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<https://doi.org/10.5109/23787>

出版情報：九州大学大学院農学研究院紀要. 28 (4), pp.177-183, 1984-03. Kyushu University
バージョン：
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Karyotypes of the Japanese Harvest Mouse (*Micromys minutus japonicus*) from Fukuoka and the Tsushima Islands*

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(Received November 29, 1983)

Karyotypes of the Japanese harvest mouse, *Micromys minutus japonicus*, from two populations occurring in Fukuoka and the Tsushima Islands, were examined in detail using conventional, G- and C-band stainings. There was no difference in karyotype both between the two populations and within each population. The karyotypes in the two populations concerned were much the same as in other Japanese and Eurasian populations. Thus, it may be said that the harvest mouse has a quite conservative karyotype in spite of its wide geographical distribution. So far as it is based upon the karyotype, this conservatism does not support a specific division of the Japanese harvest mouse (*M. japonicus*) from the Eurasian one (*M. minutus*), which was proposed by Tokuda (1941), thus we regard the Japanese harvest mouse as *M. minutus*; moreover, *M. minutus aokii* (Kuroda, 1922) from Tsushima seems to be a synonym of *M. minutus japonicus* (Thomas, 1905) from the mainland of Kyushu.

INTRODUCTION

Genus *Micromys*, the harvest mouse, is one of the smallest rodents, distributing widely from the Far East to Europe. According to the classification of Palaearctic mammals (Corbet, 1978), the genus consists of the single species (*M. minutus*) divided into 9 subspecies. However, the taxonomy of the harvest mouse has not been studied thoroughly because of its wide-spread distribution and a scanty knowledge of geographical variation. The classification of the Japanese harvest mouse also has not yet been completed (Aimi and Kaneko, 1971; Imaizumi, 1979; Murakami, 1981).

Recently, advances in the systematics of mammals have been establishing by karyotype analysis. Especially, cytogenetical data have made a great contribution to the systematics of Japanese rodents such as black rats (Yosida, 1980) and wood mice (Tsuchiya, 1974). The Japanese harvest mouse, however, has been karyotyped by only conventional staining (Tsuchiya and Yosida, 1971; Tsuchiya, 1979, 1981), but not yet by other banding techniques.

The present paper deals with the karyotype analysis of the Japanese harvest mouse from two populations inhabiting Fukuoka (the mainland of

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Kyushu) and the Tsushima Islands by conventional, G- and C-banding procedures. Further, the classification of the Japanese harvest mouse is discussed on the basis of the karyotype.

MATERIALS AND METHODS

Seven specimens (4♂♂, 3♀♀) captured with live-traps in Hisayama-machi near Fukuoka City and five (3♂♂, 2♀♀) from the Tsushima Islands, Nagasaki Prefecture were used. The conventional staining was performed by the bone marrow air-drying method (Yosida, 1980), G-band was stained in accordance with the method by Seabright (1971) and C-band by Sumner (1972). In conformity with John (1976), the chromosomes were morphologically grouped as metacentrics (M, long arm length/short a. l.=1~2.5), acrocentrics (A, 3-10) and telocentrics (T, ∞), subsequently arranged in order of size.

RESULTS

1. Conventional karyotype (Fig. 1)

There was no difference in karyotype between the Fukuoka and Tsushima populations, all specimens having the same karyotype. The karyotype consisted of one large metacentric pair (M-1), 4 small metacentric pairs (M-2-5), 28 acrocentric pairs ranging from large to small (A-1-28), a large-sized acrocentric X- and a small acrocentric Y-chromosome ($2n=68$). The X-chromosome possessed 5.5 % of the female haploid set on the average of 58 cells observed.

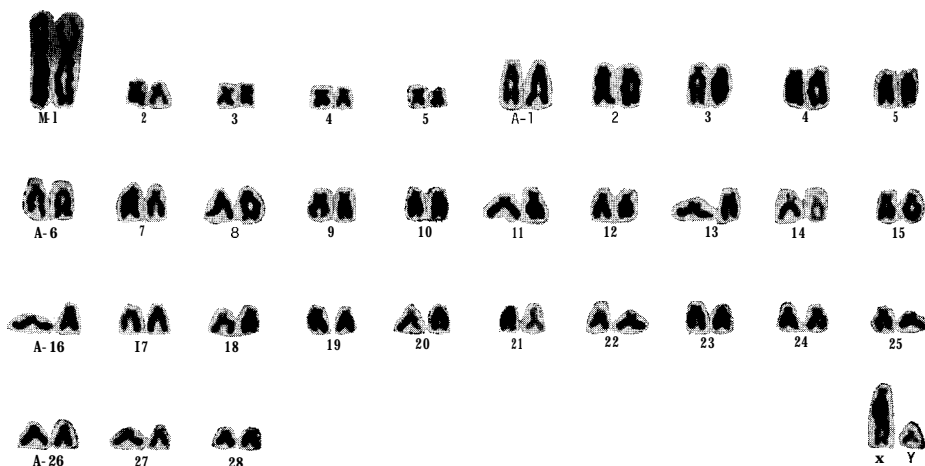


Fig. 1. Conventional karyotype of the Japanese harvest mouse from Fukuoka. $\times 2,000$.

2. G-banding pattern (Fig. 2)

All specimens of the two populations showed the same G-banding pattern. The centromeric regions of the autosomes except M-2-5 and the sex chromosomes were G-band positive.

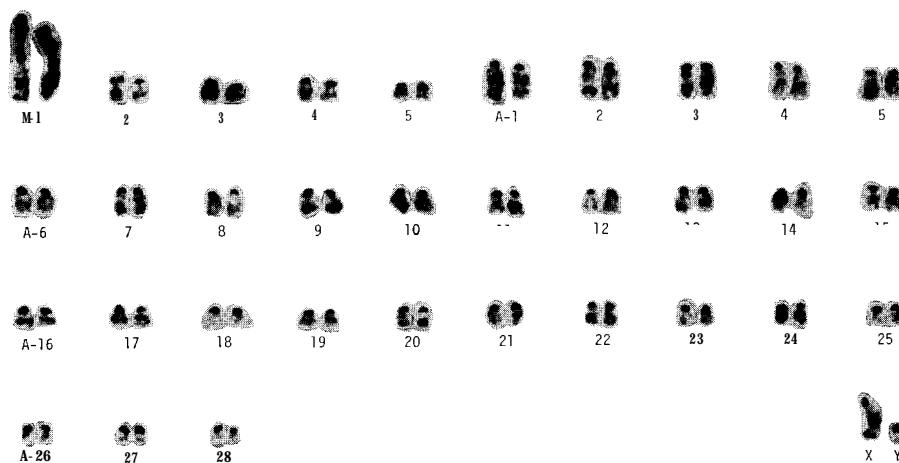


Fig. 2. G-band karyotype of the Japanese harvest mouse from Fukuoka.
x 2,000.

3. C-banding pattern (Fig. 3)

There was no difference in C-banding pattern both between the two populations and within each population, as far as we examined. Although M-1 had no C-band material, the other autosomes and sex chromosomes possessed

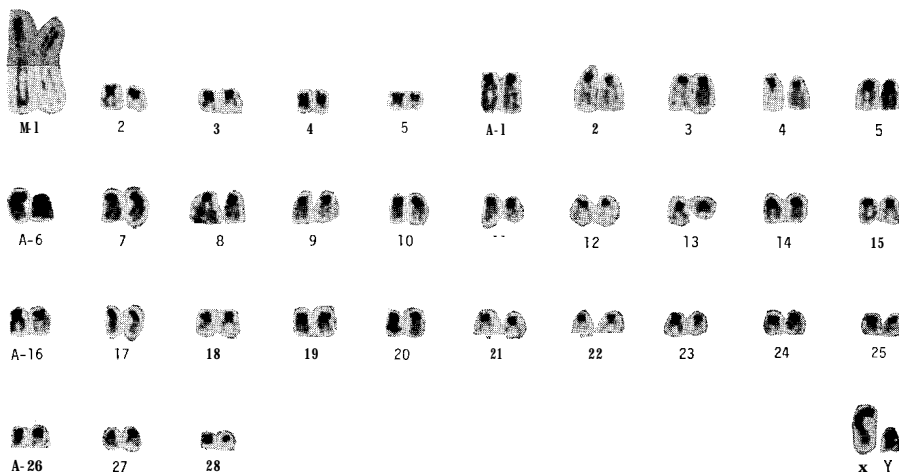


Fig. 3. C-band karyotype of the Japanese harvest mouse from the Tsushima Islands. ~2,000.

centromeric C-band material. The autosomes except M-1 and the X-chromosome had heterochromatic short arms, and the Y-chromosome was totally C-band positive.

DISCUSSION

The conventional karyotype of the harvest mouse from the two Japanese populations was the same as that of this mouse from other Japanese (Tsuchiya and Yosida, 1971; Tsuchiya, 1979, 1981), western Siberian and Czechoslovakian (Král, 1971, 1972) populations. Moreover, the G- and C-banding patterns of this mouse were in good agreement with those of the western German harvest mouse (Jiides, 1981); however, individual variations in amount of centromeric C-band material, which were suggested by him, could not be recognized in any of the 12 specimens of the two Japanese populations. The similarity in conventional karyotype and/or in C-banding pattern among the Fukuoka, Tsushima, other Japanese and Eurasian populations suggests that the karyotype of the harvest mouse is quite conservative in spite of its wide-spread distribution.

As for the classification of the Japanese harvest mouse, firstly this mouse inhabiting Shikoku and Kyushu was divided from *M. minutus minutus* occurring in Eurasia as a subspecies, *M. minutus japonicus* (Thomas, 1905), subsequently these mice from the Tsushima Islands and Honshu were taken the name of *M. minutus aokii* (Kuroda, 1922) and *M. minutus hondonis* (Kuroda, 1933), respectively. On the other hand, Tokuda (1941) separated the Japanese harvest mouse from *M. minutus* as a different species, *M. japonicus*, including the above three subspecies. Imaizumi (1949, 1970), however, has not agreed with Tokuda's opinion. Although the most prominent character in the classification of these three Japanese subspecies was said to reside in a difference of the tail coefficient, it has now been regarded as an insignificant character (Shiraishi, 1964; Imaizumi, 1970; Kaneko, 1974). In this connection, Imaizumi *et al.* (1980) proposed that *M. minutus hondonis* is a synonym of *M. minutus japonicus*. Thus, the classification of the Japanese harvest mouse has been confused at both species and subspecies level.

The rate of karyotypic evolution often corresponds with that of speciation. Consequently there are many examples of karyotypes, at least in C-banding pattern, that show some alterations between related species and/or subspecies in mammals (Årnason, 1974 for Odontoceti; Sasaki *et al.*, 1975 for Lemnidae; Baverstock *et al.*, 1977 for Muridae; Deaven *et al.*, 1977 for *Peromyscus*; Yosida, 1980 for *Rattus* spp.). So far as it is based upon the karyotype, the above conservatism of the harvest mouse does not support the specific division of the Japanese one (*M. japonicus*) from the Eurasian one (*M. minutus*), which was proposed by Tokuda (1941).

It is well known as a biological concept that the rate of speciation or subspeciation is faster among modern forms than among ancient ones, and that it differs from species (subspecies) to species (subspecies). Schindewolf (1950) showed from the fossil records that it took one million to three million

years for ancient forms to evolve from one genus to another one, 300 thousand to 400 thousand years for speciation, and 20 thousand to 25 thousand years for subspeciation even in the fastest case, while Moriwaki (1982) proposed a figure of one million years for subspeciation of *Mus musculus*, i. e. *M. m. domesticus*, *M. m. molossinus*, *M. m. bactrianus* and *M. m. castaneus* from the genetical studies.

According to the palaeographical facts, the Korean Straits began to open as a result of long lasted and prevailed erosion in the lowland areas which existed between Korea and the Tsushima Islands about 20 thousand years ago. Also, the last land bridge which had lain between the Tsushima Islands and North Kyushu was lost by a transgression ca. 16 thousand to 17 thousand years ago (Association for Geological Collaboration of Japan, 1965). On the other hand, Oshima (1980) advocated a new theory that the Korean Straits and the Tsushima Straits were formed by the so-called Shimosueyoshi transgression during the Riss-Würm interglacial period (70 thousand to 150 thousand years ago) and both the straits have been existent since then. From the facts mentioned above, we presume that the duration after formation of the two straits is not enough to cause speciation or subspeciation of *Micromys*.

Thus, it is concluded that the Japanese harvest mouse should be regarded as *M. minutus*, not *M. japonicus*, and *M. m. aokii* from the Tsushima Islands, as a synonym of *M. minutus japonicus* from the mainland of Kyushu.

ACKNOWLEDGEMENTS

We thank the staff and graduate students of our Laboratory, Faculty of Agriculture, Kyushu University for their encouragement and help. We are also indebted to Professor F. Yasuzumi and Associate Professor, K. Andō, School of Medicine, University of Ryukyus, for their encouragement, and to Professor, E. W. Jameson, Jr., University of California for comments on the manuscript. We also wish to express deepest appreciation to Professor K. Baba, Faculty of Education, Kumamoto University, Associate Professor K. Morimoto, Faculty of Agriculture, Kyushu University, and Dr. K. Moriwaki, National Institute of Genetics, for their useful suggestions.

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