UNIVERSIDADE FEDERAL DA BAHIA

FACULDADE DE MEDICINA DA BAHIA

PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS DA SAÚDE

ESTUDO ENTOMOLÓGICO NA PRINCIPAL ÁREA ENDÊMICA DE LEISHMANIOSE TEGUMENTAR DO ESTADO DA BAHIA, BRASIL.

Bruno Oliveira Cova

Tese de Doutorado

Salvador (Bahia), 2025

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Professor-orientador: PhD Albert Schriefer

Professor-coorientador: PhD Adriano Monte-Alegre

Tese apresentada ao Colegiado do Programa de PÓS-GRADUAÇÃO EM CIÊNCIAS DA SAÚDE, da Faculdade de Medicina da Universidade Federal da Bahia, como pré-requisito obrigatório para obtenção do grau de Doutor em Ciências da Saúde, na área de concentração em Infectologia.

Salvador (Bahia), 2025

COMISSÃO EXAMINADORA

Membros Titulares:

Prof. Dr. Nicolaus Albert Borges Schriefer, Doutor em Imunologia/USP, Professor Adjunto/UFBA (Presidente/Orientador);

Prof. Dr. Adriano Figueiredo Monte Alegre, Doutor em Parasitologia, Université Montpellier 2 - Sciences et Techniques, UM2, (França), Professor Associado/UFBA (Coorientador);

Prof. Dr. Paulo Roberto Lima Machado, Doutor em Medicina/ UFBA, Professor Permanente PPGCS e Pesquisador/ UFBA.

Prof. Dr. Andrey José de Andrade, Doutor em Parasitologia/ UFMG, Professor Adjunto I/ UFPR;

Profa. Dra. Eunice Aparecida Bianchi Galati, Doutora em Saúde Pública/USP, Professora Sênior no Departamento de Epidemiologia da Faculdade de Saúde Pública/USP.

Membro Suplente:

Prof. Dr. Artur Gomes Dias Lima, Doutor em Biologia Parasitária (FIOCRUZ), Professor Titular da Universidade do Estado da Bahia (UNEB).

I. RESUMO

As leishmanioses são doenças infecciosas de significativa diversidade clínica e epidemiológica, com ampla distribuição geográfica no mundo. A Bahia é um dos estados brasileiros mais afetados pela Leishmaniose Tegumentar Americana (LTA). Apresentamos esta tese de doutorado em três artigos que se propõe a descrever os resultados de estudo entomológico realizado na principal área endêmica de LTA do estado da Bahia. O Artigo 1 – "Diversity and natural infection of phlebotomine sand flies (Diptera, Psychodidae) in an endemic area of American Tegumentary Leishmaniasis in southeastern Bahia, Brazil." – consiste um estudo prospectivo da fauna flebotomínica encontrada nas residências de casos índice de LTA, recém-diagnosticados numa região com elevada endemicidade, no Baixo Sul da Bahia. O Artigo 2 – "Invertebrate-Derived DNA (iDNA) to identify sand flies' bloodmeal: A Molecular Approach to Identifying Hosts in Blood-Feeding Vectors." – traz uma continuidade dos resultados o Inquérito Entomológico apresentado no Artigo 1, onde utilizamos a metodologia do metabarcoding para identificar a fonte alimentar de flebotomíneos preferencialmente ingurgitados, encontrados nestas residências de casos índice de LTA. O Artigo 3 – "Empowering people with Cutaneous Leishmaniasis (ECLIPSE): The Brazilian experience with information and knowledge exchange training courses to primary care and educational professionals from endemic areas in southern Bahia, Brazil." – traz a experiência da equipe do projeto ECLIPSE/BRASIL na construção dos Ciclos (In)Formativos sobre Leishmaniose Cutânea, os quais, dentro de uma perspectiva intersetorial, abrangeram profissionais das áreas de saúde, educação e meio ambiente. Nossos achados sugerem que em áreas afetadas pelos surtos de LTA no Baixo Sul da Bahia ocorrem altas proporções de flebotomíneos infectados envolvendo uma variedade de espécies vetoras prováveis ou comprovadas. Analisar o iDNA através de metabarcoding pareado com NGS para determinar as fontes alimentares de flebotomíneos nos permitiu amostrar com precisão uma grande diversidade de espécies de vertebrados. As experiências vividas através do projeto ECLIPSE mostraram que a efetividade de nossas intervenções de saúde pressupõe que as trocas e os relacionamentos que sustentaram o engajamento comunitário fossem recíprocos, iguais e mutuamente vantajosos para as comunidades e as equipes de pesquisa.

Palavras-chave: 1. Leishmaniose Tegumentar Americana; 2. Flebotomíneos; 3. Bahia 4. *Leishmania (Viannia) braziliensis*.

ARTIGO 1

"Diversity and natural infection of phlebotomine sand flies (Diptera, Psychodidae) in an endemic area of American Tegumentary Leishmaniasis in southeastern Bahia, Brazil.".
Parasites & Vectors 18: 79-89, 2025 [papper no A**NEXO 1**]

TABLES

Table 1. Phlebotomine sand fly species collected between May 2018 and June 2019 in the Cacao Region, Bahia-Brazil. Entomological survey was carried out at homes of patients newly diagnosed with Cutaneous or Disseminated Leishmaniasis. Sand fly data were stratified by sex and capture ecotype: intradomicile (Intra), peridomicile (Peri) and extradomicile (Extra).

Species	Intra		Peri		Extra		Total[a]		RA[a]
	♂	♀	♂	♀	♂	♀	♂	♀	
Nyssomyia whitmani (Antunes e Coutinho, 1939)	18	51	98	57	100	61	216 (56)	169 (44)	62.2
Nyssomyia intermedia (Lutz e Neiva, 1912)	03	14	08	16	03	13	14 (25)	43 (75)	9.2
Evandromyia bahiensis (Mangabeira e Sherlock, 1971)			02	13	03	21	05 (13)	34 (87)	6.3
Trichophoromyia viannamartinsi (Sherlock e Guitton, 1970)	02	03		07	05	11	07 (25)	21 (75)	4.5
Pintomyia fischeri (Pinto, 1926)		01	02	03	02	16	04 (17)	20 (83)	3.9
Migonemyia migonei (França, 1920)	02		05	08		06	07 (33)	14 (67)	3.4
Micropygomyia schreiberi (Martins, Falcão e Silva, 1975)		01		05	01	09	01 (6)	15 (94)	2.6
Evandromyia tupynambai (Mangabeira, 1942)		01	02	03	01	04	03 (27)	08 (73)	1.8
Psathyromyia aragaoi (Costa Lima, 1932)			02		03	05	05 (50)	05 (50)	1.6
Pressatia choti (Floch e Abonnenc, 1941)				02	02	05	02 (22)	07 (78)	1.5
Psathyromyia bigeniculata (Floch & Abonnenc, 1941)				01		02		03 (100)	0.5
Psathyromyia pascalei (Barretto e Coutinho, 1940)			02		01		03 (100)		0.5
Psychodopygus hirsutus hirsutus (Mangabeira, 1942)						03		03 (100)	0.5
Micropygomyia oswaldoi (Mangabeira, 1942)			01		01		02 (100)		0.3
Pintomyia serrana (Damasceno & Arouck, 1949)			01			01	01 (50)	01 (50)	0.3
Trichopygomyia longispina (Mangabeira, 1942)						02		02 (100)	0.3
Brumptomyia cunhai (Mangabeira, 1942)					01		01 (100)		0.2
Micropygomyia capixaba (Dias, Falcão, Silva e Martins, 1987)						01		01 (100)	0.2
Psathyromyia barretoi barretoi (Mangabeira, 1942)				01				01 (100)	0.2
Psathyromyia lanei (Barretto & Coutinho, 1941)			01				01 (100)		0.2
Total[a]	25	71	124	116	123	160	272 (44)	347 (56)	100
	96 (15)		240 (39)		283 (46)		619		

[a]Relative Abundance.

Table 2. Abundance and endophilic/exophilic behavior of the most frequent phlebotomine sand fly species collected between May 2018 and June 2019 in the Cacao Region, Bahia-Brazil. Entomological survey was carried out at homes of patients newly diagnosed with Cutaneous Leishmaniasis (CL) or Disseminated Leishmaniasis (DL).

Species	CL		DL		Total[a]	
	Endophilic	Exophilic	Endophilic	Exophilic	Endophilic	Exophilic
Ny. whitmani	94	68	130	93	224 (58%)	161 (42%)
Ny. intermedia	18	15	23	01	41 (72%)	16 (28%)
Ev. bahiensis	07	11	08	13	15 (38%)	24 (62%)
Th. viannamartinsi	11	10	01	06	12 (43%)	16 (57%)
Pi. fischeri	04	10	02	08	6 (25%)	18 (75%)
Mg. migonei	13	05	02	01	15 (71%)	6 (29%)
All species collected[a]	165 (52%)	150 (48%)	171 (56%)	133 (54%)	336 (54%)	283 (46%)

[a]Relative Abundance.

Table 3. Minimum infection rate (MIR) of phlebotomine sand fly species with *L.* (*V.*) *braziliensis*. Entomological survey was carried out at homes of patients newly diagnosed with Cutaneous Leishmaniasis (CL) or Disseminated Leishmaniasis (DL) between May 2018 and June 2019 in the Cacao Region, Bahia-Brazil.

Species	♀ analised	Total of *pools*	Positive *pools*	MIR (%)
Ny. whitmani	155	26	3	1.9
Th. viannamartinsi	20	10	2	10
Ps. hirsutus hirsutus	3	1	1	33
Ty. longispina	2	2	1	50
Others	144	58	-	-
Total	324	97	7	2.2

Table 4. Minimum infection rate (MIR) of phlebotomine sand fly species with *L.* (*V.*) *braziliensis*, stratified by ecotype and number of positive pools. Results of a single Entomological survey carried out in July 2018 in homes of patients newly diagnosed with Cutaneous Leishmaniasis (CL) or Disseminated Leishmaniasis (DL) in the municipality of Taperoá, Bahia-Brazil.

Clinical Form	Ecotype MIR (%)				Positive *pools*	Negative *pools*	Species
	Domiciliation[a]	Peri-domicile	Extra-domicile	Total			
CL	3.8	7.1	10.5	6.7	3	6	*Ny. whitmani* and *Ps. hirsutus hirsutus*
DL	10.5	14.3	7.7	8.9	4	2	*Ny. whitmani*, *Th. viannamartinsi* and *Ty. longispina*
Total	6.7	10.7	8.9	7.8	7	8	-

Table S1. Phlebotomine sand fly species collected between May 2018 and June 2019 in the Cacao Region, Bahia-Brazil. Entomological survey was carried out at homes of patients newly diagnosed with Cutaneous Leishmaniasis (CL) or Disseminated Leishmaniasis (DL).

Species	May 18		June 18		July 18		Aug 18		Octob 18		Febru 19		March 19		April 19		June 19		Total		Total[a]
	CL	DL	CL	DL	CL	DL	CL	DL	CL	DL	CL	DL	CL	DL	CL	DL	CL	DL	CL	DL	
Ny. whitmani	02	-	30	23	69	104	05	03	02	06	41	01	-	-	12	72	01	14	162	223	385 (62.2)
Ny. intermedia	-	-	23	19	-	-	-	03	01	-	04	02	05	-	-	-	-	-	33	24	57 (9.2)
Ev. bahiensis	-	-	-	-	-	-	-	-	-	-	-	15	05	01	01	-	12	05	18	21	39 (6.3)
Th. viannamartinsi	04	-	01	-	05	02	11	05	-	-	-	-	-	-	-	-	-	-	21	07	28 (4.5)
Pi. fischeri	02	-	-	-	01	-	02	-	02	01	04	04	-	02	02	01	01	02	14	10	24 (3.9)
Mg. migonei	-	-	02	-	-	-	-	-	05	01	01	02	08	-	02	-	-	-	18	03	21 (3.4)
Mi. schreiberi	-	-	-	-	-	-	-	-	-	-	02	02	-	-	03	08	-	01	05	11	16 (2.6)
Ev. tupynambai	02	-	02	-	01	-	-	-	-	-	06	-	-	-	-	-	-	-	11	-	11 (1.8)
Pa. aragaoi	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	10 (1.6)
Pr. choti	-	-	-	-	-	-	-	-	-	-	09	-	-	-	-	-	-	-	09	-	09 (1.5)
Pa. bigeniculata	-	-	-	-	-	-	01	-	02	-	-	-	-	-	-	-	-	-	03	-	03 (0.5)
Pa. pascalei	-	-	02	-	01	-	-	-	-	-	-	-	-	-	-	-	-	-	03	-	03 (0.5)
Ps. hirsutus hirsutus	-	-	-	-	03	-	-	-	-	-	-	-	-	-	-	-	-	-	03	-	03 (0.5)
Mi. oswaldoi	-	-	01	-	-	-	-	-	-	-	-	01	-	-	-	-	-	-	01	01	02 (0.3)
Pi. serrana	-	-	-	-	-	-	-	-	-	-	-	-	01	01	-	-	-	-	01	01	02 (0.3)
Ty. longispina	-	-	-	-	01	01	-	-	-	-	-	-	-	-	-	-	-	-	01	01	02 (0.3)
Br. cunhai	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	01	-	01	01 (0.2)
Mi. capixaba	-	-	01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	01	-	01 (0.2)
Pa. barretoi barretoi	-	-	-	-	-	-	-	01	-	-	-	-	-	-	-	-	-	-	-	01	01 (0.2)
Pa. lanei	-	-	01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	01	-	01 (0.2)
Total	10	-	73	42	81	107	19	12	12	08	67	27	19	04	20	81	14	23	315	304	619 (100)
	10		115		188		31		20		94		23		101		37				

ARTIGO 2

"Invertebrate-Derived DNA (iDNA) to identify sand flies' bloodmeal: A Molecular Approach to Identifying Hosts in Blood-Feeding Vectors.". Draft for Memórias do Instituto Oswaldo Cruz.

Table 1. Phlebotomine sand fly species collected between May 2018 and June 2019 in the Cacao Region, Bahia, Brazil. Entomological survey was carried out at homes of patients diagnosed with American Tegumentary Leishmaniasis. Sample data were stratified by reads per sample according to barcode or mini-barcode; collection locality; and capture ecotype: intradomicile, peridomicile and extradomicile.

Sample	Species	♀	Reads/sample according barcode/minibarcode			Municipality of Bahia-Brazil	Ecotope
			12SrRNA	16SrRNA	CytB		
M3C1PA	*Nyssomyia whitmani*	13*	7.000	7.000		Taperoá	Peridomicile
M3C1EC	*Trichopygomyia longispina*	01*	7.000	7.000		Taperoá	Extradomicile
M3C2EA	*Nyssomyia whitmani*	14*	7.000	7.000		Taperoá	Extradomicile
M3C2EB	*Psychodopygus hirsutus*	03*	7.000	7.000		Taperoá	Extradomicile
M2C1I2	*Nyssomyia whitmani*	01	7.000	7.000	90.000	Teolândia	Intradomicile
M3C2I	*Trichophoromyia viannamartinsi*	01	7.000	7.000	300.000	Taperoá	Intradomicile
M4C2E	*Trichophoromyia viannamartinsi*	01	7.000	7.000	274.000	Wenceslau Guimarães	Extradomicile
M5C1E	*Migonemyia migonei*	01	7.000	7.000	80.000	Gandu	Extradomicile
M6C2E	*Migonemyia migonei*	01	7.000	7.000	80.000	Gandu	Extradomicile
M7C2P1	*Migonemyia migonei*	01	7.000	7.000		Presidente Tancredo Neves	Peridomicile
M3C1PB	*Trichophoromyia viannamartinsi*	01*			80.000	Taperoá	Peridomicile
M6C3P	*Pintomyia fischeri*	01			90.000	Gandu	Peridomicile
M9C2E	*Evandromyia bahiensis*	01			90.000	Presidente Tancredo Neves	Extradomicile

*non-engorged phlebotomine sand flies infected by *Leishmania* (*Viannia*) *braziliensis*.

Table 2. iDNA detected from samples of phlebotomine sand fly collected between May 2018 and June 2019 in the Cacao Region, Bahia, Brazil. Operational Taxonomic Units (OTUs) according to the barcode (CytB) or the mini-barcodes (12SrRNA and 16SrRNA).

Sand fly species	Samples	OTUs per sample according to mini-barcodes or barcode		
		12SrRNA	**16SrRNA**	**CytB**
Trichophoromyia viannamartinsi **(Sherlock e Guitton, 1970)**	03	*Homo sapiens* *Canis lupus* *Gallus gallus* *Equus asinus* *Equus caballus* *Gracilinanus microtarsus* *Phylomedusa bahiana*	*Homo sapiens* *Bos taurus* *Canis lupus* *Equus asinus* *Equus caballus* *Sus scrofa* *Mazama* sp. *Brachyteles arachnoides* *Sapajus xanthosternus* *Tapirus terrestris*	*Homo sapiens* *Canis lupus* *Gallus gallus* *Equus asinus* *Eunectes murinus* *Chaetomys subspinosus* *Nyssomyia* sp. *Trichophomyia* sp.
Migonemyia migonei **(França, 1920)**	03	*Homo sapiens* *Gallus gallus* *Equus asinus* *Coendou prehensilis* *Cuniculus paca* *Chiasmocleis schubarti*	*Homo sapiens* *Bos taurus* *Canis lupus* *Equus asinus* *Equus caballus* *Sus scrofa* *Cuniculus paca* *Mazama* sp. *Brachyteles arachnoides* *Sapajus xanthosternus* *Tapirus terrestris*	*Homo sapiens* *Canis lupus* *Gallus gallus* *Equus asinus* *Equus caballus* *Sus scrofa* *Chaetomys subspinosus* *Nyssomyia* sp.
Nyssomyia whitmani **(Antunes e Coutinho, 1939)**	03	*Homo sapiens* *Gallus gallus* *Dendropsophus elegans*	*Homo sapiens* *Bos taurus* *Equus caballus* *Sus scrofa* *Mazama* sp. *Sapajus xanthosternus* *Tapirus terrestris*	*Homo sapiens* *Sus scrofa* *Nyssomyia* sp.
Psychodopygus hirsutus **(Mangabeira, 1942)**	01	*Chiasmocleis schubart* *Dendropsophus elegans*	*Homo sapiens* *Bos taurus* *Sus scrofa* *Mazama* sp. *Alouatta guariba* *Sapajus xanthosternus* *Tapirus terrestris*	
Pintomyia fischeri **(Pinto, 1926)**	01			*Homo sapiens* *Gallus gallus* *Sus scrofa* *Chaetomys subspinosus* *Nyssomyia* sp.
Evandromyia bahiensis **(Mangabeira e Sherlock, 1971)**	01			*Homo sapiens* *Gallus gallus* *Trinomys albispinus* *Nyssomyia* sp.
Trichopygomyia longispina **(Mangabeira, 1942)**	01	*Homo sapiens* *Gallus gallus* *Dendropsophus elegans* *Gracilinanus microtarsus*	*Homo sapiens* *Bos taurus* *Sus scrofa* *Mazama* sp. *Brachyteles arachnoides* *Sapajus xanthosternus* *Tapirus terrestris*	
Total	**13**	**11 OTUs**	**12 OTUs**	**11 OTUs**

Table 3. Taxonomic identification of phlebotomine sand fly bloodmeals detected via iDNA from samples collected between May 2018 and June 2019 in the Cacao Region, Bahia, Brazil. Vertebrate species were presented according it Class and Order.

Taxon ID	Number of detections per sample according to mini-barcodes or barcode		
Mammalia	**12SrRNA**	**16SrRNA**	**CytB**
Primates			
Alouatta guariba Humboldt, 1812		01	
Brachyteles arachnoides Geoffroy, 1806		04	
Homo sapiens Linnaeus, 1758	08	10	08
Sapajus xanthosternus Wied-Neuwied, 1826		10	
Artiodactyla			
Bos taurus Linnaeus, 1758		10	
Mazama sp. Rafinesque, 1817		10	
Sus scrofa Linnaeus, 1758		08	03
Rodentia			
Coendou prehensilis Linnaeus, 1758	01		
Chaetomys subspinosus Olfers, 1818			04
Cuniculus paca Linnaeus, 1766	01	01	
Trinomys albispinus Geoffroy, 1838			01
Carnivora			
Canis lupus familiaris Linnaeus, 1758	01	02	04
Didelphimorphia			
Gracilinanus microtarsus Wagner, 1842	02		
Perissodactyla			
Tapirus terrestris Linnaeus, 1758		10	
Equus asinus Linnaeus, 1758	02	02	02
Equus caballus Linnaeus, 1758	01	03	01
Birds			
Gallus gallus Linnaeus, 1758	06		05
Reptilia			
Eunectes murinus Linnaeus, 1758			01
Amphibia			
Chiasmocleis schubarti Bokermann, 1952	02		
Dendropsophus elegans Wied-Neuwied, 1824	05		
Phylomedusa bahiana Lutz, 1925	01		
Total	**30**	**71**	**29**

Table S1. Vertebrate species identified from sand fly females collected between May 2018 and June 2019 in the Cacao Region, Bahia, Brazil. Sample data were stratified by reads/sample according barcode/mini-barcode.

Species (sample)	Barcode/ mini-barcode	Bloodmeal	Query cover (%)	Identity (%)	GenBank accession number
Nyssomyia whitmani (M3C1PA)*	12S	*Homo sapiens*	100	99,26	FN673842.1
		Dendropsophus elegans	96	100	MK266719.1
		Gallus Gallus	99	100	OQ562002.1
	16S	*Tapirus terrestres*	100	100	KJ584342.1
		Mazama sp.	99	97,7	OP712670.1
		Homo sapiens	100	100	MF621124.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Equus caballus	100	100	KT757764.1
		Bos taurus	100	100	KT827217.1
Trichopygomyia longispina (M3C1EC)*	12S	*Dendropsophus elegans*	100	99,21	MK266719.1
		Gracilinanus microtarsus	99	99,25	AJ628389.1
		Homo sapiens	99	100	FN673842.1
		Gallus Gallus	99	100	OQ562002.1
	16S	*Homo sapiens*	100	100	MF621124.1
		Mazama sp.	99	97,71	OP712670.1
		Tapirus terrestres	100	100	KJ584342.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Bos taurus	100	100	KT827217.1
		Sus scrofa	100	100	MG250566.1
		Brachyteles arachnoides	99	97,69	MH084743.1
Nyssomyia whitmani (M3C2EA)*	12S	*Homo sapiens*	100	99,26	FN673842.1
		Dendropsophus elegans	100	97,62	MK266719.1
		Gallus Gallus	99	100	OQ562002.1
	16S	*Homo sapiens*	100	100	MF621124.1
		Mazama sp.	99	97,71	OP712670.1
		Tapirus terrestres	100	100	KJ584342.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Bos taurus	100	100	KT827217.1
		Sus scrofa	100	100	MG250566.1
Psychodopygus hirsutus (M3C2EB)*	12S	*Dendropsophus elegans*	100	99,21	MK266719.1
		Chiasmocleis schubarti	99	99,21	MH885003.1
	16S	*Homo sapiens*	100	100	MF621124.1
		Tapirus terrestres	100	100	KJ584342.1
		Mazama sp.	99	97,71	OP712670.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Bos taurus	100	100	KT827217.1
		Alouatta guariba	99	100	KY202428.1
		Sus scrofa	100	100	MG250566.1
Nyssomyia whitmani (M2C1I2)	12S	*Homo sapiens*	100	100	NG_009191.3
		Dendropsophus elegans	100	99,21	MK266719.1
	16S	*Homo sapiens*	99	100	CP139522.1
		Sus scrofa	100	100	MG250566.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Mazama sp.	99	97,71	OP712670.1
		Tapirus terrestres	100	100	KJ584342.1
	CytB	*Homo sapiens*	95	99,72	KX697544.1
		Sus scrofa	95	100	DQ512915.1
Trichophoromyia viannamartinsi (M3C2I)	12S	*Homo sapiens*	98	100	FN673842.1
		Gracilinanus microtarsus	100	99,26	AJ628389.1
		Canis lupus	100	100	OM743430.1

	16S	*Homo sapiens*	100	100	MF621124.1
		Mazama sp.	99	97,71	OP712670.1
		Sus scrofa	100	100	MG250566.1
		Bos taurus	100	100	KT827217.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Canis lupus	99	100	LR742783.1
		Tapirus terrestres	100	100	KJ584342.1
	CytB	*Homo sapiens*	95	100	KX697544.1
		Gallus Gallus	95	100	DQ512917.1
		Canis lupus	94	99,72	DQ309764.1
Trichophoromyia viannamartinsi (M4C2E)	12S	*Equus asinus*	98	100	MK982180.1
		Gallus Gallus	100	100	MW524218.1
		Phylomedusa bahiana	100	99,21	NC_067554.1
		Homo sapiens	100	98,44	NG_009191.3
		Equus caballus	98	97,04	KT221831.1
	16S	*Equus asinus*	100	100	PP049800.1
		Mazama sp.	99	97,71	OP712670.1
		Tapirus terrestres	100	100	KJ584342.1
		Homo sapiens	100	100	MF621124.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Brachyteles arachnoides	99	97,69	MH084743.1
		Equus caballus	100	98,46	MZ040622.1
		Sus scrofa	100	100	MG250566.1
		Bos taurus	100	99,24	KT827217.1
	CytB	*Gallus Gallus*	97	100	AJ401080.1
		Homo sapiens	96	100	KX697544.1
		Canis lupus	97	100	DQ309764.1
Migonemyia migonei (M5C1E)	12S	*Coendou prehensilis*	100	94,74	KX381447.1
		Cuniculus paca	97	93,8	KX381423.1
	16S	*Cuniculus paca*	100	91,04	NC_079967.1
		Tapirus terrestres	100	100	KJ584342.1
		Mazama sp.	99	97,71	OP712670.1
		Homo sapiens	100	100	MF621124.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
	CytB	*Homo sapiens*	95	100	KX697544.1
		Canis lupus	94	99,72	DQ309764.1
		Chaetomys subspinosus	94	97,76	EU544660.1
Migonemyia migonei (M6C2E)	12S	*Equus asinus*	98	100	MK982180.1
		Gallus Gallus	100	100	MW524218.1
		Homo sapiens	99	99,26	FN673842.1
	16S	*Tapirus terrestres*	100	100	KJ584342.1
		Mazama sp.	99	97,71	OP712670.1
		Equus asinus	100	100	PP049800.1
		Homo sapiens	100	100	MF621124.1
		Bos taurus	100	100	KT827217.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Sus scrofa	100	100	MG250566.1
		Brachyteles arachnoides	99	97,69	MH084743.1
		Equus caballus	100	98,46	MZ040622.1
	CytB	*Homo sapiens*	95	100	KX697544.1
		Equus caballus	95	98,88	AY819737.1
		Equus asinus	94	98,6	MK982180.1
		Gallus Gallus	95	100	DQ512917.1
		Canis lupus	94	100	DQ309764.1
		Sus scrofa	95	100	DQ512915.1
		Chaetomys subspinosus	94	94,68	EU544660.1
Migonemyia migonei (M7C2P1)	12S	*Gallus Gallus*	99	100	OQ562002.1
		Chiasmocleis schubarti	99	99,21	MH885003.1

		Homo sapiens	99	98,52	CP139520.1
	16S	*Tapirus terrestres*	100	100	KJ584342.1
		Mazama sp.	99	97,71	OP712670.1
		Homo sapiens	100	100	MF621124.1
		Sapajus xanthosternus	100	97,67	NC_021961.1
		Brachyteles arachnoides	99	97,69	MH084743.1
		Sus scrofa	100	100	MG250566.1
		Bos taurus	100	100	KT827217.1
		Canis lupus	99	100	LR742783.1
Trichophoromyia viannamartinsi (M3C1PB)*	CytB	*Homo sapiens*	95	100	KX697544.1
		Eunectes murinus	94	97,74	U69809.1
		Chaetomys subspinosus	94	97,76	EU544660.1
		Nyssomyia sp.	94	92,09	NC_026898.1
		Equus asinus	94	98,31	MK982180.1
Pintomyia fischeri (M6C3P)	CytB	*Homo sapiens*	95	100	KX697544.1
		Gallus Gallus	95	100	DQ512917.1
		Sus scrofa	95	100	DQ512915.1
		Chaetomys subspinosus	94	97,48	EU544660.1
Evandromyia bahiensis (M9C2E)	CytB	*Homo sapiens*	95	100	KX697544.1
		Gallus Gallus	95	100	DQ512917.1
		Trinomys albispinus	95	98,61	U34856.1

*Phlebotomine sand flies naturally infected by *Leishmania* (*Viannia*) *braziliensis*.

ARTIGO 3

"Empowering people with Cutaneous Leishmaniasis (ECLIPSE): The Brazilian experience with in-formation and knowledge exchange training courses to primary care and educational professionals from endemic areas in southern Bahia, Brazil.". Draft for PLOS Neglected Tropical Diseases.

Table 1: Profile of the ECLIPSE - *CL training courses*' participants at the municipalities of Valença, Presidente Tancredo Neves and Teolândia, Bahia, Brazil (2021-2024).

Characteristics	Valença n (%)	Tancredo Neves n (%)	Teolândia n (%)	Total n (%)
Age Group				
20-29	09 (9)	0	10 (22)	19 (10)
30-40	49 (51)	13 (31)	14 (30)	76 (41)
41-50	29 (31)	16 (38)	11 (24)	56 (31)
51-63	09 (9)	13 (31)	11 (24)	33 (18)
Gender				
Feminine	85 (89)	26 (62)	29 (63)	140 (76)
Masculine	11 (11)	16 (38)	17 (37)	44 (24)
Race				
Black people	78 (81)	37 (90)	43 (94)	158 (86)
Caucasian people	13 (14)	04 (10)	02 (4)	19 (10)
Indigenous or Asian people	01(1)	0	01 (2)	02 (1)
Human/Brazilian (others)	04(4)	01 (2)	0	05 (3)
Education				
Elementary School	02 (2)	33 (79)	04 (9)	39 (21)
High School	14 (15)	01 (2)	29 (63)	44 (24)
Graduation	80(83)	08 (19)	13 (28)	101 (55)
Professional Sector				
Health	56 (58)	42 (100)	39 (85)	137 (75)
Education	39 (41)	0	0	39 (21)
Agriculture	01 (1)	0	7 (15)	8 (4)
Work Zone				
Rural	61 (64)	20 (48)	32 (70)	113 (61)
Urban	35 (36)	22 (52)	14 (30)	71 (39)
Total	**96 (52)**	**42 (23)**	**46 (25)**	**184**

Table 2: Prior knowledge about cutaneous leishmaniasis (CL) of the ECLIPSE - *CL training courses*' participants in the municipalities of Valença, Presidente Tancredo Neves and Teolândia, Bahia, Brazil (2021-2024).

Previous Questions	**Valença** **Yes (%)**	**Tancredo Neves** **Yes (%)**	**Teolândia** **Yes (%)**	**Total** **Yes (%)**
Do you know CL?	96 (100)	30 (71)	38 (83)	164 (89)
Have you ever been sick with CL?	16 (17)	09 (21)	10 (22)	35 (19)
Have you ever friends or family with CL?	16 (17)	36 (86)	28 (61)	80 (44)
Do you know about LC transmission?	64 (67)	34 (81)	42 (91)	140 (76)
Do you know how to identify LC lesions?	52 (54)	08 (19)	26 (57)	86 (47)
Do you know how to make referrals to the health service?	35 (36)	31 (74)	36 (78)	102 (56)
Do you know what medications are used for CL?	38 (40)	19 (45)	31 (67)	88 (48)
Do you know about the side effects of CL treatment?	16 (17)	10 (24)	19 (41)	45 (25)
Do you report cases to epidemiological surveillance?	21 (22)	17 (40)	24 (52)	62 (34)
Do you guide patients about the benefits of sickness in social security?	08 (08)	22 (52)	21 (46)	51 (28)
Do you know if there are many CL cases in your area?	61 (63)	25 (60)	29 (63)	115 (63)
Do you think people feel ashamed about their CL lesion?	50 (52)	37 (88)	44 (96)	131 (71)
Do you think people suffer prejudice due to the CL lesions?	63 (66)	36 (86)	42 (91)	141 (77)
Are you a voluntary Glucantime® applicator?	07 (7)	02 (5)	05 (11)	14 (8)
Do you know a voluntary Glucantime® applicator?	15 (16)	11 (26)	24 (52)	50 (27)
Have you already done some CL training?	26 (27)	12 (29)	14 (31)	52 (28)
Would you like to do CL training?	95 (99)	41 (98)	46 (100)	182 (99)
Total	**96 (52)**	**42 (23)**	**46 (25)**	**184**

Table 3: Evaluation by participants about aspects of the ECLIPSE - *CL training courses* at the municipalities of Valença and Teolândia, Bahia, Brazil (2021-2024).

Evaluation Questions and Answers	Were the themes of interest to you?	Was the information provided understandable?	Have you any questions that you couldn't clarify?
Exceeded my expectations.	19%	24%	
It was as expected.	70%	46%	
Pretty much what expected.	7%		
I had no doubts.			48%
I had a few doubts, but I got a clarify.		11%	23%
I had a few doubts about didact material.			15%
I couldn't understand some subjects.		4%	
I don't know how to answer.	4%	10%	6%
I didn't participate in some meetings.		5%	8%

IX. SUMMARY

Entomological study in the main endemic area of Tegumentary American Leishmaniasis of Bahia, Brazil.

Leishmaniasis is an infectious disease of significant clinical and epidemiological diversity, with a wide geographical distribution in the world. Bahia is one of the most affected Brazilian states for American Tegumentary Leishmaniasis (ATL). We present this doctoral thesis in three articles that aim to describe the results of an entomological study carried out in the main endemic area of ATL in the state of Bahia. The Article 1 – "*Diversity and natural infection of phlebotomine sand flies (Diptera, Psychodidae) in an endemic area of American Tegumentary Leishmaniasis in southern Bahia, Brazil*." – consists of a prospective study of the phlebotomine fauna found in the homes of index ATL-cases, recently diagnosed in a region with high endemicity, in southern Bahia. The Article 2 – "*Invertebrate-Derived DNA (iDNA) to identify sand flies' bloodmeal: A Molecular Approach to Identifying Hosts in Blood-Feeding Vectors*." – is a continuation of the results of the Entomological Survey presented in Article 1, where we used the metabarcoding methodology to identify food sources of preferentially engorged sand flies found in these residences of newly diagnosed cases of ATL. The Article 3 – "*Empowering people with Cutaneous Leishmaniasis (ECLIPSE): The Brazilian experience with in-formation and knowledge exchange training courses to primary care and educational professionals from endemic areas in southern Bahia, Brazil*." – brings the experience of the ECLIPSE/BRASIL project team in building the *In-formation and knowledge exchange training courses about Cutaneous Leishmaniasis* which, from an intersectoral perspective, included professionals of health, education and the environment. Our findings suggest that in areas affected by outbreaks of ATL in southern Bahia, there are high proportions of infected sand flies involving a variety of proven and putative vector species. Analyzing iDNA through metabarcoding paired with Next Generation Sequence to determine the food sources of sand flies has allowed us to accurately sample a large diversity of vertebrate species. The experiences gained through the ECLIPSE project showed that the effectiveness of our health interventions presupposes that the exchanges and relationships that supported community engagement were reciprocal, equal and mutually beneficial for the communities and the research teams.

Keywords: 1. Leishmaniasis; 2. Phlebotomines; 3. Bahia 4. *Leishmania (Viannia) braziliensis*.