marsh land near Cocoa, Florida, at various times of the day over a 24-hour period. Counts were made over complete body of personnel after one minute of immobility in the following typical locations:

a. Laurel tree (good canopy) on road.

b. Palm tree (fair canopy) on road.

c. Middle of bridge (open conditions) over creek.

d. Laurel tree on marsh land but dry under tree.

e—Open pickle weed grounds on marsh land.

f—Mangrove tree (fair canopy) on marsh land with water under it.

Data derived from these counts indicated that:

a. Migration starts about dawn from open into shaded areas, in or about the open marshes, over 1-hour period with the minimum count at 8 A.M. and then increases in the hot sun of late afternoon.

b. Full migration starts about dusk from shaded into open marshes. It should be noted, however, that landing rates of over 100 were obtained during the night in jungle areas.

c. Dawn flights decrease population in the open marshes but not to zero. Fairly high counts obtained in open marshes under bright sunlight.

d. There was increased activity in open marshes before dawn and after dusk.

e. Evidence points to dawn and dusk migration.

f. For practical control, open marshes should be treated in the "predawn" and forested areas after dawn.

Migratory habits of *Anopheles quadrimaculatus* were studied in swamp areas near Decatur, Alabama. The data indicated that:

a. This species is completely inactive during periods of sunlight (resting periods).

b. It does not land or bite under sunlight conditions or when in flight near resting places.

c. Between sunrise and dark, this species rests in some dark, cool, damp place such as a tree hole, hollow log, or empty keg.

d. They leave their resting place during the hour following sunset.

Since the anopheline adults had practically a zero landing rate in the vicinity of their resting places over a 24-hour period, it was concluded that the adults in this particular location have acquired a definite preference for specific locales in which blood meals are daily sought.

It was concluded that control of the adult by aerosol treatment is feasible.

a. During the day while they are resting in tree holes.

b. At dusk when they are leaving tree holes.

c. In early morning when they are returning to tree holes.—LEO KARTMAN, University of Hawaii, Honolulu, T. H.

29429 Ca

BIOLOGICAL CHARACTERISTICS OF LABORATORY-REARED *Aëdes atropalpus*. H. L. Trembley. J. Ec. Ent. 40(2):244–250. 1947.

Aëdes atropalpus, a species of rock-hole mosquito, has been added to that small group of mosquitoes which are autogenous. The females do not require blood meals, or, in fact, any food at all, in order to deposit viable eggs. A colony in which the females were fed only a sugar solution was reared in the laboratory for more than a year, and in its 26th generation continued with no apparent loss of vigor. A colony in which the females received only distilled water for several generations was thriving at the time the article went to press. A comparison of the life-cycles of individuals from the colony routinely offered blood and those denied blood showed no marked differences. The females of this species may be induced to bite when blood meals are offered, but subsequent oviposition results in comparatively few viable eggs. *Aëdes atropalpus* may mate in small spaces, has no seasonal period of comparative inactivity, and does not exhibit a decrease in the number of females with the increase in successive generations.—Author's abstract.

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RESISTANCE OF MOSQUITO LARVAE AND PUPAE TO EXPERIMENTAL DROUGHT. George H. Bick and George H. Penn. Ann. Ent. Soc. Am. 40(1):82–86. 1947.

Random field observations in New Guinea showed that numerous late stage anopheline larvae were present in rain puddles which had evaporated to the damp mud stage and subsequently reflooded. Fourth instar larvae of *Anopheles punctulatus* survived approximately 120 hours on damp filter paper flooded for 30 minutes at 24 hour intervals.

Experiments are described which attempted to determine the effects of varying periods of drought and of periodic flooding on the larvae of *Anopheles walkeri*, which breeds in the shady, grassy margins of swamps and lakes; *Aëdes vexans*, which breeds in temporary pools; and *Wyeomyia smithii*, which finds its breeding water in pitcher plants.

Oversized filter paper was placed on the bottoms of petri dishes and sufficient water from the collection source was allowed to dampen the paper without showing a free liquid. Control dishes were flooded to a depth of ¼ inch. Experimental dishes were covered for maximum humidity, and control dishes were kept uncovered. Temperature ranged from 21° C. to 28° C.

Five 4th instar larvae of *Aëdes vexans* were added to each of 30 dishes and examined as follows: 15 each after 24 and 48 hours, and 30 each after 72, 96, 120, and 144 hours of continuous drought. Maximum survival time was 96 hours (17 per cent), while survival at 48 and 72 hours was not significantly different (13 per cent and 17 per cent). Third instar larvae of *A. vexans*, treated as above, gave a maximum survival time of 120 hours (20 per cent) when examined as follows: 30 larvae each after 24, 48, 72, 96, and 120 hours of continuous drought. One dish of 14 first and second instar larvae of

A. vexans was examined after 48 hours of drought. The maximum survival time was 48 hours (36 per cent). Although the control groups in these tests showed a decrease, there was always a significant difference between them and the experimentals.

Sixty 4th instar larvae of *Wyeomyia smithii* were set up 12 to a dish and examined as follows: 12 each after 48, 96, 144, and 192 hours of drought. Maximum survival time was 192 hours (83 per cent). The survival was irregular for the intermediate time groups. At 144 hours survival of the experimental group equalled the controls (48 per cent and 42 per cent) whereas at 192 hours the experimentals were 83 per cent as against 33 per cent of controls.

One hundred 4th instar larvae of *Anopheles walkeri* were examined on the following schedule: 10 after 24 hours and 15 each after 48, 72, 96, 120, and 144 hours of drought. After examination the dishes were kept flooded. Maximum survival time was 120 hours (27 per cent) and the mortality was limited up to 96 hours. The 27 per cent which survived the maximum time were injured and decreased to 7 per cent, 48 hours after return to flooded conditions.

Groups of larvae were then subjected to drought broken at 24-hour intervals by a 30 minute period of flooding. Fifteen 4th instar larvae of *Aëdes vexans,* 30 3rd instar *A. vexans,* 15 4th instar *Anopheles walkeri,* and 12 4th instar *Wyeomyia smithii* were used. This was of no obvious benefit to *A. vexans* and *W. smithii* larvae, but *A. walkeri* survived 120 hours longer than those in continuous drought.

One hundred twenty-five pupae of *Aëdes vexans* were set up as in the above series, the number in each dish depending on numbers available daily from cultures. Each dish was examined at 24-hour intervals and the number of imagines recorded. No control was used. No emergences were recorded after a maximum of 72 hours of standing, and imagines emerged from 94 per cent of the pupae.

These experiments indicated that larvicide programs should include depressions in the damp mud stage which may subsequently be flooded.—Leo Kartman, University of Hawaii, Honolulu, T. H.

1559

RESISTANCE OF MOSQUITO LARVAE AND PUPAE TO EXPERIMENTAL DROUGHT. (Resistencia de Larvas y Ninfas de Mosquitos a la Sequía experimental.) George H. Bick y George H. Penn. Ann. Ent. Soc. Am. 40(1):82–86. 1947.

Observaciones hechas al azar en la Nueva Guinea demonstraron que numerosas larvas anofelinas en su última face de muda se encontraban en charcos de agua pluvial que se había evaporado hasta el estado de lodo húmedo y después vueltos a inundar. Cuatro larva de *Anopheles punctulatus* en estado de muda quedaron vivos después de aproximadamente 120 horas en papel de filtro húmedo inundado durante 30 minutos a intervalos de 24 horas.

Se hace una descripción de experiencias mediante las cuales se intentó averiguar los efectos de períodos variables de sequía y de la inundación periódica de larvas de *Anopheles walkeri,* los cuales se crian en los márgenes herbosos y sombríos de pantanos y lagunas; *Aedes vexans,* que se crian en charcos pasajeros, y *Wyeomyia smithii,* que busca el agua en que se cria en hojas ascidias.

Se colocó papel de filtro de tamaño un poco grande en el fondo de platillos "petri" y el agua suficiente, motado de las fuentes en las cuales se hicierón las capturas, para humedecer el papel sin dejar líquido libre visible. Los platillos de control se inundaron hasta una profundidad de .64 cm. Se taparon los platillos expermientales para conservar la humedad máxima y los platillos de control se dejaron descubiertos. La temperatura fluctuó entre 21° C y 28° C.

Cinco larvas de *Aedes vexans* en el 4o estado de muda fueron depositados en cada uno de 30 platillos y examinados como sigue; cada uno de 15, después de las 24 y las 48 horas, y cada uno de 30, después de las 72, 96, 120 y 144 horas de sequía continua. El tiempo máximo de sobrevivencia fué 96 horas (17%), aunque la sobrevivencia a las 48 y 72 horas no fué marcadamente diferente (13% y 17%). Larvas de *A. vexans* en la 3a muda, tratadas como queda indicado más arriba, dieron un tiempo máximo de sobrevivencia de 120 horas (20%) al ser examinados como sigue: cada una de 30 larvas después de las 24, 48, 72, 96 y 120 horas de sequía consecutiva. Un platillo de 14 larvas de *A. vexans* en la y 2a muda fué examinado después de 48 horas de sequía. El tiempo máximo de sobrevivencia fué 48 horas (36%). Aunque los grupos de control en estas experiencias indicaron una disminución, siempre se observó una diferencia significativa entre éllos y los experimentales.

Se colocaron 60 larvas de *Wyeomyia smithii* en su 4a muda en platillos de 12 cada uno y se examinaron como sigue: cada uno de 12 después de las 48, 96, 144 y 192 horas de sequía. El tiempo máximo de sobrevivencia fué 192 horas (83%). La sobrevivencia fué irregular en los grupos de tiempo intermedio. A las 144 horas, la sobrevivencia en el grupo experimental fué igual que en el de control (48% y 42%), mientras que a las 192 horas, la de los experimentales fué 83% comparado con 33% de los de control.

Fueron examinados 100 larvas de *Anopheles walkeri* en su 4a muda según el siguiente horario: 10 después de 24 horas y cada una de 15 después de 48, 72, 96, 120 y 144 horas de sequía. Después de examinados se conservó inundados los platillos. El tiempo máximo de sobrevivencia fué 120 horas (27%) y la mortalidad fué limitada hasta las 96 horas. El 27% que sobrevivieron el tiempo máximo habian sufrido