Field Observations on Oviposition Time of *Aedes albopictus*

Yoshio TSUDA, Masahiro TAKAGI and Yoshito WADA

Department of Medical Entomology, Institute of Tropical Medicine, Nagasaki University, Sakamoto-machi 12−4, Nagasaki 852, Japan

Abstract: An automatic recorder of the oviposition time of *Aedes albopictus* was designed. Using the recorder, field observations on the oviposition time were made in August 1988. Total of 132 eggs were observed only in the daytime, from 8:00 to 19:00, and 79.5 % of the eggs were encountered in the afternoon. In most cases, eggs were observed in a restricted period of 2−3 hr in a day and the position of the "oviposition period" in the daytime changed day by day depending on the environmental conditions.

Key words: Automatic recorder, Oviposition, *Aedes albopictus*

INTRODUCTION

The reproductive stage of the female mosquito includes three physiological phases −feeding, resting and ovipositing phase−, and reproducing mosquitoes experience these phases repeatedly. The ecological aspects of these phases such as the survival rate and the length of each phase etc. are very important when we consider the reproductive success of a mosquito. Many studies on feeding mosquitoes have been done (Howley, 1988), however, relatively little is known about the field ecology of adult mosquitoes in the resting or ovipositing phase.

In the present study, we observed ovipositing mosquitoes of *Aedes albopictus* and the time of oviposition in field situation was examined. The time favorable for oviposition in a day and the oviposition pattern of *Ae. albopictus* in time are discussed.

MATERIALS AND METHODS

An automatic recorder of oviposition time was designed to avoid the disturbance by frequent visit of the observer (Fig. 1). A strip of filter paper (4×120 cm) is set on the wall of an ovi-trap (11 cm diameter, 20 cm high). Only a part of the strip (ca. 7 cm long) is exposed to the oviposition. After about 1 hr of exposure, the filter paper is rolled up about 11 cm then the lower part of the filter paper appears and is exposed to ovipositing

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females. The upper part of the filter paper, which has been exposed already to mosquito oviposition, is covered with a strip of vinyl sheet to prevent the later oviposition. This process is repeated for about 12 hr. When oviposition takes place, eggs on the filter paper are kept between the filter paper and the vinyl sheet. The filter paper is rolled up with the vinyl cover by a small water mill placed in the machine. There is a water tank (1.5 l)

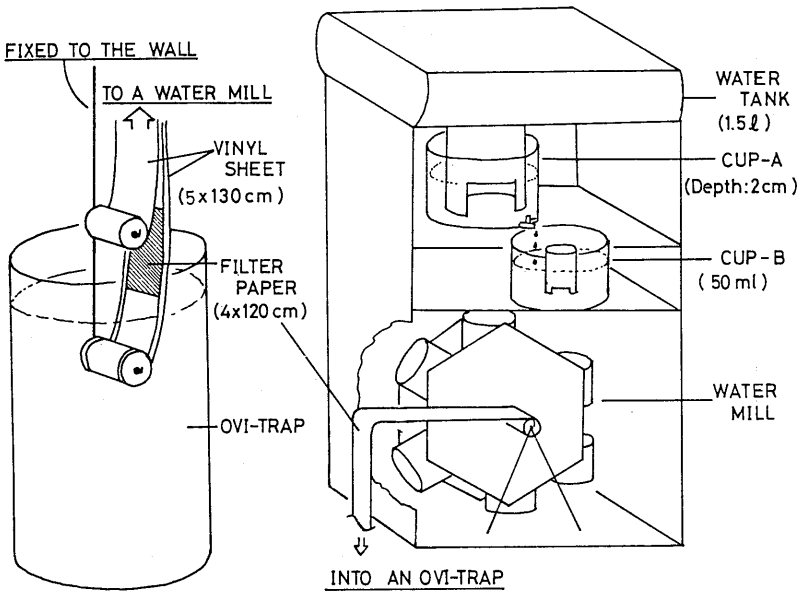

Fig. 1. An automatic recorder of oviposition time. The shaded part of filter paper is exposed to oviposition for 1 hr (See text for details).

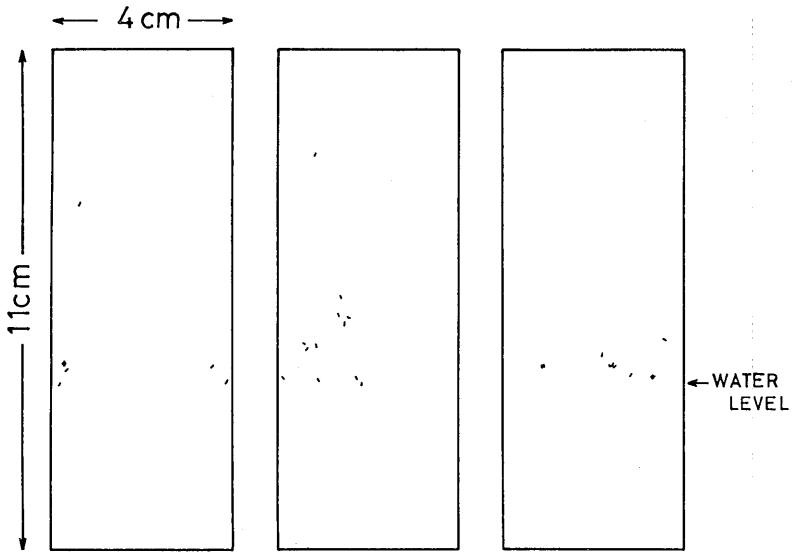

Fig. 2. Three examples of oviposition record. The dots show eggs deposited in 1 hr of exposure.

on the top of the machine from which water is supplied to keep a certain depth (2 cm) of water in cup A. The water in cup A drops at a constant interval into a cup B (50 ml). When the cup B is filled with the dropped water, all the water in the cup flows down at the same time and the small water mill makes one revolution. In this way the machine works at about 1hr intervals for 12 hr. Three examples of oviposition records obtained by the machine are shown in Fig. 2.

The machine was placed in the campus of Nagasaki University School of Medicine. Observation was made in August 1988. The machine was used from 8:00 to 19:00, then another short strip of filter paper (4×10 cm) was simply placed on the wall of the ovitrap until the next morning to examine the nighttime oviposition of *Aedes albopictus.*

Results and Discussion

Total number of eggs deposited per day is shown in Table 1 with the weather condition and the time at sunrise and sunset of the day. The total number of eggs in a day was closely related to the weather condition, and few eggs were observed in rainy days. This clear relationship is reasonable because the rain may prevent the flight and oviposition of mosquitoes. Table 2 shows the time of ovipositon in the daytime during the observation period. Because no eggs were observed from the nighttime records, *Ae. albopictus* was diurnal in its oviposition activity. Although ovipostion was observed more frequently in the afternoon, mosquitoes oviposited at all times in the daytime. From the field observation of a tree-hole breeding mosquito, *Ae. geniculatus,* Yates (1979) showed similar diel periodicity of oviposition in bamboo pots. The diel periodicity in the field seems to reflect the innate oviposition cycle demonstrated in laboratory experiments for a number of mosquito species including *Ae. africans, Ae. aegypti, Ae. apicoargenteus* (Gillett and Haddow, 1957; Haddow and Gillett, 1957; Gillett *et al.,* 1959; Haddow *et al.,* 1960). The time of oviposition and the number of eggs observed at each time period are arranged in Table 3

Table 1. Weather, times of sunrise and sunset, and total number of eggs observed in each day.

Date	Weather	Sunrise	Sunset	Total No. of eggs observed
8/ 9	Clear	5 : 39	19 : 12	16
8/15	Clear	5 : 44	19 : 06	14
8/16	Clear	5 : 44	19 : 05	16
8/17	Rain	5 : 45	19 : 04	3
8/18	Rain	5 : 46	19 : 03	2
8/19	Clear	5 : 46	19 : 01	36
8/20	Clear	5 : 47	19 : 00	1
8/21	Cloudy, occasional rain	5 : 48	18 : 59	0
8/22	Cloudy, occasional rain	5 : 48	18 : 58	1
8/23	Cloudy	5 : 49	18 : 57	20
8/24	Clear	5 : 50	18 : 56	23

Table 2. Time of oviposition observed in *Ae. albopictus* under field condition.

Date	Time of day											
	8 : 00	9 : 00	10 : 00	11 : 00	12 : 00	13 : 00	14 : 00	15 : 00	16 : 00	17 : 00	18 : 00	19 : 00
8/ 9			−	−	−	−	+	+	+	−	−	+
8/15			−	−	−	−	−	−	+	+	+	+
8/16		−	−	+	+	+	−	−	−	+	+	−
8/17		−	−	−	−	−	−	+	+	+	−	−
8/18		−	−	+	−	+	−	−	−	−	−	−
8/19		+	−	−	−	+	+	+	+	+	+	−
8/20		−	−	−	−	−	−	+	−	−	−	−
8/22		−	−	−	−	−	−	−	+	−	−	−
8/23		+	−	−	−	−	−	−	−	+	+	−
8/24		−	−	−	−	+	−	−	−	−	+	+

Table 3. Time of oviposition by *Ae. albopictus* and number of eggs observed in the daytime.

Date	Time of day											
	8 : 00	9 : 00	10 : 00	11 : 00	12 : 00	13 : 00	14 : 00	15 : 00	16 : 00	17 : 00	18 : 00	19 : 00
8/15									1	7	5	1
8/22									1			
8/17								1	1	1		
8/20								1				
8/ 9							2	7	2			5
8/24						1					18	4
8/18				1		1						
8/16				6	2	2				5	1	
8/23		5								8	7	
8/19		13				1	15	4	1	1	1	
Total		18	0	7	2	5	17	13	6	22	32	10

according to the order of earliest oviposition time in each day. Except August 19, which was the next day of heavy rain, mosquitoes laid most of their eggs in a certain time period of 2−3 hr in each day. The position of this "oviposition period" in the daytime changed day by day. Climatic conditions such as the wind velocity, temperature, humidity, light intensity, water vapour all change momentarily. Thus it seems that only when the environmental condition becomes favorable for oviposition, females lay their eggs. The irregular occurrence of the oviposition period may be explained by the results obtained by Rozeboom *et al.* (1973) that eggs from a single gonotrophic cycle are laid in more than one oviposition site.

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