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Seasonal Occurrence of *Aedes aegypti* and *Ae. albopictus* in Used Tires in 1992−1994, Chiangmai, Thailand

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Abstract: Mosquito larvae breeding in 47 used tires were collected weekly by a siphon from July, 1992 to August, 1994 at Office of Vector Borne Disease Control (former Malaria Center), Region 2, Chiangmai, Thailand. Acidity, chemical oxygen demand (COD), and concentrations of NH_4 and NO_2 were also measured every 3 weeks in the field for each tire. The number of tires with *Ae. albopictus* was always larger than that with *Ae. aegypti.* Both in 1992 and 1993 the decrease in the number of tires with *Ae. aegypti* was observed earlier than that of *Ae. albopictus.* The number of tires with *Ae. aegypti* decreased in the latter half of the rainy season, while that with *Ae. albopictus* decreased in the dry season. Significant temporal variations were observed in pH, COD and NH_4. However all the changes did not correlate with the population decline of *Ae. aegypti* during the latter half of the rainy season. The coefficient of association (C_8) between *Ae. aegypti* and *Ae. albopictus* was positive and statistically significant.

Key words: Ae. aegypti, Ae. albopictus, used tires, northern Thailand

INTRODUCTION

In Thailand some studies have been made on ecology of *Ae. aegypti* in Bangkok, but little is known about ecology of dengue vector mosquitoes in northern region. (Gould et al., 1970; Sheppard et al., 1969; Southwood et al., 1972). Mogi et al.(1988) conducted a whole year survey of mosquitoes breeding in artificial containers in residential areas in Chiangmai. They found that relative abundance of *Aedes albopictus* increased at the beginning of the rainy season and this speicies was replaced by *Ae. aegypti* in the latter half of the rainy season in the rural area. The availability of food for larvae in container habitats was suggested as one of the possible mechanisms of the seasonal decline of *Ae. aegypti.*

Used tires provide breeding sites of mosquitoes and are frequently infested with *Ae. aegypti* and *Ae. albopictus.* Although these tires were common and utilized for many purposes

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in daily life in northern Thailand, no studies have been made on seasonal occurrence of larvae of *Ae. aegypti* and *Ae. albopictus.*

Through the 2 years survey of mosquito breeding in used tires in Chiangmai, we examined seasonal occurrence of *Ae. aegypti* and *Ae. albopictus,* and tried to confirm the population decline of *Ae. aegypti* during the latter half of the rainy season. The seasonal changes in water quality was also examined in this study to analyze the relationship between the quality of water and mosquito occurrence.

MATERIALS AND METHODS

Used tires examined in this study were placed on the ground at Office of Vector Borne Disease Control (former Malaria Center), Region 2, Chiangmai, Thailand to guard newly planted small trees. Mosquito larvae breeding in 47 used tires were collected weekly as a rule with 300 ml of water by a siphon from July, 1992 to August, 1994. Water temperature was recorded and all larvae were killed and kept in 70% alcohol for later identification. The water was returned to the source tire. Quality of the water were examined every 3 weeks for each tire in the field. Acidity, chemical oxygen demand (COD), and concentrations of NH_4 and NO_2 in ppm were measured by the Simplified Water Inspection Apparatus (Kyoritu Chemical-Check Lab. Tokyo, Japan). All data were pooled to calculate the over all density (average numbers of larvae per sample) for *Ae. aegypti* and *Ae. albopictus.* Averages of water temperature, pH, COD, NH_4, and NO_2 were calculated for each census day to show seasonal changes in these environmental parameters. The temporal variations in these parameters were analyzed by analysis of variance (ANOVA) using Systat statistical software package. To analyze interspecific association between *Ae. aegypti* and *Ae. albopictus,* the data from April to September in 1992-1994 were used to construct a 2×2 contingency table (Service, 1993), because larvae of both species were found in many tires in these periods. Based on the 2×2 contingency table the coefficient of association (C_8, Hurlbert, 1969) was calculated.

RESULTS AND DISCUSSION

The number of tires with *Ae. albopictus* was always larger than that with *Ae. aegypti* (Fig.1). The number of tires with *Ae. albopictus* and/or *Ae. aegypti* larvae increased in the rainy season (May to October) and decreased in the dry season (November to April). Both in 1992 and 1993 the decrease in the number of tires with *Ae. aegypti* was observed earlier than that with *Ae. albopictus.* The number of tires with *Ae. aegypti* decreased in the latter half of the rainy season, while that with *Ae. albopictus* decreased in the dry season. This result was agreed with Mogi et al.(1988) and we can conclude that the population of *Ae. aegypti* declines in the latter half of the rainy season in Chiangmai.

The over all density (average number of larvae per sample) was 0.12 and 0.49 for *Ae. aegypti* and *Ae. albopictus,* respectively, and the difference was statistically significant ($t=12.06$, $p<0.001$). However, the average number of larvae calculated from samples with larvae was 2.65

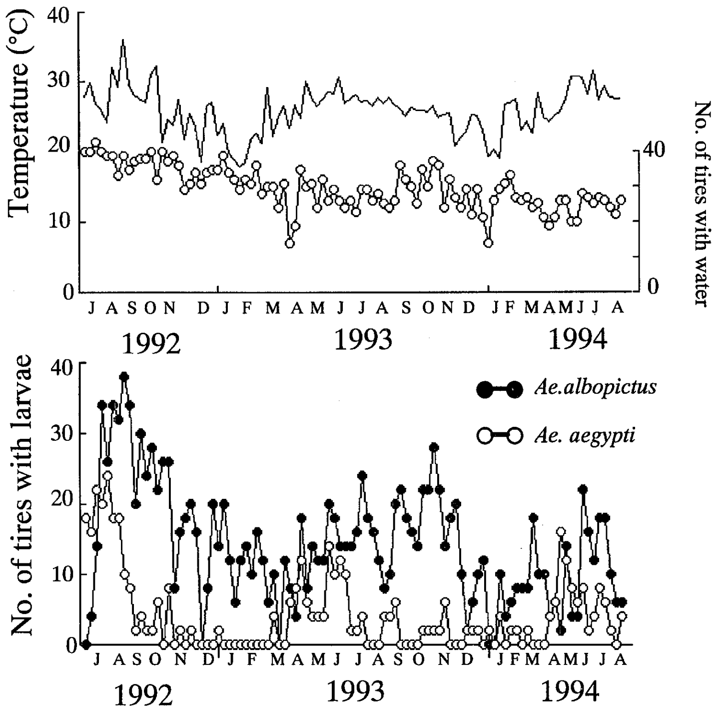

Fig. 1. Seasonal changes in the number of tires with *Ae. aegypti* or *Ae. albopictus* (lower graph), average water temperature, and the number of water positive tires in July, 1992-August, 1994 at Chiangmai, Thailand.

and 2.85 for *Ae. aegypti* and *Ae. albopictus,* respectively, and the difference was not significant ($t = 1.012$, $p < 0.312$). Therefore, the smaller number of tires with *Ae. aegypti* than that with *Ae. albopictus* as shown in Fig. 1 was the main reason for the lower over all density of *Ae. aegypti* larvae than *Ae. albopictus*.

Even in the dry season, the number of water positive tires was usually large because of the artificial water supply to the planted small trees. Therefore, the decrease in the number of *Ae. albopictus* positive tires in the dry season was not ascribed to the decrease in the number of water positive tires. The cooler temperature in the dry season may be one of the reason for the decrease in the number of tires with *Ae. albopictus.*

The water temperature in the latter half of the rainy season was >20℃ and *Ae. aegypti* larvae can develop under this temperature condition (Bar-Zeev, 1957, 1958; Chen, 1988). Thus, the earlier decrease in the number of *Ae. aegypti* positive tires was not explained by the temperature conditions in the rainy season.

The seasonal changes in water quality were shown in Fig.2. The temporal variations in pH, COD, and NH_4 were statistically significant ($p < 0.05$). Although the seasonal changes were not clear in pH and COD, the average values were higher in 1993 than 1992. Because the population

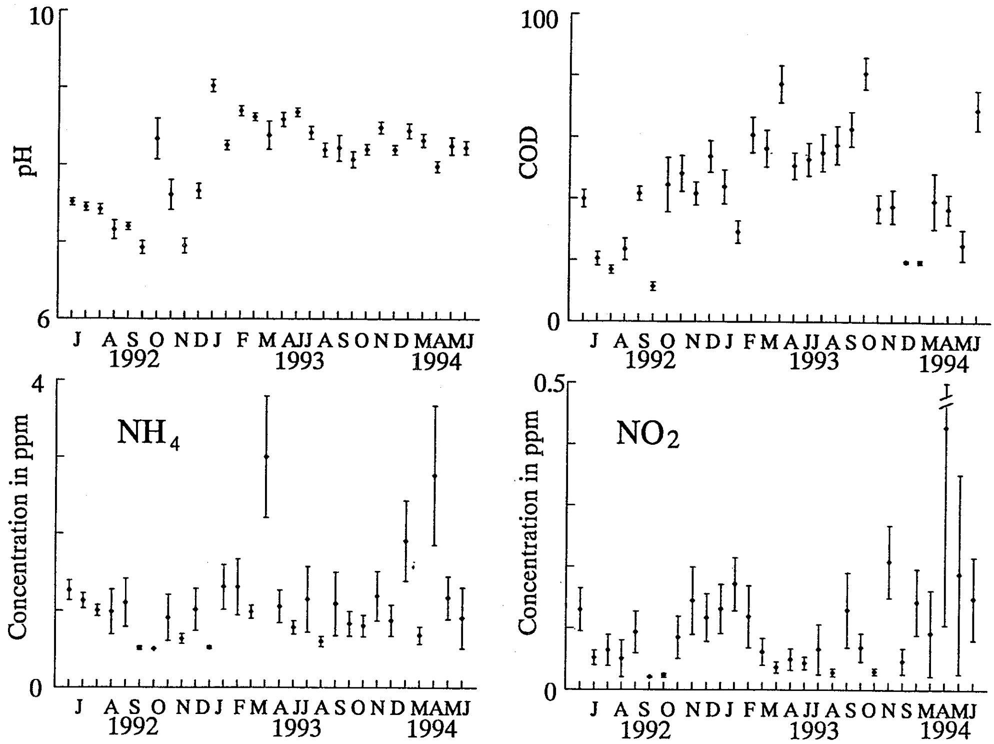

Fig.2. Temporal variations in quality of water in used tires in July, 1992 – August, 1994 at Chiangmai, Thailand. The bar shows mean ± standard error.

decline of *Ae. aegypti* in the latter half of the rainy season was observed during the period with high values of COD in 1993, the food availability for larvae might not be the effective factor of the population decline. Except 2 average values, the concentrations of NH_4 fluctuated around 1 ppm. The concentrations of NO_2 became low in the rainy season, though the temporal variation was not statistically significant. Therefore, all the observed changes in water quality were not parallel to the population decline of *Ae. aegypti* during the latter half of the rainy season.

The degree of co-occurrence of *Ae. aegypti* and *Ae. albopictus* was shown in Table 1. The coefficient of association (C_8) was 0.154 and the positive relation was statistically significant ($\chi^2 = 12.258, p < 0.05$). Although details about larval interactions between these 2 species in used tires have not been studied yet, experiments of intersepcific competition studied so far indicate that *Ae. aegypti* larvae are competitively superior to *Ae. albopictus* larvae (Hawley, 1988). Thus, it seems that the competitive interaction between *Ae. aegypti* and *Ae. albopictus* can not result in the population decline of *Ae. aegypti* in the latter half of the rainy season.

Because different habitat selection of ovipositing females was suggested between *Ae. aegypti* and *Ae. albopictus* (Gould et al., 1970; Mogi et al., 1988, Hawley, 1988), seasonal changes in behavior of ovipositing females should be studied in additional experiments to understand the population decline of *Ae. aegypti* in the latter half of the rainy season.

Table 1. The number of cases with and without *Ae. aegypti* and *Ae. albopictus* in used tires during April – September, 1992 – 1994 at Chiangmai, Thailand.

		Ae. aegypti	
		with	without
Ae. albopictus	with	69	331
	without	110	953

Coefficient of association, $C_8 = 0.154$ ($\chi^2 = 12.258$)

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