Ryuso Tanaka* & Hiroshi Uchiyama*: Chromosomes of four species of Utricularia in Japan

The genus Utricularia, Lentibulariaceae, contains about 250 carnivorous species. Although chromosomes have been observed in about 25 species of the genus, only chromosome numbers have been reported for most of them and morphological characteristics of chromosomes have scarcely been observed. In Japan, chromosome number has been reported only for U. racemosa Wall. (2n = 36) by Kondo (1973), though twelve species are known according to Ohwi (1978). The present paper deals with the morphology and number of somatic chromosomes of four Japanese species of Utricularia.

Materials and methods Materials used in this study are shown in Tab. 1. Taxonomic treatment of them followed Ohwi (1978). All of them were culti-

Tab. 1. Species, localities, number of plants and chromosome numbers of Utricularia studied.

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality</th>
<th>No. of plants</th>
<th>Chromosome number (2n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. yakusimensis</td>
<td>Mikumari-kyō, Fuchū-chō, Hiroshima Pref.</td>
<td>3</td>
<td>16</td>
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<td></td>
<td>Masam.</td>
<td></td>
<td></td>
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<tr>
<td>U. multispinosa</td>
<td>Kurokawa, Seranishi-chō, Hiroshima Pref.</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>(Miki) Miki</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. aurea Lour.</td>
<td>Tōchi, Sera-chō, Hiroshima Pref.</td>
<td>6</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Kurokawa, Seranishi-chō, Hiroshima Pref.</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>U. tenuicaulis</td>
<td>Betsusako, Kōzan-chō, Hiroshima Pref.</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Miki</td>
<td>Gōso, Saijō-chō, Higashihiroshima City, Hiroshima Pref.</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Ōyama-chō, Kure City, Hiroshima Pref.</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Nishiyahatabara, Geihoku-chō, Hiroshima Pref.</td>
<td>1</td>
<td>40</td>
</tr>
</tbody>
</table>

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vated in the experimental garden of the Botanical Institute, Hiroshima University. Preparations were made as follows. First, plant bodies were pretreated with cold water for 24 hours at about 5°C, and fixed in acetic alcohol (1:3) for 24 hours at about 5°C. Then, the shoot apices were removed from the plant bodies and were macerated in a mixture of 45% acetic acid and 1N HCl (2:1) for about 20 seconds at 60°C. After stained with 2% aceto-orcein, they were squashed. Chromosomes at the resting and mitotic stages were observed in the cells of mucilage glands of young leaves and meristematic cells of shoot apices, respectively.

**Observations** The results of chromosome counts are shown in Tab. 1. In four species investigated, mitotic cell divisions were well observed from April to September. Chromosomes at mitotic metaphase were small in size and rod-like to globular in shape. These chromosomes showed a very little variation within a complement and were considered to be rather homogeneous in size. The results of the observations in each species are as follows.


Somatic chromosome number was counted to be 2n=16 in three plants observed (Fig. 2A, B). This is the first count for this species.

At the resting stage, most of the chromatin were stained lightly, and some darkly stained chromocentral blocks scattered in the nuclear space. The chromocentral blocks were round in shape and about 0.4 μm in diameter. They were four or less in number per nucleus (Fig. 1A). The morphology of the chromosomes at the resting stage was categorized to be of the simple chromocenter type defined by Tanaka (1971).

![Fig. 1. Chromosomes at the resting stage of four species of *Utricularia*. A: *U. yakusimensis*. B: *U. multispinosa*. C: *U. aurea*. D: *U. tenuicaulis*. Bar indicates 2 μm.](image-url)
Fig. 2. Chromosomes at mitotic stage of four species of *Utricularia*. A, B: *U. yakusimensis* at prometaphase (A) and metaphase (B) (2n=16). C, D: *U. multispinosa* at prophase (C) and metaphase (D) (2n=40). E: *U. aurea* at metaphase (2n=80). F, G: *U. tenuicaulis* at metaphase (2n=40). Bar indicates 2 µm.
At mitotic metaphase, the $2n=16$ chromosomes ranged from 0.9 to 0.6 $\mu m$ in length. Most of these chromosomes had a centromere situated in the median position, but centromeres were not clearly observed in a few other chromosomes (Fig. 2B).

2) *Utricularia multispinosa* (Miki) Miki; Hime-tanukimo

Somatic chromosome number was counted to be $2n=40$ in four plants observed (Fig. 2C, D). It is noteworthy that this chromosome number agrees with the reports of $n=(18-)20$ by Reese (1952) and $2n=ca 40$ by Löve & Löve (1956) for *U. minor* L., which was considered to be conspecific with *U. multispinosa* by Ohwi & Kitagawa (1983).

The morphological characteristics of the chromosomes at the resting stage were similar to those of the previous species, but ten or less chromocentral blocks were observed in a nucleus (Fig. 1B). The morphology of the resting chromosomes was categorized to be of the simple chromocenter type.

At mitotic metaphase, chromosomes ranged from 0.8 to 0.5 $\mu m$ in length. The centromeres were located in the median position of most chromosomes, while they were not observed in some other chromosomes (Fig. 2D).

3) *Utricularia aurea* Lou.; No-tanukimo

Somatic chromosome number was counted to be $2n=80$ in ten plants collected from two localities. On the other hand, $n=21$ has been reported in Indian plants of this species (Subramanyam & Kamble 1968). The difference of chromosome number may suggest that there is an intraspecific polyploidy in this species.

The morphological characteristics of the resting chromosomes were similar to those of *U. yakusimensis*. However the chromocentral blocks were 0.4-0.6 $\mu m$ in diameter and were about 20 in number per nucleus (Fig. 1C). The morphology of the resting chromosomes was categorized to be of the simple chromocenter type.

At metaphase the variation of chromosome length and the position of the centromere resembled those of the previous species (Fig. 2E).

4) *Utricularia tenuicaulis* Miki; Inu-tanukimo

Somatic chromosome number was counted to be $2n=40$ in 18 plants collected from four localities. This is the first count for the present species.

At the resting stage, most of the chromatin were stained lightly, and only one darkly stained chromocentral block about 0.4 $\mu m$ in diameter was observed.
(Fig. 1D). The morphology of the resting chromosomes was categorized to be of the simple chromocenter type. It was remarkable that this species possessed only one chromocentral block, while in the other three species the number of chromocentral blocks was about one fourth of the somatic chromosome number.

At metaphase the variation of chromosome length and the position of the centromere resembled those of \textit{U. multispinosa} (Fig. 2F, G).

**References**


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本邦産タヌキモ属の4種について体細胞染色体を観察した。染色体数はムラサキミミカキグサ (\textit{Utricularia yakusimensis}) 2n=16, ヒメタヌキモ (\textit{U. multispinosa}) とイヌタヌキモ (\textit{U. tenuicaulis}) 共に 2n=40, ノタヌキモ (\textit{U. aurea}) 2n=80 であった。これらはいずれも新算定である。ただし、ヒメタヌキモの染色体数は、ときには同一種にみなされる \textit{U. minor} についての報告と一致するものである。観察した4種共に、分裂期中期染色体の形態は長さが 1 \mu m 以下であり、小型で球状に近い棒状であった。静止期における染色体の形状では染色中央粒の数に種間の差がみられ、ムラサキミミカキグサ, ヒメタヌキモ, ノタヌキモはそれぞれの染色体数の四分の一前後であるのに対し, イヌタヌキモは1個で特異的であった。