

Intraspecific Sex Chromosome Polymorphism in the *Bandicota bengalensis bengalensis* (Gray) Collected from India

The genus *Bandicota* (Muridae-Rodentia) is represented by two species, *B. indica* (Bechstein) and the *B. bengalensis* (Gray) in the Old World¹. Both these species of *Bandicota* have been reported from India. Bandicoot rats are very ferocious in nature. They live in burrows of cultivated fields and are well-known for their grunting noise.

The karyotype of the genus *Bandicota* ($2N = 42$) was first studied by MATTHEY² from the gonadal tissue. Using the modern technique the diploid chromosome numbers ($2N = 42$) in *B. indica indica* and in *B. bengalensis kok* have been recently reported from India³. In another species *B. nemorivaga* collected from Formosa, only the diploid chromosomes of 44 have been reported⁴. In the present paper a detailed karyotypic data and the sex chromosome polymorphism in *B. b. bengalensis* collected from different geographical areas in India, have been described.

Materials and methods. In the Table are listed the number and sex of specimens, their localities and date of collection. Colcemid treated bone marrow cells were utilized for chromosome preparations following the technique described earlier⁵. From each specimen more than 100 adequate metaphase spreads were counted to determine the diploid number and minimum 10 plates were used for karyotyping. The number of chromosomal arms (FN) was counted excluding the sex chromosomes.

Results. The diploid chromosome number and the number of chromosomal arms are determined to be $2N = 42$ and $FN = 52$, respectively. The chromosomes are grouped mainly into 2 categories: metacentric and acrocentric. There are 6 pairs of medium to small-sized metacentric and 14 pairs of varying sized acrocentric autosomes. The acrocentric autosomes are arranged into 3 rows for economy of space. In Belonia sample the X chromosome is large-sized submetacentric and the Y is small-sized submetacentric (Figures 1 and 2). The X and the Y are large and small-sized acrocentric and submetacentric chromosomes respectively in the sample collected from Varanasi (Figure 3). The X chromosomes in the only female specimen collected from Rohru are tentatively identified to be acrocentric (Figure 4).

Otherwise all these karyotypes are identical with respect to autosomes.

Discussion. The count of $2N = 42$ chromosomes in *B. bengalensis bengalensis* collected from India confirms the finding of $2N = 42$ reported for the same species². Since the later study was done from the gonadal tissue using the classical technique, it was, however, not possible to compare the karyotype data obtained in the present study.

Number, place and the date of collection of the specimens used in the present study

Number of specimens* studied		Localities
♂	♀	
—	1	Rohru, Himachal Pradesh; May, 1969
3	2	Varanasi, Uttar Pradesh; July, 1969
1	2	Belonia, Tripura State; December, 1969.

* Specimen (SM 1640) from Rohru is deposited in the museum of Virus Research Centre, Poona. Varanasi specimens are kept in the Department of Zoology, Banaras Hindu University, Varanasi-5; and the specimens (TM 56, 61 and 64) from Belonia are deposited in the museum of Zoological Survey of India, Calcutta.

¹ P. K. WALKER, *Mammals of the World* (The Johns Hopkins Press, Baltimore 1964), vol. 2.

² R. MATTHEY, Arch. J. Klaus Stift. 31, 294 (1956).

³ S. P. RAY-CHAUDHURI, P. V. RANJINI and T. SHARMA, Mammalian Chromosomes Newsl. 9, 82 (1968).

⁴ T. H. YOSIDA, K. TSUCHIYA, H. T. IMAI, K. MORIWAKI and T. UDAGAWA, Mammalian Chromosomes Newsl. 10, 217 (1969).

⁵ S. PATHAK and T. SHARMA, Caryologia 22, 35 (1969).



Fig. 1. Karyotype of a male *Bandicota b. bengalensis* collected from Belonia, Tripura State. $\times 2000$.

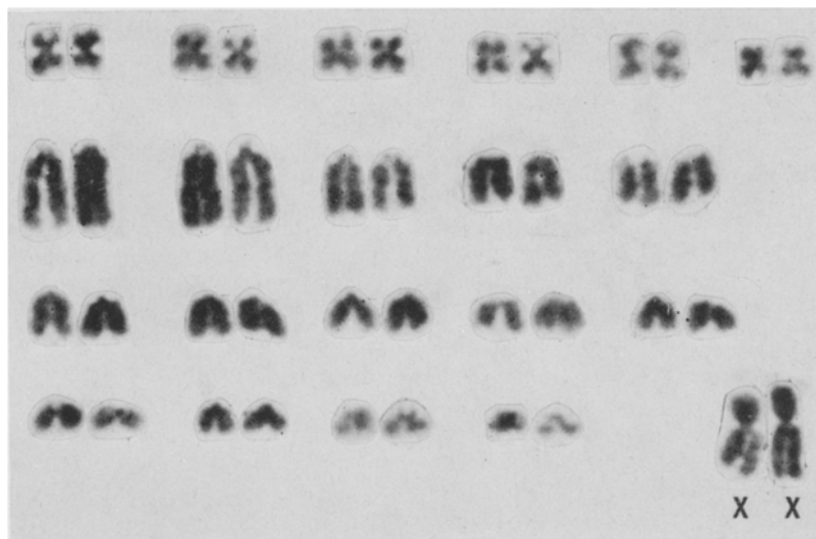


Fig. 2. Karyotype of a female *B. b. bengalensis* collected from Belonia, Tripura State. $\times 2000$.

Intrasubspecific chromosomal variation in mammals is of rare occurrence. NELSON-REES et al.⁶, reported for the first time a major karyotype variation in 2 subspecies of bat, *Macrotus waterhousii* collected from Mexico and California. The diploid number of Mexico population was $2N = 46$ and of California $2N = 40$. These two populations vary not only in their diploid numbers but also in the structure of the chromosomes. The Y chromosome in the Mexico population was telocentric whereas in California sample it was meta- or submetacentric. Variation in the morphology of X chromosomes has been reported in another subspecies of bat, *Lasiurus ega* collected from 2 different populations⁷. In another subspecies, *Taphozous l. longimanus* (Emballonuridae) collected from Varanasi and Nanded (distance between these places about 700 miles) a variation in the relative length ($L^R = 7.33 \pm$ and $13.48 \pm$) of the Y chromosome has been encountered⁸. Polymorphism of the Y chromosome has been reported in other mammals also (see UNNÉRUS et al.⁹).

The autosomes in the karyotypes of the specimens collected from Rohru, Varanasi and Belonia are almost identical. Even the morphology of the Y chromosomes, at least, in 2 populations (Varanasi and Belonia) is identical. Unfortunately, a male specimen from Rohru was not available for chromosomal evaluation. But the morphology of the X chromosomes in Rohru and Varanasi populations are almost similar. The only variation of major significance is in the morphology of the X chromosomes in the Belonia sample and in the samples collected from Varanasi and Rohru. As stated earlier, the X chromosome is a large-sized submetacentric in the Belonia

⁶ W. A. NELSON-REESE, A. J. KNIAZEFF, R. J. BAKER and J. L. PATTON, *J. Mammal.* 49, 706 (1968).

⁷ R. J. BAKER and J. L. PATTON, *J. Mammal.* 48, 270 (1967).

⁸ S. PATHAK, Ph. D. thesis, Banaras Hindu University, Varanasi (1967).

⁹ V. UNNÉRUS, J. FELLMAN and A. DE LA CHAPPELLE, *Cytogenetics* 6, 213 (1967).

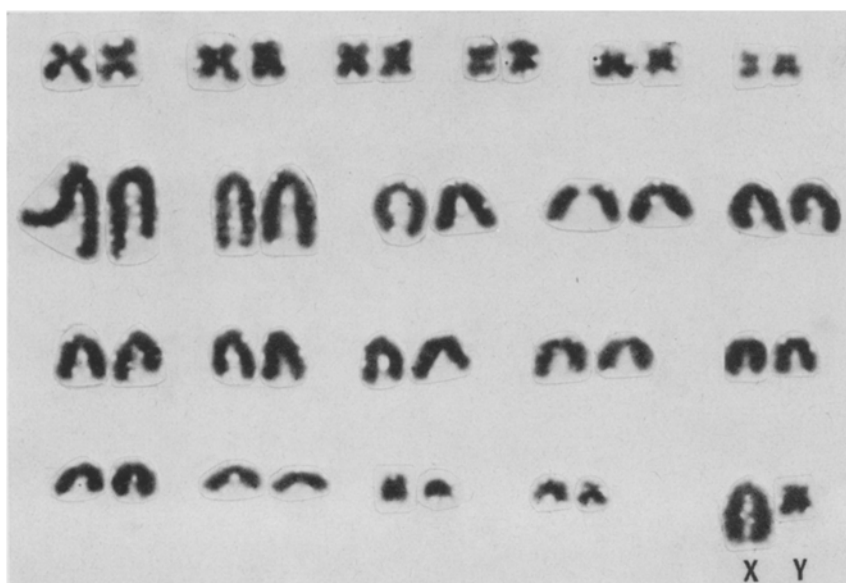


Fig. 3. Karyotype of a male *B. b. bengalensis* collected from Varanasi, Uttar Pradesh. $\times 2000$.

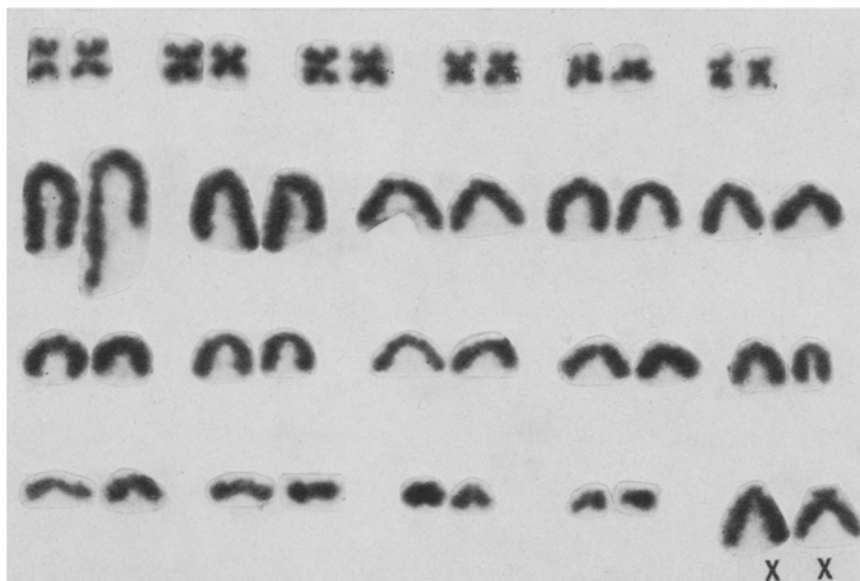


Fig. 4. Karyotype of a female *B. b. bengalensis* collected from Rohru, Himachal Pradesh. $\times 2000$.

sample and it is large-sized acrocentric chromosome in the other two samples. This variation in the morphology of the *X* chromosome could have been brought about by a pericentric inversion. Specimens with acrocentric *X* chromosome are separated by more than 800 miles from those with submetracentric *X* chromosome. Since the detailed karyotypic data of the other two species of *Bandicota*^{3,4}, studied by modern technique, are not available it is not possible to compare the karyotype of *B. b. bengalensis* reported in this paper.

At present, it is very difficult to speculate the direction of change in the morphology of the *X* chromosomes in these populations. The *X* chromosome equation, $SM \rightleftharpoons A$ could be reversible. Examination of additional specimens may reveal further course of *X* chromosome variation, if any, in this subspecies¹⁰.

Résumé. Des préparations de moëlle osseuse ont permis d'établir le nombre diploïde ($2N = 42$) et le nombre fondamental ($NF = 52$) de *Bandicota b. bengalensis* (Gray), les spécimens étudiés appartenant à trois popu-

lations distinctes (Rohru, Varanasi, Belonia, Indes). Le nombre et la forme des autosomes sont les mêmes dans les trois échantillons alors que l'*X* peut être acrocentrique ou submetracentrique; L'*Y* est petit et submetracentrique.

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Second Discovery of Multiple Sex Chromosomes Among Fishes

The viviparous fishes of the family Goodeidae (suborder Cyprinodontioidea) are confined to Mexico. Their chromosome number and some facets of their biology and classification were recently summarized by MILLER and FITZSIMONS¹, who included the first karyotype for the family. They noted that the chromosome number varies from 24 to 48 in 35 (of perhaps 38) species. None of these species showed any detectable differences between the sexes in chromosome number or form. However, one undescribed genus, subsequently karyotyped, appears to be unique for this family in having a diploid number of 42 in the female and 41 in the male. Like the genus of a related group (the Cyprinodontidae) with $2n = 48$ in the female and $2n = 47$ in the male², this species is known only from a single drainage basin in Mexico.

In order to obtain the chromosome figures gill epithelium was used, following the method of MCPHAIL and JONES³ with some modifications⁴. 60 cells of 4 females and 60 cells of 5 males were observed. Several pieces of testis tissue were squashed to obtain meiotic figures.

The female karyotype has a diploid number of 42 including 6 large metacentrics, 2 small metacentrics, 2 small

¹ R. R. MILLER and J. M. FITZSIMONS, *Copeia* 1, 1 (1971).

² T. UYENO and R. R. MILLER, *Nature*, Lond. 231, 452 (1971).

³ J. D. MCPHAIL and R. L. JONES, *J. Fish. Res. Board, Canada* 23, 767 (1966).

⁴ R. BEAMISH, Ph. D. thesis, Dept. Zool., Univ. of Toronto 1970.