	0.004	1.000	0.000	0.000	0.004	0.024	5.500
A	79	1	0.004	1.000	0.000	0.000	0.004	0.020	4.500
A	80	1	0.004	1.000	0.000	0.000	0.004	0.015	3.500
A	81	1	0.004	1.000	0.000	0.000	0.004	0.011	2.500
A	82	1	0.004	1.000	0.000	0.000	0.004	0.007	1.500
A	83	1	0.004	0.000	1.000	0.004	0.002	0.002	0.500
A	84	0	0.000			0.000	0.000	0.000	0.000

Tabla de vida de hembras *Aedes aegypti* cepa estéril

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
H	0	300	1.000	0.653	0.347	0.347	0.827	32.008	32.008
L	1	196	0.653	1.000	0.000	0.000	0.653	31.181	47.727
L	2	196	0.653	1.000	0.000	0.000	0.653	30.528	46.727
L	3	196	0.653	1.000	0.000	0.000	0.653	29.875	45.727
L-P	4	196	0.653	0.995	0.005	0.003	0.652	29.221	44.727
L-P	5	195	0.650	1.000	0.000	0.000	0.650	28.570	43.953
L-P-A	6	195	0.650	1.000	0.000	0.000	0.650	27.920	42.953
L-P-A	7	195	0.650	1.000	0.000	0.000	0.650	27.270	41.953
L-P-A	8	195	0.650	1.000	0.000	0.000	0.650	26.620	40.953
P-A	9	195	0.650	1.000	0.000	0.000	0.650	25.970	39.953
P-A	10	195	0.650	1.000	0.000	0.000	0.650	25.320	38.953
A	11	195	0.650	1.000	0.000	0.000	0.650	24.670	37.953
A	12	195	0.650	1.000	0.000	0.000	0.650	24.020	36.953
A	13	195	0.650	1.000	0.000	0.000	0.650	23.370	35.953
A	14	195	0.650	1.000	0.000	0.000	0.650	22.720	34.953
A	15	195	0.650	1.000	0.000	0.000	0.650	22.070	33.953
A	16	195	0.650	1.000	0.000	0.000	0.650	21.420	32.953
A	17	195	0.650	1.000	0.000	0.000	0.650	20.770	31.953
A	18	195	0.650	0.993	0.007	0.004	0.648	20.120	30.953
A	19	194	0.646	0.993	0.007	0.004	0.644	19.472	30.158
A	20	192	0.641	0.980	0.020	0.013	0.635	18.828	29.358
A	21	189	0.628	1.000	0.000	0.000	0.628	18.194	28.955
A	22	189	0.628	0.986	0.014	0.009	0.624	17.565	27.955
A	23	186	0.620	0.986	0.014	0.009	0.615	16.941	27.339
A	24	183	0.611	0.993	0.007	0.004	0.609	16.326	26.720
A	25	182	0.607	0.993	0.007	0.004	0.605	15.717	25.907
A	26	181	0.602	0.975	0.025	0.015	0.595	15.113	25.090
A	27	176	0.587	0.989	0.011	0.007	0.584	14.518	24.725
A	28	174	0.581	0.985	0.015	0.009	0.576	13.934	23.996
A	29	172	0.572	0.989	0.011	0.007	0.569	13.358	23.352
A	30	170	0.566	0.977	0.023	0.013	0.559	12.789	22.615
A	31	166	0.553	0.984	0.016	0.009	0.548	12.230	22.135
A	32	163	0.544	0.984	0.016	0.009	0.540	11.682	21.480
A	33	161	0.535	0.996	0.004	0.002	0.534	11.142	20.820
A	34	160	0.533	0.980	0.020	0.011	0.528	10.608	19.902
A	35	157	0.522	0.975	0.025	0.013	0.516	10.080	19.305
A	36	153	0.509	0.966	0.034	0.017	0.501	9.565	18.785
A	37	148	0.492	0.965	0.035	0.017	0.483	9.064	18.430

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
A	38	142	0.475	0.963	0.037	0.017	0.466	8.581	18.084
A	39	137	0.457	0.957	0.043	0.020	0.447	8.115	17.751
A	40	131	0.438	0.955	0.045	0.020	0.428	7.668	17.520
A	41	125	0.418	0.964	0.036	0.015	0.411	7.240	17.313
A	42	121	0.403	0.935	0.065	0.026	0.390	6.829	16.946
A	43	113	0.377	0.966	0.034	0.013	0.371	6.439	17.080
A	44	109	0.364	0.994	0.006	0.002	0.363	6.069	16.673
A	45	109	0.362	0.976	0.024	0.009	0.358	5.706	15.769
A	46	106	0.353	0.926	0.074	0.026	0.340	5.348	15.144
A	47	98	0.327	0.940	0.060	0.020	0.317	5.008	15.308
A	48	92	0.308	0.972	0.028	0.009	0.303	4.691	15.246
A	49	90	0.299	0.928	0.072	0.022	0.288	4.388	14.674
A	50	83	0.277	0.977	0.023	0.007	0.274	4.099	14.781
A	51	81	0.271	0.976	0.024	0.007	0.268	3.825	14.124
A	52	79	0.264	0.943	0.057	0.015	0.257	3.558	13.459
A	53	75	0.249	0.974	0.026	0.007	0.246	3.301	13.248
A	54	73	0.243	0.920	0.080	0.020	0.233	3.055	12.589
A	55	67	0.223	0.971	0.029	0.007	0.220	2.822	12.646
A	56	65	0.217	0.880	0.120	0.026	0.204	2.602	12.010
A	57	57	0.191	0.955	0.045	0.009	0.186	2.399	12.580
A	58	55	0.182	0.857	0.143	0.026	0.169	2.212	12.155
A	59	47	0.156	0.944	0.056	0.009	0.152	2.043	13.097
A	60	44	0.147	0.912	0.088	0.013	0.141	1.892	12.838
A	61	40	0.134	0.984	0.016	0.002	0.133	1.751	13.032
A	62	40	0.132	0.918	0.082	0.011	0.127	1.617	12.238
A	63	36	0.121	0.893	0.107	0.013	0.115	1.491	12.286
A	64	33	0.108	0.920	0.080	0.009	0.104	1.376	12.700
A	65	30	0.100	0.913	0.087	0.009	0.095	1.272	12.761
A	66	27	0.091	0.929	0.071	0.007	0.088	1.177	12.929
A	67	25	0.085	0.974	0.026	0.002	0.083	1.089	12.885
A	68	25	0.082	0.974	0.026	0.002	0.081	1.005	12.211
A	69	24	0.080	0.919	0.081	0.007	0.077	0.924	11.527
A	70	22	0.074	1.000	0.000	0.000	0.074	0.847	11.500
A	71	22	0.074	0.882	0.118	0.009	0.069	0.774	10.500
A	72	20	0.065	0.967	0.033	0.002	0.064	0.704	10.833
A	73	19	0.063	0.897	0.103	0.007	0.060	0.640	10.190
A	74	17	0.056	0.885	0.115	0.007	0.053	0.581	10.308
A	75	15	0.050	0.913	0.087	0.004	0.048	0.528	10.587
A	76	14	0.046	0.905	0.095	0.004	0.043	0.480	10.548
A	77	12	0.041	0.895	0.105	0.004	0.039	0.437	10.605

Estado	Edad (x)	N	l_x	p_x	q_x	d_x	L_x	T_x	e_x
A	78	11	0.037	1.000	0.000	0.000	0.037	0.398	10.794
A	79	11	0.037	1.000	0.000	0.000	0.037	0.361	9.794
A	80	11	0.037	1.000	0.000	0.000	0.037	0.324	8.794
A	81	11	0.037	1.000	0.000	0.000	0.037	0.287	7.794
A	82	11	0.037	0.824	0.176	0.007	0.034	0.250	6.794
A	83	9	0.030	1.000	0.000	0.000	0.030	0.217	7.143
A	84	9	0.030	1.000	0.000	0.000	0.030	0.186	6.143
A	85	9	0.030	1.000	0.000	0.000	0.030	0.156	5.143
A	86	9	0.030	0.857	0.143	0.004	0.028	0.126	4.143
A	87	8	0.026	1.000	0.000	0.000	0.026	0.098	3.750
A	88	8	0.026	0.750	0.250	0.007	0.023	0.072	2.750
A	89	6	0.020	0.667	0.333	0.007	0.016	0.049	2.500
A	90	4	0.013	0.667	0.333	0.004	0.011	0.033	2.500
A	91	3	0.009	0.750	0.250	0.002	0.008	0.022	2.500
A	92	2	0.007	0.667	0.333	0.002	0.005	0.014	2.167
A	93	1	0.004	0.500	0.500	0.002	0.003	0.009	2.000
A	94	1	0.002	1.000	0.000	0.000	0.002	0.005	2.500
A	95	1	0.002	1.000	0.000	0.000	0.002	0.003	1.500
A	96	1	0.002	0.000	1.000	0.002	0.001	0.001	0.500
A	97	0	0.000			0.000	0.000	0.000	0.000

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