

## ARTICLES

ANTHROPOPHILIC MOSQUITOES IN CENTRAL THAILAND,  
WITH NOTES ON *ANOPHELES BALABACENSIS* BAISAS  
AND MALARIA<sup>1</sup>

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During early 1968, military personnel at a U. S. Army engineer base camp in central Thailand were required to perform certain duties outdoors after dark. These duties were usually completed no later than 2400 hours. An increase in the number of cases of malaria at the camp in March and April 1968 caused concern over the increased exposure of personnel to night-biting mosquitoes. As part of a larger epidemiological investigation, studies were undertaken to (1) identify the anthropophilic mosquitoes in the area, (2) record the times of peak biting activity between 1830 and 2400 hours, and (3) measure rates of oocyst and sporozoite infection in anophelines.

The base camp was located in the Petchabun Mountain Range, 81 km southwest of Korat, Thailand, and was surrounded by jungle that had been partially cleared by native inhabitants. Several small streams were within 1 km of the compound. A small village was located near the camp and numerous people lived in thatched-roof huts in the surrounding jungle. A more complete description of the area and the existing epidemiological situation has been given by Winter *et al.* (1967).

Mosquitoes were collected from human

hosts during 15 nights from 22 April through 24 May 1968. Collections were made within the camp perimeter from 1830 to 2400 hours, since these times corresponded to the period of activity of U. S. Army personnel in the area. The mosquitoes were captured in test tubes as they landed on the bared limbs of collectors. The time of capture was recorded on each tube and identifications were made the next morning. Anophelines were dissected to determine if they were parous or nulliparous. Those found to be parous were further dissected to examine the stomach and salivary glands for oocysts and sporozoites, respectively.

Female mosquitoes representing 5 genera and 20 species, and totalling 538 individuals, were collected during the study (Table 1). Peak biting times could not be determined for most species because of the small numbers collected. However, *Anopheles balabacensis* Baisas, *Anopheles maculatus* Theobald, *Mansonia annulifera* (Theobald), *Mansonia indiana* Edwards, *Mansonia uniformis* (Theobald), and *Aedes albopictus* (Skuse) were collected in numbers sufficient to provide information on their patterns of biting activity (Figure 1). *An. balabacensis* fed in increasing numbers until peak activity at 2130 hours. Subsequently, feeding decreased to a point where only a single specimen was collected after 2300 hours. Peak activity for *An. maculatus* was between 1900 and 2100 hours, with reduced activity continuing throughout the collecting period. Biting activity for *M. annulifera*, *M. indiana*, and *M. uniformis* was

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TABLE 1.—Female Mosquitoes Collected from Human Hosts 81 km Southwest of Korat, Thailand. 22 April–24 May 1968.

Species	Total Collected
<i>Anopheles balabacensis</i>	90
<i>An. barbirostris</i>	1
<i>An. campestris</i>	13
<i>An. maculatus</i>	210
<i>An. minimus</i>	1
<i>An. philippinensis</i>	1
<i>An. vagus</i>	2
<i>Mansonia annulifera</i>	28
<i>M. indiana</i>	61
<i>M. uniformis</i>	52
<i>Aedes albopictus</i>	38
<i>Ae. macfarlanei</i>	1
<i>Ae. niveus</i>	4
<i>Ae. vittatus</i>	10
<i>Culex annulus</i>	12
<i>C. bitaeniorhynchus</i>	1
<i>C. fuscocephalus</i>	4
<i>C. gelidus</i>	5
<i>C. sinensis</i>	1
<i>Armigeres omisus</i>	3
All Species	538

greatest about 1900 hours. By 2000 hours reduced feeding activity was observed and this condition continued throughout the collecting period. *Ae. albopictus*, although predominantly a day-biter, was collected in relatively large numbers up to 1930 hours. Thereafter, only minimal activity was observed. Although no diurnal biting collections were made, this species was a persistent biter in the surrounding jungle during the day. These results are presented as a record of some anthropophilic mosquitoes in central Thailand and the times of peak biting activity, between 1830 and 2400 hours, for the species most abundant during the study.

Five species of *Anopheles* were examined

TABLE 2.—Plasmodial Parasite Infections Observed in Anopheline Mosquitoes Collected from Human Hosts 81 km Southwest of Korat, Thailand. 22 April–24 May 1968.

Species	Number Dissected	Percent Infected
<i>Anopheles balabacensis</i>	84	4.76
<i>Anopheles maculatus</i>	54	0
<i>Anopheles minimus</i>	1	0
<i>Anopheles philippinensis</i>	1	0
<i>Anopheles vagus</i>	2	0

during the study for stages of *Plasmodium* (Table 2). *An. balabacensis* was the only species found to contain oocysts or sporozoites. The following stages of *Plasmodium* were observed in the infected mosquitoes listed in Table 3. One of the two specimens collected in the period 22–26 April had both sporozoites and oocysts, and the other had only sporozoites. Only oocysts were found in the specimen collected in the period 6–10 May, and only sporozoites were found in the specimen collected in the period 20–24 May. While the total number of anophelines examined was relatively small, the number of parous individuals (48.8 percent) and the infection rate (4.76 percent) for *An. balabacensis* was considered high from the standpoint of potential malaria transmission. One member of the survey team exhibited clinical symptoms of malaria following the study, and the presence of *Plasmodium falciparum* was demonstrated in the blood by blood smear. Eleven days prior to the onset of symptoms, this individual had been bitten by, and collected, an *An. balabacensis* which was positive for sporozoites. Winter *et al.* (1967) reported high rates of infection with *Plasmodium falciparum*

TABLE 3.—Proportion of Parous Individuals and Plasmodial Infection Rate in *Anopheles balabacensis* collected from Human Hosts 81 km Southwest of Korat, Thailand. 22 April–24 May 1968.

Collection Period	Number Dissected	Parous No. (%)	Infected No. (%)
22–26 April	25	16 (64.0)	2 (8.0)
6–10 May	18	13 (74.4)	1 (5.5)
20–24 May	41	12 (29.2)	1 (2.4)
22 April–24 May	84	41 (48.8)	4 (4.76)

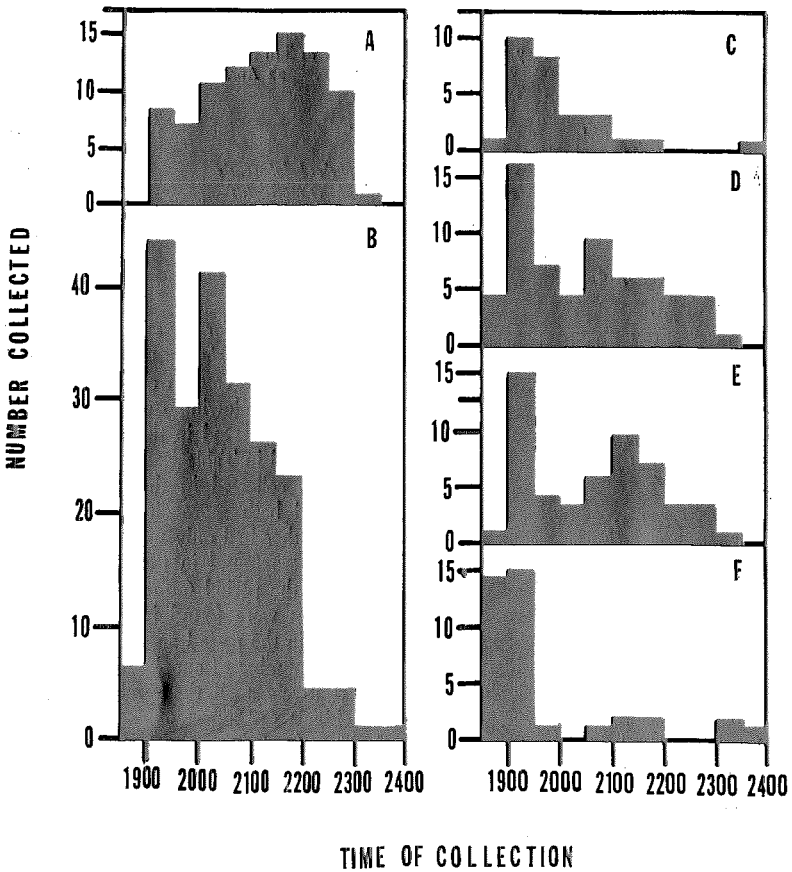


FIG. 1.—Biting times for *An. balabacensis* (A), *An. maculatus* (B), *M. annulifera* (C), *M. indiana* (D), *M. uniformis* (E), and *Ae. albopictus* (F) 81 km southwest of Korat, Thailand. 22 April–24 May 1968.

among native inhabitants of this area and indicated *An. balabacensis* as the probable vector. This anopheline species has been reported as a vector of human malaria elsewhere in Thailand (Scanlon and Sandhinand, 1965) and the observations of the present study strongly suggest that it is the vector in this area also.

#### Literature Cited

- SCANLON, J. E. and SANDHINAND, U. 1965. The distribution and biology of *Anopheles balabacensis* in Thailand (Diptera: Culicidae). *J. Med. Entomol.* 2(1):61-69.
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