that: 'Preparations from the iguanids *Iguana iguana* and *Crotaphytus collaris* made subsequent to the published karyotypes have also shown a satellited No. 2 pair.' This raises the possibility that this may be a consistent phenomenon in this family which will not be evident except under ideal tissue culture and preparative cytologic conditions.

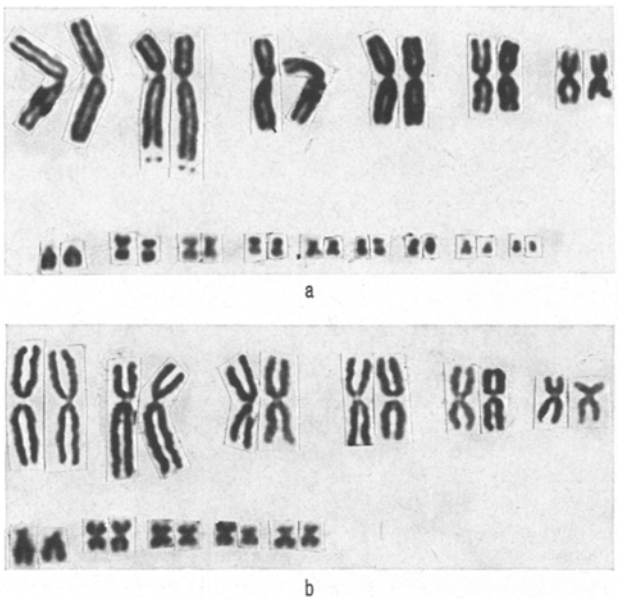

Fig. 1. (a) (top) Karyotype of *Sceloporus graciosus*. Note satellites at end of long arm of second macrochromosome pair. (b) (bottom) Karyotype of *Sceloporus occidentalis*.

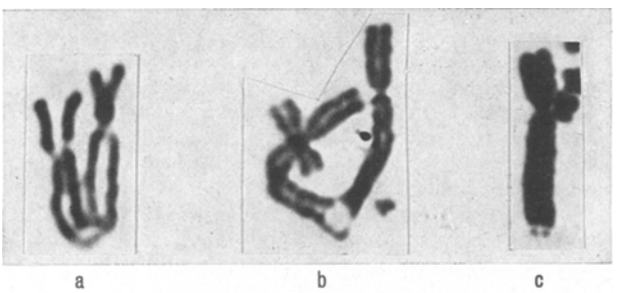

Fig. 2. (a) and (b) Long-arm telomeric association and 'bridging' of second macrochromosome pair of *S. occidentalis*. (c) Satellites of second macrochromosome pair of *S. occidentalis* appearing after multiple passages in tissue culture.

The second observations concern the microchromosome morphology and its probable importance in species differentiation and perhaps in speciation itself[5,6,9]. Our arrangement of microchromosomes for *S. occidentalis* and *S. graciosus* suggests that the 5 microchromosomal pairs in the former are very similar if not identical to the first 5 microchromosome pairs of the latter. A review of the *Uta* karyotypes of PENNOCK[2,7] suggest a similar identity for at least the first 4 pairs. Thus, it would seem that analysis of microchromosome number is not sufficient for critical interspecific comparison among the lizard karyotypes. Better preparative techniques reveal sufficient microchromosomal morphology for good comparative analysis of the larger pairs. Excellent preparations will enable one to see detail in all but the smallest pairs, even to visualization of apparently satellited microchromosomes. Another technique recently developed by SHAW[10] has demonstrated visible arm structure in the smallest microchromosomes of *S. graciosus*[11]. This promises to be helpful in the future analysis of interspecific microchromosomal differences and their meaning in karyotype evolution in the lizards. Lizard tissues are readily available and easily handled by standard tissue culture techniques and should be a valuable source of material for further studies of microchromosome behavior and function.

Résumé. Les chromosomes somatiques de deux Lézards représentatifs des sceloporins sont analysés. *S. graciosus* a 12 macrochromosomes et 18 microchromosomes, et *S. occidentalis* a 12 macrochromosomes et 10 microchromosomes. La morphologie des macrochromosomes de ces deux espèces est la même. La morphologie des microchromosomes offre des différences spécifiques importantes. Ce fait ainsi que d'autres constatations suggèrent que les changements observés dans les microchromosomes jouent probablement un rôle important dans l'évolution du karyotype des Lézards.

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The Chromosomes of *Marmosa fuscata* Thomas, from Northern Venezuela (Marsupialia, Didelphidae)

The karyotype of *Marmosa robinsoni* has been recently reported by REIG[1] as being very similar to that of *Caluromys derbianus*, described by BIGGERS et al.[2]. Both species share the same number of chromosomes ($2n = 14$) and the autosomes are quite similar in relative size and arm ratio the gonosomes are slightly different, though. *Marmosa mexicana* has also been found[2] to be very similar to *Caluromys derbianus* in the chromosome complement, but a description of its karyotype has not been presented.

The striking chromosome similarity found between fairly separate didelphid genera is noteworthy. *Marmosa* and *Caluromys* are members of different subfamilies of the Didelphidae[1,3], namely Didelphinae and Microbiotheriinae. Didelphids of the same subfamily as *Marmosa*,

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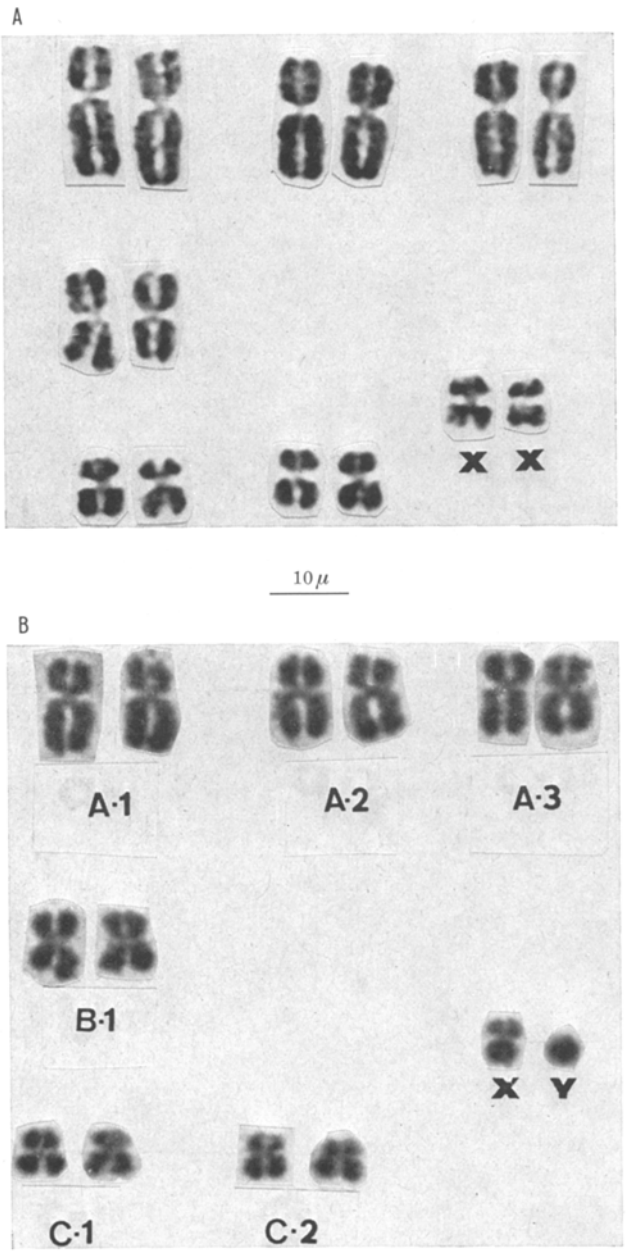
such as *Didelphis*[4] and *Monodelphis*[5], show karyotypes of $2n = 22$ or $2n = 18$ chromosomes. The differences between these karyotypes and that of *Marmosa* are much greater than the differences between the karyotypes of *Marmosa* and *Caluromys*. *Marmosa* is, however, a rather diversified and very polytypic genus of Neotropical didelphids, and we have chromosome information of only 2 of the 37 recognized species[6]. It is important, therefore, to study the chromosomes of other species of this taxon, in order to see how far the same karyotype is repeated within the genus.

The species of *Marmosa* can be grouped in 4 different subgenera, namely *Marmosa* s.s., *Micoureus*, *Marmosops* and *Thylamys*[7]. The genus is probably as old as the Paleocene[8], and the different subgenera may represent an early radiation. Chromosome information so far reported refers to 2 species (*M. robinsoni* and *M. mexicana*) of the subgenus *Marmosa* s.s. (the '*murina* group' of TATE[9]). We have investigated the chromosomes of *Marmosa fuscata* Thomas, a species of the subgenus *Marmosops* (*noctivaga* group of TATE) distributed in the subtropical forests of the Andes of Venezuela and Colombia, and the Cordillera de la Costa of northern Venezuela[9].



Karyotypes of a female (A) and a male (B) individual of *Marmosa* (*Marmosops*) *fuscata* Thomas, from northern Venezuela (Rancho Grande, Aragua). From C-metaphases of primary cultures of embryonic cells. Aceto-orcein and squash.

One female from Rancho Grande, Aragua, and 2 of their fetuses were treated by the tissue culture technique described elsewhere[10]. We cultured the tissues from the ovary, lung, liver and kidney of the mother, and the whole embryos. Very good results were obtained from the ovary tissue of the mother and from the embryos, which included 1 male and 1 female, as determined by the chromosomes. Skin and skull of the adult female were deposited in the collection of mammals of the Institute of Tropical Zoology, Central University of Venzuela, catalogued under the number MBUCV 1-1583. In order to confirm the male karyotype, we studied 1 adult male (MBUCV 1-1606) from Altos de Pipe, Miranda, using the bone marrow[11] and cornea[12] direct techniques. A total of 88 cells were observed and counted, and 25 karyotypes were constructed from enlarged prints (Figure, A and B). The karyotypes were consistent in the 4 individuals studied.

The chromosome complement of *Marmosa fuscata* comprises the same groups of chromosomes as in *Marmosa robinsoni* and *Caluromys derbianus*: 3 pairs of large metacentric to submetacentric autosomes (group A); 1 pair of medium-sized metacentric autosomes (group B); 2 pairs of metacentric small-sized autosomes (group C), and a sexual pair formed by a small metacentric *X* Similar in size to those of pair C 2 from which it may be difficult to distinguish, and a telocentric *Y* of size somewhat larger than the arms of the *X* chromosome.

The chromosomes of group A and group B are probably the same in *Marmosa fuscata*, *M. robinsoni* and *Caluromys derbianus*: they are indistinguishable in relative size and arm ratio in the 3 species. A clear-cut difference occurs, however, in the group C of autosomes. In *Marmosa robinsoni* and *Caluromys derbianus* the 2 pairs of small autosomes have subterminal centromeres and they are quite similar in size and arm ratio. In *Marmosa fuscata* these 2 pairs agree in relative size with those of the other species, but the centromeres are medial in position in each pair. The *X* is metacentric in *M. fuscata*, as in *M. robinsoni*, whereas it is acrocentric in *C. derbianus*. The *Y*s, though slightly different in size, are quite similar in the 3 species.

Marmosa fuscata is thus different in karyotype from *Marmosa robinsoni* only in the position of the centromere in the 2 small-sized autosomes of group C, these chromosomes being metacentric in the former and subtelocentric in the latter. Therefore, the over-all karyotype difference between these 2 species belonging to 2 different subgenera

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probably does not imply more than 2 pericentric inversions. It is, however, striking to realize that there are more karyotype differences between these 2 species than between *Marmosa robinsoni* and *Caluromys derbianus*, which seem to differ only in the *X* chromosome, acrocentric in the latter, metacentric in the former. Karyotype changes appear not to run parallel to phylogeny in the evolution of these taxa[13].

Resumen. Los cromosomas de *Marmosa fuscata* (subgénero *Marmosops*), estudiados por cultivo de tejidos en base a 4 individuos de la Cordillera de la Costa en el norte de Venezuela, resultaron diferir de los de *Marmosa robinsoni* sólo en el quinto y sexto par de autosomas, metacéntricos en la primera y subtelocéntricos en la segunda especie. Con todo, se encuentran mayores diferencias entre los cariotipos de estas 2 especies que entre los de *M. robinsoni* y *Caluromys derbianus*.

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[13] We thank Pablo Kiblisky and Omar Linares for assistance in field work.

Isomorphic Sex-Chromosomes in Two Venezuelan Populations of the Spiny Rat, Genus *Proechimys* (Rodentia, Caviomorpha)

The spiny rats (family Echimyidae) of the genus *Proechimys* are common habitants of the forests of the lowlands and mountain slopes of tropical South America and of southern Middle America. They are typical members of the suborder Caviomorpha of Neotropical rodents, representing one of the generalized, rat-like groups of the caviomorph radiation[1]. The species of *Proechimys* proved to be highly variable and therefore very difficult to classify[2–4].

Purporting to contribute to clarification of the taxonomy of the genus, the senior author started to gather chromosome information from samples of different Venezuelan populations of *Proechimys*. In this routine work, he became surprised to discover that one female and one male individual, caught by himself in the gallery forest near La Esmeralda, Amazonas Territory, Venezuela (upper Orinoco River), showed exactly the same karyotypes of 26 chromosomes without morphologically distinguishable *X* and *Y* chromosomes in the male (Figure 1). Unfortunately, only 2 individuals were available from this locality. The skins and skulls are deposited in the collection of mammals of the Institute of Tropical Zoology, Central University of Venezuela (♂, MBUCV 1-1716; ♀, MBUCV 1-1790). 18 karyotypes were constructed of the female, and 29 of the male, from a total of 100 studied cells from bone-marrow, prepared with the well-known colchicine-hypotonic pretreatment technique[5,6]. The karyotypes were consistent in all the cells studied, and in none of the male cells was a heteromorphic pair observed which could be ascribed to the usual *XY* sexual system.

Due to the fact that the locality of La Esmeralda is located very far away in a rather isolated part of the Orinoco jungle, it was impossible until now to get more specimens from this population. In order to compare these results, we studied slides from our files of specimens of *Proechimys* from Aragua State in northern Venezuela, currently classified as *Proechimys guyannensis guairae* Thomas[2,7,8]. We had preparations from bone-marrow cells of 3 individuals of this taxon: 1 female (MBUCV 1-1760) and 1 male (MBUCV 1-1642) from Bahía de Cata, Ocumare de la Costa, Aragua, and 1 female from La Horqueta, near Tiara, Aragua, deposited in the United States National Museum (USNM 395261). We examined 60 cells of these individuals, and found that the diploid number is $2n = 46$ chromosomes. The male also proved not to have distinguishable *X* and *Y* chromosomes, so that the female and the male karyotypes were identical, repeating the situation found in the sample from La Esmeralda (Figure 2).

Comparing the karyotypes of the 2 forms studied, it becomes obvious that they are markedly different. The specimens from La Esmeralda have 1 pair of large subtelocentric, 1 pair of large metacentric, a gradually decreasing series of 7 pairs of metacentric of medium and small size, and 4 pairs of telocentric chromosomes (1 of medium size and 3 of small size). The karyotype of the specimens from Aragua has 1 pair of large metacentric, a series of 11 pairs of acrocentric and telocentric (3 medium sized and the remainder small sized) and a decreasing series of 11 pairs of medium and small sized, meta- and submetacentric chromosomes. More detailed comparisons, involving measurements and idiogram constructions are certainly required, but it is equally obvious that these 2 karyotypes could hardly be thought of as belonging to the same species.

However, the specimens from La Esmeralda are not distinguishable from a series of the same locality in the American Museum of Natural History referred by Tate[9] to *P. guyannensis guyannensis* (mispelled *P. cayennensis cayennensis* in his paper). The fact that 2 forms formally considered as subspecies of the species *P. guyannensis* show such different chromosome complements, suggests

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