ANOPHELES ACONITUS AND *AN. SUBPICTUS* NATURALLY INFECTED WITH *WUCHERERIA BANCROFTI* IN FLORES, INDONESIA[1]

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Anopheles aconitus Dönitz is well known in Indonesia as a vector of malaria but has not previously been incriminated in the transmission of filariasis. Brug (1938) demonstrated the potential filarial vector capability of this species by obtaining an experimental infection rate of 68% with *Wuchereria bancrofti.*

An. subpictus Grassi has been recorded as a vector of malaria in South Sulawesi (Bouman 1940) and Timor (Lien et al. 1975). An experimental infection rate of 72% was obtained with *W. bancrofti* (Soewadji Prawirohardjo 1939).

We conducted surveys during 1975–76 in the filaria-endemic village of Hengga (08°24'S, 122°37'E) on the north coast of Flores, Southeast Indonesia, and found *An. aconitus* and *An. subpictus* naturally infected with *W. bancrofti.* One hundred wild-caught *An. aconitus* were dissected in September 1975: 4 mosquitoes harbored 1st stage larvae, 1 had 2nd stage larvae and 1 had infective stage larvae of *W. bancrofti.* In March 1976 among 1396 wild-caught *An. aconitus* dissected, 10 harbored 1st stage larvae, 3 had 2nd stage larvae and 1 had infective stage larvae.

Dissections of 30 wild-caught *An. subpictus* in September 1975 revealed 1 infected with 2nd stage larvae and 1 with infective stage larvae of *W. bancrofti.* Eight specimens were dissected in March 1976 and no larvae were found.

In the same village *An. barbirostris* Van der Wulp was found to be harboring *Brugia timori.* Among 154 specimens dissected in September 1975, 3 were infected with 2nd stage and 15 with infective stage larvae of *B. timori.* Five hundred thirty-three specimens were dissected in March 1976 and 3 harbored 1st stage larvae, 1 had 2nd stage larvae, and 21 had infective stage larvae of *B. timori.* No developing larvae of *W. bancrofti* were found in *An. barbirostris.*

At the time of these studies, in September 1975 and March 1976, anophelines were readily collected indoors and outdoors on human bait and resting on inside walls of homes.

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EVALUATION OF ELECTRONIC SOUND-PRODUCING DEVICES AGAINST *AEDES TAENIORHYNCHUS* AND *AE. SOLLICITANS*[1]

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INTRODUCTION. Shortly after an article describing how to build an electronic mosquito "repeller" appeared in Popular Electronics Magazine (Greenlee 1970), a number of commercially produced devices began to show up on the U.S. market.

[1]Mention of a commercial or proprietary product in this paper does not constitute an endorsement of this product by the USDA.

Gorham (1974) and Kutz (1974) reported that 2 of these devices did not protect against certain mosquito species. Likewise Rasnitsyn et al. (1974) reported that in Russia 4 types of electronic sound-producing devices did not repel 3 mosquito species.

In addition, we tested models called Moziquit, Skeeter Skat, and Mosquito Chaser in both laboratory and field studies against *Aedes aegypti* (L), *Ae. taeniorhynchus* (Wiedemann), *Ae. sollicitans* (Walker), and *Anopheles quadrimaculatus* Say and concluded there was no evidence of repellency to the mosquitoes tested (unpublished results).

Recently, 2 new instruments were submitted by the Environmental Protection Agency for evaluation by our laboratory. The test methods and results are discussed in this report.

TEST METHODS. The devices, "Buzz-Off" and the Norris Electronic Mosquito Repeller, were field tested near El Dora, New Smyrna, Florida, against 2 species of salt marsh mosquitoes, *Ae. taeniorhynchus* and *Ae. sollicitans*, from September 27–29, 1976, when daytime temperatures were in the low 90's (°F).

Three different tests were conducted. In the 1st test, the repellency of the 2 devices against *Ae. taeniorhynchus* was studied by comparing the number of mosquito bites obtained by 4 subjects who walked single file 0.2 mile along a road from a fairly open area with relatively few mosquitoes to a wooded area where mosquitoes were numerous. There was a distance of 30 paces between subjects as they walked through the test site; they walked in unison; and they stopped at intervals of 20 paces to count the number of mosquitoes biting. Counts were made of only those mosquitoes biting bare forearms and hands in 1 min. The *Ae. taeniorhynchus* were killed so they would not be recounted. Eleven such counts were made by each subject along the roadway. Two subjects carried electronic devices, and 2 did not. At the end of the 0.2 mile, the subjects returned on the same road taking mosquito biting counts as before but with the other 2 men carrying the devices.

In the 2nd test the effectiveness of the devices was compared with that of a standard skin repellent treatment. The procedure was similar to that of the 1st test with the following exceptions. Only 2 subjects at a time walked through the test area. One subject carried an electronic device; the other had treated his forearms with the repellent deet (*N,N*-diethyl-*m*-toluamide). Only 10 counts each were taken of the number of mosquitoes biting on bared forearms. Hands were covered with gloves to reduce mosquito biting. A total of 4 subjects was used with 2 groups of 2 testing 45 min apart.

In the third test, the two devices were evaluated against *Ae. sollicitans*. The subjects wore clothing to protect parts of the body other than forearms or hands, but it was necessary to reduce the scope of the evaluations because of the severe annoyance of the biting mosquitoes. Consequently each of the 4 subjects carried a device, walked down another road 40 paces apart, and took 5 mosquito biting counts each. These tests were conducted at the dead end of Route A1A, New Smyrna, Florida, where a mixture of both *Ae. sollicitans* and *Ae. taeniorhynchus* occurred. Only the *Ae. sollicitans* biting were counted. Because of the reduced scope of the test, a control (no device) was not included.

RESULTS. In the 1st test, the 4 subjects made a total of 44 counts of biting mosquitoes when no electronic devices were carried. The average number of females biting on forearms and hands per subject per minute was 30. The counts ranged from 0 to 100 bites per minute. Two subjects made 22 counts while carrying the "Buzz-Off" device and averaged 25 bites on forearms and hands per subject per minute. Counts ranged from 4 to 47. Two subjects made 22 counts while carrying the Norris Electronic Mosquito Repeller and averaged 36 bites on forearms and hands per subject per minute. Counts ranged from 4 to 100. Thus there was no significant difference between results with or without the devices, which indicated that the devices gave no protection. No difference could be discerned in the numbers of mosquitoes landing on clothing or hovering around subjects with or without the devices.

In the 2nd test, the 2 subjects using the repellent received no bites in 10 counts each on treated forearms while the subject using the 2 devices averaged 9.2 bites per count on the forearms in 10 separate counts each. Thus while the 2 subjects who protected their forearms with deet received no bites, 2 other subjects carrying the 2 types of devices recorded 187 bites on forearms in 20 min of counting. Finally in the 3rd test against *Ae. sollicitans*, the 4 subjects recorded a total of 233 bites in 20 min of counting. (There were many more *Ae. taeniorhynchus* than *Ae. sollicitans* biting, but only *Ae. sollicitans* was counted.) Although no control was used in this experiment, there is no indication that the devices provide sufficient protection from annoyance to warrant their use against *Ae. sollicitans*.

In summary, the 1st test showed no difference in the biting by *Ae. taeniorhynchus* with or without the devices. The 2nd test demonstrated

effective protection with a topical repellent at the same time mosquitoes were readily biting subjects carrying electronic devices. Finally subjects carrying the devices were readily bitten by *Ae. sollicitans*. There is therefore no evidence that these devices have any effect on the biting behavior and annoyance caused by the 2 species in these tests.

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OBSERVATIONS ON THE TIME OF ATTRACTION OF SOME PAKISTAN MOSQUITOES TO LIGHT TRAPS

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Concomitant with a series of all-night biting collections at the Ghulam Mohammad cattle shed near the village of Sattoki, Kasur District, Punjab Province, Pakistan (Reisen and Aslamkhan 1977), New Jersey and C.D.C. light traps were operated throughout the night at monthly intervals during 1976. With the exception of the studies of Aslamkhan and Salman (1969) and Reisen et al. (1976a, b), reports on light trap operation have not been published from Pakistan.

A N.J. light trap was suspended from a tree about 2-m from the ground and 25-m to the east of the cattle shed, and 2 C.D.C. light traps suspended from the eaves on the east and west end of the cattle shed. Traps were operated from dusk to dawn at monthly intervals with collection containers changed at 2-hr intervals. As few specimens were collected during each interval, collections were pooled over the entire year to ascertain the time of attraction of the mosquitoes to light traps.

A total of 522 female and 82 male mosquitoes comprising 14 species in 5 genera were taken during the 28 trap nights in 1976 (Table 1). *Cx. tritaeniorhynchus* was most prevalent among female specimens comprising 56.8% of the total followed by *An. culicifacies* (14.4%) and *An. annularis* (8.1%) (Table 1). Conversely, *An. culicifacies* was most prevalent among male specimens collected (51.2%) followed by *Cx. tritaeniorhynchus* (17.1%), *Aedes caspius* (9.8%) and *An. stephensi* (9.8%) (Table 1). Mosquitoes were attracted to light traps throughout the year, although during the colder months only 4 species were collected.

Over 82% of the females and over 78% of the males were collected during the first half of the night with most of these (44.7% and 42.7%, respectively) coming to lights between dusk and 2000 hrs (Table 1). These times coincided with most mosquito biting (Reisen and Aslamkhan 1977) and swarming (Reisen1976, Reisen et al. 1977) and (Aslamkhan, 1976) rhythms at Sattoki. The C.D.C. traps collected more females, while the N.J. trap collected more males. This was attributed to trap juxtaposition in relation to available hosts and breeding sites. The N.J. trap was situated closer to the agricultural field resting sites of the exophilic species (e.g. *Cx. pseudovishnui, Cx. tritaeniorhynchus, Ae. caspius*) and was adjacent to a stagnant pool which produced *Cx. tritaeniorhynchus* and several anopheline species during part of the year, while the C.D.C. traps were hung over bovid feed troughs and were thus near the primary blood meal source and the resting sites of the endophilic species (e.g. *An. annularis, An. culicifacies,* and *An. stephensi*). In agreement, a majority of the females collected in the C.D.C. traps were freshly fed, while with the exception of *Cx. tritaeniorhynchus,* most specimens collected in the N.J. trap were unfed or gravid. Another possible factor could be the degree of illumination provided by the two types of traps, although this aspect requires further investigation.

Light trap operation seems to be an adequate method for sampling Pakistan mosquitoes, although it is far less productive than buffalo biting collections which yielded 18,873 female mosquitoes comprising 18 species during the same time period (Reisen and Aslamkhan

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