Scientific Note

Sand fly surveillance and control on Camp Ramadi, Iraq, as part of a leishmaniasis control program

Craig A. Stoops1,2, Bryan Heintshcel2, Shabaan El-Hossary3, Rania M. Kaldas3, Peter J. Obenauer3, Mohammad Farooq4, and Jeffrey T. Villinski3

1Navy and Marine Corps Public Health Center detachment USDA ARS Center for Medical, Agricultural and Veterinary Entomology, 1600 SW 23rd Drive, Gainesville, FL 32608, Craig.Stoops@med.navy.mil
2U.S. Navy Environmental and Preventive Medicine Unit 6, Pearl Harbor, HI
3U.S. Naval Medical Research Unit 3, Cairo, Egypt PSC 452, Box 154, FPO AE 09835-9998
4U.S. Navy Entomology Center of Excellence, Bldg 931, Naval Air Station Jacksonville, Jacksonville, FL 32212

Vector-borne diseases are a serious health threat to U.S. troops stationed around the world. U.S. forces deployed to Iraq following the 2003 invasion experienced serious risk of infection by several vector-borne pathogens, specifically cutaneous (CL) and visceral leishmaniasis (VL) (Aliaga and Aronson 2007). Camp Ramadi, a U.S. military Forward Operating Base, was established in 2003 at the Al Anbar provincial capital of Ramadi, approximately 110 km west of Baghdad. In Iraq the total number of cases of CL reported per year from 2004 to 2008 was 1,655 and for VL was 1,711 (Alvar et al. 2012). In Al Anbar province in 2008, the estimated incidence of CL and VL was <1 per 10,000 (Alvar et al. 2012). Because of the war, the number of cases of both CL and VL was most likely underreported in Al Anbar and all provinces of Iraq (Alvar et al. 2012).

Because of the risk of vector-borne diseases, each large U.S. military facility, such as Camp Ramadi, had a vector control program operating throughout the year. As part of a base-wide vector control program, unbaited Center for Disease Control and Prevention (CDC) light traps were placed at three locations on Camp Ramadi between April and August, 2009 to gather baseline population estimates of adult sand flies and monitor the success of subsequent control measures. This paper reports sand fly collections over the five-month period, whether they were positive for Leishmania, and describes efforts to control sand fly populations using ultra-low volume (ULV) insecticide applications.

Three sites on Camp Ramadi were established for trap placement in areas where U.S. troops worked and lived. Site one was in a grove of palm trees near troop living quarters and the base medical clinic. Site two was in a plot of scrub vegetation near the helicopter landing pad, and site three in tall vegetation near buildings occupied by the base Commander. All three sites had active rodent burrows. Traps were placed 1 m above ground and deployed overnight (from 18:00 until 06:00) approximately every other day. Captured sand flies were taken to the base Preventive Medicine office, frozen, sorted by sex, and counted. Dried specimens were sent to the U.S. Naval Medical Research Unit 3 in Cairo, Egypt, for identification and pathogen testing.

As outlined in the Multinational Force Iraq-1 Pest Management Plan, control operations were implemented when the number of sand flies collected in unbaited CDC light traps exceeded a threshold of 15 and when the prevailing wind speed was less than 5 mph as measured by a Kestrel 4000™ (Kestrel Meters, Birmingham, MI) weather meter (Blow et al. 2007). Spray operations were carried out after sunset between 21:00 and 05:00. Two pyrethroid insecticides were used: Scourge® Insecticide (Bayer Environmental Science, Research Triangle Park, NC, U.S.A.) and Anvil® 10+10 ULV (Clarke Mosquito Control Products, Roselle, IL, U.S.A.). Scourge® was used from April to June and Anvil® from June to August.

All safely accessible areas of Camp Ramadi had to be sprayed in their entirety as U.S. troops and civilian personnel worked on nearly every part of the base 24 h per day. Therefore, we were not able to establish an untreated area to compare the number of sand flies in sprayed and unsprayed areas. Due to security outside Camp Ramadi, we were unable to access unsprayed areas off the installation.

Trap data were transformed using log (x+1) because there were nights when one or more traps collected no sand flies (Kline et al. 2006). Table 1 provides transformed trap collections before and after ULV applications combined to calculate a mean catch for each night before and after ULV operations. Mean catches, pre-spray and post-spray, and total catches before and after ULV operations were compared with Student’s t-test using JMP statistical package (Version 9.02, SAS Inc., Cary, NC).

From April to August, 2009, traps were set 57 times and 6,686 sand flies were collected at the three sites combined, of which 6,366 were identified to genus. For identified sand flies, 1,269 (20%) were from species of Phlebotomus; the remainder (5,097, 80%) were Sergentomyia. Female Phlebotomus spp. composed 10% (n=636) of the total catch, whereas females of Sergentomyia spp. represented 44% (n=2,801) of the total catch. Consistent with seasonal fluctuations of sand fly populations (Coleman et al. 2007), capture rates increased from April to July (April: n=481, May: n=1,109, June: n=1,638, July: n=1,842) and declined in August (n=1,616). Although we did not identify captured sand flies to species level, previous surveys in Iraq indicate three predominant species of Phlebotomus: P. alexandri, P. papatasi, and P.