

RESEARCH NOTE

The Usefulness of Bergmann's Rule for the Distinction of Members of *Lutzomyia intermedia* Species Complex (Diptera, Psychodidae, Phlebotominae)

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Bergmann's rule says that homeotherm animals from higher altitudes and latitudes, or bred at lower temperatures, tend to be bigger, and the validity of this rule to most studied ectotherms was noted by D Atkinson (1994 *Adv Ecol Res* 25: 1-58). RP Lane (1988 Geographic variation in Old World phlebotomine sandflies, p. 77-90. In MW Service *Biosystematics of Haematophagous Insects*, Clarendon Press, Oxford), made preliminary observations on the effect of temperature on the size of *Lutzomyia longipalpis* and CB Marcondes [1997 *Morfometria e DNA Mitochondrial de Populações Sul Americanas de Lutzomyia intermedia* (Lutz & Neiva, 1912) (Diptera, Psychodidae, Phlebo-

tominae), PhD Thesis, UFPR, xxiv+260 pp.] observed that altitude and latitude also modify several dimensions of *L. intermedia s. s.* Moreover, RP Lane and G Fritz (1986 *Syst Ecol* 11: 439-445) observed that females of *Phlebotomus papatasi* are bigger than *P. bergeroti* females. However, the former occurs in lower altitudes than the other one, and they concluded that this apparent discordance from Bergmann's rule corroborates the distinction of these species.

Recently, CB Marcondes (1996 *Mem Inst Oswaldo Cruz* 91: 457-462) proposed the revalidation of *L. neivai* and distinguished it from *L. intermedia s. s.* To check this conclusion, we compared the size of specimens of *L. intermedia s. s.* from the eastern region of the State of São Paulo, between the "Serra do Mar" and the ocean (below 5 m a. s. l.), with *L. neivai* from many localities at higher altitudes (500-800 m a. s. l.) of the same state. It were obtained 39 measurements for each sex (Marcondes 1997 *loc. cit.*). Due to the current difficulty of differentiating males from these species (Marcondes 1996 *loc. cit.*), specimens were only included if associated to well identified females.

In the analysis of the results obtained, the significantly different measurements of insects of both species were calculated and shown in Table.

Although there was a great difference in the altitude of the two regions where the insects were collected, a small number of differences were noted. The dimensions of *L. neivai* were similar to those of *L. intermedia s. s.* If both belonged to the same species, according to Bergmann's rule, several dimensions of the former would probably be greater than those of the last. Therefore, our observations corroborate the differentiation between the species. As previously shown by Marcondes (1996 *loc. cit.*), *L. neivai* has greater dimensions in extragenital structures, while *L. intermedia s. s.* has greater dimensions in genital structures.

Some species of sandflies with very similar females, like *L. shannoni* and *L. abonnenci*, occur at different latitudes (DG Young & M Duncan 1994 *Mem Am Entom Inst* 54: 881). The different proportions of *L. wellcomei* and *L. complexa* at several altitudes in the "Serra dos Carajás" (State of Pará, Brazil) indicated a greater epidemiological role of the first species (PD Ready et al. 1984 *Trans R Soc Trop Med Hyg* 78: 543-544), and the differentiation of their females is very difficult. Measurements of the females of these insects should be obtained. The possible non-validity of Bergmann's rule to these pairs of species could help in their differentiation and corroborate their specific status.

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TABLE

Comparison between anatomical structures of specimens of both sexes of *Lutzomyia intermedia* s. s. from eastern lower localities of the State of São Paulo and of *L. neivai* from higher altitudes of the same state

Structures (in mm)	<i>L. intermedia</i> s. s. (lower altitudes)				<i>L. neivai</i> (higher altitudes)			
	Mean	S. D.	N	C. V.	Mean	S. D.	N	C. V.
Females								
Total length palps ^a	334.7	22.63	43	6.8	347.2	23.19	61	7.5
a ^a	595.8	59.38	32	10	634.9	57.24	37	9
b ^b	309	59.19	32	19.2	279.1	29.65	37	10.6
Total length sperm. ^b	51.96	6.25	25	12	39.97	4.21	32	10.5
Males								
Length mesonotum ^b	499.6	21.41	31	4.3	517.7	29	59	5.6
Length style ^b	138.8	9.46	34	6.8	132.2	5.78	33	4.4
Length genital pump ^b	213	12.9	34	6	190	10.22	77	5.4

S. D.: standard deviation; N: number of specimens; C. V.: coefficient of variation; a: length of R₂; b: length of R₂₊₃; sperm.: spermatheca; a: significant at 5%; b: significant at 1%.