Karyotype of Lysichiton camtschatcense (Araceae)

Kyoko Sato[1, 4], Takahiro Yamazaki[2], Minami Ohno[1], Norihito Miura[1] and Yoshikane Iwatsubo[3] : **Karyotype of *Lysichiton camtschatcense* (Araceae)**

佐藤杏子[1, 4]・山崎貴博[2]・大野美波[1]・三浦憲人[1]・岩坪美兼[3]：ミズバショウ（サトイモ科）の核型

The following three genera belong to the tribe Orontieae, a subfamily of Orontioideae of the family Araceae : *Lysichiton* Schott comprised of the two species *L*. *americanus* Hultén et H. St. John distributed in Northwest America and *L*. *camtschatcense* (L.) Schott distributed in Kamchatka, Sakhalin and Kuriles of Russia, and Japan (Petersen 1989 ; Ohwi and Kitagawa 1992 ; Mabberley 1997) ; *Orontium* L., a monotypic genus with *O*. *aquaticum* L., distributed in eastern North America (Mabberley 1997) ; and *Symplocarpus* Salisb. ex W. P. C. Barton comprised of 3-4 species (Otsuka et al. 2002) distributed in both North America and Eastern Asia (Mabberley 1997).

The following chromosome numbers for species in the tribe Orontieae have been reported. The two species of *Lysichiton*, *L*. *americanus* and *L*. *camtschatcense*, have the same chromosome number of 2n= 28 (Sokolovskaya 1960 ; Löve and Kawano 1961 ; Gurzenkov 1973 ; Marchant 1973 ; Pojar 1973, reported as n=14 ; Sokolovskaya and Probatova 1985) ; *O*. *aquaticum* of *Orontium* has 2n=26 chromosomes (Petersen 1989) ; and *S*. *nipponicus* Makino of *Symplocarpus* has 2n=30 chromosomes, *S*. *foetidus* (L.) Salisb. ex Nutt. var. *latissimus* H. Hara has 2n=30 (Ito 1942), ca. 54 (Sokolovskaya 1960) and 60 chromosomes (Sokolovskaya and Probatova 1985 ; Iwatsubo and Otsuka 2005), and *S*. *nabekuraensis* Otsuka et K. Inoue has 2n=60 chromosomes (Iwatsubo and Otsuka 2005). Thus, the basic chromosome numbers of the subfamily Orontioideae are considered to be x=13, x=14 and x=15 in *Orontium*, *Lysichiton* and *Symplocarpus*, respectively. The consecutive nature of basic chromosome numbers in the three genera indicate that the differentiation of these genera was accompanied by dysploid changes in their basic chromosome numbers.

Karyotypic studies of the three genera in Orontieae have provided fundamental insight into the evolutionary course that resulted from dysploid changes in basic chromosome numbers. However, karyotypic features of species in Orontieae are definitively known for only Japanese *Symplocarpus*. Both *S*. *nipponicus* (2n=30) and *S*. *foetidus* var. *latissimus* (2n=60) have two long chromosomes in their somatic chromosome complements, while *S*. *nabekuraensis* (2n=60) has four long chromosomes in its somatic chromosome complement (Iwatsubo and Otsuka 2005). This reveals that the karyotypes of Japanese *Symplocarpus* are bimodal.

An elucidation of the karyotypes of the three genera is useful for investigating the divergence in basic chromosome numbers in Orontieae. In this study, we present the karyotype of *L*. *camtschatcense*, the only species of *Lysichiton* in Japan.

Materials and methods

One individual *L*. *camtschatcense* plant was grown from a seed collected at Nawaga-ike, Nanto City, Toyama Prefecture, central Japan, and maintained in an experimental garden at the Faculty of Science, University of Toyama. The karyotype was determined using a meristematic cell obtained from a root tip subjected to the squash technique. The root tip that sprouted from the plant was collected, pretreated in 2 mM 8-hydroxyquinoline at room temperature (ca. 25℃) for 1 h, and then incubated at ca. 5℃ for 15 h. The root tip was then fixed with a mixture of glacial acetic acid and ethyl alcohol (1 : 3) for 1 h, soaked in 1 N HCl at room temperature for a few hours, macerated in 1 N HCl at 60℃ for 10 minutes, washed in tap water, and stained in a drop of 1.5% lacto-propionic orcein on a slide glass. Chromosomes were described based on nomenclature developed by Levan et al. (1964).

Results and discussion

Consistent with studies performed in Russia by Sokolovskaya (1960), Gurzenkov (1973) and Sokolovskaya and Probatova (1985), we found that Japanese *L*. *camtschatcense* has 2n = 28 chromosomes (Fig. 1). This demonstrates that the plants of *L*. *camtschatcense* distributed in Russia and Japan each

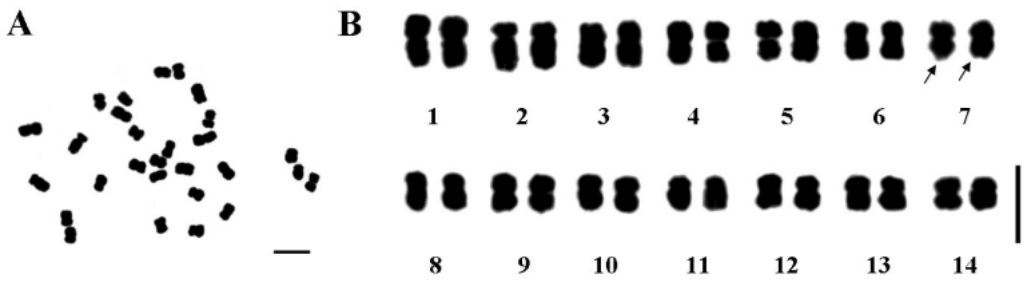

Fig. 1. Photograph (A) and karyotype (B) of somatic metaphase chromosomes of *Lysichiton camtschatcense*. Arrows indicate satellite chromosomes. Bars indicate 5 μm.

Table 1. Measurements of somatic metaphase chromosomes of *Lysichiton camtshatcense*

Chromosome pair	Length (μm)	Total (μm)	Arm ratio	Form
1	1.5+1.9	3.4	1.3	m
2	0.9+2.0	2.9	1.1	m
3	1.2+1.4	2.6	1.2	m
4	1.3+1.4	2.7	1.1	m
5	1.0+1.4	2.4	1.4	m
6	1.0+1.3	2.3	1.3	m
7	1.1+1.2-t	2.3	1.1	m
8	1.1+1.2	2.3	1.1	m
9	1.0+1.1	2.1	1.1	m
10	0.8+1.2	2.0	1.5	m
11	0.8+1.2	2.0	1.5	m
12	0.7+1.2	1.9	1.7	m
13	0.8+1.1	1.9	1.4	m
14	0.9+1.0	1.9	1.1	m

t : satellite.

have the same number of chromosomes (2n=28). While earlier cytological studies reported the number of chromosomes in *L. camtschatcense*, they did not describe the karyotypic features.

The karyotype of Japanese *L. camtschatcense* (Table 1) revealed that metaphase chromosomes in the somatic chromosome complement ranged from 1.9 to 3.4 μm in length, and 1.1 to 1.7 in arm ratio. The somatic chromosome complement of *L. camtschatcense* was composed solely of metacentric chromosomes. Of the 14 chromosome pairs, one had satellites at the tips of the long arms. Our findings indicate that the karyotype of *L. camtschatcense* can be represented by the equation $2n=28=26\,m+2\,m_{cs}$. Thus, in contrast to all species studied in *Symplocarpus* which have bimodal karyotypes (x=15), *L. camtschatcense* has a monomodal karyotype (x=14).

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摘要

サトイモ科ミズバショウ亜科ミズバショウ連は，ミズバショウ属，ザゼンソウ属および *Orontium* 属の 3 属からなる。染色体基本数は，*Orontium* 属が x=13，ミズバショウ属は x=14，ザゼンソウ属が x=15 とそれぞれ異なる連続した染色体基本数をもつことが知られている。また，ザゼンソウ属の核型は，染色体長において 2 グループに分けることができる二相的核型であることが報告されているが，その他の 2 属の核型はこれまで明らかにされていない。

本研究は，ミズバショウの核型を明らかにし，3 属の連続した異なる染色体基本数が，どのようにして生じたかを考察することを目的とした。材料は，富山県南砺市の縄ヶ池に自生するミズバショウの，種子より育てた 1 株を用いた。染色体数は，ロシア産のミズバショウでの報告と同じ 2n=28 であった。染色体の長さは，1.9 μm～3.4 μm，腕比は 1.1～1.7 であり，一対の染色体の長腕末端にはサテライトが認められ，核型式は，2n=28=26 m+2 mcs で表された。また，ザゼンソウ属の二相的核型に対して，ミズバショウは，一相的核型をもつことが判った。

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