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Research Article

A Karyological Study on *Johrenia Dichotoma* DC. (Apiaceae) by Image Analysing System

Johrenia Dichotoma DC. (Apiaceae) Üzerinde Görüntü Analiz Sistemi İle Karyolojik Bir Çalışma

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Abstract

In this study, Karyotype Analysis was defined in *Johrenia dichotoma* DC. This taxon contained diploid chromosome number of as 2n=22. The total haploid chromosome lengths 29.84 µm with average chromosome lengths from 2.25 to 3.47 µm. The karyotype formulae of this taxa consisted of eleven pairs of median chromosome. Also, the chromosome morphology of *J. dichotoma* was identified by calculating arm and centromeric index, the ratio length of its chromosome arms, and its ideogram was done. Chromosome morphology is new for science world. The research has made contribution to the cytotaxonomic revision of the genus *Johrenia* in Turkey.

Keywords: Karyotype, *Johrenia dichotoma*, Turkey

Özet

Bu çalışmada *Johrenia dichotoma* DC. taksonunun Karyotip Analizi belirlendi. Bu taksonun diploid kromozom sayısı 2n=22 dir. Toplam haploid kromozom uzunluğu 29.84 µm, ortalama kromozom boyları 2.25-3.47 µm'dir. Bu taksonun karyotip formülü on bir median kromozomdan oluşmuştur. Ayrıca *J. dichotoma*'nın kromozom morfolojisi kol oranları, sentromerik indeks hesaplanarak belirlendi ve idiyogramı yapıldı. Kromozom morfolojisi bilim dünyası için yenidir. Bu çalışma Türkiye' deki *Johrenia* cinsinin sitotaksonomik revizyonuna katkı yapmıştır.

Anahtar Sözcükler: Karyotip, *Johrenia dichotoma*, Türkiye

1. Introduction

In flowering plants Umbelliferae Juss. (Apiaceae Lindl.) is one of the best known families. The Apiaceae family is represented by approximately 450 genera and 3700 species worldwide (Pimenov and Leonov 1993, Duran et al. 2011). The family consists of 102 genera and 434 species in Turkey (Erik and Tarıkahya 2004, Doğan et al. 2010). Apiaceae (Umbelliferae) family is the 8. largest family with approximately 434 species and 33% of these are endemic in terms of genus in Turkey (Davis et al. 1988, Güner et al. 2000, Özhatay and Kültür 2006, Özhatay et al. 2009, Özhatay et al. 2011, Uruşak and Kızılarslan 2013). Its members include many commonly grown vegetables (e.g., carrot, parsnip, and celery/celeriac) and condiments (e.g., coriander, anise, caraway, chervil, cumin, parsley, and dill). They owe their distinctive flavor largely to diverse volatile compounds in the fruits and leaves (Downie et al. 2000, Doğan et al. 2010), which not only account for their culinary use but for their wide application in medicine (Downie et al. 2000). The family is of considerable economic importance for food, flavoring and ornamental plants. Umbelliferae also has some poisonous plants. Seeds of Umbelliferae are important because of their essential oils. (Perveen and Qaiser 2006).

Johrenia was described first by Candolle (1829) based on *J. dichotoma* DC. Later, *Dichoropetalum* Fenzl, based on *D. alpinum* Fenzl, was described (Fenzl 1842) but soon after sunk by its author into synonymy with *Johrenia* (Fenzl 1843, Doğan et al. 2010). According to the latest taxonomic analysis on some of the genera in Apiaceae family, the *Johrenia* genus are represented by six taxa respectively in Turkey. These taxon are as follows: *Johrenia selinoides*, *J. porteri*, *J. dichotoma* subsp. *dichotoma*, *J. dichotoma* subsp.

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sintenisii, *J. tortuosa*, *J. polyscias* (Pimenov et al. 2007, Doğan et al. 2010).

The reported chromosome numbers are 2n=22 in the genus *Johrenia* (Vasilyeva et al. 1981, Constantinidis et al. 1997, Pimenov et al. 1998, Shner 2004).

The purpose of this study is to provide a detailed karyology of chromosome of *Johrenia dichotoma.* The lack of karyological studies in Apiaceae are probably a result of the difficulties faced in attempting to germinate the seeds properly. In this study chromosome number and chromosome morphology of this taxon were determined.

2. Materials and Methods

2.1. Plant material

Johrenia dichotoma samples were collected from C5 square (İçel; Gülek throat, rocky areas, 823 m, 17.06.2009, 37 13 330 K 34 48 153 D, Bağcı 3983 and Dinç) during the field studies in Turkey.

Glaucous, glabrous perennials; rootstock thick, crowned by a fibrous collar. Basal leaves 1-2-pinnate, ultimate segments simple to pinnatisect. Upper stem leaves reduced to a swollen vaginate petiole. Umbels terminal, 3-20 rayed. Bracts absent. Bracteoles 3-5, linear to setaceous. All flowers hermaphrodite; sepals absent; petals yellow, equal. Fruit oblong or elliptic, dorsally compressed, smooth, glabrous; interior three ridges reduced to raised lines, exterior two embedded in or contiguous with the thick white usually spongy margin, vittae restricted to the ridges; commissures concave, plane or convex. Close to *Peucedanum* but distinguished by its non-winged mericarp and the absence of clearly differentiated vittae in the valleculae. (Figure 1), (Davis et al. 1972).

2.2. Chromosome analysis

For the karyological study of somatic chromosomes, root tips germinated in sterilized petri dishes. After germination, the fresh root tip meristems were pretreated

Figure 1. General appearance of *Johrenia dichotoma*, **A)** unripe fruit, **B)** semi-ripe fruit, **C)** general appearance.

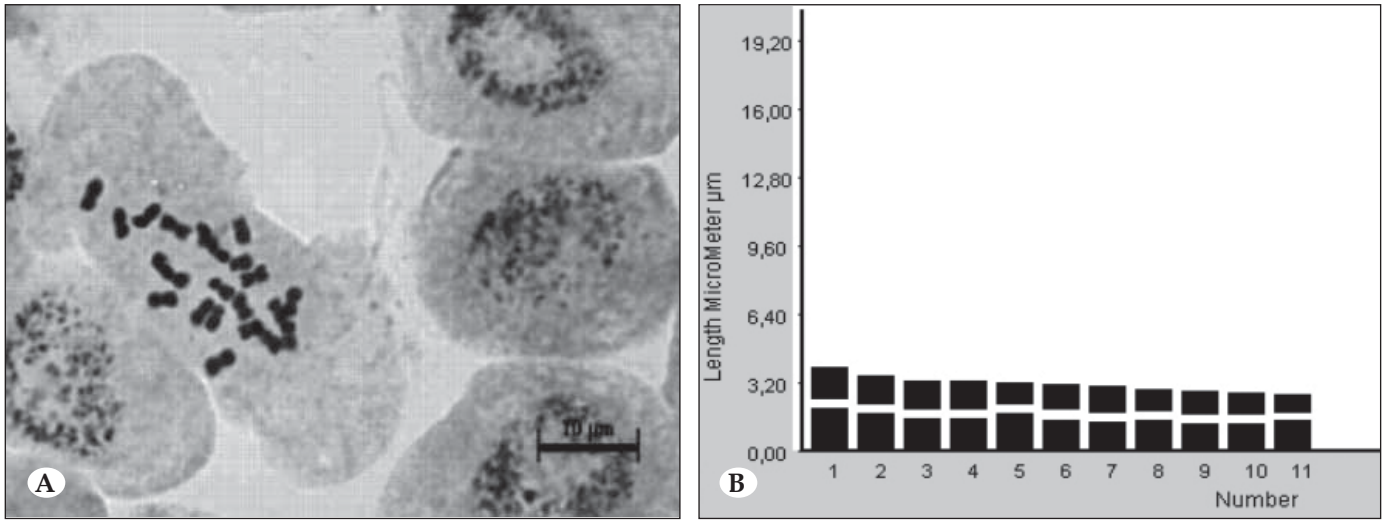

Figure 2. **A)** Somatic metaphase in *Johrenia dichotoma* (2n=22). Scale bar: 10 µm, **B)** Ideogram for *Johrenia dichotoma.*

in α-mono-bromonaphthalene at 4°C for 16 hours and washed with distilled water and fixed in Carnoys solution (3:1) absolute ethanol: glacial acetic acid, finally deposited in 70% ethanol at 4°C. The root tips were hydrolysed for 12 min in 1 N HCl at room temperature, washed and stained in 2% (w/v) 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. The photographs, enlarged 10x100, 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 planewere used. Chromosome measurements were made in at least five well-spread metaphases, bearing the same chromosome contraction. The ideogram was designed by using an Image Analysis System and karyotype characterizations were measured (Öztürk et al. 2009; Martin et al. 2012).

3. Results

Johrenia dichotoma was studied for their chromosome number and karyotype for the first time in our study. The chromosome number of *Johrenia dichotoma* was determined as 22=22 (Figure 2A). Ideogram of the studied taxon was prepared using Image Analysis System (Figure 2B). The chromosome length of *Johrenia dichotoma* ranges from 2.25 µm to 3.47 µm. The chromosome arm ratio ranges from 1.06 µm to 1.63 µm. Centromeric index varies between 2.87 and 4.99, and relative lengths vary from 7.55 to 11.61. Eleven chromosome pairs of *J. dichotoma* are median. Total haploid chromosome length is 29.84 µm and other morphological details were given (Table 1).

4. Discussion

The reported chromosome numbers are 2n=22 in the genus *Johrenia*. The somatic chromosome numbers of *J. aromatica* Rech. f., *J. dichotoma* DC., *J. distans* Halácsy, *J. paucijuga* Hoffm., *J. selinoides* Boiss. & Balansa and *J. tortuosa* Chamb. were counted as 2n=22 (Vasilyeva et al. 1981, Constantinidis et al. 1997, Pimenov et al. 1998, Shner 2004). The study, reported in the literature, the number of chromosomes is compatible with the type of *Johrenia*.

Umbelliferae some karyological studies conducted as follows; Bell and Constance (1960) made a cytological study, 100 taxa belonging to the family Umbelliferae reported that the number of somatic chromosomes. Out of these 77 families, 100 taxa mentioned for the first time in the world of science are expressed in number of chromosomes (Bell and Constance 1960). In a second study the researchers did the same in 1966, the Umbelliferae, 100 taxa belonging to these families were able to identify the number of somatic chromosomes. *Eryngium* 78 taxa in this study for the first time mentioned in chromosome number and polyploidy are watching lomatium stated categories of species (Bell and Constance 1966).

Some of the taxon belonging to the genus of the family Umbelliferae, *Seseli* observed in two different somatic chromosome number indicated (Doğan Güner 2006). These taxa and chromosome numbers; *S. terraces* 2n=20, *S. gummiferum* subsp. *gummiferum* 2n=22, *S. gummiferum* subsp. *corymbosum* 2n=20, *S. resinosum* 2n=20 and *S. peucedanoides* is 2n = 22. The results obtained show parallels with the literature.

Table 1. Measurements (µm) of somatic chromosomes in *Johrenia dichotoma*

Chromosome Pairs	Chromosome arms (µm)		Total Length (µm)	Arm Ratio (L/S)	Centromeric Index	Relative length	Chromosome types
	Long arm (L)	Small arm (S)					
1	1.98	1.49	3.47	1.33	4.99	11.61	m
2	1.73	1.33	3.06	1.30	4.46	10.27	m
3	1.55	1.33	2.89	1.16	4.47	9.68	m
4	1.51	1.34	2.85	1.13	4.49	9.55	m
5	1.73	1.06	2.79	1.63	3.55	9.36	m
6	1.48	1.23	2.71	1.20	4.11	9.06	m
7	1.38	1.30	2.68	1.06	4.36	8.99	m
8	1.47	1.07	2.54	1.37	3.59	8.51	m
9	1.25	1.09	2.34	1.15	3.64	7.85	m
10	1.25	1.01	2.26	1.24	3.38	7.57	m
11	1.40	0.86	2.25	1.63	2.87	7.55	m
Haploid chromosome length: 29.84 µm							

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