COLONIZATION OF THE OASIS MALARIA VECTOR, *ANOPHELES SERGENTII*, IN EGYPT[1]

JOHN C. BEIER[2], MAGDA S. BEIER[3], EPTESAM A. EL KORDY[3], SHERIF EL SAID[3] AND MOHAMED A. KENAWY[3]

Anopheles sergentii (Theobald) is the principal vector of oasis-desert malaria, and shows unique physiological and behavioral adaptability in its extreme environment (Farid 1956). Throughout the range of this species, including North Africa, the Middle East and Pakistan (Knight and Stone 1977), it is an efficient malaria vector (Farid 1956). In Egypt, *An. sergentii* transmits malaria in the Western Desert Oases and in Faiyum Oasis (Halawani and Shawarby 1957), and on two occasions has been found naturally infected with sporozoites (Farid 1940; J. C. Beier and M. A. Kenawy, unpublished data).

Studies on *An. sergentii* in the laboratory have been limited to observations of field-collected specimens (Saliternik 1955) due to the lack of laboratory colonies. Many unsuccessful efforts have been made to colonize this species in Egypt (Farid 1956; M. A. Kenawy, personal communication). Except for an unpublished report to WHO on the colonization of this species from Jordan by G. Davidson in 1967 (see Zahar[4]), we are unaware of other colonization attempts. The main obstacle to colonization is that this species is eurygamous as it does not mate readily under laboratory conditions. This report describes the establishment of three colonies of *An. sergentii*.

The initial *An. sergentii* colony originated from more than 500 larvae collected in Siwa Oasis, Matrouh Governorate, Egypt, during October 1982. The other two colonies originated from collections of over 200 larvae from Sinnuris District, Faiyum Governorate during June and October, 1983. Using artificial mating techniques, the Siwa colony was maintained nine months through the eighth generation. The Faiyum strains were maintained for 10 generations over one year.

Field collected larvae were brought to the insectary in Cairo for colonization. The insectary was maintained at 20–30°C, 40–80% RH, with illumination by fluorescent lighting for approximately 8 hours a day.

The artificial mating technique was similar to that employed at the National Institutes of Health (R. Gwadz, personal communication) and described by Ow Yang et al. (1963). Females, held either in a 30 cm^3 cage, or in a 300 ml screened cup, were offered a human blood meal immediately prior to mating. Males were lightly anesthetized by ether and pinned to an applicator stick with a minuten pin. This species, in comparison to other established *Anopheles* colonies maintained by this technique was difficult to force-mate and all matings were made using a dissecting microscope at 100–150X. Experienced individuals could mate up to 20 females per hour. Matings were most successful using males 3–6 days of age.

Mated females were held in 30 cm^3 wooden framed cages and provided with 10% sucrose on cotton which was changed daily. A 12 cm diam. bowl lined with filter paper and ¾ filled with distilled water was used for oviposition. Eggs were collected and usually allowed to hatch in the oviposition bowls. Mated females were refed in the cages on human blood and it was common to refeed the same females up to 6 times over a 1-month period, as most mated females survived 1 month.

First instar larvae were placed in 30 cm diam. round enameled pans half-filled with water. Usually, larvae were reared in a mud slurry (2 kg clay soil stirred in 50 liters tap water; water was used for larvae after 2 days). Preliminary experiments showed faster development and better survival in this water when compared to distilled or tap water. Larvae were fed ground dog food pellets (fat-free), once a day.

Observations were made using the Faiyum colonies in generations 2 to 6 held at 27 ± 2°C. With individual females held in 300 ml screened paper cups, containing 50 ml of water; the duration of the first and second gonotrophic cycles were 4.9 ± 0.9 (n = 55) and 3.6 ± 0.7 (n = 11), days, respectively. The number of eggs per female ranged from 21 to 148, with means of 66.4 ± 26.8 and 74.1 ± 23.7 for the first and second gonotrophic cycles, respectively. Usually, eggs hatched in 2 days and the mean percentage hatch was 81% for 14 replicates containing at least 50 eggs. In larval rearing experiments with 10 replicates of 50 larvae per pan in mud slurry preparation, the

[1] This study was supported by research contract No. N01 AI 22667/NIH-NIAID, entitled "Epidemiology and Control of Arthropod-Borne Diseases in Egypt" between Ain Shams University, Abbassia, Cairo, Egypt and the National Institute of Allergy and Infectious Diseases (NIAID), National Institutes of Health (NIH), Bethesda, Maryland, U.S.A.

[2] National Institutes of Health (NIAID) resident consultant to the Ain Shams Center. Present address: Department of Immunology, WRAIR, Walter Reed Army Medical Center, Washington, DC 20307–5100.

[3] Ain Shams Research and Training Center on Vectors of Diseases, Ain Shams University, Abbassia, Cairo, Egypt.

[4] Zahar, A. R. 1973. Review of the ecology of malaria vectors in the WHO Eastern Mediterranean Region. WHO/MAL/73.808 21 p.

mean pupation time was 10.4 days, with 81% survival. For 10 replicates using tap water, and 8 replicates of distilled water, mean pupation times were 13.2 days and 15.2 days, with mean survival rates of 55% and 33%, respectively. Although adult females were usually fed on human blood, they also readily fed on pigeons, mice and guinea pigs.

Natural mating in cages was not observed, and on several occasions females were dissected and found to be uninseminated, including those from trials with large cages (90 cm^3) containing over 500 adults. Artificial mating appears to be necessary for colony maintenance. However, as the survival and parity potential of the species is high under laboratory conditions, the number of females mated per generation does not have to be great for routine colony maintenance.

We thank Dr. Adel Merdan for logistical support and helpful advice.

References Cited

Farid, M. A. 1940. Malaria infection in *Anopheles sergentii* in Egypt. Riv. Malariol. 19:159–161.

Farid, M. A. 1956. The implications of *Anopheles sergentii* for malaria eradication programmes east of the Mediterranean. Bull. W.H.O. 15:821–828.

Halawani, A. and A. A. Shawarby. 1957. Malaria in Egypt. J. Egypt. Med. Assoc. 40:753–792.

Knight, K. L. and A. Stone. 1977. A catalog of the mosquitoes of the world (Diptera: Culicidae). 2nd edition. Thomas Say Found., Entomol. Soc. Am. 6:1–611.

Ow Yang, C. K., F. L. Sta Maria and R. H. Wharton. 1963. Maintenance of a laboratory colony of *Anopheles maculatus* Theobald by artificial mating. Mosq. News 23:34–35.

Saliternick, Z. 1955. The specific biological characteristics of *Anopheles (Myzomyia) sergentii* (Theo.) and their correlation with malaria control in Israel. Bull. Entomol. Res. 46:445–462.

U.S. POSTAL SERVICE

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
(Required by 39 U.S.C. 3685)

1. TITLE OF PUBLICATION	A. PUBLICATION NO.	2. DATE OF FILING
JOURNAL OF THE AMERICAN MOSQUITO CONTROL ASSOC.	8 7 5 6 9 7 1 X	Dec. 20, 1985
3. FREQUENCY OF ISSUE	A. NO. OF ISSUES PUBLISHED ANNUALLY	B. ANNUAL SUBSCRIPTION PRICE
Quarterly	4	$ 35.00US

4. COMPLETE MAILING ADDRESS OF KNOWN OFFICE OF PUBLICATION (Street, City, County, State and ZIP Code) (Not printers)
American Mosquito Control Association, Cultural Education Center, Albany, NY 12224

5. COMPLETE MAILING ADDRESS OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICES OF THE PUBLISHERS (Not printers)
American Mosquito Control Association, 5545 E. Shields Avenue, Fresno, CA 93727-7713

6. FULL NAMES AND COMPLETE MAILING ADDRESS OF PUBLISHER, EDITOR, AND MANAGING EDITOR (This item MUST NOT be blank)

PUBLISHER (Name and Complete Mailing Address)
American Mosquito Control Association, 5545 E. Shields Avenue, Fresno, CA 93727-7713

EDITOR (Name and Complete Mailing Address)
Dr. Ronald A. Ward, Dept. Entom, Walter Reed Army Inst. of Res., Washington, DC 20307-5100

MANAGING EDITOR (Name and Complete Mailing Address)

7. OWNER (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) (Item must be completed)

FULL NAME	COMPLETE MAILING ADDRESS
American Mosquito Control Association, Inc.	5545 East Shields Avenue Fresno, CA 93727-7713

8. KNOWN BONDHOLDERS, MORTGAGEES, AND OTHER SECURITY HOLDERS OWNING OR HOLDING 1 PERCENT OR MORE OF TOTAL AMOUNT OF BONDS, MORTGAGES OR OTHER SECURITIES (If there are none, so state)

FULL NAME	COMPLETE MAILING ADDRESS
NONE	

9. FOR COMPLETION BY NONPROFIT ORGANIZATIONS AUTHORIZED TO MAIL AT SPECIAL RATES (Section 411.3, DMM only)
The purpose, function, and nonprofit status of this organization and the exempt status for Federal income tax purposes (Check one)

☒ (1) HAS NOT CHANGED DURING PRECEDING 12 MONTHS ☐ (2) HAS CHANGED DURING PRECEDING 12 MONTHS (If changed, publisher must submit explanation of change with this statement.)

10. EXTENT AND NATURE OF CIRCULATION	AVERAGE NO. COPIES EACH ISSUE DURING PRECEDING 12 MONTHS	ACTUAL NO. COPIES OF SINGLE ISSUE PUBLISHED NEAREST TO FILING DATE
A. TOTAL NO. COPIES (Net Press Run)	2200	2200
B. PAID CIRCULATION 1. SALES THROUGH DEALERS AND CARRIERS, STREET VENDORS AND COUNTER SALES	0	0
2. MAIL SUBSCRIPTION	1936	1912
C. TOTAL PAID CIRCULATION (Sum of 10B1 and 10B2)	1936	1912
D. FREE DISTRIBUTION BY MAIL, CARRIER OR OTHER MEANS SAMPLES, COMPLIMENTARY, AND OTHER FREE COPIES	42	38
E. TOTAL DISTRIBUTION (Sum of C and D)	1978	1950
F. COPIES NOT DISTRIBUTED 1. OFFICE USE, LEFT OVER, UNACCOUNTED, SPOILED AFTER PRINTING	222	250
2. RETURN FROM NEWS AGENTS	0	0
G. TOTAL (Sum of E, F1 and 2 - should equal net press run shown in A)	2200	2200

11. I certify that the statements made by me above are correct and complete

SIGNATURE AND TITLE OF EDITOR, PUBLISHER, BUSINESS MANAGER, OR OWNER
James R. Caton, Interim Exec. Director

PS Form 3526 July 1981 (See instruction on reverse) (Page 1)