Karyotypes of Three Species of Rats from Hong Kong and Thailand (Muridae, genus *Rattus* Fischer)

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The chromosomes of wild rats are poorly investigated. Most studies have been confined to *Rattus norvegicus* albino, most recently reviewed by Robinson (1965). Makino (1942, 1943) studied the chromosomes of 5 species of Asiatic rats with old testis-section methods—*R. norvegicus*, *R. rattus*, *R. losea*, *R. fulvescens coxinga*, and *R. confucianus culturatus*. Recently, Huang (1968) studied the chromosomes of *Rattus (Mastomys) natalensis* from Africa, and Yong (1968a) reported the karyotypes of 4 Malayan rats—*R. bowersii*, *R. muelleri*, *R. edwardsi*, and *R. sabanus*.

The present paper deals with the chromosomes of 3 species of Asiatic rats, *Rattus rattus sladeni* (Anderson) and *Rattus huang* (Bonhote) from Hong Kong, and *Rattus berdmorei* (Blyth) from Thailand.

Materials and methods

All rats were trapped from the wild. The number of individuals used of each species is shown in Table 1.

Table 1. Karyotype of *R. r. sladeni*, *R. huang* and *R. berdmorei*

Subgenus	Species	Number of specimens examined		2n	Autosomes			Allosomes		FN*
		Male	Female		S	A	M	X	Y	
<i>Rattus</i>	<i>R. r. sladeni</i>	1	—	42	12	12	16	S	A	73
<i>Maxomys</i>	<i>R. huang</i>	1	—	46	8	30	6	S	A	61
<i>Berylmys</i>	<i>R. berdmorei</i>	1	1	40	16	4	18	S	A	75

* FN: Fundamental number (number of major chromosome arms).

The marrow tissue of long bones (femur or tibia) was used for chromosome preparations. The techniques of colchicine/colcemid treatment, hypotonic pretreatment, acetic-alcohol fixation, and air-drying of cell suspension on microscopic slide were employed (Yong 1968a). A total of 10 to 20 slides were made for each rat, and a total of at least 20 well-spread cells from each preparation were counted visually under high power and counter-checked with photomicrographs.

Results

Table 1 shows the karyotype of the 3 species. The convention of Tjio and Levan (1956) for chromosome morphology was adopted. The chromosomes are grouped together according to their morphology (i.e. metacentric, subterminal, and acrocentric), and within each morphological group they are arranged in a descending order in the total length (Yong 1968a).

1. *Rattus (Rattus) rattus sladeni* (Figs. 1 and 4)

The diploid number of 42 consists of 6 pairs of subterminal, 6 pairs of acrocentric, and 8 pairs of metacentric autosomes; subterminal X and acrocentric Y sex-chromosomes, with a fundamental number (i.e. the number of major chromosome arms) of 71.

Figs. 1-3. Photomicrographs of the karyotypes of male *Rattus*. 1, *Rattus rattus sladeni*. 2, *Rattus huang*. 3, *Rattus berdmorei*.

The subterminals constitute the longest chromosomes in the complement. The shortest chromosomes are the metacentrics. The longest pair of subterminals differ markedly from the second pair in total chromosome length. The decrease in total chromosome length in the other pairs are rather gradual. The X-chromosome is about the fourth longest subterminal.

The longest acrocentrics, the second longest in the complement, also differ markedly in size from the next pair. The difference in size in the remaining pairs of acrocentrics is very small. The Y-chromosome is the shortest acrocentric. The metacentrics differ slightly from each other in size. On the whole, the descending order in total chromosome length in the complement is very gradual.

2. *Rattus (Maxomys) huang* (Figs. 2 and 5)

The diploid number is 46, being composed of 4 pairs of subterminal, 15 pairs of acrocentric, and 3 pairs of metacentric autosomes; subterminal X and acrocentric Y sex-chromosomes. The fundamental number is 61.

The longest acrocentrics are the longest elements in the complement. The shortest acrocentric is the Y-chromosome, being about equal in length with the shortest metacentric, the shortest in the complement. The X-chromosome is the second longest subterminal. The longest subterminal is not very

much shorter than the longest acrocentric in total length. The subterminals,

Figs. 4-6. Karyograms of male *Rattus*. 4, *Rattus rattus sladeni*, constructed from Fig. 1. 5, *Rattus huang*, constructed from Fig. 2. 6, *Rattus berdmorei*, constructed from Fig. 3.

acrocentrics, and metacentrics, all differ very slightly in size from their own morphological type. There is a very gradual decrease in total chromosome length in the complement.

3. *Rattus (Berylmys) berdmorei* (Figs. 3 and 6)

The diploid number of 40 is comprised of 8 pairs of subterminal, 2 pairs of acrocentric and 9 pairs of metacentric autosomes; subterminal X and acrocentric Y sex-chromosomes. The fundamental number is 75.

The longest sub-terminal autosome is the longest element in the complement. It is distinctly different from the other subterminals, which differ slightly from each other in total chromosome length. The longest metacentric also differs markedly in size from the other metacentrics, which decrease gradually in

total length. The two pairs of acrocentric autosomes differ very slightly in size. The X-chromosome is about the fourth longest subterminal, while the Y-chromosome is the shortest acrocentric. The shortest chromosome in the complement is the shortest metacentric, which is about the same size as the Y-chromosome. The descending order in total chromosome length in the complement is very gradual.

Discussion

The karyotypes of 3 species of *Rattus* were described. The karyotype of each rat is species-specific. The 3 species possess different diploid number— $2n=40$ in *berdmorei*, $2n=42$ in *sladeni* and $2n=46$ in *huang*. These species therefore further confirm the variability in the diploid number ($2n$) within the genus *Rattus*, as reported by Makino (1943) and Yong (1968a, b).

The fundamental numbers of these rats are also different—61 in *huang*, 73 in *sladeni* and 75 in *berdmorei*.

These rats, however, possess the same morphological type of sex-chromosomes—subterminal X and acrocentric Y. Yong (1968a) has reported metacentric X and acrocentric X sex-chromosomes within the genus *Rattus*. It is therefore evident that the X-chromosome of the genus *Rattus* can be of any of the 3 morphological types.

Rattus rattus sladeni is currently recognised as a subspecies of *Rattus rattus* (Ellerman and Morrison-Scott 1951). Its species status and relation with the other subspecies of *Rattus rattus* will be discussed in a future paper.

Rattus huang is a member of the subgenus *Maxomys* (Ellerman 1947). Its diploid number is similar to those of *R. niviventer culturatus*¹ and *R. coxingi coxingi*² (Makino 1943), which are members of the same subgenus.

Rattus berdmorei is a member of the subgenus *Berylmys*. Karyotype information for members of this subgenus is not available. Ellerman (1949) described this subgenus as the “nearest ally” of *R. bowersii*. The karyotype of *R. bowersii* has been recently studied (Yong 1968a). Both *bowersii* and *berdmorei* possess the same diploid number ($2n=40$). *R. berdmorei* is however characterized by having more subterminal and metacentric autosomes (hence a higher fundamental number). The X-chromosome of these 2 species also differs—subterminal in *berdmorei* but acrocentric in *bowersii*. The relationship of these and other rats of the genus *Rattus* is to be discussed in a future paper.

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¹ and ² Makino named these species as *R. confucianus culturatus* and *R. fulvescens coxinga* respectively. According to Ellerman and Morrison-Scott (1951), those species names are incorrect.

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