THE COLLECTION OF *AEDES AEGYPTI* AND *AE. ALBOPICTUS* FROM BALTIMORE, MARYLAND

KEVIN J. SWEENEY,[1] MICHAEL A. CANTWELL[2] AND JEANNINE DOROTHY[2]

In August, 1985 an infestation of *Aedes albopictus* (Skuse) was discovered in Harris County, Texas. It was the first breeding population reported in the continental USA (Sprenger and Wuithiranyagool 1986). Since 1985, *Ae. albopictus* has spread to 17 eastern states (Centers for Disease Control 1987) and eggs have the ability to diapause and overwinter in northern latitudes (G. B. Craig, personal communication). On the other hand, the yellow fever mosquito, *Aedes aegypti* (Linn.), has long resided in the Southern USA where repeated attempts have failed to eradicate it (Schlessmann 1964, 1966). *Aedes aegypti* is rarely found above latitude 35°N in the USA (Darsie and Ward 1981), however, breeding summer populations have been reported as far north as Rhode Island (Cookman and Lebrun 1986) and southeastern New York State (Benach and Bell 1973). In both cases, *Ae. aegypti* failed to overwinter and was not recovered the following season.

In 1987, the Maryland Department of Agriculture conducted a survey for *Ae. albopictus* from July 5 to October 1. It was learned from inquires made of U.S. Customs and the U.S. Public Health Service that tires arriving in the Port of Baltimore included shipments from Japan and Taiwan. The tires arrive in sealed containers and are unloaded at their final destination, usually a tire retreader or rubber recycling plant. This information led us to consider tire retreading operations as the major source of infestation and probable site of introduction of *Ae. albopictus*. Inquiries were made by telephone and in writing to businesses in Maryland that provided tire retreading services. Seven businesses were inspected for mosquito breeding, tire storage and turnover of used tires. Inspections revealed that two concerns were likely to import tires from regions or nations with endemic populations of *Ae. albopictus* and to provide the necessary breeding habitat. One was located in Baltimore City, while the other was located in Gaithersburg, Montgomery County.

The protocol for surveillance was essentially the same as the CDC protocol (unpublished). Fifteen sites were selected at each business for oviposition trap placement. Red velour strips clipped to wooden tongue depressors were placed inside black plastic cups partially filled with water. Each strip was labeled and serviced weekly. The collected strips and depressors were placed in plastic bags that were sealed and taken to the laboratory for incubation, hatching and adult rearing. All reared adults were identified (Darsie and Ward 1981, Darsie 1986) and were stored in labeled petri dishes. Landing rate stations were established near oviposition sites. Carbon dioxide-enhanced CDC light trap surveys were conducted on two nights in July.

Sixteen *Ae. albopictus* eggs were collected in oviposition traps at a tire retreading business in Baltimore City on August 8 and 13, and September 16 and 23, 1987. Five males and 11 females were reared from these eggs. Four larvae were collected on September 9 and were reared to yield four males. Four adults were taken in landing rate counts (human bait) during 3 weeks in September. As expected, *Ae. albopictus* was not collected in CO_2-enhanced CDC light traps. Vectobac-G® was applied as a larvicide to all tires containing mosquito larvae in September.

Aedes aegypti was collected for the first time in over 80 years in Maryland (Howard 1905, Theobald 1901, Dyar 1922, Christophers 1960, Tinker and Hayes 1959). On September 4, 1987 an adult was collected during a landing rate count. Three weeks later, *Ae. aegypti* was collected as an egg in an oviposition trap. Both collections yielded females. No larvae were collected. Identification of *Ae. albopictus* and *Ae. aegypti* was confirmed by Ronald A. Ward, Walter Reed Biosystematics Unit at the U. S. National Museum.

Aedes triseriatus (Say) and *Aedes atropalpus* (Coq.) were the species most frequently collected by the ovitrap method, comprising approximately 99% of the collected eggs. Larval collections included *Culex pipiens* Linn., *Cx. restuans* Theobald, *Ae. triseriatus* and *Ae. atropalpus*. One *Toxorhychites rutilis septentrionalis* (Dyar and Knab) egg collected in an ovitrap was reared to yield an adult male. The *Ae. atropalpus* collection, which consisted of 75 eggs and three larvae, is a new record for Baltimore City.

It is not known whether *Ae. aegypti* and *Ae. albopictus* arrived from the same location. Various modes of transportation have increased the mobility and distribution of these vector species (Reiter and Darsie 1984, Eads 1972, Pratt et al. 1946, Knudson 1986). *Aedes albopictus* was prob-

[1] Maryland Department of Agriculture, Mosquito Control Section, 50 Harry S Truman Parkway, Annapolis, MD 21401.

[2] Maryland Department of Agriculture, Mosquito Control Section, 51st Avenue, College Park, MD 20742.

ably transported to Baltimore from North Carolina through a tire retreader in Milford, Delaware where *Ae. albopictus* became established in 1987 (C. Stachecki, personal communication). The geographic origin of the Baltimore strain remains unknown. *Aedes albopictus* was colonized in the Annapolis laboratory and 200 eggs sent to researchers at the University of Notre Dame. The results of their research indicate that the Baltimore strain of *Ae. albopictus* is photoperiod sensitive and capable of diapause. Therefore, it is very likely that it will overwinter in Baltimore (G. B. Craig, personal communication).

Since *Ae. aegypti* was not detected in Delaware, it must have been imported from a different location. *Aedes aegypti* may have originated in Puerto Rico since numerous trailers from Puerto Rico are imported by the retreader in Baltimore City. It also may have been transported from another location in the USA.

Further research was conducted through the Baltimore City Health Department to document the number of generations *Ae. aegypti* may have had in Baltimore during the 1800s and early part of the 20th century. Data on yellow fever was examined to obtain this information. It should also be noted that prior to 1850, yellow fever was referred to as "bilious fever" in Health Department Records. Historically, yellow fever cases in Baltimore have occurred in mid- to late August. No cases appear to have been endemic after 1850 or thereabouts. In 1855, a yellow fever epidemic occurred in Norfolk, Virginia. Fleeing residents, together with patients suffering from this disease were transported in large numbers to Baltimore for refuge and treatment (J. Dunning, personal communication). Despite the introduction of infected individuals, no epidemic occurred. Baltimore City had a well organized vector control program at this time and breeding areas were regularly eliminated and swamps drained to suppress mosquito populations. No collection records or data on the number of generations of *Ae. aegypti* occurring during a summer were recorded by the Baltimore City Health Department. We suspect that climatic conditions would be favorable to multiple generations.

In 1988, surveillance for *Ae. albopictus* and *Ae. aegypti* will include tire retreading businesses and tire dumps. Testing will proceed to determine the susceptibility of this species to malathion and control efforts will be implemented when necessary.

REFERENCES CITED

Benach, J. L. and D. D. Bell. 1973. *Aedes aegypti* in Southeastern New York State. Mosq. News 33:248–249.

Centers for Disease Control. 1987. Update: *Aedes albopictus* infestation—United States. Morbidity Mortality Week Rep. 36:769–773.

Christophers, S. R. 1960. *Aedes aegypti* (L.), the yellow fever mosquito. Its life history, bionomics and structure. Cambridge Univ. Press, Cambridge, England.

Cookman, J. E. and R. A. LeBrun. 1986. *Aedes aegypti* larvae in Portsmouth, Rhode Island. J. Am. Mosq. Control Assoc. 2:96–97.

Darsie, R. F., Jr. 1986. The identification of *Aedes albopictus* in the Nearctic Region. J. Am. Mosq. Control Assoc. 2:336–340.

Darsie, R. F., Jr. and R. A. Ward. 1981. Identification and geographic distribution of the mosquitoes of North America, north of Mexico. Mosq. Syst. Suppl. 1, 313 pp.

Dyar, H. G. 1922. The mosquitoes of the United States. Proc. U. S. Nat. Mus. 62(1):1–119.

Eads, R. B. 1972. Recovery of *Aedes albopictus* from used tires shipped to United States ports. Mosq. News 32:113–114.

Howard, L. O. 1905. Concerning the geographic distribution of the yellow fever mosquito. Public Health Rep. Suppl. 18. No. 46, ed 2.

Knudson, A. B. 1986. The significance of the introduction of *Aedes albopictus* into the Southeastern United States with implications for the Caribbean, and perspectives of the Pan American Health Organization. J. Am. Mosq. Control Assoc. 2:420–423.

Pratt, J. J., R. H. Heterick, J. B. Harrison and L. Haber. 1946. Tires as a factor in the transportation of mosquitoes by ships. Military Surg. 99:785–788.

Reiter, P. and R. F. Darsie, Jr. 1984. *Aedes albopictus* in Memphis, Tennessee (USA): An achievement of modern transportation? Mosq. News 44:396–399.

Schliessmann, D. J. 1964. The *Aedes aegypti* eradication program of the U. S. Mosq. News 24:124–132.

Schliessmann, D. J. 1966. Progress report of the *Aedes aegypti* eradication program in the United States for 1965. Mosq. News 26:486–489.

Sprenger, D. and T. Wuithiranyagool. 1986. The discovery and distribution of *Aedes albopictus* in Harris County, Texas. J. Am. Mosq. Control Assoc. 2:217–219.

Theobald, F. V. 1901–1910. Monograph of the Culicidae of the world. Vols. I–V. Br. Mus. (Nat. Hist.), London.

Tinker, M. E. and G. R. Hayes, Jr. 1959. The 1958 *Aedes aegypti* distribution in the United States. Mosq. News 19:73–78.