

Robertsonian Translocations in the Malayan House Shrew, *Suncus murinus* (Insectivora, Soricidae)

The chromosomes of the house shrew, *Suncus murinus* (Linnaeus), have been studied extensively in different parts of Asia¹⁻⁹. However, chromosome polymorphism has only recently been reported in the Malayan taxon⁸. The animals from Kuala Lumpur and Petaling Jaya, Selangor, West Malaysia, fell into one of three karyotypic groups with 38, 39 and 40 chromosomes, respectively. The differences in chromosome number were attributed to autosomal Robertsonian polymorphism. It was, however, not certain 'whether two or more pairs of autosomes are involved' (ref.⁸).

Recently, 2 specimens (1 male and 1 female) of *Suncus murinus* collected from Ipoh, Perak, West Malaysia, were found to possess 36 and 37 chromosomes, respectively. Two other specimens (1 male and 1 female) from the same locality both had 38 chromosomes. A further male collected from Kampong Pandan, Kuala Lumpur, possessed 37 chromosomes.

The male shrew with 36 chromosomes (Figure 1) had 2 pairs of distinctively large metacentric autosomes as compared to the single pair in animals with $2n = 38$ (cf. ref.⁸). On the other hand, it had only 8 pairs of acrocentric autosomes, in contrast to the 10 pairs present in $2n = 38$ individuals. The number of submetacentric and subacrocentric autosomes were similar (Table). That this $2n = 36$ karyotype represented a homozygous state was confirmed by meiotic (testis) preparations where only 18 bivalents but no trivalents were observed.

The animals with 37 chromosomes had 3 distinctively large metacentric autosomes but had only 9 pairs of acrocentric autosomes (Figures 2 and 3, Table). The female shrew from Ipoh had only a single longest metacentric (Figure 2) while the longest metacentric in the male specimen from Kuala Lumpur was represented by a pair (Figure 3). The converse was true for the shorter (2nd longest) of these large metacentrics. The 2 specimens (from Ipoh) with 38 chromosomes also differed in the composition of the 2 distinctively large metacentric autosomes;

the male was homozygous for the shorter metacentric while the female was heterozygous viz. 1 short and 1 long (Figure 4).

The variations in the chromosome number of the present material were also due to Robertsonian translocations as were described for the animals with 38, 39 and 40 chromosomes. It is clear that the extensive karyotypic variation found in the Malayan house shrew, *Suncus murinus*, resembles that of the common shrew, *Sorex araneus*, which exhibits Robertsonian variation in elements 3-8 of the 9 pairs of metacentric autosomes¹⁰⁻¹³ (Chromosome polymorphism in *S. araneus* has been recently reviewed by FORD and HAMERTON¹⁴). Whether karyotypic variation in *S.*

¹ D. S. BORGAONKAR, *Comparative Mammalian Cytogenetics* (Springer-Verlag; New York 1969), p. 218.

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¹¹ C. E. FORD, J. L. HAMERTON and G. B. SHARMAN, *Nature, Lond.* 180, 392 (1957).

¹² A. MEYLAN, *Rev. Suisse Zool.* 71, 903 (1964).

¹³ A. MEYLAN, *Rev. Suisse Zool.* 72, 636 (1965).

¹⁴ C. E. FORD and J. L. HAMERTON, *Symp. zool. Soc. Lond.* 26, 223 (1970).

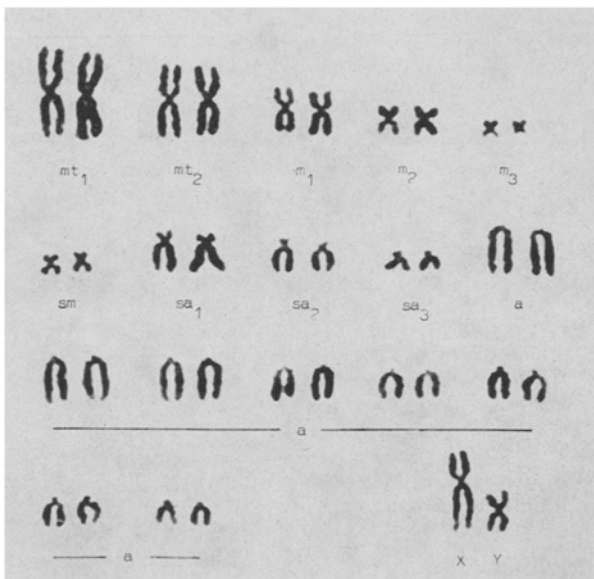


Fig. 1. Karyotype of male *Suncus murinus* trapped at Ipoh with a diploid number $2n = 36$. This animal was homozygous for both the large metacentric autosomes.

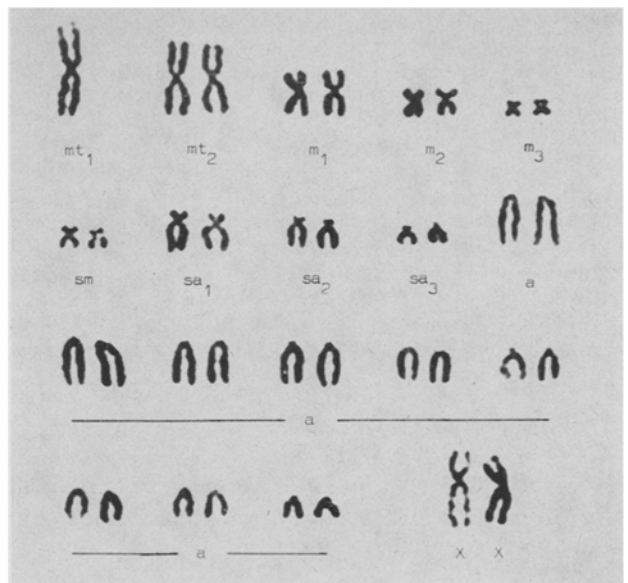


Fig. 2. Karyotype of female *Suncus murinus* trapped at Ipoh with $2n = 37$. This animal was heterozygous for the longest 'translocation' metacentric but homozygous for the second longest.

Autosome composition of the Malayan house shrew, *Suncus murinus*

2n	Autosomes ^a					NA ^b	No. of karyotypic classes
	m _t	m	sm	sa	a		
40	0	6	2	6	24	52	1
39	1	6	2	6	22	52	2
38	2	6	2	6	20	52	3
37	3	6	2	6	18	52	2
36	4	6	2	6	16	52	1

^am_t, 'translocation' metacentric; m, metacentric; sm, submetacentric; sa, subacrocentric (= subtelocentric); a, acrocentric. ^bNA, total number of autosome arms. It is assumed that only 2 types of 'translocation' metacentric are involved.

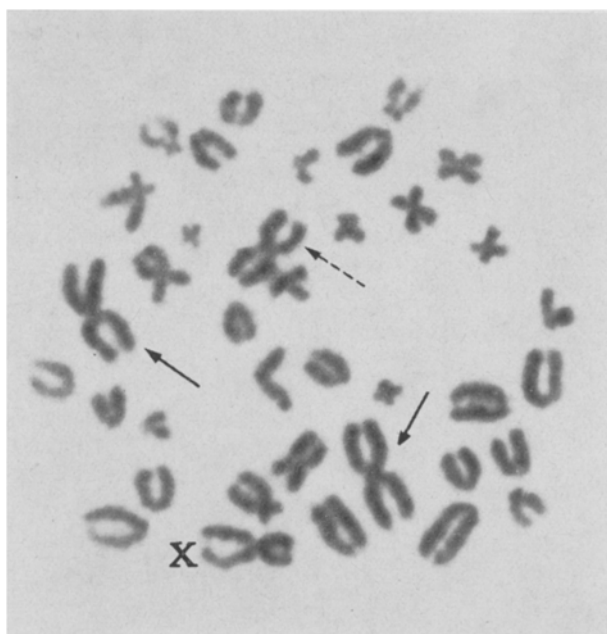


Fig. 3. Chromosomes at metaphase in a bone marrow cell from *Suncus murinus* male trapped at Kuala Lumpur with $2n = 37$. This shrew was homozygous for the longest 'translocation' metacentric (arrowed) but heterozygous for the other element (broken arrow).

murinus is more extensive than the present finding could only be answered when more specimens have been examined. It is, however, certain that $2n = 40$ forms one end of the spectrum; the present lower limit is $2n = 36$.

Based on the existing data and assuming that only 2 kinds of 'translocation' metacentric are involved, there should exist 9 karyotypic classes viz. 1 each for 36 and 40 chromosome types, 2 each for 37 and 39 chromosome types, and 3 for 38 chromosome type (Table). These

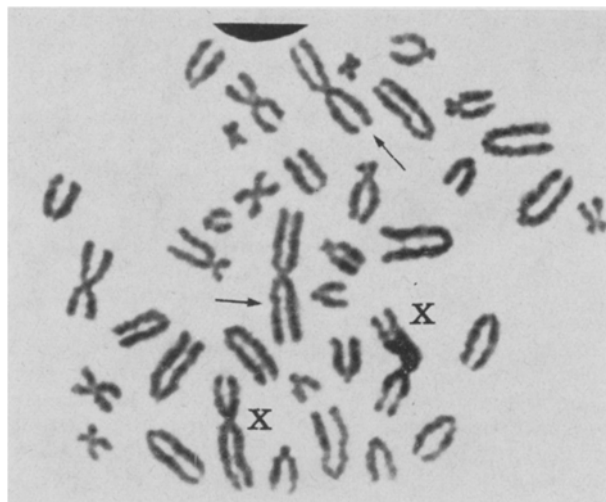


Fig. 4. Chromosomes at metaphase in a bone marrow cell from *Suncus murinus* female trapped at Ipoh with $2n = 38$. This shrew was heterozygous for both the 'translocation' elements (arrowed).

karyotypic classes can be positively identified as the largest metacentric element is longer than the X-chromosome while the other large metacentric element is shorter. The $2n = 36$ and 37 karyotypic classes and 2 of the 3 $2n = 38$ karyotypic class are described in this report. The third $2n = 38$ karyotypic class is represented in Figure 1 of ref.⁸ while the two $2n = 39$ karyotypic classes are represented in Figures 2 and 4 of ref.⁸ and the $2n = 40$ karyotypic class represented by Figure 3 of ref.⁸. Hence all the 9 karyotypic classes based on the 2 'translocation' elements have been found in the Malayan *Suncus murinus*. Further studies – meiotic, population, etc. – are being conducted to seek an answer to some of the questions posed by the extensive karyotypic variation in this animal¹⁵.

Zusammenfassung. Zwei neue Chromosomen ($2n = 36$ und 37; früher 38, 39 und 40) wurden in der malayischen Spitzmaus *Suncus murinus* gefunden und als numerische Variationen der Robertsonschen Translokation zugeschrieben. Es wird angenommen, dass es sich um zwei Arten von «Translokation» handelt, die metazentrisch mitwirkten und woraus die Produktion 9 karyotypischer Klassen resultiert.

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¹⁵ I thank Mr TEH KOK LENG for technical and Miss KUAN LAI WAH for clerical assistance.

Structural Correspondence Between Nucleolus- and Sphere-Organizing Regions of the Lampbrush Chromosomes and Secondary Constrictions of the Mitotic Chromosomes¹

In two previous works, a definitive description has been given of the karyotype of the lampbrush chromosomes² and that of the mitotic chromosomes³ of the Italian alpine newt *Triturus alpestris apuanus* (Bonaparte, 1839). The former is diagrammatically represented in the form of

maps arranged in decreasing order on the basis of the relative lengths⁴, showing the centromeres (vertical arrows), the regions in which there is greater preference for the formation of chiasmata (horizontal brackets), the nucleolus-organizing regions (white circles) and the sphere-organiz-