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Mitotic Chromosomes of Some North American Sciuridae.* (27413)

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A previous study(1) demonstrated that several species of chipmunk (genera Tamias and Eutamias) had a diploid chromosome number of 38. Karyogram analysis permitted classification and identification of most of the chromosome pairs. A close taxonomic relationship between the above genera was demonstrated. These findings suggested that the chipmunk was a suitable experimental animal for cytogenetic studies.

The present study consisted of a survey of mitotic chromosomes in various other genera of the Family Sciuridae. The purpose was to 1) determine taxonomic and genetic relationships within the family and 2) ascertain the suitability of these animals for cytogenetic studies.

Methods. Animals were trapped alive and studied in the laboratory. Identification and classification were made according to Hall and Kelson(2). The following specimens were studied: 1) *Ammospermophilus harrisii harrisii*, 2 males, 2) *Ammospermophilus leucurus leucurus*, 1 male, 3) *Spermophilus richardsonii elegans*, 2 males, 4) *Spermophilus mexicanus parvidens*, 2 males and 1 female, 5) *Spermophilus beecheyi douglasii*, 3 females, 6) *Spermophilus lateralis lateralis*, 1 male and 3 females, 7) *Tamiasciurus hudsonicus fremonti*, 1 male.

Chromosome preparations were made from femoral marrow(1). Animals were first given colcemide intraperitoneally. After 2 hours the marrow was removed, treated with 1% sodium citrate, fixed in 1 part 1 N HCl and 10 parts 2% acetic orcein. The tissue was stained in acetic orcein and squashed between a slide and coverslip. Cells were counted at 1250× and photographed for karyogram analysis. Chromosomes were arranged according to centromere position (median, submedian or terminal) and were paired in order of descending size. Unpaired chromosomes in male karyograms were considered tenta-

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TABLE I. Chromosome Counts of Cells from Specimens of Amniospermophilus and Spermophilus.*

Specimen	Sex	Total cells counted	30	31	31(♀+1)	32	32(♀+1)	33	33(♀+1)	34	34(♀+1)	36	37	38
A. harrisii harrisii	♂	115	1	6	1	103	1	1	1	1				
Idem	♂	110	1	11		97		1						
A. leucurus leucurus	♂	13				11	2							
S. richardsonii elegans	♂	50				1	1	3		42	3			
Idem	♂	41		1		1		5	2	32				
S. mexicanus parvidens	♂	31		1		1		4		25				
Idem	♂	40		1				2		37				
S. mexicanus mexicanus	♀	60				2		3		55				
S. beecheyi douglasii	♀	40										1	3	36
Idem	♀	25										2	1	22
"	♀	33											3	30

* Counts are listed as definite numbers. When the number was in question it was listed as the closest figure (♀+1).

tively as sex chromosomes and placed in the lower right corner of the karyogram.

Results. Chromosome Number. The data are listed in Tables I and II. The modal dip-

TABLE II. Chromosome Counts of 4 Specimens of *Spermophilus lateralis lateralis.**

Sex	Total cells counted	40	41	41(♀+1)	42	42(♀+1)	43
♀	35		4	2	27	1	1
♂♀	48	1	2		45		
♂♀	47	1	3	1	40		2
♀	27	2		2	23		

* The counts are listed as in Table I.

loid (2n) chromosome number in *A. harrisii* and *A. leucurus* was 32, in *S. richardsonii* and *S. mexicanus* 34, in *S. beecheyi* 38, and in *S. lateralis* 42. In the only analyzed specimen of *T. hudsonicus* 2n was 46 in 79% of the 26 cells counted.

Chromosome morphology. More submedian than median chromosomes were found in all the animals. Autosomal terminal chromosomes were not present. However, one pair of nearly terminal chromosomes was present in *S. lateralis* and 1 to 2 pairs in *A. harrisii* (Fig. 1 and 3) and *A. leucurus.*

A single unpaired medium sized terminal chromosome, which probably was the Y chromosome, was noted in karyograms of *A. harrisii* (Fig. 3), *A. leucurus, S. richardsonii, S. mexicanus* (Fig. 4) and *S. lateralis.* Definite identification of this chromosome as the Y was made in *S. mexicanus* (Fig. 4) where female karyograms were available for comparison. The other unpaired chromosome in males was submedian and probably represented the X chromosome (Fig. 3 and 4).

In some instances absolute identification of chromosome pairs was possible. For example, in the karyogram of *A. harrisii* the 6 pairs of chromosomes in the middle row (Fig. 3) were readily differentiated. Chromosome morphology could not be defined in *T. hudsonicus* due to an insufficient number of karyograms.

Discussion. Chromosome analysis of 5 of 11 genera of North American Sciuridae(2) carried out in this and in a previous study(1) showed a wide variation of number and

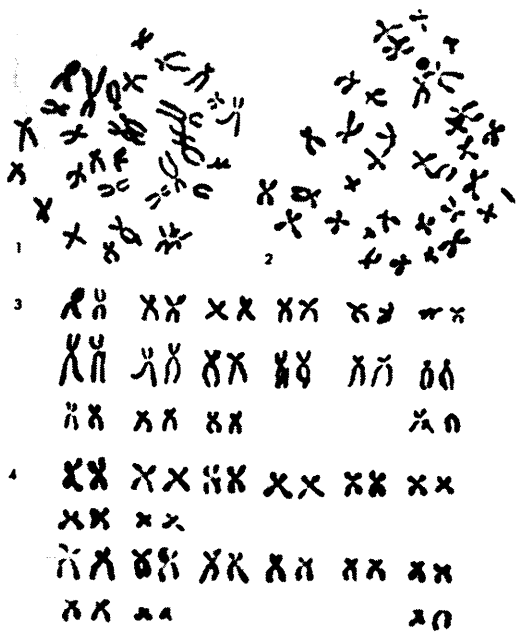

FIG. 1. An intact cell from a male *A. harrisii harrisii*, 900 ×.
FIG. 2. An intact cell from a male *S. mexicanus parvidens*, 900 ×.
FIG. 3. Karyogram constructed from cell depicted in Fig. 1.
FIG. 4. Karyogram constructed from cell depicted in Fig. 2.

morphology. Although there was considerable similarity between chipmunk genera(1), the animals examined in the present study showed no close chromosomal relationship. Likewise, in 4 of the 6 subgenera of Spermophilus analyzed no relationship was noted. These findings support the present classification of the Family Sciuridae and especially the genus Spermophilus.

A large terminal sex chromosome was noted in all male karyograms from the genera Spermophilus and Ammospermophilus. This finding suggested a closer relationship between these 2 genera than with the 2 chipmunk genera in which a dot-like Y chromosome was described(1). Examination of the Y chromosome in other Sciuridae may further clarify intergeneric relationships.

Some of the animals studied may provide useful models for cytogenetic experiments. Valuable cytogenetic features are low chromosome number and easily identifiable pairs in the karyogram. Among the animals investigated *A. harrisii* was the best model with 32 chromosomes and at least 6 chromosome pairs individually identifiable. However the Chinese hamster with 22 chromosomes (11 easily separable pairs) still remains the best mammalian cytogenetic model described to date(3).

Summary. Mitotic chromosomes of several North American Sciuridae have been analyzed. The diploid chromosome number was 32 in *Ammospermophilus harrisii harrisii* and *Ammospermophilus leucurus leucurus*, 34 in *Spermophilus richardsonii elegans* and *Spermophilus mexicanus parvidens*, 38 in *Spermophilus beecheyi douglasii*, 42 in *Spermophilus lateralis lateralis* and 46 in *Tamiasciurus hudsonicus fremonti*.

Chromosome number and morphology were analyzed and found to support the present classification of Sciuridae. A large terminal sex chromosome, probably the Y chromosome, was found in examples of Ammospermophilus and Spermophilus, and suggested a similarity between these genera. The usefulness of these mammals for cytogenetic studies, especially *A. harrisii harrisii*, was described.

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