Similarity of Giemsa Banding Patterns of Chromosomes in Several Species of the Genus *Rattus*

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Abstract. Giemsa banding patterns of chromosomes in seven *Rattus* species were compared. Four species (*R. rattus tanezumi*, *R. norvegicus*, *R. exulans* and *R. muelleri*) had all $2n = 42$ and their karyotypes and banding patterns were similar, although slight differences were observed. Another subspecies (*R. rattus rattus*) and two other species (*R. fusipes* and *R. conatus*) had fewer chromosomes than the above species by having large biarmed chromosomes developed probably by Robertsonian fusion. The origin of the arms of biarmed chromosomes was recognized by their characteristic banding patterns. The remaining species, *R. sabanus*, had a karyotype markedly different from the other species by having two small metacentrics although in the others their number was 7. Banding patterns of the chromosomes in this species, however, were also very similar to those of the other, and therefore the 7 small metacentrics seemed to have originated by pericentric inversion of small acrocentrics.

Introduction

The relation between evolution of karyotypes and differentiation of species in the genus *Rattus* has been demonstrated by Yosida (1972) on the basis of karyological studies of 13 species by use of the usual staining technique. It was shown that each species had its specific karyotype differing from the others, but their chromosome constitutions were basically the same in all species. Karyotype differences in these species were suggested to be caused by pericentric inversion and Robertsonian fusion. From the banding pattern analysis in the polymorphic karyotypes of the black rats, *Rattus rattus*, it was confirmed that the chromosomal changes found in the polymorphism of the animals depended on pericentric inversion and Robertsonian fusion (Yosida and Sagai, 1972).

If the species differentiation occurred by chromosomal inversion and Robertsonian fusion their banding patterns should be similar. To confirm this conclusion the Giemsa banding patterns in seven *Rattus* species each with a different karyotype were compared. The present paper describes the results of observations with special consideration of the relationship between chromosome bands and species differentiation.

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Material and Methods

Animals. Black rats from Japan (*Rattus rattus tanezumi*) and from Australia (*R. rattus rattus*), Wistar-King A strain of Norway rat (*R. norvegicus*), *R. exulans* from Hawaii, *R. muelleri* from Malaysia, *R. fuscipes* and *R. conatus* from Australia and *R. sabanus* from Malaysia, all of which were bred in our laboratory, were used in the present study.

Preparations for chromosome observations. For the observation of chromosomes bone marrow cells were used in Japanese black rats, but for all other animals cell cultures were used. In Wistar-King A rat and *R. sabanus*, tissues of the lung and in all other species tissues of the tail tip were cultured according to our technique described in the previous paper (Yosida et al., 1971a). To study the banding patterns of chromosomes our SDS technique was applied (Yosida and Sagai, 1972).

Results

Banding pattern idiograms of all species are shown in Figs. 1 and 2. Those of the Japanese black rat (*Rattus rattus tanezumi*) with 2n=42 are shown in the first column of the chromosome alignments. Those of the Norway rat, *R. norvegicus* (2n=42), *R. exulans* (2n=42), *R. muelleri* (2n=42), Australian black rat, *R. rattus rattus* (2n=38), *R. fuscipes* (2n=38), *R. conatus* (2n=32) and *R. sabanus* (2n=42) are shown in the second to the eight columns. As the figures show, banding patterns of all chromosome pairs in all these species are similar although there are few exceptions.

Pair No. 1. Chromosomes of this pair were in all species subtelocentrics, except in the Japanese black rat which showed acrocentric and subtelocentric polymorphism. In Fig. 1 the subtelocentric pair No. 1 is represented. These chromosomes had two constrictions, one near the centromere and the other near the distal end, as already described for the black rat (Yosida and Sagai, 1972). Similar constrictions were observed in all other species. In the black rat (*R. rattus tanezumi*), about 7 segmental bands were recognized. One band is on the short arm, and the other one (the second band) is near the centromere of the long arm. The first constriction is seen between the second and the third band. About four bands, two deeply and the other two palely stained, are recognized between the two constrictions. The 7th band was observed under the second constriction. Banding patterns in the Oceanian type black rat...