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Socio-environmental factors and sandfly prevalence in Delft Island, Sri Lanka: implications for leishmaniasis vector control

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Sri Lanka was free of any form of leishmaniasis until recently. The first autochthonous case of cutaneous leishmaniasis (CL) was only detected in 1992[1]. By the year 2002, 65 cases, mainly from northern dry zone, were reported[2]. *Leishmania donovani* zymodeme MON-37 was identified to be responsible for CL in Sri Lanka[3], though *L. donovani* is more typically associated with visceral leishmaniasis (VL). In neighbouring India anthroponotic CL (ACL) is mainly caused by *L. tropica* and is vectored by *Phlebotomus sergenti* and *P. papatasi*[4]. In Sri Lanka the presence of *P. argentipes*, the well known vector of VL caused by *L. donovani* in the Indian subcontinent, has been reported for many years[5–7]. However, the presence of *P. sergenti* and *P. papatasi* has not been reported so far from Sri Lanka.

Delft Island lies in the Palk strait, 37 km from the coast of Tamil Nadu state in India where kalar-azar (a form of VL) caused by *L. donovani* is endemic. There was a request from the health officers in Delft Island to the Jaffna Health Services to take necessary action to control severe insect biting nuisance in early 2004. In mid-May 2004, flies were collected in Delft Island using human landing catches (HLC) and cattle baits. Later, the collected flies were identified as sandflies with *P. argentipes* as the predominant species[8]. In early 2005, three patients from northern mainland were diagnosed with CL. In May 2005, the presence of morphospecies B of *P. argentipes*, which is more associated with VL caused by *L. donovani* than morphospecies A in India[9] was detected in Delft Island[10]. These developments prompted the health authorities in Jaffna to carry out a single indoor residual spray (IRS) in Delft Island in June 2005. In this context, a questionnaire-based study was carried out among the residents of Delft Island to assess their perception of sandflies and knowledge of leishmaniasis transmission and also to determine factors that influence sandfly biting frequencies.

Sandfly specimens were collected from a western area of Delft Island (9:32N 79:41E). Collections were made in two adjacent houses on a single day in mid-May 2004 and in the months of May, July and August of 2005 using HLC. Due to logistical problems HLC were carried out from 2000–2200 h.

In addition, a questionnaire and accompanying interviews were carried out in July/August 2005 in the inhabited western and eastern sectors of Delft Island (9:31:35N, 79:41:26E). These were designed to elicit four types of information: (a) demographic information; (b) knowledge about sandfly and leishmaniasis; (c) attitude towards and steps taken to prevent sandfly biting; and (d) details of the dwellings that could in-

fluence sandfly breeding. Details investigated included: house type, monthly income, occupation of the respondent, educational qualifications, sandfly and its role in disease transmission, perceived severity of sandfly biting, knowledge of conditions ideal for sandfly breeding, sandfly biting times, sleeping habits, measures taken against sandfly biting and their cost. The questionnaires were prepared in Tamil, the local language and were administered by university undergraduates and health workers with secondary education.

In mid-May 2004, during two hours collection from 2000–2200 h, 154 flies were collected. In mid-May 2005, during similar collections, 162 sandflies were collected. After the June 2005 IRS, however, no sandfly could be collected during similar collections in mid-July and August 2005.

Chief of occupants, 59 males and 49 females, of randomly selected 108 house-holds (10% of the total house-holds in Delft Island) were interviewed. Seventy-nine percent of the respondents were daily paid workers and had a monthly income <LKR 5000 (≈US$ 50). Forty percent had their education up to Year 8 and 43% studied up to Year 10. Forty-five percent of the respondents travelled to the Jaffna mainland once a week and 51% at least once in a month. Of the travellers, 39% reach the mainland to purchase essential commodities and 31% for medical treatment. The type of dwellings in Delft Island, that has an impact on sandfly biting is presented in Table 1.

Ninety-three percent of those interviewees categorised the biting by sandflies as severe, and the rest as a moderate nuisance in the period before the June 2005 IRS. They agreed that this IRS had reduced the biting intensity. Knowledge on possible sandfly breeding sources is given in Table 2. Sixteen percent had knowledge of more than one possible breeding site and 30% however, had no knowledge of the possible breeding sites of sandflies. Biting activity of sandflies was reported to be in the evening by 2%, midnight 41%, early morning 8% and throughout the night 49%. None of the respondents reported daytime biting, were aware of leishmaniasis, or its symptoms, and all were unaware of the prevalence of leishmaniasis in mainland Sri Lanka and Tamil Nadu (India). Eighty percent did not think that parapet-walls or boundary walls made of coral were good breeding grounds for sandflies. Forty percent were unaware of the high density of sandflies in the island. Interestingly, 28% of the interviewees believed that sandflies were introduced into the island during the British colonial period (before 1947) to destroy *Opuntia* sp, a cactus that encroaches arable and pasture lands.

Eighty-four percent of the respondents stated that their family members slept on the floor and not beds. Fifty-one percent of the respondents' family members slept on the floor of the open verandah during the

Table 1. Type of houses where the respondents dwell

Type of houses	No. of respondents
Floor-cement, wall-cement, roof-tiles	57 (52.8)
Floor-cement, wall-cement, roof-cadjan leaves	15 (13.9)
Floor-mud, wall-cement, roof-cadjan leaves	8 (7.4)
Floor-mud, wall-mud, roof-cadjan leaves	27 (25)
Floor-cement, wall-cement, roof-asbestos	1 (0.9)

Figures in parentheses are percentages.

Table 2. Knowledge on sandfly breeding source

Type of breeding source	No. of respondents
Moist soil	31 (28.7)
Caves	4 (3.7)
Cervices in the mud-floor	22 (20.4)
Coral stones used to construct parapet-wall	19 (17.6)
None of the above	32 (29.6)

Figures in parentheses are percentages.

night, whilst 48% on the floor indoors. Eighty-five percent of the interviewees used one personal protection measure against sandfly bites. The common personal protection measures were the use of mosquito coils and mosquito nets not treated by insecticides (Table 3). However, nearly 23% employed more than one personal protection measure against sandfly bites. Among the mosquito net users, 36% had only one net for the whole house-holds where average members in the family was five. This indicates the inadequate protection to all members in the family. Nearly 57% of the respondents agreed that sandfly biting had occurred throughout the year. However, only 54% employed personal protection measures daily. This shows all of the inhabitants are exposed to sandfly bites frequently. The cost of personal protection against insect bites, ranged from 1% (57% spent <LKR 50) to 2% (33% >LKR 100) of the total monthly income.

CL is an emerging vector-borne disease in Sri Lanka. No study had been reported so far to assess local knowledge on CL and personal protection measures against sandfly bites by residents in areas of the country where CL can be transmitted. While most respondents perceived sandflies as a biting nuisance they did not suspect them as potential vectors of disease in Delft Island. There was no awareness of leishmaniasis itself, and this ignorance is likely to be widespread in the northeastern province. If sandflies are not recognised as important in the transmission of leishmaniasis, the villagers will not take sufficiently stringent measures to protect themselves against their bites. Although no case of CL had been reported from permanent Delft Island residents, there is a serious risk of infecting the vector population on Delft Island with *L. donovani* arriving from mainland Sri Lanka. The disease may also not be easily recognised among the residents since the medical community in Sri Lanka has become aware of local occurrence of the disease only recently. Hence, there is a clear need to educate the people of Delft Island, and also probably other areas of the northeastern dry zone, on the role of sandflies in the transmission of leishmaniasis.

Table 3. Personal protection measures used by the respondents

Methods	No. of respondents
Mosquito coil	52 (48.2)
Evaporating repellents	0
Mosquito net	45 (41.7)
Electric fan	1 (0.2)
Smoke	2 (1.9)
Net made up of clothes	7 (6.5)
Spring oil on the floor	1 (0.9)

Figures in parentheses are percentages.

Floors and plinths of houses, soil at the edges of heaps of refuse, and soil at the bases of stone walls are good breeding sites for the sandflies[6]. In the mid-May 2005 study, sandfly larvae were identified in the crakes of mud floor of 3/10 houses inspected (unpublished data). The cervices in the uniquely constructed parapet-walls made of local coral-stones also provide a suitable environment for the immature forms in the Delft Island[6]. In addition, the environment in Delft Island is conducive for propagation and breeding of sandflies. The high humid and dry gray loam soil (suitable for extensive growth of pasture grass) with forest cover favours, in addition to the life style of the inhabitants, the high prevalence of *P. argentipes* in Delft Island. As there is the potential for a resurgence of the sandlfly population, with the attendant danger of CL, in Delft Island the IRS needs to be performed at regular intervals, accompanied by continuous surveillance of the sandfly populations.

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References

1. Athukorale DN, Seneviratne JKK, Ihalamulla RL, Premaratne UN. Locally acquired cutaneous leishmaniasis in Sri Lanka. *J Trop Med Hyg* 1992; *95:* 432–3.

2. Siriwardena HVYD, Udagedara CU, Karunaweere ND. Clinical features, risk factors and efficacy of cryotherapy in cutaneous leishmaniasis in Sri Lanka. *Cey Med J* 2003; *48:* 10–2.

3. Karunaweera ND, Pratlong F, Siriwardena HVYD, Ihalamull RL, Dedet JP. Sri Lankan cutaneous leishmaniasis is caused by *Leishmania donovani* zymodeme MON-37. *Trans R Soc Trop Med Hyg* 2003; *97:* 380–1.

4. Kalra NL, Bang YH. Sandfly vector competence for transmission of *Leishmania* parasite in tropical Asia. *J Com Dis* 1986; *1:* 28–34.

5. Lewis DJ. The Phlebotomine sandflies (Diptera: Psychodidae) of the Oriental region. *Bull Br Museum (Natural History) (Entomology)* 1978; *37:* 277–343.

6. Carter HF, Antonipulle P. Observation on sandflies (*Phlebotomus*) in Delft Island, North Ceylon. *Ann Trop Med Parasitol* 1949; *43:* 62–73.

7. Lane RP, Pile MM, Amerasinghe FP. Anthropophagy and aggregation behaviour of the sandfly *Phlebotomus argentipes* in Sri Lanka. *Med Vet Entomol* 1990; *4:* 79–88.

8. Surendran SN, Karunaratne SHPP, Adams Z, Hemingway J, Hawkes NJ. Molecular and biochemical characterisation of a sandfly population from Sri Lanka: evidence for insecticide resistance due to altered esterases and insensitive acetylcholinesterase. *Bull Entomol Res* 2005; *95:* 371–80.

9. Ilango K, Srinivasan VDR, Sadanand AV, Lane RP. Phlebotomine sandflies (Diptera: Psychoidae) of Tamil Nadu and Pondicherry, southern India, in relation to visceral leishmaniasis. *Ann Trop Med Parasitol* 1994; *88:* 413–31.

10. Surendran SN, Kajatheepan A, Hawkes NJ, Ramasamy R. First report on the presence of morphospecies A and B of *Phlebotomus argentipes sensu lato* (Diptera: Psychodidae) in Sri Lanka – implications for leishmaniasis transmission. *J Vect Borne Dis* 2005; *42:* 155–8.

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