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AUTHOR(S):
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Karyotypes of *Dremomys pernyi* and *D. pyrrhomerus* (Rodentia: Sciuridae) from China

Masaharu Motokawa¹, Haiyan Cong², Lingming Kong², Masashi Harada³, Yi Wu⁴ and Yuchun Li²,*

¹ The Kyoto University Museum, Kyoto University, Kyoto 606-8501, Japan
² Marine College, Shandong University, Weihai 264209, China
³ Laboratory Animal Center, Graduate School of Medicine, Osaka City University, Osaka 545-8585, Japan
⁴ College of Life Sciences, Guangzhou University, Guangzhou 510006, China

**Abstract.** Karyotypes of *Dremomys pernyi* from Kanding, Sichuan Province, China and *D. pyrrhomerus* from Nanling, Guangdong Province, China were examined. The karyotype of *D. pernyi* was of 2n = 40 and FNa = 72, while that of *D. pyrrhomerus* was of 2n = 38 and FNa = 70. Karyotype of *D. pernyi* from Kanding was different in 2n and FNa from reported karyotype of conspecific population from Taiwan, and it is suggested that the Taiwan population represents a distinct species *D. owstoni* from *D. pernyi*. The difference between karyotypes of *D. pernyi* and *D. pyrrhomerus* may involve at least a Robertsonian rearrangement and a heterochromatin addition.

**Key words:** *Dremomys*, karyotype, Sciuridae, Taiwan, taxonomy.

The genus *Dremomys* is plain long-nosed squirrels of Asia comprising six species (Thorington and Hoffmann 2005; Thorington et al. 2012). Five species, including *D. pyrrhomerus* (Thomas, 1895), *D. rufigenis* (Blanford, 1878), *D. pernyi* (Milne-Edwards, 1867), *D. gularis* Osgood, 1932, and *D. lokriah* (Hodgson, 1836), are distributed in China and Indochina region, while another species *D. everetti* is known from Borneo (Hoffmann and Smith 2008; Thorington et al. 2012). Species taxonomy and boundary is still unclear, especially among *D. pyrrhomerus*, *D. rufigenis*, and *D. pernyi*. Oshida et al. (2003) reported a karyotype of *D. pernyi* from Taiwan and discussed the karyotype differences between Taiwan and Yunnan populations reported by Wang et al. (1980), and noted that the Taiwan *D. pernyi* population is more similar to *D. rufigenis* from Vietnam with a diploid chromosome number (2n) of 38 and a fundamental number of autosomal arms (FNa) of 68, reported by Nadler and Hoffmann (1970). Although 2n is similar between *D. pernyi* from Taiwan and *D. rufigenis* from Vietnam, the karyotypes were found to be different in the published figures; there were seven subtelocentric pairs in Vietnam *D. rufigenis* population, and nine pairs in Taiwan *D. pernyi* population. Among *Dremomys* species, the taxonomic status of *D. pyrrhomerus* has also been confused; it had been considered conspecific with *D. rufigenis* (e.g., Corbet and Hill 1992). While, these two species are currently considered different species due to their sympatric distribution (Thorington and Hoffmann 2005; Hoffmann and Smith 2008), but their distribution boundary between species is still unclear. Karyological study of *Dremomys* species is expected for the revision of species taxonomy of the genus. In the present study, we report karyotypes of two *Dremomys* species from China and discuss the taxonomic implications of *D. pernyi*, *D. pyrrhomerus*, and *D. rufigenis*.

**Materials and methods**

One male specimen of *D. pernyi* (G10138) was collected in August 2010, from Kangding, Ganzi Tibetan Autonomous Prefecture, Sichuan Province, China; and one male specimen of *D. pyrrhomerus* (G12185) was collected in August 2012, from Nanling, Guangdong Province, China (Fig. 1). The voucher specimens were deposited in the Key Laboratory of Conservation and
Application in Biodiversity of South China, Guangzhou University (G10138) and Marine College, Shandong University, Weihai (G12185).

Cytological preparations were made from tail and/or lung tissue culture cells using the standard air-drying method as described by Harada and Yosida (1978). G-band and C-band stainings were accomplished with the methods of Seabright (1971) and Sumner (1972), respectively. Terminology for chromosomes follows Levan et al. (1964): metacentric, submetacentric, subtelocentric, and acrocentric. The 2n and FNa values for each species were calculated.

Results

The karyotype of *D. pernyi* (Fig. 2) was of 2n = 40 (FNa = 72) chromosomes consisting of eight large- to small-sized metacentric or submetacentric pairs (nos. 1–8), nine large- to small-sized subtelocentric pairs (nos. 9–17), and two medium- to small-sized acrocentric pairs (nos. 18–19) in autosomes and a medium-sized submetacentric X chromosome and a small-sized subtelocentric Y chromosome. In an acrocentric pair (no. 19), there was secondary constriction at the proximal region of long arms as shown with an arrow (Fig. 2A). Short arm of a subtelocentric pair (either of nos. 10–13) was stained with C-band and considered heterochromatic (Fig. 2C, shown with an arrow). In addition, the autosomal pairs of nos. 1–3 and no. 9 had small centromeric C-bands; the short arms of pairs 15–17 were entirely heterochromatic; telomeric C-bands were detected either on the short arm or the long arm, or on both arms of pairs nos. 1–4, 9, 18 and 19; the Y chromosome was entirely heterochromatic (Fig. 2C).

The karyotype of *D. pyrrhomerus* (Fig. 3) was of 2n = 38 (FNa = 70) chromosomes consisting of 12 large- to small-sized metacentric or submetacentric pairs (nos. 1–12), five large- to small-sized subtelocentric pairs (13–17), and one small-sized acrocentric pair (no. 18) in autosomes, and a medium-sized submetacentric X chromosome and a small-sized subtelocentric Y chromosome. In a medium-sized metacentric pair (no. 8), there was secondary constriction at the proximal region of short arms as shown with an arrow (Fig. 3A). The autosomal pairs of nos. 4 and 8 had small centromeric C-bands; the short arms of pairs nos. 3, 8, 10, 11, 15, and 17 were entirely heterochromatic; telomeric C-bands were detected either on the short arm or the long arm, or on both arms of pairs nos. 2–4, 8, 13–16, and X chromosome; the long arms of Y chromosome was heterochromatic (Fig. 3C).

G-band comparison detected chromosome pair matching between *D. pernyi* and *D. pyrrhomerus* (Fig. 4). We found that *D. pernyi* no. 18 long arm and no. 13 long arm...
correspond to *D. pyrrhomerus* no. 5 long arm and short arm, respectively (Fig. 4, indicated in box). *Dremomys pernyi* no. 19 long arm corresponded with *D. pyrrhomerus* no. 8 long arm, while we could not detect the homology of *D. pyrrhomerus* no. 8 short arm. Meta- or submetacentric *D. pernyi* no. 8 pair corresponded with acrocentric *D. pyrrhomerus* no. 18 pair; and subtelocentric *D. pernyi* no. 11 pair corresponded with metacentric *D. pyrrhomerus* no. 3 pair; while detailed chromosome rearrangements could not be detected in these pairs.

**Discussion**

*Dremomys pernyi* was originally described from Mouping (currently Baoxing) in Sichuan Province, China, and it is distributed in northeast India, north Burma, north Vietnam, and south China including Taiwan (Thorington and Hoffmann 2005). The collection site of the present
Karyotype composition of

Table 1.

<table>
<thead>
<tr>
<th>Species</th>
<th>2n</th>
<th>FNa</th>
<th>Autosomal pair</th>
<th>X</th>
<th>Y</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. peryn (Sichuan)</td>
<td>40</td>
<td>72</td>
<td>8</td>
<td>9</td>
<td>2</td>
<td>SM ST</td>
</tr>
<tr>
<td>D. peryn (Yunnan)</td>
<td>40</td>
<td>70</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>SM SM</td>
</tr>
<tr>
<td>D. peryn (Taiwan)</td>
<td>38</td>
<td>68</td>
<td>7</td>
<td>9</td>
<td>2</td>
<td>SM A</td>
</tr>
<tr>
<td>D. pyrrhomerus (Guangdong)</td>
<td>38</td>
<td>70</td>
<td>12</td>
<td>5</td>
<td>1</td>
<td>SM ST</td>
</tr>
<tr>
<td>D. rufigenis (Vietnam)</td>
<td>38</td>
<td>68</td>
<td>9</td>
<td>7</td>
<td>2</td>
<td>SM SM</td>
</tr>
</tbody>
</table>

To our knowledge, this is the first report of the karyotype of D. pyrrhomerus. It resembles the karyotype of D. rufigenis from Vietnam with 2n = 38 (Nadler and Hoffmann 1970), but there are some differences in conventionally stained karyotypes between two species in this study in addition to different interpretation for the numbers of M/SM, ST, and A (Table 1). Difference in FNa (70 in D. pyrrhomerus and 68 in D. rufigenis) is likely to be related to the possible chromosomal rearrangement between medium-sized metacentric pair with a secondary constriction (no. 8) in D. pyrrhomerus and the acrocentric pair developing secondary constriction on the proximal part of short arms and prominent satellite on terminal region of short arms in D. rufigenis reported by Nadler and Hoffmann (1970). Dremomys rufigenis has been considered a sister species of D. pyrrhomerus based on the mitochondrial cytochrome b gene phylogeny (Li et al. 2008) and similarity in skull morphometrics (Li 2010). In the past, D. pyrrhomerus was sometimes considered conspecific with D. rufigenis (e.g., Corbet and Hill 1992); but the two species showed mostly separate but close distributions involving sympatric localities (Zhang et al. 1997; Thorington and Hoffmann 2005). This study may suggest the occurrence of reproductive isolation between the two species due to chromosomal rearrangement; and future study for G-band and C-band karyotypes for D. rufigenis is expected for detailed comparison between these two species.

G-band and C-band comparisons between D. peryn and D. pyrrhomerus showed well matching of homologous arms. Notable chromosome rearrangements were found between D. peryn nos. 13/18 pairs and D. pyrrhomerus no. 5 pair. We suggest that D. peryn karyotype might have been derived from the karyotype similar to D. pyrrhomerus, with the Robertsonian fission of D. pyrrhomerus no. 5 pair, producing D. peryn nos. 13 and 18 pairs; and subsequent heterochromatin addition in D. peryn no. 13 pair to form short arms. Future studies...
for G-band and C-band karyotypes for other Dremomys species including D. owstoni in Taiwan are expected to explore detailed chromosome evolution in the genus Dremomys.

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References

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