

THE DISTRIBUTION OF TWO MORPHOLOGICAL FORMS OF *LUTZOMYIA LONGIPALPIS* (LUTZ & NEIVA) (DIPTERA: PSYCHODIDAE)

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The males of the sandfly Lutzomyia longipalpis occur in two forms, one which bears a single pair of pale spots on tergite 4 and another in which an additional pair of spots characterizes tergite 3. Almost complete reproductive isolation between sympatric populations of the two forms and between allopatric populations of the one-spot form has been reported (Ward et al., 1983). Micromorphological differences in cuticular structures on the spots have also been observed and may be sites of pheromone release (Lane & Ward, 1984). Details of the known distribution of the two are based on the examination of new specimens captured in Brazil during 1982, as well as museum collections and specimens from other laboratories. Males with a single pair of pale spots have been found from Mexico to southern Brazil, whilst the two-spot form is found only from the state of Maranhão in North Brazil to Minas Gerais and the border with Paraguay. In the eastern area of Brazil the two forms occur sympatrically in some locations and separately in others.

The original observations on morphological variation in *Lu. longipalpis* males were made by Mangabeira (1969) in a posthumous publication on the sandflies of Ceará. He noted that males captured in Pará State, N. Brazil, bore a single pair of pale spots on the abdominal tergites, whilst those he examined from Ceará had two pairs. His observation that the single pair of pale spots on the flies from Pará were on the third tergite is, however, doubtful. All the one-spot flies we have examined to date, including material from the island of Marajó, bear the spots on the fourth tergite. Those flies with two pairs of spots bear the extra pair on the third tergite. Recently Lane & Ward (1984) have shown that the pale spots bear papules which differ in prominence and distribution between the two forms. They suggested that the papules may be sites of pheromone release and that precopulatory wing beating by males is an effective method of dispersing the sex attractant. In addition, Ward et al. (1983) found that there is almost complete reproductive isolation between sympatric populations of the two forms. Mating barriers have subsequently been demonstrated between allopatric populations separated by distances of only 1000 kms (Sobral, Ceará — Marajó island, Pará) (Ward, in press). Further crossing experiments have also indicated that the two-spot form is conspecific within a range of approximately 700 kms (São Luis, Maranhão — Morada Nova, Ceará). There are therefore at least two forms of *Lu. longipalpis* which are to a large extent sexually isolated and may represent members of a species complex. It was also suggested that the large number of cases of visceral leishmaniasis in the north-east of Brazil may reflect the relative distribution of the two forms of vector. Therefore, in this paper we present in detail what is known of the distribution of the two male forms.

MATERIAL AND METHODS

During 1979 collections of sandflies were made in Colombia and in 1982 in Brazil. CDC miniature light traps, catches from animal houses, and landing catches on human volunteers, were made usually between 1800 and 2200h. Most of the flies were preserved in liquid nitrogen for electrophoretic studies, but some were stored in 70% ethyl alcohol. These males were subsequently examined to determine if they bore one of two pairs of pale spots on the abdominal tergites. Museum collections of *Lutzomyia longipalpis* were also examined in Rio de Janeiro, Belo Horizonte and Belém. In addition, a number of specimens have been received from laboratories in the USA, Costa Rica and Mexico.

RESULTS

The collection site, number of specimens, collector or museum source and the tergal patterns of the male *Lu. longipalpis* are shown in the Table. Map coordinates are given where known, but for two sites this information was unobtainable. The distribution of the two forms of the male are also shown on the map. Numbered sites on the figure are those listed in the table.

Our results show the wide distribution of the one-spot form from Mexico (18.20N) to southern Brazil (21.08S). In the La Paz area of Bolivia only the one-spot form of *Lu. longipalpis* has been observed (Dr. P. Desjeux, personal communication). In addition, Lainson et al. (in press) have identified populations

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of the one-spot form in Santarém, Pará. In contrast, the two-spot form has a more limited range extending from southern Brazil northwards almost to the equator.

The distribution of male *Lutzomyia longipalpis* and their tergal colouration

Site n ^o	Location	Country	Map coordinates	Source	Number of flies with		
					1 pair tergal spots	2 pairs tergal spots	
1	Huitzucó	Mexico	18.20N 99.20W	CIES	12	—	
2	Brasilito, Guanacaste	Costa Rica	10.24N 86.46W	UF & UN	59	—	
3	Melgar, Tolima	Colombia	4.10N 74.40W	A	133	—	
4	Mariguitar, Sucre	Venezuela	— —	CPRR	24	—	
5	Barbacoas, Aragua	Venezuela	9.31N 66.57W	CPRR	10	—	
6	Salvaterra, Marajó	Brazil	0.46S 48.31W	IEC	54	—	
7	Piratuba, Pará	Brazil	2.18S 48.59W	IOC	25	—	
8	São Luis, Maranhão	Brazil	2.31S 44.16W	MU	—	65*	
9	Tucunzal, Piauí	Brazil	— —	A	7	6	
10	Massapê, Ceará	Brazil	3.31S 40.19W	A	1265	286	
11	IPL, Ceará	Brazil	4.20S 40.42W	A	48	31	
12	Nova Maranguape, Ceará	Brazil	3.53S 38.40W	A	—	54	
13	Quixadá, Ceará	Brazil	4.58S 39.01W	IOC	—	2	
14	Jacobina, Bahia	Brazil	11.11S 40.31W	IOC	—	55	
15	Serrolândia, Bahia	Brazil	11.26S 40.18W	IOC	4	—	
16	Iguaí, Bahia	Brazil	14.45S 40.04W	IOC	15	1	
17	Euclides da Cunha, Bahia	Brazil	10.31S 39.01W	IOC	—	8	
18	Itaeté, Bahia	Brazil	12.59S 40.58W	IOC	140	—	
19	Guandu, Espírito Santo	Brazil	20.15S 41.05W	CPRR	80	—	
20	Amaro Leite, Goiás	Brazil	8.58S 46.52W	CPRR	—	7	
21	Betim, Minas Gerais	Brazil	19.58S 44.13W	CPRR	30	6	
22	Itanhomi, Minas Gerais	Brazil	19.10S 41.52W	CPRR	11	—	
23	Mato Verde, Minas Gerais	Brazil	17.04S 44.02W	CPRR	—	8	
24	Januária, Minas Gerais	Brazil	15.29S 44.22W	CPRR	31	22	
25	Diamantina, Minas Gerais	Brazil	18.15S 43.36W	CPRR	13	—	
26	Montes Claros, Minas Gerais	Brazil	16.43S 43.52W	CPRR	49	—	
27	Porteirinha, Minas Gerais	Brazil	15.44S 43.02W	CPRR	9	4	
28	Gruta da Lapinha, Minas Gerais	Brazil	19.34S 43.58W	A	553	—	
29	Bonito, Mato Grosso	Brazil	21.08S 56.28W	CPRR	1	—	
30	Miranda, Mato Grosso	Brazil	20.14S 56.22W	CPRR	—	1	
31	Campo Grande, Rio de Janeiro	Brazil	22.54S 43.34W	A	36	—	
Totals						2561	556

A = Collected by present authors; CIES = Centro de Investigaciones Ecologicas del Sureste, San Cristobal, Mexico; CPRR = Centro de Pesquisas, René Rachou, Belo Horizonte, Brazil; IEC = Instituto Evandro Chagas, Belém, Brazil; IOC = Instituto Oswaldo Cruz, Rio de Janeiro, Brazil; MU = Maranhão University, São Luis, Brazil; UF = University of Florida, Gainesville, USA; UN = Universidad Nacional, Heredia, Costa Rica.

*reared in laboratory, Liverpool, UK.

DISCUSSION

Following discussions with Professor O.M. da Costa of the Oswaldo Cruz Institute, Adler (1964) reported Costa's ideas concerning the biogeography of *Lu. longipalpis*. Costa believed that *Lu. longipalpis* is a species which once occupied much larger areas than at present and that climatic changes had resulted in its current focalised pattern of distribution. There is much evidence reflected in studies on plants, birds, insects, reptiles and mammals, that during the Pleistocene period the South American climate was much drier than at present (Haffer, 1969). Under such circumstances it is possible that *Lu. longipalpis*, which thrives in semi-arid conditions, was more widespread than today. There are, for example, large areas of the Amazon basin from Amapá to southern Venezuela where *Lu. longipalpis* is now unknown. Presumably therefore with the change in climate and the development of the humid tropical forest the central and northern populations of this species became separated from those in Brazil south of the equator. Separation and re-association of populations under climatic influences, therefore, may have contributed to the development of reproductively isolated sympatric populations.

From the Table and Figure presented here it is evident that male *Lu. longipalpis* examined from locations north of São Luis, Maranhão, Brazil were of the one-spot type. However, this form also extends south as far as Rio de Janeiro. In contrast, the two-spot form of the fly is, to our knowledge, largely restricted to eastern Brazil, though a single specimen from Mato Grosso extends its distribution as far west as 56°. From the limited data available so far, it appears that the two-spot form is more commonly found in the vegetation zone known as Caatinga. This region was recently defined by Eiten (1982) as having low rainfall (300-800 mm per annum) and scrub woodland. It extends through southern Piauí, Ceará, the western parts

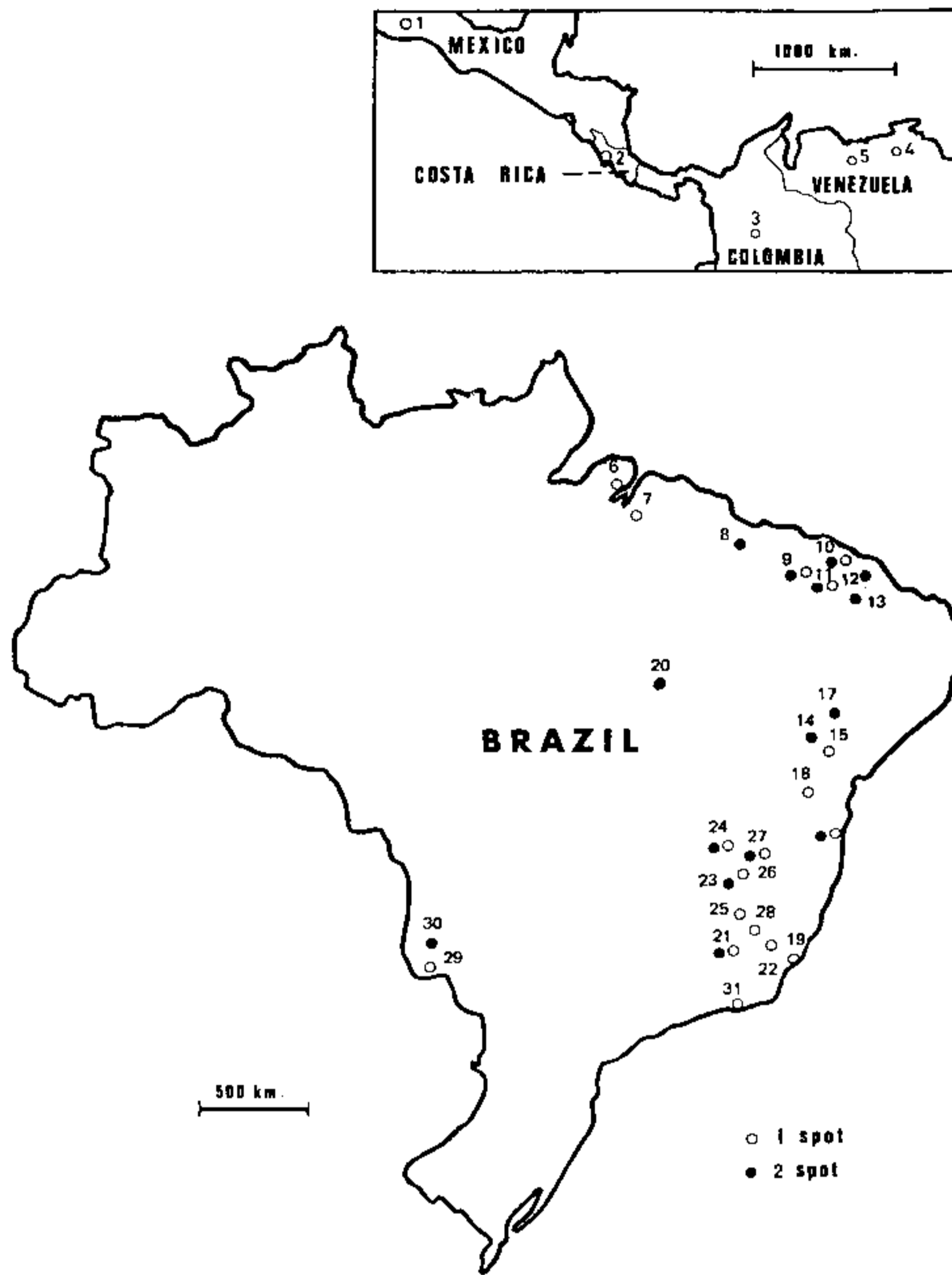


Fig. 1: the distribution of two morphological forms of *Lutzomyia longipalpis* males.

of the small north-eastern states, central Bahia from north to south and north-central Minas Gerais. There are, however, records of two-spot *Lu. longipalpis* from Maranhão⁸, Goiás²⁰, southern Minas Gerais²¹ and Mato Grosso³⁰, which occur in Cerrado (savannah in its broadest sense).

Only further collections and observations on more populations of *Lu. longipalpis* will result in a more accurate picture of the relative distribution of the two forms.

RESUMO

Os machos do flebótomo *Lutzomyia longipalpis* apresentam-se sob duas formas, uma que possui um par de manchas claras apenas no tergito 4, enquanto a outra distingue-se por possuir um par adicional de manchas claras no tergito 3. Isolamento reprodutivo foi observado entre populações simpátricas com as duas formas e também entre populações alopátricas da forma com um só par de manchas (Ward et al., 1983). Foram também constatadas diferenças micromorfológicas em estruturas cuticulares nas manchas, que talvez sejam locais de liberação de feromônios (Lane & Ward, 1984). Machos com um único par de manchas claras são encontrados desde o México até o sul do Brasil, enquanto a forma com duas manchas é achada somente no Maranhão, no norte do Brasil, até Minas Gerais e a fronteira do Brasil com o Paraguai, ao sul. No leste do Brasil as duas formas são simpátricas em algumas localidades e alopátricas em outras. São apresentados detalhes da distribuição conhecida das duas formas baseados na observação de espécimes capturados no Brasil em 1982, ou vistos em coleções de museus ou recebidos de outros laboratórios.

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