

## A cytotaxonomic study of the Korean *Veratrum* species

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### 韓國產 兪朮屬 (*Veratrum*) 의 染色體 研究

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#### Abstract

The present study was carried out to clarify the chromosome number and karyotype of Korean *Veratrum*. The result revealed that the genus is divided into two groups on the basis of chromosome number:  $2n = 32$  in section *Alboveratrum* species tested;  $2n = 16$  in section *Fuscoveratrum* species tested. In the position of centromere of haploid complement, the most of chromosomes of *V. patulum* (section *Alboveratrum*) and *V. maackii* (section *Fuscoveratrum*) have median and submedian centromere, except only one chromosome with highly submedian centromere of *V. patulum*. The average chromosome length of *V. maackii* was longer than that of *V. patulum*.

#### Introduction

Since the description of the characteristics of species, section and subgenus of Korean *Veratrum* by Loesener (1926, 1927, 1928) and Nakai (1937), there were the studies on cortex and stele of *V. coreanum* (Rim & Chung 1963), chromosome number of *V. coreanum* (Lee 1967), and the kinds, gross morphological characteristics and distribution of Korean *Veratrum* species. All Korean *Veratrum* species belong to subgenus *Euveratrum* of genus *Veratrum* (Nakai 1937, Lee 1985). There are two sections, *Alboveratrum* and *Fuscoveratrum*, in subgenus *Euveratrum* (Loesener 1926). Chromosome numbers of *Veratrum* previously reported are:

*V. album* var. *grandiflorum*  $2n = 32$ , *V. album* var. *oxysepalum*  $2n = 32$ , *V. maackii* var. *japonicum*  $2n = 16$ , *V. maackii*  $2n = 16$ , *V. maackii* var. *parviflorum*  $2n = 16$  and so on (Darlington 1956, Fedorov 1969, Moore 1973). For the chromosome number of Korean *Veratrum* species, there was the only one report *V. coreanum*  $2n = 16(32)$  by Lee(1976).

This study, as a part of the taxonomic studies of *Veratrum*(Lee 1985), was intended to reveal the chromosome numbers as well as karyotypes of Korean *Veratrum* species.

### Materials and Methods

Plants for this study were collected from the central southern parts of Korean peninsula (Table 1) and transplanted in the greenhouse of Ewha Womans University. Root tips were collected from the potted plants and pretreated in 0.05% colchicine solution at 4°C for 4-4.5 hours and then fixed in glacial acetic acid. The fixed root tips were hydrolyzed in 1N HCL at 58-60°C for 7-8 minutes and stained in 1% acetic orcein solution for 2 hours. Chromosomes were observed and photographed at  $\times 1000$  by using an Olympus microscope. The method of karyotype analysis followed Edward(1979): arm ratio 1.00-1.30 is median centromeric position(m), 1.31-1.70 submedian(sm), more than 1.71 highly submedian(h sm), because most of the chromosomes have median centromere by the criteria of Levan(1964).

### Result and Discussion

On the view point of the chromosome number, the Korean *Veratrum* species were divided into two groups: Group 1, including *V. dolichopetalum* and *V. patulum*, in which the number of chromosome was  $2n = 32$ ; Group 2, including *V. maackii*, *V. maackii* var. *parviflorum*, *V. coreanum* and *V. versicolor*, in which the number was  $2n = 16$ . The Group 1 corresponds to section *Alboveratrum* species, while Group 2 to section *Fuscoveratrum* species.

Table 1. Taxa of *Veratrum* and localities collected

Taxa	Localities
Section <i>Alboveratrum</i>	
<i>V. dolichopetalum</i>	Mt. Odae
<i>V. patulum</i>	Mt. Halla
Section <i>Fuscoveratrum</i>	
<i>V. maackii</i>	Kwangnung, Mt. Chonma and Mt. Sang
<i>V. maackii</i> var. <i>parviflorum</i>	Mt. Chiri and Mt. Kaya
<i>V. coreanum</i>	Mt. Halla
<i>V. versicolor</i>	Mt. Chilbo

Previously reported chromosome number of *V. album* var. *grandiflorum* and *V. album* var. *oxysepalum* were included in Group 1; the number of *V. maackii* var. *parviflorum* was the same as this result, included in Group 2, and *V. maackii* var. *japonicum* was also included in Group 2. The chromosome number of *V. coreanum* which grows in Mt. Halla was reported to  $2n = 16(32)$  by Lee(1967), however, the present author observed the number was  $2n = 16$  only(Plate I). The previous result,  $2n = 32$ , is open to doubt, because present result was only  $2n = 16$  in more than ten individuals at the same locality as Lee(1967). But it is known for a fact that there can be  $2N$  or  $4N$  according to the individuals in the same species. The difference of chromosome number supports Nakai(1937) and Lee(1985) that all Korean *Veratrum* species belong to two sections of subgenus *Euveratrum* because *V. coreanum* had the same chromosome number as the other *Fuscoveratrum* species.

Because chromosome size of genus *Veratrum* species was too small, it was difficult to analyze the karyotypes of all species. Karyotype analysis of *Veratrum*, therefore, was carried out in *V. patulum* of *Alboveratrum* and *V. maackii* of *Fuscoveratrum*.

The haploid complement of *V. patulum* has ten chromosomes with median centromere, five with submedian centromere, and one with highly submedian centromere. Chromosome

Table 2. Measurement of somatic chromosomes of *Veratrum patulum*

Chromosome	Long arm length	Short arm length	Total length		Arm ratio	Position of centromere	Secondary constriction
			average	variation			
1	3.39	2.47	5.86	5.46-6.26	1.37	sm	
2	2.92	2.68	5.60	5.05-6.15	1.09	m	
3	2.95	2.41	5.36	3.95-5.70	1.22	m	
4	2.71	2.45	5.16	4.76-5.68	1.11	m	
5	2.84	2.21	5.05	4.62-5.31	1.29	m	
6	2.73	2.16	4.89	4.54-5.23	1.26	m	
7	2.64	2.23	4.87	4.54-5.14	1.18	m*	
8	2.37	2.06	4.43	4.07-4.78	1.15	m*	
9	2.66	1.75	4.41	4.03-4.78	1.52	sm	long arm
10	2.12	2.05	4.17	3.88-4.46	1.51	sm	long arm
11	2.56	1.48	4.04	3.77-4.32	1.73	h sm	
12	2.17	1.81	3.98	3.70-4.26	1.20	m	
13	2.18	1.71	3.89	3.66-4.19	1.27	m	
14	2.09	1.79	3.88	3.66-4.12	1.17	m	
15	2.18	1.63	3.81	3.66-4.10	1.34	sm	long arm
16	2.16	1.52	3.68	3.59-3.76	1.42	sm	
Total per cell			73.08				

\* Satellite chromosome, Unit:  $\mu\text{m}$

7 and 8 have a satellite at the end of the short arm, and chromosome 9, 10 and 15 have a secondary constriction in the long arm. Within the complement, a little size variation was observed, i.e. 1.52-2.47  $\mu\text{m}$  in the short arms; 2.16-3.39  $\mu\text{m}$  in the long arms. The average total length of the largest chromosome was 5.86  $\mu\text{m}$ , the shortest was 3.68  $\mu\text{m}$ . The total length of 16 chromosomes was 73.08  $\mu\text{m}$  and the average length of each chromosome was 4.57  $\mu\text{m}$  (Table 2; Plate II).

The haploid complement of *V. maackii* has five chromosomes with median centromere and three with submedian centromere. Chromosome 4 has a satellite at the end of the short arm, and chromosome 6 has a secondary constriction in the long arm. Within the complement, great size variation was observed in the short arms, 1.89-3.58  $\mu\text{m}$  and little in the long arms, 3.02-3.99  $\mu\text{m}$ . The average total length of the largest chromosome was 7.57  $\mu\text{m}$  and the smallest was 4.94  $\mu\text{m}$ . These were longer than those of *V. patulum*. The total length of 8 chromosomes was 48.41  $\mu\text{m}$ , with an average chromosome length of 6.05  $\mu\text{m}$  (Table 3; Plate II). This average length was longer than that of *V. patulum*. The shorter average chromosome length of *V. patulum* than that of *V. maackii* can be explained by that a considerable degree of elimination of chromosomal material has taken place in tetraploid and polyploid (Darlington 1963, Kihara 1963). In both *V. patulum* and *V. maackii*, all the complement of chromosomes contain median and submedian except for highly submedian in one chromosome in *V. patulum*. *V. patulum* has not double number of the chromosomes which have secondary constriction and satellite in *V. maackii*.

Table 3. Measurement of somatic chromosomes of *Veratrum maackii*

Chromosome	Long arm length	Short arm length	Total length		Arm ratio	Position of centromere	Secondary constriction
			average	variation			
1	3.99	3.58	7.57	6.56-8.64	1.11	m	
2	3.66	3.13	6.79	6.19-7.40	1.17	m	
3	3.45	3.08	6.53	6.04-7.18	1.12	m	
4	3.36	2.69	6.05	5.49-6.41	1.25	m*	
5	3.16	2.77	5.93	5.49-6.26	1.14	m	
6	3.06	2.29	5.35	5.16-5.53	1.34	sm	long arm
7	3.02	2.23	5.25	4.80-5.71	1.35	sm	
8	3.05	1.89	4.94	4.36-5.35	1.61	sm	
Total per cell			48.41				

\* Satellite chromosome, Unit:  $\mu\text{m}$

## 摘 要

본 연구는 한국산 여로屬식물의 염색체수와 핵형을 밝히기 위하여 한반도 이남에서 채집이 가능한 5종 1변종을 대상으로 하였다.

염색체수를 바탕으로 한국산 여로속 식물은 두 군으로 구분되었다. 즉 1군에 속하는 식물은 푸른박새와 박새로 염색체수  $2n=32$ 였으며 이는 박새족(section *Alboveratrum*)에 해당되었다. 2군에 속하는 식물은 염색체수  $2n=16$ 으로, 여로, 파란여로, 한라여로 및 흰여로가 속하였고 이는 여로족(section *Fuscoveratrum*)에 일치하였다.

박새(박새족)와 여로(여로족)의 핵형분석에서 대부분의 염색체는 중부(median) 또는 차중부(submedian)의 동원체를 가진 것으로 나타났다. 각 염색체의 평균길이는 여로가 박새보다 길었다.

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Plate I. Somatic chromosomes of *Veratrum* ( $\times 790$ ).

1. *V. dolichopetalum* Loesener fil.
2. *V. patulum* Loesener fil.
3. *V. maackii* Regel
4. *V. maackii* Regel var. *parviflorum* (Miq.) Hara et Mizushima
5. *V. coreanum* Loesener fil.
6. *V. versicolor* Nakai

Plate II. The karyotypes of two taxa in the genus *Veratrum* ( $\times 2730$ )

1. *V. patulum* (section *Alboveratrum*)  $2n = 32$
2. *V. maackii* (section *Fuscoveratrum*)  $2n = 16$