Journal of the American Mosquito Control Association, 18(1):63–64, 2002

SCIENTIFIC NOTE

SURVEY OF *AEDES AEGYPTI* EGGS IN AND AROUND HOMES IN TUCSON, ARIZONA

JASON T. BOTZ

Department of Ecology and Evolutionary Biology, 1200 Sunnyside Avenue, University of Kansas, Lawrence, KS 66045-7534

ABSTRACT. The abundance and location of eggs of *Aedes aegypti* were evaluated through inspection of 24 Tucson homes during the winter of 1998–99 to assess the potential of the mosquitoes to overwinter in this area. Eggs were found either indoors or outdoors in 46% of residences surveyed. After immersion in water, about 23% of eggs found indoors hatched, and about 5% of eggs found outdoors hatched.

KEY WORDS *Aedes aegypti,* distribution, eggs, mosquito, Arizona

The mosquito *Aedes aegypti* (L.) is an avid biter of humans and a vector of the pathogen that causes dengue fever, and is found mainly in urban settings in the tropics and subtropics of both hemispheres (Matheson 1929, Christophers 1960). Before 1947, the northern range of *Ae. aegypti* included southern Arizona, but the mosquito was eliminated from the southwestern USA and Mexico through eradication efforts in the late 1940s to early 1960s (Pinheiro and Corber 1997). However, the mosquito has since regained most of its former range, and starting in the mid-1990s, it has been found each summer in the city of Tucson in southern Arizona. Meanwhile, global incidence of dengue and dengue hemorrhagic fever has risen dramatically, and the geographic extent of epidemic activity has followed close behind the expanding range of *Ae. aegypti* (Pinheiro and Corber 1997, Rigau-Perez et al. 1998). These factors have prompted renewed emphasis on control of the mosquito vector (World Health Organization 1997).

Many of the Tucson residents that I interviewed reported that they could hardly step outside their homes on summer days without receiving numerous mosquito bites. The mosquitoes causing this nuisance are most likely *Ae. aegypti,* because this species is the only daytime biter prevalent in Tucson (Ramberg, personal communication). Furthermore, the residents generally claimed that they first began to experience problems with mosquitoes just 2–3 years earlier, coinciding with the recent reappearance of *Ae. aegypti* in Tucson.

Knowing whether or not a viable population of *Ae. aegypti* remains in Tucson during the winter would be useful for effectively managing the mosquito population. Although any life stage of the mosquito could overwinter given hospitable temperature and humidity, preliminary observations suggested that larvae were rare, and adults were either too rare or too elusive for detection by a visual survey of residences. Therefore, this study was restricted to determining the prevalence and location of eggs of *Ae. aegypti* in Tucson residences during the coolest months of winter.

Between January 11, 1999, and March 20, 1999, 24 Tucson residences, including house interiors and yards, were inspected for the presence of eggs of *Ae. aegypti.* The survey area was 1.6 km (north–south) by 6.4 km (east–west), and was located near the geographic center of the city.

Objects that were inspected included the interior of all watering pails, recently used vases, water-catching plates under potted plants (under-pot plates), fountains, and pet water dishes, as well as any other container that could have contained standing water. The eggs on each substrate were counted by close visual inspection (counts of larger numbers of eggs will have greater uncertainty). Only 2 counts exceeded 1,000; these counts were stopped and recorded as 1,000. A flashlight was used in shaded areas, or where the surface of the container was dark or covered with soil, to improve visibility of eggs. All eggs were counted, whether living, dead, or hatched.

Where possible, the eggs in a container were tested for viability by immersing them in tap water to a level about 2 cm above the highest eggs (tap water was used to simulate the hatching conditions that would commonly occur in a residential container). The immersed eggs were kept indoors on their original substrates at approximately room temperature. The number of eggs hatched from each substrate (Table 1) was determined by counting the number of larvae that emerged within 3 wk after immersion. A sample of 7 of these larvae was reared to adults, all of which were determined to be *Ae. aegypti* (Darsie and Ward 1981). Possible confusion with similarly marked *Aedes papago* Zavortink was considered unlikely given this native mosquito's restricted range in the distant desert mountains (Zavortink 1972; Ramberg, personal communication).

Table 1. Hatching of *Aedes aegypti* eggs after immersion in water.

Substrate	Location	No. eggs on substrate	% eggs hatched
Watering pail 1	Indoors	120	19
Watering pail 2	Indoors	10	50
Under-pot plate 1	Indoors	10	40
Total from indoors		140	23
Watering pail 3	Outdoors	65	0
Watering pail 4	Outdoors	80	0
Under-pot plate 2	Outdoors	40	5
Dry fountain stones	Outdoors	200	9
Total from outdoors		385	5

Of the 24 residences surveyed, 17% had eggs indoors only, 21% had eggs outdoors only, 8% had eggs both indoors and outdoors, and 54% contained no eggs of *Ae. aegypti.* Houses that were positive for eggs ranged from the western to the eastern edge of the survey area. The average number of eggs per surveyed residence was greater outdoors (280) than indoors (24), although the difference was not statistically significant for this sample size. The proportion of eggs collected that hatched within 3 wk of immersion in water was higher for eggs collected indoors (23%) than for eggs collected outdoors (5%) (Table 1).

Analyses of these data provide qualitative insights into the bionomics of overwintering *Ae. aegypti* in Tucson. They reveal that viable mosquito eggs are present during the winter in residences. If the residences surveyed are an unbiased sample of all Tucson homes, then the mean proportion of homes infested in the city is 46% (95% confidence interval, 24–67%). However, because the participants in this survey were drawn from a neighborhood mosquito watch group (i.e., those residents who are most informed about the biology of mosquitoes and the importance of eliminating breeding sites), these data probably underestimate the actual proportion of Tucson residences containing *Ae. aegypti* eggs. Even so, it is not known if eggs in residences represent an important source of new mosquitoes in the spring. Eggs may be deposited in containers that are drained too frequently for the immature stages to complete their development. However, the most common residential egg-harboring substrates were plant-watering pails, which if not completely drained for a week or more can produce adults. Further study will be needed to determine whether the first *Ae. aegypti* adults to appear in the spring arise from eggs or are overwintering adults, and to establish the relative importance of residential versus nonresidential sites such as cemeteries or junkyards as sources of mosquitoes that attack Tucson residents.

I would like to thank Frank Ramberg and Henry Hagedorn for their advice and assistance with this project, David Byrne for organizational assistance, and Sarah Palmer and the members of the Sam Hughes Neighborhood mosquito watch group for their invaluable help in allowing me to survey their homes. I also thank Catherine Loudon, Elizabeth Davis, and 2 anonymous reviewers for providing helpful feedback about the manuscript.

REFERENCES CITED

Christophers SR. 1960. Aedes aegypti *(L.) the yellow fever mosquito: its life history, bionomics, and structure* London: Cambridge University Press.

Darsie RF Jr, Ward RA. 1981. Identification and geographical distribution of the mosquitoes of North America, north of Mexico. *Mosq Syst* 1(Suppl):1–313.

Matheson R. 1929. *A handbook of the mosquitoes of North America* Springfield, IL: Thomas Books.

Pinheiro FP, Corber SJ. 1997. Global situation of dengue and dengue haemorrhagic fever, and its emergence in the Americas. *World Health Stat Q* 50:161–169.

Rigau-Perez JG, Clark GG, Gubler DJ, Reiter P, Sanders EJ, Vorndam AV. 1998. Dengue and dengue haemorrhagic fever. *Lancet* 352:971–977.

World Health Organization. 1997. *Dengue haemorrhagic fever: diagnosis, treatment, prevention and control* Geneva, Switzerland: World Health Organization.

Zavortink TJ. 1972. Mosquito studies (Diptera, Culicidae) XXVII. The New World species formerly placed in *Aedes* (*Finlaya*). *Contrib Am Entomol Inst* 8:1–206.