

Chromosome numbers of Japanese *Symplocarpus* (Araceae)

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Yoshikane Iwatsubo¹ and Koichi Otsuka² : Chromosome numbers of Japanese *Symplocarpus* (Araceae)

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Symplocarpus Salisb. belonging to Araceae, distributed in North America and eastern Asia, is a small genus comprised of 3-4 species (Ohashi 1982 ; Otsuka et al. 2002). In Japan, the following three species occur : *S. foetidus* var. *latissimus*, *S. nabekuraensis*, and *S. nipponicus*. The first cytological study of this genus gave $n=8$ and $2n=16$ chromosomes for *S. foetidus* Nutt. var. *foetidus* (Gow 1907, as *Spathyema foetida*) collected from Blairstown, New Jersey. Thereafter, using a cultivated plant, Ito (1942) found $2n=30$ chromosomes in *S. foetidus* Nutt. var. *latissimus* Hara (under the name of *S. foetidus* Nutt.). In the same taxon from Russia, $2n=ca. 54$ chromosomes was also reported by Sokolovskaya (1960). Mulligan (1965) observed $2n=60$ chromosomes in *S. foetidus* var. *foetidus* collected from each of Quebec and Ontario in Canada. Recently, Sokolovskaya and Probatova (1985) recorded $2n=60$ chromosomes for *S. foetidus* var. *latissimus* (as *S. renifolius* Schott.) from the Russian Far East. On the basic chromosome number of $x=15$ proposed by Darlington and Wylie (1955), the counts previously published for the taxa of *Symplocarpus* are interpreted as dip-

loid ($2n=30$), hypotetraploid ($2n=ca. 54$) and tetraploid ($2n=60$), respectively, whereas the record of $n=8$ and $2n=16$ chromosomes for *S. foetidus* var. *foetidus* given by Gow (1907) seems improbable.

Except for a count of $2n=30$ by Ito (1942) on *S. foetidus* var. *latissimus* whose origin is unknown, we have no data concerning the chromosome numbers of Japanese *Symplocarpus*. Thus, the aim of this study is to determine the chromosome numbers of Japanese *Symplocarpus* species.

Materials and methods

The species studied were of *Symplocarpus foetidus* Nutt. var. *latissimus* Hara, *S. nabekuraensis* Otsuka et K. Inoue., and *S. nipponicus* Makino. Plant materials were collected from wild populations in both of Nagano and Yamagata Prefectures in Honshu, Japan (Table 1). All the living plants were grown in the experimental garden of University of Toyama. Newly formed root tips collected from potted plants were pre-treated in a 2 mM 8-hydroxyquinoline aqueous solution for 1 h at 25°C and subsequently kept

Table 1. Collection localities and number of individuals (in parentheses) of Japanese *Symplocarpus* taxa subjected to the cytological study

Taxon	Collection locality and number of individuals examined
<i>S. foetidus</i> var. <i>latissimus</i>	Yamagata Pref., Oguni-machi, Kanomizu, (3) ; Nagano Pref., Hakuba-mura, (4)
<i>S. nabekuraensis</i>	Nagano Pref., Iiyama-shi, Nabekura-yama, (1)
<i>S. nipponicus</i>	Nagano Pref., Nagano-shi, Iizuna-kogen, (2) ; Nagano Pref., Oomachi-shi, (2)

for 15 h at 6°C. The root tips were fixed in a mixture of glacial acetic acid and absolute ethyl alcohol (1 : 3) for 1 h, and soaked in 1 N HCl for a few hours followed by maceration in 1 N HCl at 60°C for about 10 min and then immersed in tap water for a few minutes to several hours. They were stained in a drop of 1.5% lacto-propionic orcein on the slide glass and ordinary squash technique was applied in preparation. Voucher specimens are deposited in NAC.

Results and discussion

Chromosome counts of the three species of Japanese *Symplocarpus* in the study were $2n=60$ chromosomes in both *S. foetidus* var. *latissimus*

(Fig. 1 A) and *S. nabekuraensis* (Fig. 1 B) ; and $2n=30$ chromosomes in *S. nipponicus* (Fig. 1 C).

All three species showed a bimodal variation in their chromosome length from the longest to the shortest chromosomes, as follows : the metaphase chromosomes of *S. foetidus* var. *latissimus* had a range from $0.8\mu\text{m}$ to $3.5\mu\text{m}$ and the 60 chromosomes could be divided into two groups of two chromosomes showing $3.5\mu\text{m}$ and 58 chromosomes having a range from $0.8\mu\text{m}$ to $2.6\mu\text{m}$ (Fig. 1 D) ; the somatic chromosome complement of *S. nabekuraensis* showed a range from $1.1\mu\text{m}$ to $3.7\mu\text{m}$ and the 60 chromosomes could be divided into two groups of four chromosomes having a range from $3.1\mu\text{m}$ to $3.7\mu\text{m}$,

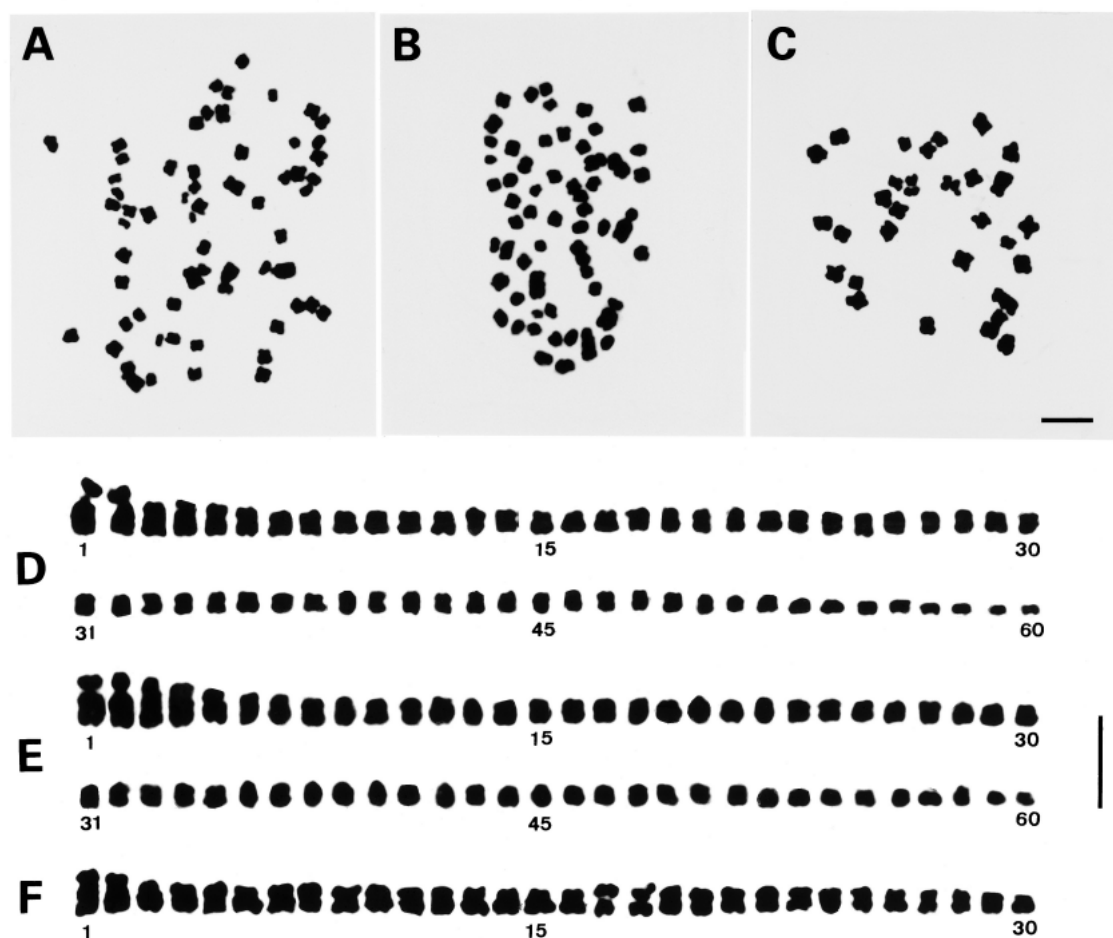


Fig. 1. Somatic metaphase chromosomes of *Symplocarpus foetidus* var. *latissimus* (A, D), *S. nabekuraensis* (B, E) and *S. nipponicus* (C, F). Scale bars equal $5\mu\text{m}$.

and 56 chromosomes ranging from 1.1 μm to 2.6 μm (Fig. 1 E) ; the 30 chromosomes in the somatic chromosome complement of *S. nipponicus* had a range from 1.4 μm to 3.1 μm , and they could be divided into two groups ; two chromosomes with about 3.1 μm , and 28 chromosomes with a range from 1.4 μm to 2.4 μm (Fig. 1 F).

The karyotypic feature shown in Fig. 1 suggests that *S. foetidus* var. *latissimus* is an allotetraploid species, because its chromosome complement is considered to be composed of a pair of chromosome sets with long chromosomes and a pair of chromosome sets having no long chromosomes. The genomic constitutions of *S. nabekuraensis* are different from those in *S. foetidus* var. *latissimus*, because four long chromosomes constitute the chromosome complement in *S. nabekuraensis*, on the other hand, only two long chromosomes in *S. foetidus* var. *latissimus*. *Symplocarpus foetidus* var. *latissimus* and *S. nabekuraensis* are tetraploid plants with the same chromosome number, however, they are judged to be different in their genomic constitutions.

Ito (1942) reported $2n=30$ chromosomes for *S. foetidus* var. *latissimus* in Japan. However, the present study indicates that *S. foetidus* var. *latissimus* is an allotetraploid plant with $2n=60$ chromosomes. Thus further cytological study is necessary for *S. foetidus* var. *latissimus*.

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- (Received December 12, 2005 ; accepted December 25, 2005)
- 岩坪美兼¹・大塚孝一²：日本産ザゼンソウ属の染色体数
- ザゼンソウ属には、日本ではザゼンソウ、ヒメザゼンソウ、それにナベクラザゼンソウの3種が知られている。日本におけるこの属の染色体数は、東京大学で栽培されていた植物について、ザゼンソウとして $2n=30$ (Ito 1942) が報告されている。国外ではザゼンソウについてロシアから $2n=ca. 54$ (Sokolovskaya 1960), 60 (Sokolovskaya and Probatova 1985) が報告されている。
- 今回、わが国に自生する3種について染色体数を調べたところ、ザゼンソウは $2n=60$ 、ヒメザゼンソウは $2n=30$ 、それにナベクラザゼンソウは $2n=60$ であり、ザゼンソウの染色体数は Ito (1942) の報告と異なっていた。この属の染色体基本数は $x=15$ (Darlington and Wylie 1955) とされていることから、ザゼンソウとナベクラザゼンソウは四倍体、ヒメザゼンソウは二倍体と判断される。ザゼンソウの60本の染色体のうち2本は他よりも大型であった。ナベクラザゼンソウでは60本の染色体のうち4本が他よりも大型であった。ヒメザゼンソウでは30本の染色体のうち2本が他よりも大型であった。わが国のザゼンソウ属の核型は、いずれの種においても染色体の長さにおいて2つのグループに分けられたことから二相的であることが判った。四倍体植物であるザゼンソウとナベクラザゼンソウは、互いに核型が異なることから、構成しているゲノムの違いが示唆された。
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