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SCIENTIFIC NOTE

IDENTIFICATION OF *AEDES ALBOPICTUS* IN URBAN NICARAGUA

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ABSTRACT. Larvae of *Aedes albopictus*, a mosquito known for transmitting dengue virus, were identified in the city of León, Nicaragua, in 2003. Mosquito larvae were collected from a total of 2,225 residences in the 2 largest cities in Nicaragua during the period from June to September of 2003, and larval *Ae. albopictus* were identified in 4 homes in León. This represents the 1st detection of *Ae. albopictus* in a major Nicaraguan urban center, and increased control efforts appear to have eliminated the mosquito subsequently from León. The presence of *Ae. albopictus* in urban Nicaragua highlights the need for surveillance of areas thought to be free of the mosquito so that early detection and control activities can prevent its spread.

KEY WORDS *Aedes albopictus*, mosquito, dengue, Nicaragua, control

Aedes albopictus (Skuse), a mosquito species native to Southeast Asia, 1st appeared in the New World in 1985. Subsequent to its initial discovery near Houston, TX (Sprenger and Wuithiranyagool 1986), the mosquito has extended its range substantially in the USA. Hawley et al. (1987) hypothesized that the photoperiod adaptation of the strain introduced to the USA inhibited its dispersal southward. However, in 1988 Mexican health authorities identified the presence of *Ae. albopictus* in Matamoros, Tamaulipas State, Mexico (Womack 1993). Additional findings in Mexico (Ibáñez-Bernal and Martínez-Campos 1994, Rodríguez Tovar and Ortega Martínez 1994, Pesina et al. 2001), Cuba (Broche and Borja 1999), and Guatemala (Ogata and Lopez Samayoa 1996) followed. Most recently, a collaboration between the Cuban and Nicaraguan Ministries of Health in 2002 discovered larval *Ae. albopictus* in 5 rural communities in northwestern Nicaragua, near the Gulf of Fonseca (Nicaraguan Ministry of Health 2002). *Aedes albopictus* transmits dengue virus, which is responsible for a major public health problem in Nicaragua and in tropical and subtropical regions throughout the world.

In July 2003, we monitored mosquito breeding sites in Nicaragua's 2 largest cities, Managua and León; follow-up surveys were conducted in October 2003 and January 2004 in León. Entomologists surveyed every 3rd house in designated neighborhoods. All domestic and peridomestic water-holding containers were assessed for the presence of mosquito larvae and pupae. All larvae and pupae were collected; larvae were placed in 70% ethanol and pupae were collected in water and left to emerge. Species identification was determined in the laboratory at 40× magnification by using the keys of Darsie and Ward (1981), Estrada-Franco and Craig (1995), the Brazilian Ministry of Health (1989), and the Centers for Disease Control (1980). Confirmation of species identification was performed at the Florida Medical Entomology Laboratory at Vero Beach. Although *Ae. albopictus* was not found among the 1,383 houses examined in Managua, the presence of the mosquito in urban León was identified in 2 of 3 surveys and in intermittent larvitrap screening.

In the 1st survey in León, comprised of 842 residences, 2 houses (A and B) located on adjacent city blocks were found to possess breeding containers infested with larval *Ae. albopictus* (Table 1). In both cases, the breeding sites positive for *Ae. albopictus* were partially shaded, rain-filled guayabo tree trunk orifices; however, the sizes of the tree holes differed somewhat (Table 1). Interestingly, these tree holes also held between 10 and 100 larval *Aedes aegypti* (L.).

A larvitrap study was implemented to further investigate the spread of *Ae. albopictus*. Larvitraps were placed on August 28 in and around 22 houses situated within a 500-m radius of the previous sites of detection. For each of the 22 residences, 1 larvitrap was placed within the home and 1 was placed in a shaded area between 10 and 40 m outside of the home. The larvitraps consisted of a quarter automobile tire filled with 1 liter of tap water and suspended 50 cm above the ground. Every 7th day for 3 wk after the initial placement, samples were collected and the tires were scrubbed and refilled with water. The most commonly collected larvae were *Ae. aegypti*, followed by *Toxorhynchites theobaldi* (Dyar and Knab), *Aedes albopictus*, *Cu-*

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Table 1. Detection of *Aedes albopictus* in León, Nicaragua, in 2003.

House code	Type of container	Size of container: Diameter (cm)	Size of container: Depth (cm)	Distance from house A	Date of collection	No. larvae *Ae. albopictus*	Larval stage of *Ae. albopictus*	Other species present
A	Tree hole	12	18		June 27, 2003	2	III, IV	1–10 *Ae. aegypti*
					Aug. 28, 2003	2	III, IV	—
					Sept. 10, 2003	1	IV	—
B	Tree hole	6	2	1 block	June 27, 2003	1	IV	1–10 *Ae. aegypti*
C	Tree hole	13	18	2 km NE	Sept. 2, 2003	3	III	10–100 *Ae. aegypti*
D	Larvitrap[a]	—	—	1 block	Sept. 3, 2003	1	IV	—

[a] One quarter of an automobile tire.

lex nigripalpus Theobald, *Culex corniger* Theobald, and *Aedes* (*Howardina*).

In this 1st larvitrap study, *Ae. albopictus* was identified on 3 separate occasions: twice in the same tree hole at house A, and once in a peridomiciliary larvitrap located within 1 city block of the initial sites of detection (Table 1). The 2nd citywide house-to-house survey, in which 626 houses were investigated, was performed in September 2003. In 1 residence approximately 2 km northeast of the sites where *Ae. albopictus* was originally detected, *Aedes albopictus* was encountered in a peridomiciliary tree hole coinhabited by larval *Ae. aegypti* (Table 1).

In an attempt to assess the distribution of *Ae. albopictus*, a mosquito control campaign was briefly postponed in León. A 2nd more extensive larvitrap study using 32 bamboo and 32 tire larvitraps were placed surrounding the original sites and parts of the city flanking the Pan-American Highway during October, November, and December 2003. No additional *Ae. albopictus* was found. In December and January, an intensive mosquito control program aimed at eliminating any remaining larval *Ae. albopictus* reduced mosquito indices to virtually zero. In the 3rd and final house-to-house survey in late January 2004, no *Ae. albopictus* was found in 542 residences inspected—including all 3 homes previously positive for *Ae. albopictus*.

León is located in northwestern Nicaragua, at an altitude of 109 m above sea level and geographic coordinates of 12°N, 86°W. The ca. 151,000 inhabitants live in an area spanning 22 km^2. Ambient temperatures range from 18°C to 40°C, averaging 28°C. The city experiences distinct rainy (May–September) and dry (November–April) seasons, with an average annual precipitation of 1,250 mm. Approximately 130 km separate León from the sites near the Gulf of Fonseca where *Ae. albopictus* had previously been sighted.

Here, we document the 1st positive identification of *Ae. albopictus* in an urban area of Nicaragua and the southernmost detection of *Ae. albopictus* in the Northern Hemisphere in the Americas. The Pan-American Highway, which approaches the Nicaraguan communities near the Gulf of Fonseca that were infested with *Ae. albopictus* in 2002 and enters the city of León, may have facilitated the mosquito's passage from a rural to urban environment. This highway represents a potential conduit for expansion of the mosquito further southward to Managua, the capital of Nicaragua and a city of 1.3 million inhabitants. Although we did detect *Ae. albopictus* in urban León, no larvae or pupae of *Ae. albopictus* were found in man-made, manually filled containers predominated by *Ae. aegypti*, the principal vector targeted by mosquito control campaigns. Notably, the presence of 9 of the 10 larvae encountered in tree holes outside the home highlights the importance of this type of container as a breeding site for *Ae. albopictus* (Gratz 2004). Also of note is the presence of *Ae. aegypti* coinhabiting tree holes with *Ae. albopictus*, because *Ae. aegypti* usually is found in artificial containers rather than tree holes. The tree holes positive for *Ae. albopictus* identified in these surveys were 1st treated with Abate (Clarke Mosquito Control, Roselle, IL) to eliminate mosquito larvae and then filled in with soil to remove the breeding site.

Nicaragua has experienced endemic dengue since 1985, and the introduction of a 2nd mosquito vector could alter the epidemiological potential of the virus. Additionally, the tendency of *Ae. albopictus* to thrive in natural reservoirs in the peridomestic environment and its capacity to transmit viruses vertically would increase the difficulty of dengue vector control. Although early detection and control efforts appear to have eliminated *Ae. albopictus* from the urban center of León, heightened awareness of *Ae. albopictus* throughout the national entomological surveillance system is in effect so that early detection and subsequent source reduction and adulticide campaigns can be implemented to contain the spread of this 2nd dengue vector in Nicaragua.

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