

Seasonal Change in the Oviposition Activity of *Culex pipiens pallens* in Shanghai, China*

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Abstract: The seasonal change in the oviposition activity of *Culex pipiens pallens* was observed at Fuxing Gongyuan (Renaissance Park), Shanghai for one year from August, 1981 through July 1982. An earthen jar of about 10 liters in size and containing wheat bran solution was set up as an ovi-trap for house mosquitoes in a corner of the park. All egg rafts of *Culex pipiens* complex, which were deposited on the water surface in the jar, were picked up every morning and examined for hatching in the laboratory. From the results of the survey, the oviposition activity of *Cx. p. pallens* in Shanghai seems to be rather low during the summer when the maximum temperatures are over about 30 C. Two clear peaks of the activity were observed; higher peak was in late August through early September and lower one was in early July. No egg rafts were found from late November, 1981 to late April, next year, when the maximum temperatures were below about 10 C. The first egg rafts in 1982 were collected in the beginning of May when the temperatures were 23.9 C (Mean Max.) and 15.0 C (Mean Min.). Although the seasonal distribution of activity seems to be different every year by climatic and environmental conditions, the pattern of seasonal change in the oviposition activity of *Cx. p. pallens* in Shanghai is similar to the pattern of seasonal distribution in adults of this mosquito in Japan.

INTRODUCTION

In China, *Culex pipiens* complex is known as the most important vector of Bancroftian filariasis (Manson, 1878; Li, 1959; Sasa, 1976; Zhong *et al.*, 1981), and *Cx. pipiens pallens*, one of the members of the complex, is the most common house mosquito in Shanghai. The breeding places of this subspecies in Shanghai are polluted water in ditches, ponds and various kinds of containers etc. (Liu, 1954). Since there had been no reports about the seasonal change of its oviposition activity, field observations were made at Fuxing Congyuan (Renaissance Park), Shanghai in 1981 and 1982.

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MATERIALS AND METHODS

An earthen jar of about 10 liters in size and containing wheat bran solution was set up as an ovi-trap for house mosquitoes under the trees near a building in a east corner of Fuxing Gongyuan in Shanghai. All egg rafts of *Cx. pipiens* complex, which were deposited on the water surface in the jar, were picked up every morning and each egg raft was separately incubated for 2 or 3 days in a polyethylene cup of 90ml in an insectarium of about 27 C for observations of the hatching conditions. The observations were continued for one year from August, 1981 through July, 1982.

RESULTS

The results of the observations are shown in Table 1 and Fig. 1. As shown in Table 1, 1,245 (98.9%) out of 1,259 egg rafts collected by the ovi-trap were *Cx. p. pallens*. While 1,228 (98.6%) out of 1,245 egg rafts of *Cx. p. pallens* hatched well,

Table 1. Number of egg rafts collected by an ovi-trap at Fuxing Gongyuan, Shanghai from August, 1981 through July, 1982

Year	Period	No. of egg rafts			Total
		<i>Cx. p. pallens</i>	<i>Cx. tritaeniorhynchus</i>	<i>Cx. vorax</i>	
1981	Aug.	1-10	21	1	22
		11-20	72(1)		73
		21-31	293(3)	1	297
	Sep.	1-10	189(5)		197
		11-20	42		42
		21-30	37		37
	Oct.	1-10	6		6
		11-20	12		12
		21-31	13(1)		13
	Nov.	1-10			0
		11-20	5		5
		21-30			0
Dec.	1-31			0	
Jan.-Apr.					0
1982	May	1-10	4		4
		11-20	24(1)		24
		21-31	5		5
Jun.	1-10	34		34	
	11-20	66		66	
	21-30	117(3)		117	
Jul.	1-10	210(3)		210	
	11-20	49		49	
	21-31	46		46	
Total (%)		1,245(17) (98.9)	2 (0.2)	12 (0.9)	1,259 (100.0)

* Figures in parentheses show the number of egg rafts that produced no larvae or only a few larvae.

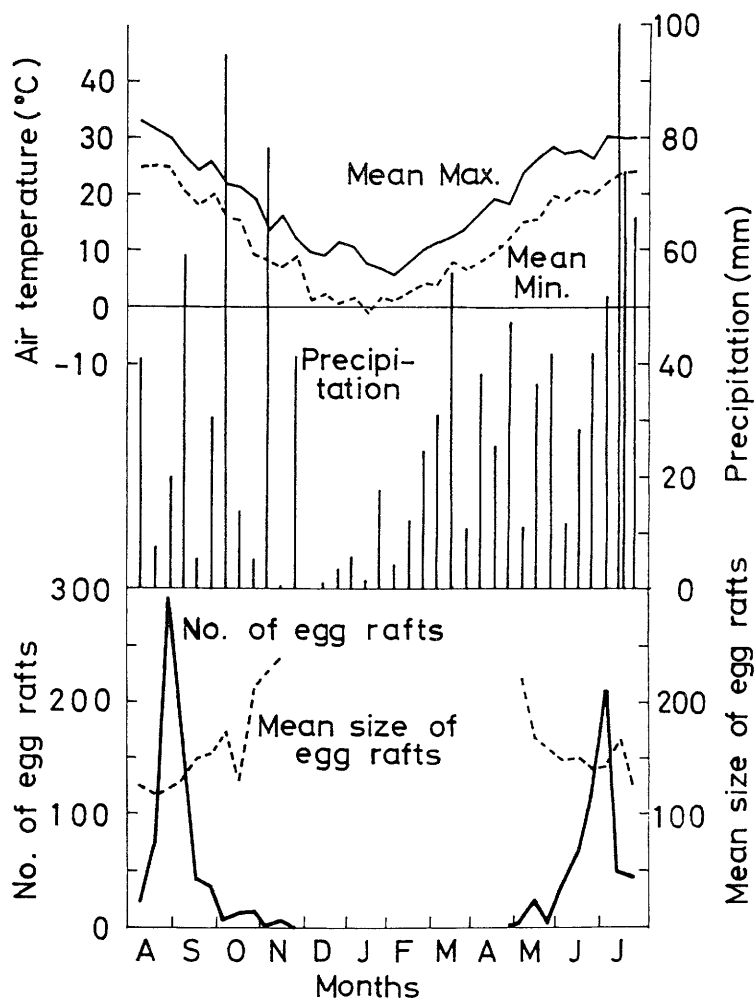


Fig. 1. Seasonal changes of air temperatures, precipitation, and the number of egg rafts collected by an ovi-trap at Fuxing Gongyuan (Renaissance Park), Shanghai from August, 1981 through July, 1982. The air temperatures and precipitation are based on the data from the Meteorological Bureau of Shanghai, and the number of egg rafts is shown by the total in each 10 days.

17 egg rafts (1.4%) did not hatch but 11 of them contained some eggs with developed embryos.

Seasonal changes of the number and mean size of egg rafts of *Cx. p. pallens* deposited in the jar, and some climatic conditions; air temperatures and precipitations, during the survey period are shown in Fig. 1. Although the number of egg rafts was relatively small in early August when the mean maximum air temperature was 32.8 C and the mean minimum was 24.8 C, it began to increase soon and showed the highest

peak in late August and early September when the mean maximum and minimum temperatures were 30.3 C and 24.8 C, respectively. Then the numbers of egg rafts decreased towards the winter and disappeared in early December at 9.9 C and 1.1 C. The last egg raft was collected on November 20, 1981. No egg rafts were found from late November, 1981 to late April, next year. The first egg raft in 1982 was collected in the beginning of May when the temperatures were 23.9 C and 15.0 C. Then the numbers of egg rafts began to increase gradually and reached a peak in early July at 30.3 C and 22.3 C, and decreased rapidly in summer.

The mean size of egg rafts was about 116-124 in August, but it increased gradually and reached to 239 in mid November. Although the size was 220 in early May, it decreased to 128 in late July.

DISCUSSION

From the results of the field observations mentioned above, the oviposition activity of *Cx. p. pallens* in Shanghai seems to be rather low during the summer when the maximum temperatures are over about 30 C. The highest peak of the activity might occur in late August or early September and the 2nd one may appear in early July. No activity will be observed in late November when the maximum temperatures are below about 10 C. Only females of this mosquito can overwinter in China (Liu and Chen, 1955) and Japan (Oda, 1968). Oviposition activity in spring will begin in April or May when the maximum temperatures are over about 20 C and minimums are 12 C.

Similar experiments had been done in Nagasaki (Oda, 1967; Oda and Ueda, 1979; Suenaga, 1982). In general, the results of the present study are similar to those in Nagasaki except that the two peaks of activity were not so clear in Nagasaki.

In 1953, a field survey of seasonal distribution in adult mosquitoes of *Cx. p. pallens* had been made at the same area in Shanghai, as shown in Liu (1954), in which two peaks of activity in June and October was indicated. *Cx. p. pallens* seems to show the two clear peaks in Shanghai every year.

In Japan, seasonal distributions of this mosquito were observed by using light traps at Kawasaki (Ogata *et al.*, 1959), Kyoto (Nakata and Ito, 1955), Yonago (Nagahana and Toyama, 1957, 1958), Kurashiki (Inatomi *et al.*, 1962), Yamaguchi (Shibata and Oka, 1954) and Nagasaki (Ito, 1964). From the results of these experiments in Japan, it seems that hibernated femals begin to appear in February or March. New generations appear in late April or May, slightly decreasing in August, and continuing their activities till late November with small rises in September, October or November, and finally they disappear in November or December. Although the seasonal distribution of activity seems to be different every year by geographical, climatic and environmental conditions, the pattern of seasonal change in the oviposition activity of *Cx. p.*

pallens in Shanghai is similar to the pattern of seasonal distribution in adults of this mosquito in Japan.

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中国上海市におけるアカイエカの産卵活動の季節的推移

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アカイエカの産卵活動の季節的推移が1981年8月から1982年7月までの1年間にわたり上海市内の復興公園で調べられた。容量約10lの水がめに水をはり、少量の糞を入れてイエカ用の産卵容器とし、これを公園の一角の人家に隣接した木蔭に設置した。この水がめを毎朝点検し、水表面に産み落されているすべての卵塊を採集して卵塊別に小容器に収容し、27°Cの恒温室内で2~3日間放置してそれらの孵化状況を調べた。その結果次のことが明らかになった。アカイエカの産卵活動は平均最高気温が30°Cを越す夏の間はむしろ低調である。年間を通じて2つの活動の山があり、最盛期は8月下旬から9月上旬にかけてみられ、もう一つの山は7月上旬頃にみられる。11月下旬から翌年4月上旬までの最高平均気温が10°C以下を示す寒い期間は産卵活動がみられない。1982年春最初の卵塊は5月上旬の最高平均気温が23.9°C、最低平均気温が15.0°Cのときに採集された。この蚊の活動の消長は年により、地理的、気候的及び環境的条件によって異なると思われるが、上海におけるアカイエカの産卵活動の季節的推移の型は日本におけるこの蚊の成虫の季節的消長の型に似ているようである。

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