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SCIENTIFIC NOTE

DISCOVERY OF DIURNAL RESTING SITES OF PHLEBOTOMINE SAND FLIES IN A VILLAGE IN SOUTHERN EGYPT

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ABSTRACT. In an attempt to find diurnal resting sites of adult phlebotomine sand flies, potential phlebotomine adult habitats were aspirated in the village of Bahrif in Aswan, Egypt. During this survey, sand flies were aspirated from low (30–45 cm high) irregular piles of mud bricks found under high date palm canopies between the village and the Nile River. There were 5 ♂♂ and 7 ♀♀ of *Phlebotomus papatasi* and 3 ♂♂ of *Sergentomyia schwetzi*. Six of the 7 aspirated females were engorged with blood. A total of 78 sand flies was captured on 3 glue boards placed overnight on the ground next to the mud bricks. Attempts to aspirate sand flies from adjacent walls and plants were unsuccessful. The identification of diurnal resting sites in less structured habitats may ultimately lead to more effective adult sand fly control.

KEY WORDS Habitats, backpack aspirator, *Phlebotomus papatasi*, *Sergentomyia schwetzi*, Aswan

Sand flies (Diptera: Psychodidae: Phlebotomi-nae) are a medically important group in many parts of the world. Besides the biting nuisance factor, they are vectors of human pathogens, e.g., *Leishmania* spp., *Bartonella bacilliformis*, and several arboviruses. Management of phlebotomine populations has been difficult because little is known about the biology of the fly (Coleman et al. 2006). Thus, control efforts have been confined mainly to spray applications of pesticides during periods when adult flies are thought to be active; however, these applications have been ineffective at reducing disease transmission (Maroli and Khoury 2006, Orshan et al. 2006). Knowledge of the diurnal resting sites of adults is lacking (Alexander and Maroli 2003). Although descriptions of various types of habitats used for diurnal resting sites can be found in the literature, records of sand flies being recovered from these or other sites are few (Alexander 2000).

Therefore, a survey was conducted in a village in southern Egypt to identify the diurnal resting sites of adult sand flies. The structure of the village and its surrounding habitat, coupled with work conducted in this area for the past several seasons, suggested that adult resting sites should be present within or near the village (Hoel et al. 2007).

The village of Bahrif (approximate center at 24°10'22"N, 32°52'35"E) is located about 10 km north of the center of Aswan, Egypt (see Hanafi et al. [2001] for map). It is bordered on the east by the Aswan–Edfo Road (Highway 02) and a dry ridge of boulders approximately 500 m from the edge of the village, and on the west by the Sharei El Cornish roadway that runs parallel to the Nile River (approximately 60 m from the edge of the Nile to the nearest village house). The western edge of the roadway is 8 m away and up an embankment from the edge of the Nile River. The village is bounded north and south by other similar villages. The land to the east of the village is tilled for production of row crops, grains, and forages. There is a narrow strip of mango trees separating the housing area from the agricultural fields. The land between the village and the Nile is planted in mango trees and date palms. All trees and crops are irrigated, with the exception of the date palms.

The tall date palms provide broken shade for the grasses and shrub habitat beneath them. One or 2 small areas are used repeatedly to tether and feed livestock, e.g., cows or donkeys, overnight. In these areas, the surface of the sandy soil is obscured by a compressed layer of moist manure and feed residues. Some low (1 m) fences in this area are made from mud and mud bricks, which provide potential resting places for sand flies. Other fences are made from contiguous palm fronds arranged vertically. Refuse materials are scattered throughout the date palm area. Most are paper goods, but there are also discarded building materials such as bricks made of mud or other materials.

For our survey we used a backpack aspirator (Model 1412; John W. Hock Co., Gainesville, FL) and a handheld aspirator (Mechanical

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aspirator; Clarke Mosquito Control, Roselle, IL), both of which are battery powered. Habitats selected for sampling were all under or near the date palm canopy and included walls and low fences made from mud or mud bricks, a palm frond fence, and low shrubs and grasses. Other prospective habitats, e.g., piles of mud bricks, were also sampled. Because this was strictly an investigative survey, very little sampling structure or procedure was involved. Both aspirators could be fitted with 10-ml disposable pipettes (with tapered tips removed) for the aspiration of cracks and crevices in the mud walls and fences. Palm frond fences, grasses, and shrubs were aspirated with the backpack unit fitted with the standard open sampling container (8 cm diam $\times$ 9.5 cm high) sold by the manufacturer. The same type of container was used when the piles of mud bricks were aspirated with the backpack unit. After sampling portions of the selected habitats, sample containers were capped, removed from the aspirators, and checked for the presence of live sand flies.

Sampling began on April 20, 2008, at approximately 1600 h at a mud wall adjacent to the date palm canopy. A mud wall, grasses, and shrubs (all low) under the canopy were sampled next. Between 1625 and 1705 h, a row of bricks approximately 10 m long, 1.5–2 m wide, and 30–45 cm high, located near 24°10'16"N and 32°52'29"E, was sampled in 4 locations. During the same 40-min period, the lower 30 cm of a palm frond fence, parallel to and ca. 60 cm from the row of bricks, was aspirated over 10 m of its length. With the exception of the palm frond fence, each of the above sampling intervals was 90–180 sec.

Sampling of mud walls and the palm frond fence involved a single person operating an aspirator. Other sampling involved 2 individuals, one to shake the grass and shrubs or move the bricks and a second to operate the aspirator. After sampling was completed, glue boards (15 $\times$ 15 cm) were placed on the ground about 8 m apart at 3 locations in the piles of mud bricks and retrieved at 0630 h the following morning. Sand flies in aspirator cups were pooled, stored in vials with 75% ethanol, transported to Cairo, and identified to species in the laboratory at Navy Medical Research Unit-3 with the use of Lane (1986). Because we did not have the materials necessary to remove the sand flies from the glue boards, these were not identified to species.

Sand flies were not aspirated from any fences or walls, or from any grasses or shrubs. However using the backpack aspirator with the standard open sampling container, 15 sand flies, consisting of 12 *Phlebotomus papatasi* (Scopoli) (7 ♀♀ and 5 ♂♂) and 3 *Sergentomyia schwetzi* Adler, Theodor, and Parrot ♂♂, were collected from the 4 locations among irregular piles of mud bricks.

Six of the 7 ♀♀, or 86%, were bloodfed. Numbers of sand flies captured on the 3 glue boards were 6, 51, and 21, respectively.

The survey at the village was a preliminary one, but it appears that the piles of mud bricks are being used as diurnal resting sites by large numbers of sand flies. Although numerous sand flies have been captured in trapping studies performed in the village during the past 3 years, no adult sand flies were recovered by aspiration in a brief study we conducted in 2007. At that time, mud walls, but not mud bricks, were aspirated. It has been reported that it is difficult to aspirate sand flies when they are attached to a substrate, but sand flies in flight are easy to aspirate. When we examined the piles of mud bricks, sand flies flew out of the piles and were collected with the backpack aspirator as bricks were removed one at a time from the piles. No sand flies were collected from mud walls even when the pipettes or other objects were inserted into the cracks and crevices. It seems reasonable to surmise that mud bricks, whether in piles or in fences or walls, would be used in a similar way by sand flies.

Because of time constraints, additional sampling could not be done at this time. However, an additional study is being planned so the village and the area around the village can be sampled in a systematic manner. We propose to find and characterize diurnal resting sites of sand flies in a structured environment inhabited by humans along with domestic and feral animals. Results can lead to discovery of diurnal resting sites in less structured habitats and ultimately lead to more effective adult sand fly control.

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