Annals of Tropical Medicine and Parasitology, Vol. 79, No. 5, 533–538 (1985)

Biting activity of two anthropophilic species of sandflies, *Lutzomyia*, in an endemic area of leishmaniasis in Ecuador

By YOSHIHISA HASHIGUCHI

Department of Parasitology, Kochi Medical School, Nankoku City 781–51, Kochi, Japan

EDUARDO A. GOMEZ L., VICENTA V. DE CORONEL

Departamento de Parasitologia, Instituto Nacional de Higiene y Medicina Tropical, Guayaquil, Ecuador

TATSUYUKI MIMORI

Department of Parasitic Diseases, Kumamoto University, School of Medicine, Honjo, Kumamoto City 860, Kumamoto, Japan

AND MASATO KAWABATA

Department of Parasitology, National Institute of Health, Kamiosaki, Tokyo 141, Japan

Received 15 June 1984

The biting patterns of *Lutzomyia trapidoi* and *Lu. hartmanni*, vectors of leishmaniasis, were studied using a human bait in an endemic area on the Pacific slope of the Andes in Ecuador. The results suggest that *Lu. trapidoi* is primarily an early biter at dusk, with the first peak at 20.00–21.00 hours and the second at 03.00–04.00 hours; and that *Lu. hartmanni* bites more constantly throughout the night, with a pronounced peak between 23.00 and 24.00 hours. The biting activity, however, shows a marked variation at each site and between different collections at the same site.

The activity and the biting places on man are discussed in relation to human infection with leishmaniasis in the area and the location of lesions on patients.

Cutaneous or muco-cutaneous leishmaniasis caused by *Leishmania braziliensis s.l.* is widespread in Ecuador and is a serious public health problem in the rural population of both the Pacific and Amazon regions of the Andes. In contrast to neighbouring South American countries, however, little is known of the biology of Ecuadorian sandflies. In Ecuador, 17 sandfly species belonging to two genera, *Brumptomyia* and *Lutzomyia*, have been reported (Rodriguez, 1950, 1952, 1953*a*,*b*, 1956, 1974; Martins *et al.*, 1978). Of these, several are already known as vectors of leishmaniasis in the New World, but in Ecuador only rarely have attempts been made to find natural infections of flies with promastigotes. Recently, Hashiguchi *et al.* (1985) incriminated two species, *Lutzomyia trapidoi* and *Lu. hartmanni*, as vectors of leishmaniasis in this country. The main purpose of the present investigation was to study the biting behaviour of these two species in an attempt to clarify the transmission of the disease in this endemic area.

MATERIALS AND METHODS

Study Area

The study was carried out in Ocaña, Department of Cañar, Ecuador (2°30′S : 79°0′E). This village is situated about 70 km from Guayaquil City, and is a newly established agricultural

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TABLE 1

Numbers of females of Lutzomyia trapidoi *and* Lu. hartmanni *caught using human baits from dusk to dawn in Ocaña, Cañar, Ecuador, July–October, 1983*

Sandfly species	*Locality**	*Hours*												*Total*
		18–19	*19–20*	*20–21*	*21–22*	*22–23*	*23–24*	*24–01*	*01–02*	*02–03*	*03–04*	*04–05*	*05–06*	
Lu. trapidoi	350	—	0	0	0	0	5	92	58	49	196	31	2	433
	450	—	3	1	0	5	2	1	1	0	2	0	0	15
	600	25	178	275	142	175	141	35	46	29	4	3	8	1061
	600	65	109	246	134	31	23	5	6	5	32	3	20	679
	Total	90	290	522	276	211	171	133	111	83	234	37	30	2188
	Average	45·0	72·5	130·5	69·0	52·8	42·8	33·3	27·8	20·8	58·5	9·3	7·5	569·8
Lu. hartmanni	350	—	11	9	42	34	123	67	50	39	41	57	20	493
	450	—	55	52	14	50	37	27	35	20	26	11	3	330
	600	2	34	27	21	17	34	39	45	26	6	10	14	275
	600	27	27	74	54	17	25	8	11	4	7	4	0	258
	Total	29	127	162	131	118	219	141	141	89	80	82	37	1356
	Average	14·5	31·8	40·5	32·8	29·5	54·8	35·3	35·3	22·3	20·0	20·5	9·3	346·6

*Altitudes above sea level in metres at each locality.

community on the highway to Cuenca City. In this area are sugar cane and banana plantations interspersed with rain forest. Almost all the houses in the village are close to dense forest.

Sandfly Catches

Two persons took part in each fly-catching session, one being the human bait and the other the collector. The human bait sat on a chair with rolled-up sleeves and trousers, and the collector aspirated sandflies with a collecting tube immediately they alighted on the exposed skin. When investigating the location of biting sites on the body, the bait wore only underpants. Sandflies caught were preserved for identification in the laboratory. In all, four fly catches were made at three different sites in and around the village, at 350, 450 and 600 m above sea-level, during the period from July to October 1983.

Climate, Temperature and Humidity

The climatic conditions in the sites are nearly uniform throughout the year, apart from the rainfall which fluctuates considerably within a six-month dry season (May–October) and a six-month wet season (November–April). Measurements of temperature and relative humidity (RH) were made during the hours of fly collection.

RESULTS

Only two anthropophilic species, *Lu. trapidoi* and *hartmanni,* were caught. *Lutzomyia trapidoi* was the dominant species, totalling 61·7% of the total catch (3544 flies). Even though the bait was seated, these sandflies preferred to bite the lower part of the body: lower extremity, 80·0%; higher extremity, 7·0%; back, 6·6%; abdomen, 3·6%; thorax, 1·4%; neck, 0·7% and face, 1·7%. There appeared to be no correlation between the site of biting and the time of collection.

Biting Patterns

The number of females of *Lu. trapidoi* and *hartmanni* caught during uninterrupted collection from dusk to dawn is shown in Table 1. The number of both species varied with locality and time of collection, and there were also differences between two collections made at one of the sites (600 m above sea-level) on different days. The summarized data from the four collections are shown in the Fig. The biting activity of *Lu. trapidoi* was greater from 20.00 to

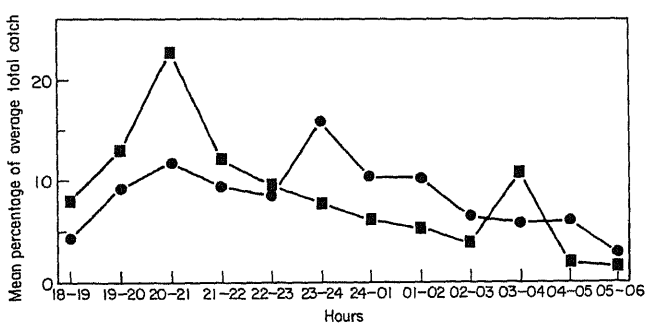

Fig. Biting pattern of *Lutzomyia trapidoi* (■—■) and *Lu. hartmanni* (●—●). The points on the graphs are the average catch during the hour concerned expressed as a percentage of the average total catch.

TABLE 2

Temperature and relative humidity (RH) at collecting sites in Ocaña, Cañar, Ecuador

*Temperature and RH**	*Locality*†	*Hours*											
		18–19	*19–20*	*20–21*	*21–22*	*22–23*	*23–24*	*24–01*	*01–02*	*02–03*	*03–04*	*04–05*	*05–06*
Temperature (°C)	350	22	22	22	22	21	20	20	20	20	20	20	19
	600	24	23	21	21	20	21	20	20	20	20	20	19
	Average	23·0	22·5	21·5	21·5	20·5	20·5	20·0	20·0	20·0	20·0	20·0	19·0
RH (%)	350	74	75	78	83	83	82	84	82	84	82	82	82
	600	70	76	78	85	84	86	84	84	81	84	86	85
	Average	72·0	75·5	78·0	84·0	83·5	84·0	84·0	83·0	82·5	83·0	84·0	83·5

*Measured on 10 September, 1983, at 600 m and on 22 October, 1983, at 350 m.
†Altitudes above sea level in metres at each locality.

21.00 hours, and that of *Lu. hartmanni* was greatest from 23.00 to 24.00 hours. *Lutzomyia trapidoi* also showed a secondary peak of biting activity from 03.00 to 04.00 hours.

The climatic conditions at two of the collecting sites are given in Table 2, and are generally similar. No correlation was observed between the biting patterns of either species of fly and the temperature or humidity of the collecting sites.

Species Composition at Different Biting Hours

Table 3 shows the numbers of *Lu. trapidoi* and *hartmanni* at different times expressed as percentages of the total numbers from all four fly catches. During the hours from 18.00 to 23.00, *Lu. trapidoi* visited the human bait in greater numbers than *Lu. hartmanni*. Thereafter, *Lu. hartmanni* was commoner, except from 03.00 to 04.00 hours when there was a second peak of *Lu. trapidoi*. No correlation was found between the species composition and the climatic conditions.

No sandflies were caught using human bait at the same collection sites in the daytime.

TABLE 3

Numbers of Lutzomyia trapidoi *and* Lu. hartmanni, *expressed as percentages of the total catches, caught from dusk to dawn in Ocaña, Cañar, Ecuador, July–October, 1983*

Sandfly species	*Hours*											
	18–19	*19–20*	*20–21*	*21–22*	*22–23*	*23–24*	*24–01*	*01–02*	*02–03*	*03–04*	*04–05*	*05–06*
Lu. trapidoi	75·6	69·5	76·3	67·8	64·1	43·8	48·5	44·0	48·3	74·5	31·1	44·8
Lu. hartmanni	24·4	30·5	23·7	32·2	35·9	56·2	51·5	56·0	51·7	25·5	68·9	55·2
Total catches	119	417	684	407	329	390	274	252	172	314	119	67

DISCUSSION

The two species caught during the work, *Lu. trapidoi* and *hartmanni*, plus four other species, *Lu. panamensis*, *shannoni*, *serrana* and *gomezi*, have been recorded previously as anthropophilic sandflies in endemic areas of leishmaniasis in Ecuador (Hashiguchi *et al.*, 1985). The present results demonstrate that *Lu. trapidoi* is primarily an early crepuscular biter, with a first peak at 20.00–21.00 hours and a second smaller peak at 03.00–04.00 hours, and bites particularly at the higher site (600 m); and that *Lu. hartmanni* shows a pronounced peak of activity between 23.00 and 24.00 hours (Fig.).

The activity of sandflies seemed to show no correlation with the temperature or humidity of the collecting sites. Chaniotis *et al.* (1971) showed, however, that the biting activities of several species of sandflies in Panama increased with a reduction in light intensity. This was also noticed during our field collections, though light intensity was not recorded in the present study. It is also possible that the biting behaviour of *Lu. trapidoi* and *hartmanni* was affected by various factors at the different sites. Rain and wind, for example, are known to inhibit sandfly activity (Hoogstraal *et al.*, 1962; Quate, 1964).

Of 221 inhabitants of the area who were examined, 14·5% were found to have leishmaniasis (unpublished data). It is assumed that most of these infected individuals would be exposed to the bites of infective sandflies at night-time in and around their houses.

Most sandflies landed on the lower parts of the body of the human bait. These sites are very different from the locations of leishmanial lesions in Ecuadorian patients (Hashiguchi *et al.*, 1984). The discrepancy might be caused by the unusual unclothed condition of our human bait; but on the other hand, the findings may be related to the characteristic behaviour of the flies, which often fly for short distances searching for hosts (Lewis, 1973), and so tend to bite the lower parts of the hosts' bodies near the ground.

ACKNOWLEDGEMENTS. This study was supported by the Ministry of Public Health, Republic of Ecuador and the Japan International Cooperation Agency (JICA). We are greatly indebted to Dr. E. Gutierez V. and Dr. R. Lazo S. of the Instituto Nacional de Higiene y Medicina Tropical, Guayaquil, Ecuador. We express our hearty thanks to Dr. N. Urdillares and Messrs R. Sud and M. Leyton for their helpful assistance. Thanks are also due to Drs N. Ishida, I. Tada, N. Suzuki, S. Hayashi and H. Osaki for their encouragement throughout the study.

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