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Karyotype Analysis of *Silene behen* L. (Caryophyllaceae)

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Abstract

In this study, the karyotype analysis of the species of *Silene behen* L. was examined using Image Analysis System. The chromosome lengths range from 2.54 to 4.74 µm; also diploid chromosome number is $2n = 24$. In terms of the arm lengths, while three pairs of mitotic metaphase chromosomes are mediab, nine pairs of them are submedian types. The karyotype analysis of this species was first carried out in our study.

Key words: *Silene behen*, Caryophyllaceae, Karyotype Analysis.

INTRODUCTION

Silene L. (Caryophyllaceae) genus is represented throughout the world with 700 and in Turkey with 136 taxa [1-5]. Regarding the *Silene* genus, some floristic studies [4-7], molecular genetic studies [8], pollen morphology studies [9], chemical studies [10-11], and studies on the chromosome number and morphology [12-17] have been conducted. The chromosome numbers of the genus *Silene* are reported as $2n = 20$, 24 and 28 in 40 taxa in the Turkish Flora [1-2].

Karyotype analyses have been conducted in recent years with similar computer supported programs with different names. The Image Analysis Program plays a vital role in the minimization of errors in karyotype analyses. Moreover, the use of Image Analysis Program, compared to karyotype analyses which are made using scales and compass, has three chief advantages. First, the preparation of the karyotypes takes less time. Second, it is more practical in the measurement of the chromosomes. Third, the karyograms and idiograms are prepared automatically.

The karyotype analysis of *Silene behen* taxon has been conducted for the first time in the present study.

MATERIAL AND METHODS

The plant samples and seeds of *Silene behen L.* taxon, *Silene* are preserved in the Herbarium of Selçuk University, Faculty of Education, Biology Teacher Education Department. The locality of the taxon *Silene behen* L., C5 used in the present study is Mersin, Arslanköy, Cocakdere, Şahinlik Tepe. A composite forest of pine, fir, cedar trees and forest clearings at 1900 m altitude, 05.07.2003, M. Dinç, 1967.

In order to define the karyotype of this taxon belonging to genus *Silene*, the seeds collected from the nature have been germinated in humidified petri dishes at room temperature in the laboratory. The root tips were placed into α-monobromonapthalene and kept for 16 hours at 4 C°. Afterwards, the root tips were determined in a 3:1 absolute alcohol: glacial acetic acid mixture. Until the root tips were analyzed in this mixture, they were stored in 70 % alcohol in a refrigerator. The root tips were hydrolyzed in 1N HCl for 12 minutes at room temperature for the preparation after were they taken out of alcohol. The root tips were stained with 2 % aceto-orcein room temperature for two hours. The squashed preparations of root tips were made with 45 % acetic acid. The preparations made were frozen in liquid nitrogen at room temperature and they were thus made permanent.

The counting of the chromosomes, measuring their lengths, and conducting the karyotype analysis, were realized by using permanent slides which contain the chromosomes at the metaphase stage of the mitosis. The photographs, enlarged 10 x 100, were taken using a camera attached to the microscope. Only the slides with a good spread, with clearly observable morphologies, and with somatic root tips on the same plane were used.

Afterwards, the procedures for the location of the centromer, determination of the arm index, chromosome arms and total length, were conducted after the transfer of the images for the computer using Image Analysis System.

Relative chromosome length = (chromosome length / total chromosome lengths) x 100. Arm ratio = Length of long arm / Length of short arm [18]. The position of centromeric constriction was recorded as median (m: 1.0-1.7) and submedian (sm: 1.7-3.0) by the arm ratio [19].

RESULT AND DISCUSSION

The karyotype analysis of *Silene behen* L. reveales that the diploid chromosome number is $2n = 24$ (Figure 1).

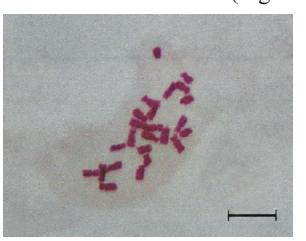

Figure 1. Mitotic metaphase chromosomes of *Silene behen* ($2n = 24$) Scale bar: 10 µm.

The idiogram of this species has been prepared as a result of the study (Figure 2).

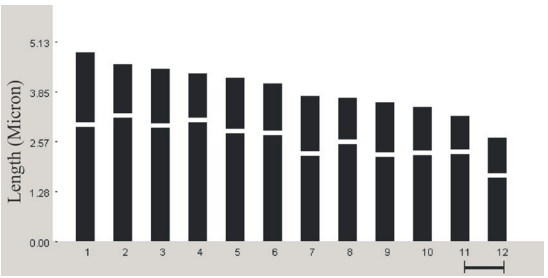

Figure 2. Idiogram of *Silene behen* (2*n* = 24) Scale bar: 10 µm.

The chromosome lengths range from 2.54 to 4.74 µm. In terms of the arm ratio, the chromosome types of the first, seventh, and nineth chromosomes are median, whereas those of two, six, eight, tenth and twelfth are submedian. The total haploid length of this species is 45.32 µm. The detailed features of these somatic metaphase chromosomes are given in Table 1.

Table 1. The detailed features of these somatic metaphase chromosomes *Silene behen*.

Chromosome pairs	Chromosome arms (µm)		Total length (µm)	Arm ratio (L/S)	Relative lengths (%)	Chromosome type
	Long arm (L)	Short arm (S)				
1	2.95	1.79	4.74	1.65	10.46	m
2	3.18	1.27	4.45	2.50	9.82	sm
3	2.91	1.40	4.31	2.08	9.51	sm
4	3.06	1.14	4.21	2.69	9.28	sm
5	2.77	1.31	4.08	2.12	9.01	sm
6	2.72	1.21	3.93	2.26	8.67	sm
7	2.20	1.42	3.62	1.55	7.99	m
8	2.49	1.07	3.56	2.32	7.85	sm
9	2.17	1.29	3.46	1.69	7.64	m
10	2.21	1.12	3.33	1.97	7.34	sm
11	2.24	0.86	3.09	2.61	6.82	sm
12	1.63	0.92	2.54	1.77	5.62	sm
Total haploid chromosome length: 45.32 µm						

The chromosome number of *Silene behen* is determined as 2*n* = 24 as reported [20-21]. The somatic chromosome number of this species did not show any difference within these two studies; however, the karyotype analysis of this species has been conducted for the first time with the present study. The size of the diploid chromosomes ranges from 2.54 to 4.74 µm. The karyotype formula of this species is 3m + 9sm.

When compared to previous studies which have been conducted on *Silene*, there are some cytological differences regarding their chromosome number and chromosome morphology in our study.

In the karyological study conducted by Yıldız and Çırpıcı in 1996, of 19 taxa of genus *Silene*, the chromosome number of 15 taxa is determined as 2*n* = 24, and four of which as 2*n* = 48. The basic chromosome number is determined to be *x* = 12 [16].

In a meiotic study of *S. latifolia* and *S. dioica* genus *Silene*, the chromosome numbers were reported for *S. latifolia* as 2*n* = 24, 26 and for *S. dioica* as 2*n* = 24 [22].

Constantinidis *et al.* [23] determined the chromosome number in a karyological study on 20 Angiosperm taxa and they found out that the chromosome numbers were the same (2*n* = 24) in *S. fabarioides*, *S. salamandra*, *S. fabaria* subsp. *domokina*, *S. haussknechtii* genus *Silene*. As regards the chromosome numbers are similar to those of Constantinidis et al the findings of in our study.

Damboldt and Phitos [20] reported that the diploid chromosome number was the same (2*n* = 24) in the cytological study of the *Silene* taxa (*Silene cephallenia, congesta, paeonensis, behen, reinholdii*, *graeca, holzmannii, ungeri*) in the Greek Flora. This study is also similar to ours with in regard to the chromosome numbers. Besides, in the present study, the chromosome morphology of *Silene behen* is determined as well.

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