BRAIN CELL KARYOTYPES OF SIX NEW WORLD SAND FLIES (DIPTERA: PYCHODIDAE)

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ABSTRACT. The brain cell karyotypes of six New World sand flies are described and compared. *Lutzomyia trapidoi* has three pairs of chromosomes, 2N = 6. The other species, *L. gomezi*, *L. erwindonaldoi*, *L. carmelinoi*, *L. walkeri* and *L. columbiana*, have four pairs of chromosomes, 2N = 8. No heteromorphic chromosomes were observed. Cytogenetic similarities among sand fly species are discussed.

INTRODUCTION

The brain cell karyotypes of six species of sand flies were described in a recent paper (Kreutzer et al. 1987). The authors reported that among four Old World species the chromosome number varies between 2N = 6 and 2N = 10. In the two New World species 2N = 8. The brain cell karyotypes of six additional New World species have been studied.

MATERIALS AND METHODS

Eggs were obtained from identified field-collected females. Larvae were reared to the fourth instar following techniques reported by Modi and Tesh (1983). Five of the sand fly species studied were collected in Colombia: *Lutzomyia trapidoi* (Fairchild and Hertig)-Mariquita, Tolima; *L. gomezi* (Nitzulescu)-Arboledas, Norte Santander; *L. erwindonaldoi* (Ortiz)-Durania, Norte Santander; *L. walkeri* (Newstead)-Mariquita, Tolima; *L. columbiana* (Ristorcelli and Van Ty)-Samaniego, Narino. The *L. carmelinoi* Ryan, Fraiha, Lainson and Shaw sample was provided by J. Shaw from sand flies collected near Santarem, Para, Brazil (Ryan et al. 1986).

The brain cell slide preparation procedures have been reported elsewhere (Kreutzer et al. 1987). The slides were studied and the photographs were made with a Zeiss microscope system at 1000×. About 30 slides of each species (except *L. erwindonaldoi* from which three slides were made, each of which contained 5-20 karyotypes) were prepared, of which an average of 50% contained karyotypes which could be studied. The slides contained from 10 to > 100 karyotypes.

RESULTS

The chromosomal characteristics of the six species are summarized in Table 1. Photomicrographs and diagrams of the six karyotypes are shown in Figs. 1–6. The lengths of arms reported in Table 1 are average lengths which varied from complement to complement, but the relative lengths, as noted in each description below, do not vary significantly. Designation of the short arm of a chromosome as the left arm follows the recommendation of Bridges (1935), and following the system of Rai (1963) for mosquitoes. The shortest chromosome of each complement is designated I, II is the next longest, etc.

Lutzomyia (Nyssomyia) trapidoi (Fairchild and Hertig). The karyotype consists of six chromosomes (2N = 6). Heterogamy (possible chromosomal sexual dimorphism) as noted in *Phlebotomus perniciosus* Newstead was not observed in the karyotypes of any of the six species studied. Chromosome I is metacentric and is the shortest element of the complement. Chromosome II is also metacentric and about 20% longer than I. Submetacentric chromosome III is about one-third longer than I, the right arm is about 30% longer than the left arm.

Lutzomyia (Lutzomyia) gomezi (Nitzulescu). The chromosomal complement consists of eight units (2N = 8). The subtelocentric chromosome I has a right arm that is 2.5-fold longer than the left arm. Chromosomes II, III and IV are metacentric. Chromosome II is about twice as long as I, chromosome III is ca. 2.5-fold longer than I and chromosome IV is slightly longer than III.

Lutzomyia erwindonaldoi (Ortiz). The complement consists of eight chromosomes (2N = 8). Chromosomes I, II, and III are metacentric. II is about twice as long as I and III is ca. 2.5-fold longer than I. Chromosome IV is submetacentric with a right arm about 30% longer than the left arm, and chromosome IV is about 2.7-fold longer than chromosome I.

Lutzomia carmelinoi Ryan, Fraiha, Lainson and Shaw. The complement consists of eight elements (2N = 8), and it is identical to the complement of *L. erwindonaldoi*. Chromosomes I, II and III are metacentric and IV is submetacentric. The relative lengths are also the same in both species.

Lutzomyia walkeri (Newstead). This complement and the relative lengths of the chromosomes are identical with those of *L. erwindonaldoi* (2N = 8). Chromosomes I, II, and III are metacentric and IV is submetacentric.

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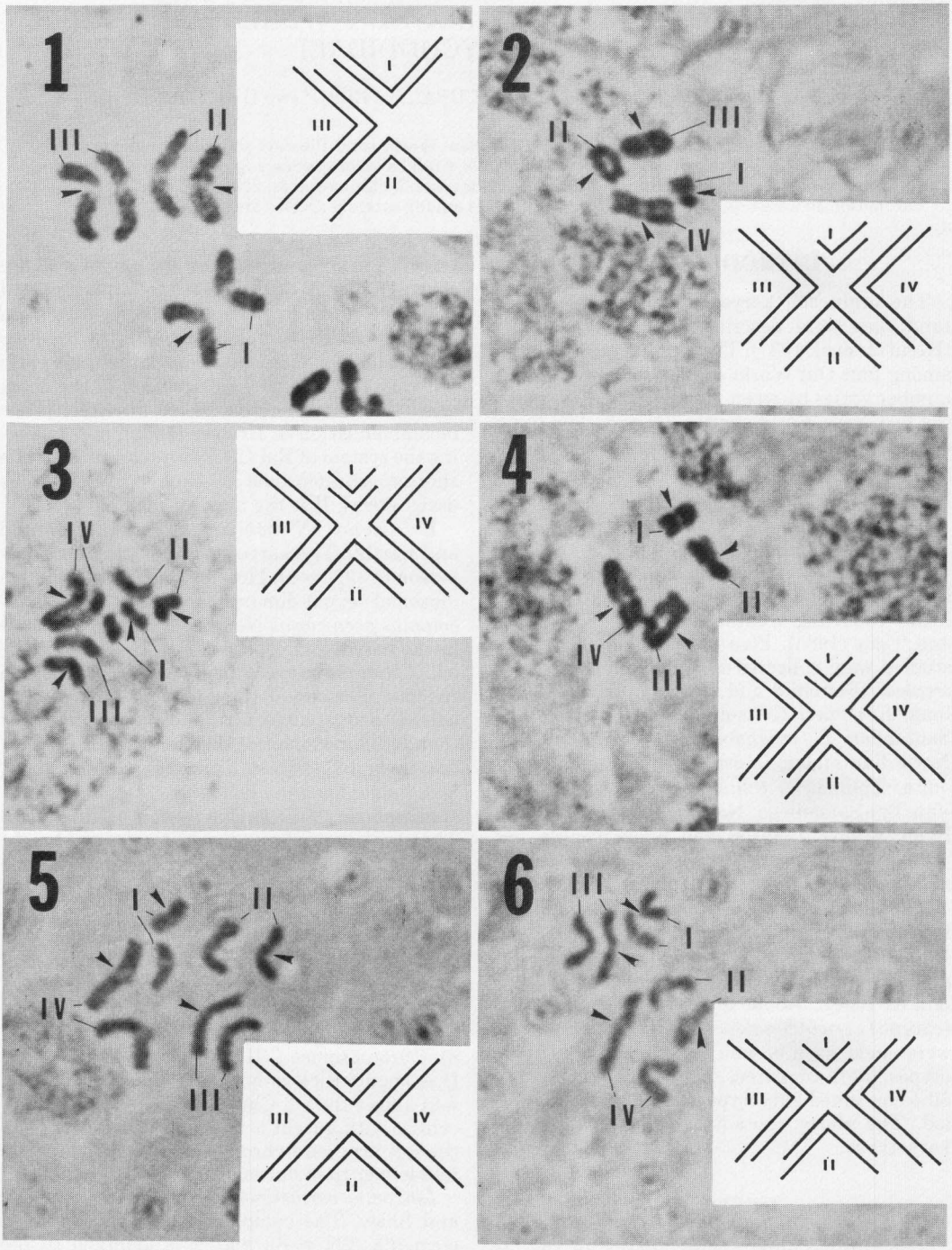

Fig. 1–6. Metaphase mitotic chromosomes of *Lutzomia* species from brain cells, ca. 900X. Arrows indicate centromeres. (1) *L. trapidoi*, (2) *L. gomezi*, (3) *L. erwindonaldoi*, (4) *L. carmelinoi*, (5) *L. walkeri*, (6) *L. columbiana.*

Lutzomyia columbiana (Ristorcelli and Van Ty). This complement and the relative lengths of the elements are identical with those of *L. erwindonaldoi* (2N = 8). Elements I, II, and III are metacentric and IV is submetacentric.

DISCUSSION

Among the eight New World sand fly species which have been studied, the chromosome numbers are 2N = 6 in one species and 2N = 8 in

Table 1. Brain cell chromosome descriptions of *Lutzomyia* species including average lengths of the arm.

Species	Chromosome and lengths (μm)							
	I		II		III		IV	
	Left arm	Right arm	Left arm	Right arm	Left arm	Right arm	Left arm	Right arm
L. trapidoi	3.1 M[a]	3.1	3.8 M	3.8	3.5 SM	4.9	—	—
L. gomezi	0.8 ST	2.0	2.8 M	2.8	3.5 M	3.5	3.8 M	3.8
L. erwindonaldoi	1.4 M	1.4	2.8 M	2.8	3.5 M	3.5	3.3 SM	4.3
L. carmelinoi	1.4 M	1.4	2.8 M	2.8	3.5 M	3.5	3.3 SM	4.3
L. walkeri	1.4 M	1.4	2.8 M	2.8	3.5 M	3.5	3.3 SM	4.3
L. columbiania	1.4 M	1.4	2.8 M	2.8	3.5 M	3.5	3.3 SM	4.3

[a] M, metacentric; SM, submetacentric; ST, subtelocentric. Measurements were taken with an ocular micrometer.

seven species (Kreutzer et al. 1987). Among the Old World species there is greater chromosome number variability, 2N = 6–10. The karyotypes of the species in subgenus *Lutzomyia*, *L. gomezi* and *L. longipalpis* (Lutz and Neiva) are identical. The chromosome morphology of the New World species *L. trapidoi* is not identical to the 2N = 6 complements of the two Old World species, *P. colabaensis* (Young and Chalam) and *P. argentipes* (Annandale and Brunetti) which themselves are slightly different. Chromosome I of *L. trapidoi* is metacentric and over twice as long as the submetacentric I of the two Old World species. The second element, II, of the New World species is metacentric and about 30–40% longer than submetacentric II of *P. colabaensis* or metacentric II of *P. argentipes*. The third chromosome is metacentric in the two Old World species, but it is submetacentric as well as about 20% longer in *L. trapidoi*.

The complements of *L. erwindonaldoi*, *L. carmelinoi*, *L. walkeri* and *L. columbiana* are identical. Chromosome I of these four species is metacentric, but I of *L. gomezi* and *L. longipalpis* is submetacentric. Chromosomes II and III are metacentric and equal in length in these six New World species. Chromosome IV of the *L. gomezi* and *L. longipalpis* pair is metacentric, but in the other four species IV is submetacentric.

The karyotypes of seven (since publication of Kreutzer et al. 1987 the identification of the *L. spinicrassa* population studied is in question) New World sand fly species which have been reported fall into three groups: 2N = 6, *L. trapidoi*; 2N = 8, *L. gomezi* and *L. longipalpis* -I submetacentric and II, III, IV metacentric; 2N = 8, *L. erwindonaldoi*, *L. carmelinoi*, *L. walkeri*, *L. columbiana* -I, II, III metacentric and IV submetacentric. The four Old World species studied each have distinctive brain cell karyotypes. The data from this study combined with the data previously reported suggest that there could be a relationship between sand fly chromosome morphology and the classification of sand flies based on typical taxonomic criteria. Whether or not such relationships actually do exist would require information from additional sand fly karyotypes. This study does note that variations in chromosome number and morphology are present in both New and Old World species.

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