TABLE 1.—Three major agricultural crops on Okinawa in hectares.*

	Sugar	Pineapple	Rice
1960–1961	6,164	2,577	11,728
1961–1962	7,894	3,234	10,520
1962–1963	10,916	3,357	9,717
1963–1964	13,810	3,738	3,901
1964–1965	19,118	4,036	4,066
1965–1966	21,328	4,654	3,469
1966–1967	19,744	5,466	4,312
1967–1968	18,271	5,923	3,935
1968–1969	17,380	5,864	4,274
1969–1970	17,380	5,637	4,571
1970–1971	17,200	5,174	4,387

* Information furnished by the Farm Crop Section, Agriculture and Forestry Division, Government of the Ryukyu Islands.

1 hectare=10,000 sq. meters=2.471 acres.

standing pools of water now provided excellent temporary breeding sites for *Aedes vexans.*

Table 1 reflects the general changes in the area of agricultural crop land used for rice, sugar cane, and pineapple production. From 1960 to 1970 the amount of land utilized for rice production decreased by approximately 63 percent whereas the amount of land used for sugar and pineapple production increased by 179 percent and 100 percent respectively.

Table 2 indicates the total numbers of *Ae. vexans, An. sinensis, C. quinquefasciatus,* and *C. tritaeniorhynchus* adult mosquitoes taken in 25 light traps on Okinawa from 1965 to 1971. Table 3 gives the relative percentages of the total number of mosquitoes trapped for the same four species.

Unfortunately there are no figures available for numbers of mosquitoes that may have been trapped from 1960–1964. Nevertheless, a distinct correlation can be drawn between the declining number of hectares used for rice growing and a steady drop in the populations of *An. sinensis*

TABLE 2.—Selected mosquito species population Trend over a 6-year period.

Year	*Aedes vexans*	*Anopheles sinensis*	*Culex quinque-fasciatus*	*Culex tri-taenior-hynchus*
1965	8,118	23,883	26,577	115,606
1966	19,318	17,994	21,039	155,271
1967	2,166	31,744	15,672	100,500
1968	5,928	9,768	28,540	65,058
1969	30,572	11,130	11,582	26,963
1970	32,994	5,507	14,911	13,380
1971	16,237	4,123	7,770	9,887

TABLE 3.—Percentage of totals of all mosquitoes collected.

Year	*Aedes vexans*	*Anopheles sinensis*	*Culex quinque-fasciatus*	*Culex tri-taenior-hynchus*
1965	4.46	13.12	14.60	63.51
1966	8.74	8.14	9.52	70.28
1967	1.34	19.70	9.72	62.32
1968	5.17	8.51	24.87	56.69
1969	36.16	13.16	13.69	31.87
1970	45.14	7.54	20.40	18.31
1971	38.62	9.81	18.48	23.52

and *C. tritaeniorhynchus.* In reciprocity the number of *Ae. vexans* and their respective proportions of the total of all mosquitoes increased as the hectares for sugar cane production were increased.

Although other geographic areas in the world could demonstrate similar changes in mosquito populations through changes in agriculture, few, if any, would have as clear-cut and dramatic changes as those noted in Okinawa.

ACKNOWLEDGMENT. The authors wish to express their gratitude to Mr. Richard See and Dr. C. C. Lin of the NAMRU-2 Data Processing Department for their continuous assistance in processing the data presented in this study.

MAN-BITING ACTIVITY OF *AEDES AEGYPTI* IN DJAKARTA, INDONESIA

SOEROTO ATMOSOEDJONO,[1] P. F. D. VAN PEENEN,[1] R. SEE [2] AND J. SULIANTI SAROSO [3]

This study was supported through funds provided by the Bureau of Medicine and Surgery, Navy Department, for Work Unit MF12.524.009–0015B.

The opinions and assertions contained herein are those of the authors and are not to be construed as official or as representing the views of the Indonesian Ministry of Health or the U. S. Navy Department.

Reprint requests should be addressed to Publication Office, NAMRU-2, Box 14, APO San Francisco 96263.

[1] U. S. Naval Medical Research Unit No. 2 Detachment, Djakarta, APO San Francisco 96356.

[2] U. S. Naval Medical Research Unit No. 2, Box 14, APO San Francisco 96263.

[3] Chairman, National Institute for Medical Research, Djalan Pertjetakan Negara I, Djakarta, Indonesia.

Studies of the mosquito *Aedes aegypti,* which is presumed to be the vector of dengue virus in Indonesia, were undertaken by the Naval Medical Research Unit No. 2 (NAMRU-2) Djakarta Detachment in 1970–1971. Studies included collection of mosquitoes biting man during daylight hours, as noted below.

MATERIALS AND METHODS. Collectors using sucking tubes collected landing and biting mosquitoes from a sitting, disrobed colleague. Collection was continuous for about 6 hours on 2 consecutive days. Morning and afternoon 6-hour periods were alternated to avoid a possible high bias in numbers of mosquitoes caught the first hour.

Collections were made inside houses, usually in the largest (living) room. Pekodjan, Djatipinggir, and Rawabangke are sections of the city with crowded lower-class housing; Grogol is a middle-class suburb on the western edge of the city.

All landing and biting mosquitoes were collected; these were almost always female *Aedes aegypti.*

RESULTS. Numbers of female *Aedes aegypti* biting man during 13-hour daytime collections from houses in various sections of the city of Djakarta are shown in Table 1. The first four collections were made during the dry season of 1970; the fifth was at the end of the rainy season of 1971. Sight examination of data showed a peak of biting behavior in the morning for tests in the dry season. At the end of the rainy season the peak seemed to occur later, and there was more biting in the afternoon (Fig. 1).

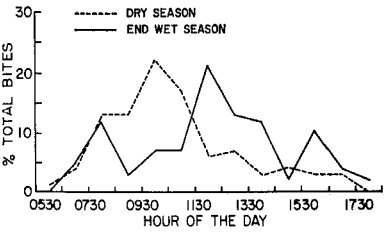

FIG. 1.—Summary of *Aedes aegypti* collected from man during dry and end of wet seasons expressed as percent of total bites.

Statistical analysis of results of the five tests was performed by the Data Processing Department of NAMRU-2, Taipei. Data from the first four tests were pooled and compared with that from the last test. Chi-square values were very high, confirming that the rainy season data dif-

TABLE 1.—*Aedes aegypti* collected biting man.

Hour	30–31 Jul 70 Djatipinggir Total: 187	28–29 Aug 70 Pekodjan Total: 39	4–5 Sep 70 Rawabangke Total: 63	18–19 Sep 70 Grogol Total: 229	17–18 Apr 71 Rawabangke Total: 151
0530–0600	0	0	0	0	..
0600–0630	1	0	0	3	0
0630–0700	2	2	3	4	3
0700–0730	4	2	2	3	6
0730–0800	9	2	1	14	8
0800–0830	19	1	1	21	11
0830–0900	23	3	2	18	1
0900–0930	10	0	2	10	4
0930–1000	4	0	18	6	8
1000–1030	9	4	7	67	3
1030–1100	30	2	10	14	8
1100–1130	21	2	3	6	3
1130–1200	5	1	0	4	13
1200–1230	10	0	3	7	20
1230–1300	2	0	0	5	12
1300–1330	13	10	1	7	8
1330–1400	0	5	0	3	10
1400–1430	2	0	4	1	8
1430–1500	0	4	5	10	2
1500–1530	0	1	1	4	2
1530–1600	0	0	0	13	5
1600–1630	5	0	0	2	10
1630–1700	6	0	0	3	5
1700–1730	5	0	0	2	1
1730–1800	3	0	0	1	0
1800–1830	4	0	..	1	..

fered significantly from the pooled dry season data.

DISCUSSION. There is a seasonal pattern for human illness caused by dengue virus in Djakarta with most severe hospitalized cases ("dengue hemorrhagic fever") occurring during the rainy season (Kho et al., 1969). Interestingly, previous work by Detachment failed to reveal a pattern of seasonal abundance of *Aedes aegypti* since numbers collected using various methods remained relatively constant throughout the year.

The present study showing an apparent shift of biting behavior towards the afternoon hours at the end of the rainy season in Djakarta may be of significance for transmission of dengue. One possible hypothesis is that uninterrupted feeding by mosquitoes may take place during the afternoon when many family members may take naps.

Reference

Kho, L. K., Wulur, H., Karsono, A. and Thaib, S. 1969. Dengue hemorrhagic fever in Djakarta. J. Indonesian Med. Assoc. 19:417–437.

ASSOCIATION NEWS

Plans for the 29th annual meeting of AMCA to be held in Houston, Texas March 25–28, 1973, are proceeding nicely and a fine program is assured. There will be something in it for everyone interested in mosquitoes whether it is control, biology, ecology, taxonomy, genetics, medicine—or any other department of knowledge, both practical and scientific.

The theme of the meeting will be "Education." The exhibits will be open to the public in order to spread knowledge about mosquitoes and their control as widely as possible. Chris Vieser, for the local committee, is hoping that universities, research institutes, and similar agencies will take advantage of the offer to them of free space for educational exhibits. Any AMCA members who know of educational or research agencies which might be interested are urged to notify them, or give their names either to Chris Vieser or to the program chairman, Bob Altman.

Futher announcements about the program, including the "call for papers" will be mailed about October 1, perhaps before this number of *Mosquito News* has reached you. Unless a change is announced in that mailing, the deadline for receiving titles of papers is November 15.

Among other features of the program will be a *Symposium on Recent Developments in Mosquito-Borne Diseases,* moderated by Harry D. Pratt. The panel and subjects will include Don Johnson (malaria); R. W. Chamberlain (encephalitides of the United States); P. K. Russell (dengue); Don Schliessmann (yellow fever); and T. C. Orihel (dog heartworm).