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Karyotype Analysis of *Silene muradica* Schischk. (Caryophyllaceae), an Endemic Species in Turkey

Türkiye'de Endemik Silene muradica (Caryophyllaceae)'nın Karyotip Analizi

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Abstract

In this research the mitotic metaphase chromosome number and karyotype of *Silene muradica* Schischk. which is endemic species and growing naturally in Turkey, were studied for the first time. The diploid chromosome study was conducted using squash preparation method. The study revealed that the chromosome number of *S. muradica* is 2n = 24. The basic chromosome number of species is determined as x = 12. The karyotype formula of *S. muradica* is found as 12m. The total length of the somatic chromosomes of *S. muradica* ranges between 1.50 µm - 2.77 µm. The total haploid chromosome length of *S. muradica* is measured as 25.12 µm. The chromosome morphology and ideogram are made using Image Analysis System (Bs200ProP).

Keywords: Caryophyllaceae, Chromosome, Endemic, Karyotype, *Silene muradica*, Turkey

Öz

Bu araştırmada Türkiye'de doğal olarak yetişen ve endemik olan *Silene muradica* Schischk. türünün mitotik metafaz kromozom sayı ve karyotipi ilk kez incelenmiştir. Diploid kromozom çalışması ezme yayma preparasyon yöntemi kullanılarak gerçekleştirildi. Çalışmada *S. muradica*'nın kromozom sayısının 2n = 24 olduğu ortaya konuldu. Temel kromozom sayısı x = 12 olarak belirlendi. *S. muradica*'nın karyotip formülü 12m olarak bulundu. *S. muradica*'nın somatik kromozomlarının toplam uzunluğu 1.50 µm - 2.77 µm arasında değişmektedir. *S. muradica*'nın toplam haploid kromozom uzunluğu 25.12 µm olarak ölçüldü. Kromozom morfolojisi ve ideogramı Görüntü Analiz Sistemi (Bs200ProP) kullanılarak yapıldı.

Anahtar Kelimeler: Caryophyllaceae, Kromozom, Endemik, Karyotip, *Silene muradica*, Türkiye

1. Introduction

Silene L. (Linnaeus 1753) is the largest genus of the family Caryophyllaceae. Also, *Silene* is one of the largest genera of World's flowering plants by comprising about 750 species of which approximately half naturally distributed in the Mediterranean area (Melzheimer 1988, Oxelman et al. 2001, Rautenberg et al. 2012, Atasagun et al. 2016). Two main diversity centers of the genus are known as South Balkan Peninsula and Southwest Asia (Greuter 1995, Mabberley 2008). Concerning Turkey, *Silene* is represented by 165 taxa (31 sections) of which 72 are endemic (Coode and Cullen 1967, Davis et al. 1988, Marhold 2011, Güner et al. 2012, Atasagun et al. 2016). Members of this genus are locally known as "nakıl" in Turkish.

Silene muradica Schischk. is one of the endemic species for flora of Turkey and is belong to Sect. *Spergulifoliae* Boiss. of the genus *Silene*. *S. muradica* is close to *S. spergulifolia* (Desf.) Bieb. and *S. otitis* (L.) Wibel, morphologically and is distributed only a few cities of Turkey (Coode and Cullen 1967).

The chromosome numbers of the species of the genus *Silene* are reported as 2*n* = 20, 24 and 28 in 40 taxa in the Flora of Turkey (Coode and Cullen 1967, Davis et al. 1988, Özhatay et al. 2000).

In the present study, the chromosome number and karyotype of the *S. muradica* has been studied for the first time. We

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Table 1. Collection data of *Silene muradica*.

Species	Locality	Collector and collector number	Collection date
Silene muradica	B6 Sivas: Şarkışla, Kayadibi to Menşurlu village, 1 km E of Kayadibi center, roadside, 1375 m, 39° 29' 09,6" N, 36° 43' 11,4" E	M. Tekin 1279	28.06.2012

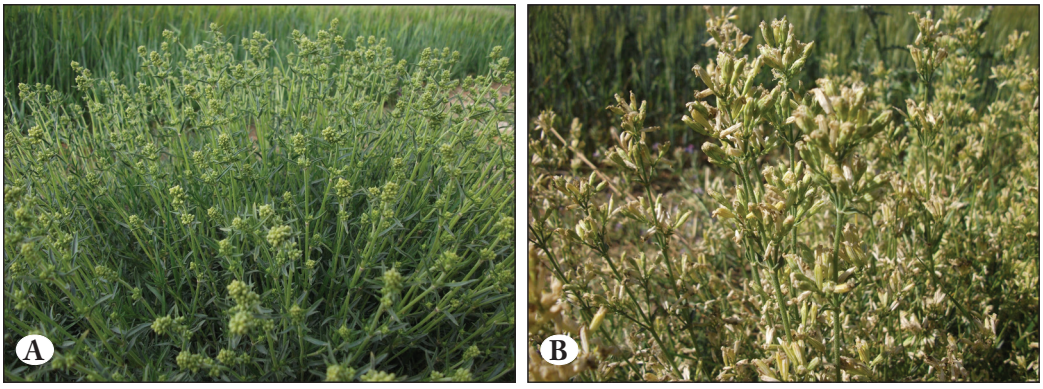

Figure 1. *Silene muradica* in natural habitat. At pre-flowering stage **(A)**, and at fruiting stage **(B)**.

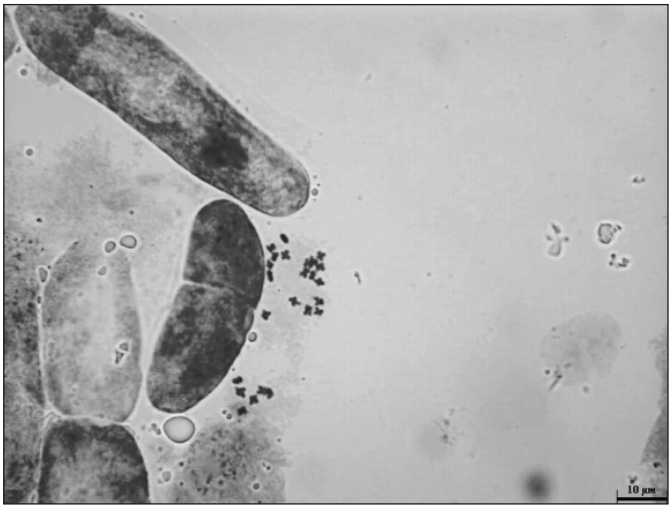

Figure 2. Photomicrograph of metaphase chromosomes of *Silene muradica* (Scale bar: 10 µm).

hope that this study will contribute to future karyological studies of the genus *Silene*.

2. Material and Methods

The plant specimens were collected from Sivas province during the vegetation season of 2012 and dried using standard herbarium methods. The plant specimens were stored in the Herbarium of Trakya University Faculty of Pharmacy, with collector code M. Tekin 1279. The habitat of *Silene muradica* was shown in Figure 1. The data of the locality and collector for the studying species were given in Table 1. For diploid chromosome numbers, root tips were obtained from seeds germinated for 10 days on wet filter paper in petri dishes. Root tips were pretreated with α-monobromonaphthalene for 16 h at 4 °C, fixed in ethanol:glacial acetic acid (3:1) for 24 h and stored at 4 °C until use. Root tips were washed in distilled water to remove the fixative, hydrolyzed in 1 N HCl for 12 min at room temperature, and stained in 2% aceto-orcein for 2 h. Permanent slides were made with the standard liquid nitrogen method; slides were dried for 24 h at room temperature and mounted in depex. Photomicrographs were taken using BX51 Olympus light microscope. The ideogram was prepared with measurements taken on enlarged micrographs of ten well spread metaphase plates. The classification of chromosomes, the length of long and short arms, arm ratios, centromeric index, and relative chromosomal lengths were measured by Image Analysis System (Bs200ProP).

3. Results and Discussion

Silene muradica has $2n = 24$ chromosomes (Figure 2). The shortest chromosome length is 1.50 µm, the longest chromosome length is 2.77 µm, while total haploid chromosome length is 25.12 µm of the metaphase chromosomes, all pairs are of median type. Chromosome arm ratio is ranging from 1.12 to 1.62, centromeric index from 2.63 to 4.75, and relative length from 5.97 to 11.01. The ideogram of the species is reported in Figure 3.

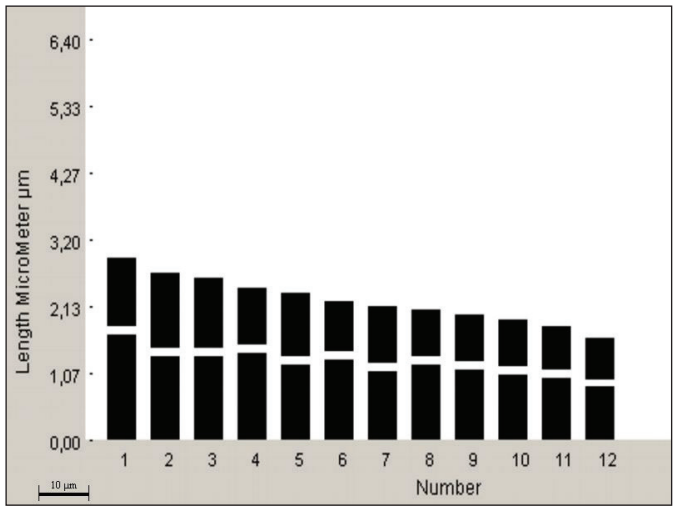

Figure 3. Ideogram of *Silene muradica* (Scale bar: 10 µm).

There are karyotype researches carried out in different years on various taxa of the genus *Silene* naturally growing in Turkey (Abdel Bari 1973; Martin et al. 2008; Atasagun et al. 2016). When compared to literature which has been conducted on *Silene* taxa, there are some karyological differences regarding their somatic chromosome number and chromosome morphology in our study. In the study carried out Martin et al. (2008), karyotypes of the *Silene lycaonica* Chawdh. *Silene duralii* Bağcı and *Silene cappadocica* Boiss. & Heldr. have been reported. The number of chromosomes of *S. lycaonica* is the same as that of *S. muradica*, $2n = 24$. The species *S. duralii* and *S. cappadocica* were tetraploid and their chromosome number has been reported as $2n = 48$. In present study, polyploidy was not found in *S. muradica*. When we compare chromosome measurements, *S. cappadocica* was reported as the species possess the shortest chromosome as 1.31-3.02 µm. In *S. muradica*, chromosome length varies between 1.50-2.77 µm. The largest chromosome size of *S. lycaonica* has been reported as 5.31 µm, which is considerably longer than the chromosomes of *S. muradica*.

Total haploid chromosome lengths have been reported to be 44.34 µm in *S. lycaonica*, 28.88 µm in *S. duralii* and 49.52 µm in *S. cappadocica* (Martin et al. 2008). In the *S. muradica*, the total haploid chromosome length is 25.12 µm, and this length is closely related to the *S. duralii*. Karyotype formulas of 8m + 3sm + 1st in *S. lycaonica*, 11m + 1sm in *S. duralii* and 20m + 4sm in *S. cappadocica* (a synonym of *Silene argentea* Ledeb.), are differ from *S. muradica* which has formulae as 12m.

In a different karyological study carried out on 14 species which are members of sections *Siphonomorpha* Otth and *Auriculatae* (Boiss.) Schischkin belonging to the genus *Silene*; the presence of tetraploidy in *S. boryi* Boiss. and *S. vallesia* L., and the presence of satellite choromosomes in *S. viridiflora* L. and *S. nodulosa* Boiss. were shown (Ghazanfar 1983). In present study, there were no satellite chromosomes and polyploidy in *S. muradica*.

Silene latifolia Poir., *Silene vulgaris* (Moench) Garcke, *Silene. pendula* L. and *Silene chalcedonica* E.H.L.Krause species were reported to have $2n = 24$ diploid chromosomes (*Široký* et al. 2001). *S. muradica* also had a parallel number of chromosomes in mentioned literature.

Yıldız and Çırpıcı 1996 carried out a cytological study, and they were reported chromosome number and morphology of *S. paphlagonica* Bornm. *S. vulgaris* var. *vulgaris*, *S. gallica* L., *S. sangaria* Coode & Cullen, *S. bellidifolia* Thunb., *S. chlorifolia* Sm., *S. compacta* Fisch. ex Hornem., *S. olympica* Boiss., and *S. italica* (L.) Pers. In the study mentioned, the presence of metacentric and submetacentric chromosome pairs was reported. In addition, they were observed acrocentric chromosome pairs *in S. chlorifolia*, *S. sangaria* and *S. compacta* (Yıldız and Çırpıcı 1996). Unlike the species mentioned above, according to our result, all chromosome pairs are metacentric in *S. muradica*.

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