

Chromosome Numbers in the Some Taxa of *Hesperis* L. (Brassicaceae) from Turkey

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Abstract

Hesperis L. genus belongs to Brassicaceae family and has 27 species in Turkey. In this study, chromosome numbers were defined for the first time in five taxa of *Hesperis* L. which grows up naturally. These taxa are *Hesperis schischkinii* Tzvelev, *H. anatolica* A. Duran, *H. pendula* DC. subsp. *dirmilensis* A. Duran, *H. özcelikii* A. Duran and *H. aspera* Fourn., according to their floristic order. Diploid chromosome numbers of *Hesperis schischkinii*, *H. anatolica* and *H. aspera* species were counted as $2n = 14$, while those of *H. pendula* subsp. *dirmilensis* and *H. özcelikii* taxa were $2n = 12$. There was only one double satellited metaphase chromosome in *H. anatolica* among these five *Hesperis* taxa.

Key words: Cruciferae, Chromosome number, *Hesperis*, Image Analysis System.

INTRODUCTION

Most of the Brassicaceae (Cruciferae) family members are spread in the mild Northern hemisphere. They are widely represented in the world with more than 3700 species belonging to 338 genus [1]. In Turkey from the Brassicaceae family, there are 85 genus and approximately 567 taxa [2-4].

Hesperis L. (Brassicaceae) species is spread on a wide geography in the mild zone of the Northern hemisphere ranging from south and middle Europe, southwest Asia, Caucasus, to the mountainous area of western China and Mongolia. This genus is represented throughout the world with approximately 56 species [5-6]. *Hesperis* species is represented with 27 species in seven different sections. 70 % taxa are endemic to Turkey [7].

Karyological studies on species *Hesperis* have shown that the chromosome numbers of this species are $2n = 12, 14, 24, 26$ and 28. These studies are given at Table 1.

Among the taxa of species *Hesperis*, *H. matronalis* is cultivated as a garden plant. It is grown in the gardens of Thracian and Blacksee regions in Turkey. There are significant differences between the cultivated and wild plant groups in terms of hair characteristics. The genus *Hesperis* has biannual and perennial life forms. We see that the taxa of this species grow high up in the mountains and they have a strong root system and these are perennial plants. The perennial life forms of genus *Hesperis* is a feature that has emerged as a secondary characteristics due to the harsh climate conditions up in the mountains [7].

The genus *Hesperis* is widely represented with multiple taxa forms in the transition zones of the Mediterranean, Irano-Turanian and Euro-Siberian phytogeographic regions. The transition zone of these three phytogeographic regions is the Anatolian peninsula. The densest *Hesperis* taxa population of the world is the Anatolian peninsula and Anatolia is probably the place of genetic differentiation and evolutionary development center [7].

The aim of the present study is to determine the chromosome numbers of five *Hesperis* taxa growing naturally in Turkey, which are endemic to Turkey. The chromosome numbers of these taxa are determined for the first time.

Table 1. Chromosome counts in some taxa of the genus *Hesperis* in the world.

Taxon	2n	Authors
<i>H. bicuspidata</i>	14, 28	Duran <i>et al.</i> , 2003
<i>H. matronalis</i> subsp. <i>matronalis</i>	14, 24, 28	Dvořák and Dadáková, 1976 Duran <i>et al.</i> , 2003
<i>H. matronalis</i> subsp. <i>adzharica</i>	14	Duran <i>et al.</i> , 2003
<i>H. matronalis</i> subsp. <i>nivea</i>	24, 26	Dvořák and Dadáková, 1976 Dvořák, 1980
<i>H. sylvestris</i>	14	Dvořák, 1964
<i>H. sylvestris</i> subsp. <i>sylvestris</i>	12, 16	Dvořák 1973
<i>H. velenovskyi</i>	14	Dvořák 1973
<i>H. sibirica</i>	14	Sokolovskaja & Strelkova, 1948
<i>H. laciniata</i> subsp. <i>secundiflora</i>	12	Tan & Iatrou, 2001
<i>H. varolii</i>	14	Duran <i>et al.</i> , 2003
<i>H. podocarpa</i>	12	Duran <i>et al.</i> , 2003
<i>H. persica</i>	12	Duran <i>et al.</i> , 2003
<i>H. pendula</i> subsp. <i>duralii</i>	12	Duran <i>et al.</i> , 2003
<i>H. novakii</i>	14	Ünal <i>et al.</i> , 2006
<i>H. syriaca</i>	14	Ünal <i>et al.</i> , 2006
<i>H. bottae</i>	12	Ünal <i>et al.</i> , 2006
<i>H. balansae</i>	12	Ünal <i>et al.</i> , 2006
<i>H. turkmenagensis</i>	14	Martin <i>et al.</i> , 2006
<i>H. schischkinii</i>	14	Present study
<i>H. anatolica</i>	14	Present study
<i>H. pendula</i> subsp. <i>dirmilensis</i>	12	Present study
<i>H. özcelikii</i>	12	Present study
<i>H. aspera</i>	14	Present study

MATERIAL AND METHODS

The taxa examined were *Hesperis schischkinii*, *H. anatolica*, *H. pendula* subsp. *dirmilensis*, *H. özcelikii* and *H. aspera* (Table 2). Cytological observations were made on mitotic metaphase cells of root tips obtained from germinating seeds. Root tips were pretreated for 16 h in α -monobromonaphthalene at 4°C and washed and fixed in Carnoy solution (3:1 absolute ethanol: glacial acetic acid) overnight. The root tips were hydrolyzed for 10 min in 1 N HCl at room temperature, washed and stained in 2 % aceto-orcein for 2 h. Stained root tips were then squashed in a drop of 45 % acetic acid and permanent slides were made by mounting in Depex.

RESULTS

The chromosome numbers of each of the five taxa of genus *Hesperis* are determined for the first time as a result of the

karyological studies. Diploid chromosome numbers of *Hesperis schischkinii*, *H. anatolica* and *H. aspera* species were counted as $2n = 14$, while those of *H. pendula* subsp. *dirmilensis* and *H. özcelikii* taxa were $2n = 12$. Two different basic chromosome numbers were obtained from the taxa studied ($x = 6$ and $x = 7$). In this karyological study on the taxa of genus *Hesperis*, the chromosome morphology and types could not be determined due to the problems during the processes of germination, staining and hydrolyze. Based on the data obtained, the features of the mitotic metaphase chromosomes are given below.

Hesperis schischkinii Tzvelev

The result of the cytological analyses reveals that the somatic chromosome number is $2n = 14$ (Fig. 1a). This taxon is endemic to Turkey and has a basic chromosome number as $x = 7$.

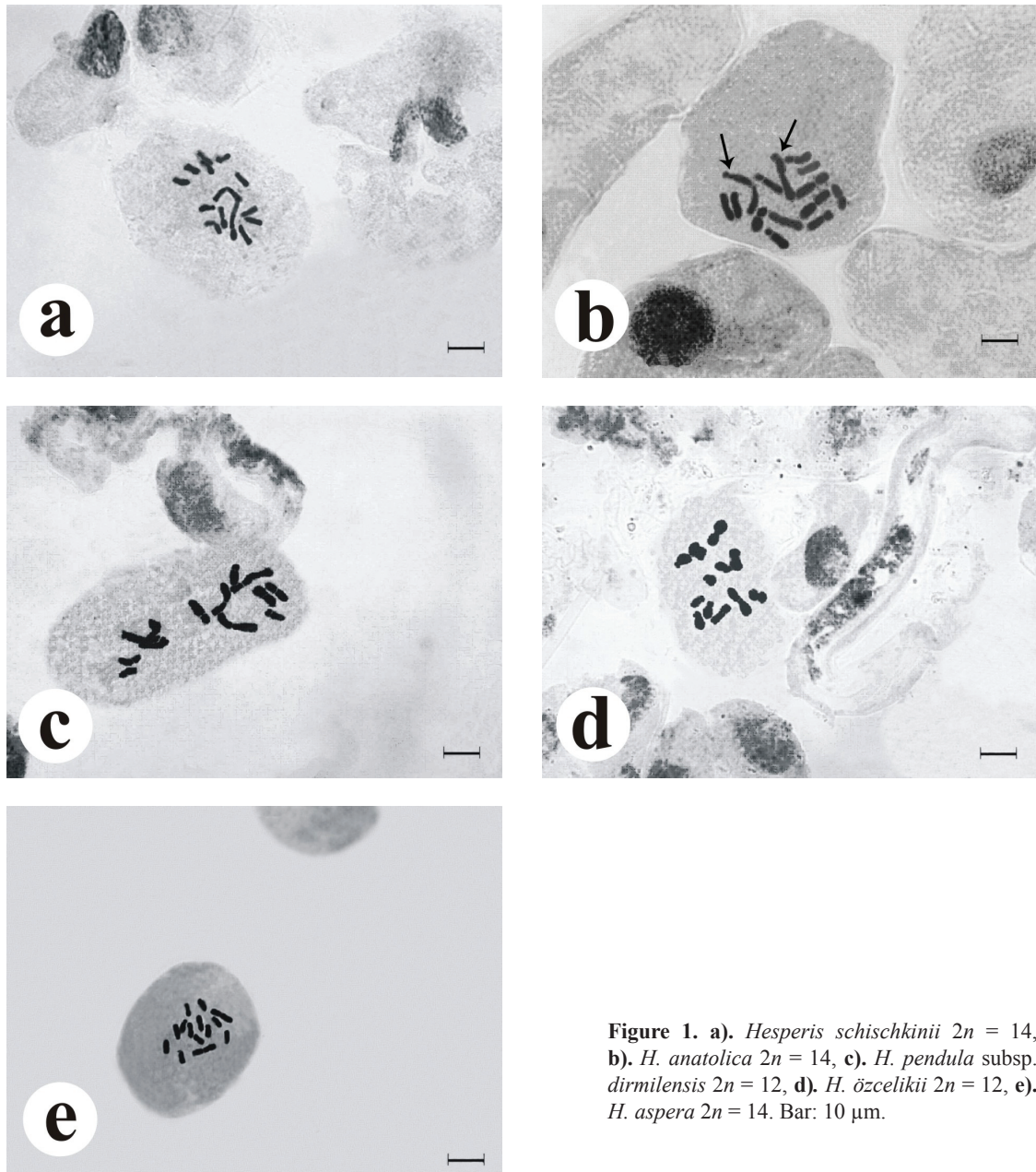


Figure 1. a). *Hesperis schischkinii* $2n = 14$, b). *H. anatolica* $2n = 14$, c). *H. pendula* subsp. *dirmilensis* $2n = 12$, d). *H. özcelikii* $2n = 12$, e). *H. aspera* $2n = 14$. Bar: 10 μ m.

***Hesperis anatolica* A.Duran**

As a result of the cytological analyses, the somatic chromosome number of this taxon is determined as $2n = 14$ (Fig. 1b). The basic chromosome number of this taxon is $x = 7$. This taxon is endemic to Turkey.

***Hesperis pendula* DC. subsp. *dirmilensis* A.Duran**

The somatic chromosome number of this taxon is determined to be $2n = 12$ as a result of the cytological analyses (Fig. 1c). $x = 6$ is the basic chromosome number of this taxon which is endemic to Turkey.

***Hesperis özcelikii* A.Duran**

The somatic chromosome number of this taxon is determined to be $2n = 12$ as a result of the cytological analyses (Fig. 1d). The basic chromosome number of this taxon is $x = 6$. This taxon is endemic to Turkey.

***Hesperis aspera* Fourn.**

The somatic chromosome number of this taxon is determined as a result of the cytological analyses. The chromosome number is $2n = 14$ (Fig. 1e). The basic chromosome number of this taxon is $x = 7$. This taxon is endemic to Turkey.

Table 2. The localities, collector and chromosome numbers of *Hesperis* specimens studied cytologically.

Taxon	2n	Locality	Voucher
<i>H. schischkinii</i>	14	Erzurum: Horasan-Erzurum Road, 4 km, 1580m, 13.07.2000, on the rail roadside	A.Duran 5535, Sağıroğlu & Menemen
<i>H. anatolica</i>	14	Adana: Between Pozantı Hamidiye Köyü-Karakuz (Çamlıbel), 4 km, 24.07.1999, serpentine stone locations, 1400m.	A.Duran 4959 & Hamzaoğlu
<i>H. pendula</i> subsp. <i>dirmilensis</i>	12	Burdur: Dirmil-Korkuteli Road, after Dirmil passage Karaçulla valley, Karlağaç stone location, 1850m, 06.07.2000, limestone cliff	A.Duran 5497 & Sağıroğlu
<i>H. özcelikii</i>	12	Isparta: Sütçüler, Ayvalıpınar-Kesme road 17 km, on the sliding ropes at the right, 1025m, 04.08.1999, road side	A.Duran 4973
<i>H. aspera</i>	14	Kastamonu: Between Tosya-Sekiler villages, 7 km, 1000 m, 21.vii.2001, Under <i>Quercus</i> clearings, field sides, stone piles	A.Duran 5822

DISCUSSION

In this study, somatic chromosome numbers were counted in *H. schischkinii*, *H. anatolica*, *H. pendula* subsp. *dirmilensis*, *H. özcelikii* and *H. aspera* in the section of *Hesperis* L., *Mediterranea* (Borbás) A.Duran, and *Pachycarpus* (Fourn.) of genus *Hesperis* growing in the Flora of Turkey.

There are previous studies conducted with Image Analysis System on genus *Hesperis*. The somatic chromosome number of *H. turkmenaghensis* A.Duran & A.Ocak collected from Türkmenadağı in Eskişehir is determined as $2n = 14$ [7-8]. The somatic chromosome number of the taxa in our study, *H.*

schischkinii and *H. aspera* is the same as *H. turkmenaghensis*. However, though *Hesperis anatolica* has the same amount of metaphase chromosome number, a unique property distinguishing it from other species is that it has a pair of chromosomes with satellite.

Another cytological analysis was conducted with Image Analysis System on *H. balansae* Fourn, in the *Diaplectos* (Dvořák) section genus *Hesperis* [9]. The chromosome number is reported as $2n = 12$ in taxon *H. balansae*. The chromosome number of the two different taxa (*Hesperis pendula* subsp. *dirmilensis* and *H. özcelikii*) in our study is identical with taxon *H. balansae*.

Previous cytological analyzes on the taxa of genus *Hesperis* have shown that the chromosome number of these taxa is $2n = 12, 14, 24$ and 28 [10-14]. The taxa in the present study has a chromosome number of $2n = 12$ and 14 . The finding of our study is similar to the findings of previous cytological studies.

The chromosome number of *H. syriaca* (DC.) Dvořák species *Hesperis* in the *Diaplectos* (Dvořák) section is $2n = 14$. Four different chromosome types have been reported in this taxon. Besides, in some of the cells, some satellites, one or two, over the acrocentric chromosome have been observed as well [6]. The diploid chromosome number is the same in *H. anatolica* A.Duran in the present study. Another karyological similarity is the presence of chromosome with two satellites.

In the karyological study on *Hesperis* species made by Duran et al. on taxon *H. bicuspidata* (Willd.) Poir., the chromosome number is shown to be $2n = 14$ or 28 [6]. In *H. bicuspidata* taxon the somatic chromosome number is reported to be $2n = 2x = 14$. The present study shows similarities in the diploid chromosome numbers; however, *H. bicuspidata* has $4x = 28$ tetraploid members. There was not any polyploidy observed in any of the taxa analyzed in this study.

In the cytological study conducted on *H. matronalis* L. subsp. *matronalis* the diploid chromosome number is reported as $2n = 14$ and $2n = 28$ [6]. The findings of this study are compatible with the findings of Duran et al's. As mentioned above, no polyploidy was seen.

The chromosome number of *H. matronalis* L. subsp. *adzharica* (Tzvelev) Cullen is observed to be $2n = 14$. In some cells at one of the acrocentric chromosomes, a small satellite is seen [6]. The chromosome number of *H. anatolica* species in the present study is $2n = 14$ as in *H. matronalis* subsp. *adzharica*. In one of the chromosome pairs, a pair of a metaphase chromosome with a satellite pair is observed in *H. anatolica*. At the same time, in *H. novakii* Dvořák and *H. bottae* Fourn. taxa, the somatic chromosome number is $2n = 14$; *H. podocarpa* Boiss. and *H. varolii* A. Duran taxa the somatic chromosome number is determined as $2n = 12$ [6].

The chromosome number of *Hesperis pendula* DC. subsp. *duralii* A.Duran is reported as $2n = 12$ [6].

In our study we analysed a subspecies of this taxon (subsp. *dirmilensis*) and no differences were seen in the chromosome number.

In conclusion, the chromosome number of five taxa in genus *Hesperis* was counted for the first time in our study.

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