

# Molecular and biochemical characterization of a sand fly population from Sri Lanka: Evidence for insecticide resistance due to altered esterases and insensitive acetylcholinesterase

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## Abstract

With an increasing incidence of cutaneous leishmaniasis in Sri Lanka, particularly in northern provinces, insecticide-mediated vector control is under consideration. Optimizing such a strategy requires the characterization of sand fly populations in target areas with regard to species composition and extant resistance, among other parameters. Sand flies were collected by human bait and cattle-baited net traps on Delft Island, used as an illegal transit location by many refugees returning to the north of Sri Lanka from southern India where leishmaniasis is endemic. For species identification, genomic DNA was extracted and a fragment of the ribosomal 18S gene amplified. The sequence from all flies analysed matched that of *Phlebotomus argentipes* Annandale & Brunetti, the primary vector in India and the most likely vector in Sri Lanka. Independent morphological analysis also identified *P. argentipes*. To establish the current susceptibility status of vector species, data were obtained at the biochemical level, from which potential cross-resistance to alternative insecticides can be predicted. The Delft Island collection was assayed for the activities of four enzyme systems involved in insecticide resistance (acetylcholinesterase, non-specific carboxylesterases, glutathione-S-transferases and cytochrome p450 monooxygenases), establishing baselines against which subsequent collections can be evaluated. There was preliminary evidence for elevated esterases and altered acetylcholinesterase in this population, the first report of these resistance mechanisms in sand flies to our knowledge, which probably arose from the malathion-based spraying regimes of the Anti-Malarial Campaign.

## Author keywords

Acetylcholinesterase; Biochemical assays; Carboxylesterase; Insecticide resistance; *Phlebotomus argentipes*; Ribosomal 18S gene; Sri Lanka

## Indexed keywords

**EMTREE drug terms:** acetylcholinesterase; esterase; insecticide; ribosome DNA; RNA 18S

**GEOBASE Subject Index:** insecticide; pesticide resistance

**EMTREE medical terms:** animal; article; bioassay; chemistry; classification; consensus sequence; disease carrier; enzymology; female; genetics; insecticide resistance; male; metabolism; molecular genetics; nucleotide sequence; *Phlebotomus*; physiology; Psychodidae; sequence alignment; Sri Lanka

**MeSH:** Acetylcholinesterase; Animals; Base Sequence; Biological Assay; Consensus Sequence; DNA, Ribosomal; Esterases; Female; Insect Vectors; Insecticide Resistance; Insecticides; Male; Molecular Sequence Data; Phlebotomus; Psychodidae; RNA, Ribosomal, 18S; Sequence Alignment; Sri Lanka

*Medline is the source for the MeSH terms of this document.*

**Regional Index:** Asia; Eastern Hemisphere; Eurasia; South Asia; Sri Lanka; World

**Species Index:** Bos taurus; Phlebotominae; Phlebotomus (proper); Phlebotomus (subgenus); Phlebotomus argentipes