

G-, C-bands and NOR studies in two species of bats from Southern Brazil (Chiroptera: Vespertilionidae, Molossidae)

By T. R. O. FREITAS, M. R. BOGO, and A. U. CHRISTOFF

Departamento de Genética, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Receipt of Ms. 24. 2. 1992

Acceptance of Ms. 16. 6. 1992

Abstract

Described the karyotypes of two species of bats from Southern Brazil, *Eptesicus brasiliensis* ($2n = 50$; $AN = 48$) and *Molossus molossus* ($2n = 48$; $AN = 54$). The study of *E. brasiliensis* was based in seven males and seven females, while that of *M. molossus* included three males and 13 females. All autosomal chromosomes of *E. brasiliensis* are acrocentric, while *M. molossus* presents four pairs of submetacentric and 19 pairs of acrocentric chromosomes. Both species present an acrocentric Y chromosome; the X is submetacentric in *E. brasiliensis* and metacentric in *M. molossus*. The G-bands of *E. brasiliensis* do not differ markedly from those reported for other species of *Eptesicus*. *M. molossus*, however, presents a rather different G-pattern from those of other species of the same family. As for the C-bands, the results for both species are not remarkably different from those of other species of the same families. *E. brasiliensis* and *M. molossus* show a nucleolus organizing region (NOR) in only one pair, the one that presents a secondary constriction near the centromere.

Introduction

The bats present in the Southern Brazilian state of Rio Grande do Sul inhabit an area between two subregions of the Neotropical region, the Brazilian Highlands and Coast, and Patagonia. Eleven species of the family Vespertilionidae and eight of the Molossidae have been reported to live in the state (SILVA 1985). This work deals with *Eptesicus brasiliensis* (Vespertilionidae) and *Molossus molossus* (Molossidae), bats which are distributed over all South America (KOOPMAN 1982). Previous studies on these species report a diploid number ($2n$) equal to 50 for *E. brasiliensis* (ANDO et al. 1977; WILLIAMS 1978; BICKHAM 1979; VOLLETH 1987), and $2n = 48$ for *M. molossus* (BAKER and LOPEZ 1970; WARNER et al. 1974), but no chromosome bands or NOR observations were made on them. The objective of this study was to fill this gap in our knowledge.

Material and methods

Fourteen specimens of *Eptesicus brasiliensis* (Desmarest, 1819) were studied, seven males and seven females from Fazenda Caçapava, in Taim's Ecological Station ($32^{\circ} 32'S$; $52^{\circ} 32'W$). The sample of *M. molossus* (Pallas, 1766) is constituted by 16 specimens, two males and 10 females from this same place, one male from Porto Alegre ($30^{\circ} 10'S$; $51^{\circ} 15'W$), and three females from Torres ($29^{\circ} 21'S$; $49^{\circ} 46'W$), all localities in the Brazilian state of Rio Grande do Sul.

LEE and ELDER's (1980) technique was employed in the bone marrow chromosome preparations. The G-bands were induced following SEABRIGHT's (1971) method with the modifications proposed by PATTON and BAKER (1978), while the C-band patterns were obtained with SUMNER's (1972) technique. The NOR observations were made using HOWELL and BLACK's (1980) method.

Results

Eptesicus brasiliensis presented $2n = 50$ with an autosomal arm number (AN) equal to 48. Figure 1a shows the standard karyotype of this species. All the autosomes are acrocentric, roughly classifiable in large (pairs 1 to 15), median (pairs 16 to 21), and small (pairs 22 to 24) chromosomes. The X is a median submetacentric and the Y is a small acrocentric. Figure 1b presents the patterns of constitutive heterochromatin for this species. There are well defined, small C-bands in pairs 3 to 8, 10 to 13, 16, 18, 20 and 21, representing 58 % of the autosomes with marked centromeres. The X chromosome also has a C-band, while the Y is totally heterochromatic. G-bands are shown in Figure 1c, while Figure 1d presents the nucleolar organizer region in pair 14, which has a secondary constriction near the centromere (Fig. 1a).

M. molossus has $2n = 48$ and AN = 54. Conventional staining (Fig. 1e) shows four pairs of submetacentric chromosomes, pair 1 being the larger; the other three are median submetacentrics, while the remaining autosomes are all acrocentric. Pairs 22 and 23 are very small compared to the rest of the karyotype. The X chromosome is a median metacentric, a little larger than pairs 2–4, while the Y is a small acrocentric. C- and G-band patterns are shown in Figures 1f and 1g, respectively. C-bands occur in almost all autosome pairs, the exception being pair 7, and in the X. The nucleolar organizer region (Fig. 1h) occurs in pair 8 at the secondary constriction near the centromere.

Discussion

Eptesicus brasiliensis

The genus *Eptesicus* comprises about 30 species worldwide (EMMONS 1990). Approximately 50 % of them present $2n = 50$ and AN = 48 (ANDO et al. 1977; WILLIAMS 1978; ZIMA 1982; VOLLETH 1987; VARELLA-GARCIA et al. 1989), but others show reduced chromosome numbers (for instance, *E. capensis* with $2n = 32$, AN = 50; *E. zulensis* with $2n = 28$, AN = 48). Species with different chromosome numbers, however, are morphologically similar (MCBEE et al. 1986; MCBEE et al. 1987; MORALES et al. 1991). We found $2n = 50$ and AN = 48 for *E. brasiliensis* from Rio Grande do Sul, thus agreeing with BICKHAM (1979) who found the same numbers studying specimens from the Nearctic region.

No remarkable differences were found between the G-bands presented here and those found by ZIMA (1982) in *E. nilssoni*. This fact, and the relative constancy in chromosome numbers, demonstrates that this genus is chromosomically conservative. In relation to the C-bands, we found only 58 % of autosome pairs marked, while ANDO et al. (1980) determined low quantities of constitutive heterochromatin for other species of Vespertilionidae. Only pair 12 of *E. brasiliensis* showed a nucleolar organizer region, in accordance with the findings in *E. serotinus* (VOLLETH 1987).

Molossus molossus

Five diploid numbers were reported within the family Molossidae: $2n = 34, 38, 40, 42$, and 48 (BAKER et al. 1982; VARELLA-GARCIA et al. 1989). The $2n = 48$ karyotype is the most frequently found. WARNER et al. (1974) found $2n = 48$ and AN = 58, while BAKER and LOPEZ (1970) reported $2n = 48$ and AN = 56 for *M. molossus* of North and Central America, respectively. We observed $2n = 48$, AN = 54. This suggests variation due to pericentric inversions, but since no banding was performed in these earlier studies, we cannot be sure about that.

For the C-bands, our results are not too different from those reported by MORIELLE-VERSUTE et al. (1991). These authors studied two species of the genus *Molossops*: *M.*

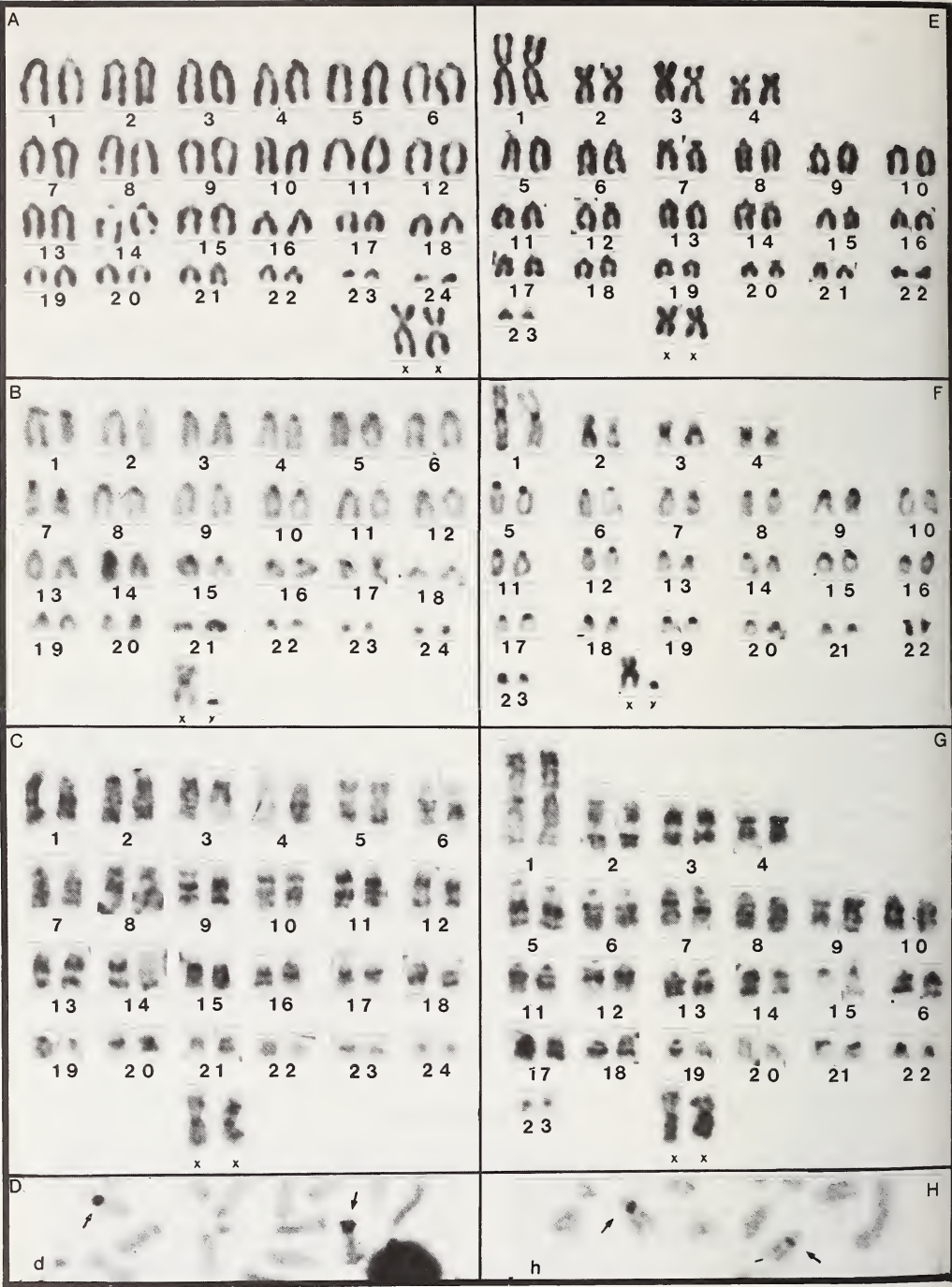


Fig. 1. Chromosomes of *E. brasiliensis*. A: Standard bone marrow Giemsa stained karyotype; B: C-bands; C: G-bands; D: NOR identification. E-H: Chromosomes of *M. molossus*. E: Giemsa stained karyotype; F: C-bands; G: G-bands; H: NOR identification

abrasus and *M. temminckii*. Both showed C-bands in all centromeres. Additionally *M. abrasus* presented a C-band in the telomeric region of the short arms of the largest acrocentric pair, and *M. temminckii* a C-band in the satellite region of the short arm of a large acrocentric pair. We found in *Molossus molossus* blocks of pericentromeric constitutive heterochromatin in 22 of the 23 autosome pairs and in the X. However, this species presents rather different G-bands from those reported for *M. abrasus* and *M. temminckii*. In addition, nucleolar organizing regions were found in one pair in *M. molossus* while *M. abrasus* presented such regions in five small chromosomes, and *M. temminckii* in three pairs.

Acknowledgements

We thank Drs. MARGARETE S. MATTEVI, LUIZ F. B. OLIVEIRA, RIVO R. FISHER and FRANCISCO M. SALZANO for valuable comments on the manuscript, ADRIANA GAVA for drawing the figures, and CARLA FREITAS for revising the English version. Thanks are also due to Instituto Brasileiro do Meio Ambiente for allowing the work in the Estação Ecológica do Taim. This research has been sponsored by grant no. 409272/87 of Conselho Nacional de Desenvolvimento Científico e Tecnológico.

Zusammenfassung

G-, C- und NOR-angefärbte Karyotypen von zwei Fledermausarten aus Südbrasilien
(Chiroptera: Vespertilionidae, Molossidae)

Es werden Standardkaryogramme sowie G-, C- und NOR-gefärbte Metaphasen von zwei Fledermausarten aus Südbrasilien beschrieben. Je 7 Männchen und Weibchen von *Eptesicus brasiliensis* (Vespertilionidae) und 3 Männchen und 13 Weibchen von *Molossus molossus* (Molossidae) wurden untersucht. Die cytogenetische Analyse ergab $2n = 50$ und $AN = 48$ für *E. brasiliensis* und $2n = 48$ und $AN = 54$ für *M. molossus*. Bei *E. brasiliensis* sind alle Autosomen akrozentrisch; *M. molossus* weist 4 Paare submetazentrischer und 19 Paare akrozentrischer Chromosomen auf. Beide Arten haben ein akrozentrisches Y-Chromosom, das X-Chromosom ist submetazentrisch bei *E. brasiliensis* und metazentrisch bei *M. molossus*. Die Muster der G-Bänder bei *E. brasiliensis* unterscheiden sich nicht von denen anderer *Eptesicus*-Arten. Dagegen unterscheidet sich *M. molossus* deutlich von anderen Arten der Familie. Bei den C-Bändern ergaben sich keine wesentlichen Unterschiede. Bei beiden Arten ließen sich NORs nur in einem Chromosom anfärben, welches eine sekundäre Einschnürung in der Nähe des Centromers aufweist.

References

- ANDO, K.; TAGAWA, T.; UCHIDA, T. A. (1977): Consideration of karyotypic evolution within Vespertilionidae. *Experientia* 33, 877–879.
- ANDO, K.; TAGAWA, T.; UCHIDA, T. A. (1980): The C-banding of Japanese species of vespertilionine bats (Mammalia: Chiroptera). *Experientia* 36, 653–654.
- BAKER, R. J.; LOPEZ, G. (1970): Karyotypic studies of the insular populations of bats on Puerto Rico. *Caryologia* 23, 465–472.
- BAKER, R. J.; HAIDUK, M. W.; ROBBINS, L. W.; CADENA, A.; KOOP, B. F. (1982): Chromosomal studies on South American bats and their systematic implications. In: *Mammalian Biology in South America*. Ed. by M. A. MARES, and H. H. GENOWAYS. Pittsburgh Special Publication Series. Pymatuning Laboratory of Ecology, Univ. Pittsburgh. Vol. 4, 303–327.
- BICKHAM, J. W. (1979): Chromosomal variation and evolutionary relationships of vespertilionid bats. *J. Mammalogy* 60, 350–363.
- EMMONS, L. H. (1990): *Neotropical rainforest mammals, a field guide*. Chicago: Chicago University Press.
- HOWELL, W. M.; BLACK, D. A. (1980): Controlled silver-staining of nucleolus organizer regions with a protective colloidal developer: a 1-step method. *Experientia* 36, 1014–1015.
- KOOPMAN, K. F. (1982): Biogeography of bats of South America. In: *Mammalian Biology in South America*. Ed. by M. A. MARES and H. H. GENOWAYS. Pittsburgh Special Publication Series. Pymatuning Laboratory of Ecology, Univ. Pittsburgh. Vol. 4, 327–332.
- LEE, M. R.; ELDER, F. F. B. (1980): Yeast stimulation of bone marrow mitosis for cytogenetic investigation. *Cytogenet. Cell Genet.* 26, 36–40.
- MCBEE, K.; BICKHAM, J. W.; YENBUTRA, S.; NABHITABHATA, J.; SCHLITTER, D. A. (1986): Standard karyology of nine species of vespertilionid bats (Chiroptera: Vespertilionidae) from Thailand. *Ann. Carnegie Mus.* 47, 361–383.
- MCBEE, K.; SCHLITTER, D. A.; ROBBINS, R. L. (1987): Systematics of African bats of the genus

- Eptesicus* (Mammalia: Vespertilionidae). 2. Karyotypes of African species and their generic relationships. *Ann. Carnegie Mus.* **56**, 361–383.
- MORALES, J. C.; BALLINGER, S. W.; BICKHAM, J. W.; GREENBAUM, I. F.; SCHLITTER, D. A. (1991): Genetic relationships among eight species of *Eptesicus* and *Pipistrellus* (Chiroptera: Vespertilionidae). *J. Mammalogy* **72**, 286–291.
- MORIELLE-VERSUTE, E.; VARELLA-GARCIA, M.; TADDEI, V. A. (1991): Variação cromossômica no gênero *Molossops* (Molossidae, Chiroptera). *Rev. Bras. de Genética* **14** (3, suppl.), 60.
- PATTON, J. C.; BAKER, R. J. (1987): Chromosomal homology and evolution of phyllostomatoid bats. *Rev. Sys. Zool.* **27**, 449–462.
- SEABRIGHT, M. (1971): A rapid banding technique for human chromosomes. *Lancet* **2**, 971–972.
- SILVA, F. (1985): Guia para determinação de morcegos: Rio Grande do Sul. Porto Alegre: Martins Livreiro.
- SUMNER, A. T. (1972): A simple technique for demonstrating centromeric heterochromatin. *Exp. Cell Res.* **75**, 304–306.
- VARELLA-GARCIA, M.; MORIELLE-VERSUTE, E.; TADEI, V. A. (1989): A survey of cytogenetic data on Brazilian bats. *Rev. Bras. Genética* **12**, 761–794.
- VOLLETH, M. (1987): Difference in the location of nucleolus organizer regions in European vespertilionid bats. *Cytogenet. Cell Genet.* **44**, 186–197.
- WARNER, J. W.; PATTON, J. L.; GARDNER, A. L.; BAKER, R. J. (1974): Karyotypic analysis of twenty-one species of molossid bats (Molossidae:Chiroptera). *Can. J. Genet. Cytol.* **16**, 165–176.
- WILLIAMS, D. F. (1978): Taxonomic and karyologic comments on small browns bats, Genus *Eptesicus*, from South America. *Ann. Carnegie Mus.* **47**, 361–383.
- ZIMA, J. (1982): Chromosomal homology in the complements of bats of the family Vespertilionidae. II. G-band karyotypes of some *Myotis*, *Eptesicus* and *Pipistrellus* species. *Folia Zoologica* **31**, 31–36.

Authors' address: THALES RENATO O. FREITAS, MAURICIO R. BOGO, and ALEXANDRE U. CHRISTOFF, Departamento de Genética, Universidade Federal do Rio Grande do Sul, Caixa Postal 15053, 91501 Porto Alegre, RS, Brazil

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Mammalian Biology \(früher Zeitschrift für Säugetierkunde\)](#)

Jahr/Year: 1992

Band/Volume: [57](#)

Autor(en)/Author(s): Freitas Thales Renato O., Bogo Mauricio R.

Artikel/Article: [G-, C-bands and NOR studies in two species of bats from Southern Brazil \(Chiroptera: Vespertilionidae, Molossidae\) 330-334](#)