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## Karyotype of *Matthiola trojana* (Brassicaceae), a recently described endemic from Turkey

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**Abstract:** In this research, the chromosome number and morphology of *M. trojana* species are determined. Somatic chromosome number was counted as  $2n = 12$ . The karyotype of this species consisted of four metacentric chromosome pairs and two submetacentric chromosomes. Chromosome length varies between 2.44-4.27  $\mu\text{m}$ . The karyogram and idiogram were determined based on centromeric index and arranged in the decreasing size order.

**Key words:** Cruciferae, karyomorphology, *Matthiola*, Turkey

### INTRODUCTION

The genus of *Matthiola* R.Br. (Cruciferae) grows in Europe, Asia and Africa. The genus is represented approximately 50 species in the world and with ten species in Turkey (Heywood, 1993; Cullen, 1965; Dirmenci *et al.*, 2006).

*Matthiola trojana* grows on the rocky slopes and limestones of Kazdağı National Park that is located in the district of Edremit (Balıkesir province) Nanekırı vicinity. This species is endemic to Turkey. Kaz Dağı, the highest mountain in the Biga peninsula called in antique ages as Ida Dağı, separates the Aegean region from the Marmara region.

Different forest formations, deep canyons, rocky cliffs, subalpine areas contribute with their different ecological conditions to the diversity of the flora within the region.

Among the forest vegetation of the national park; *Pinus brutia*, *P. nigra*, *Abies nordmanniana* subsp. *equi-trojana* taxa form the different forest zones, respectively the sea level to the mountain-peak. There are microclimate zones caused by special ecological systems in the isolated areas within the surroundings of Kazdağı. Therefore, a lot of different local taxa are endemic to Kazdağı. Some of them are as follows; *Galium trojanum* Ehrend., *Digitalis trojana* Ivan, *Sideritis trojana* Bornm., *Armeria trojana* Bokhari and Quezel, *Hesperis theophrasti* Borbas subsp. *sintenisii* Dvorak, *Jasione idaea* Stoj., *Astragalus idae* Sirj., *Hieracium idae* (Zahn) Sell and West, *Abies nordmanniana* (Stev.) Spach subsp.

*equi-trojani* (Aschers. and Sint. ex Boiss.) Cood. and Cullen, *Achillea fraasii* Schultz Bip. var. *trojana* Aschers. and Heimerl, *Centaurea odyssei* Wagenitz, *Cirsium steriolepis* Petrax, *Asperula sintenisii* Achers ex Bornm, *Ferulago idaea* Özhatay et Akalın, *Ferulago trojana* E. Akalın and Pimenov., *Allium kurtzianum* (Aschers. and Sint. ex) Kollmann, *Thymus pulvinatus* Eelak, *Hypericum kazdaghensis* Gemici and Leblebici. Finally, *M. trojana* was introduced to the scientific world as a new taxon in 2006 from Kazdağı National Park.

The karyological research on the taxa of *Matthiola* showed genus the chromosome numbers to be  $2n = 10, 12$  and  $14$  (Dahlgren *et al.*, 1971; Polatschek, 1983; Soliman and Parker, 1986; Izuzquiza, 1989; Canzobre and Castroviejo, 1993; Tiniakou, 1996; Soliman, 2002; Sánchez *et al.*, 2004).

In this research, the chromosome number and morphology of the species has been studied for the first time.

### MATERIALS AND METHODS

The seeds of *M. trojana* were obtained from Kazdağı Mountain in Turkey in 2006 (Fig. 1). In this research, the specimen which belongs to the genus *M. trojana* was collected and identified by Dr. Dirmenci. Voucher specimen and its seeds are kept in Balıkesir University, Education Faculty Herbarium. Seeds were germinated on moist filter paper in Petri dishes in room temperature. The other procedures followed are as described by Martin *et al.* (2007).

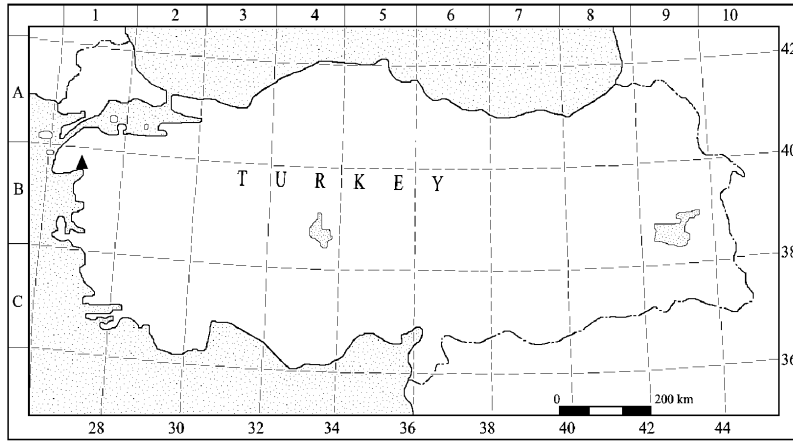


Fig. 1: *Matthiola trojana* distribution (▲) in Turkey

Table 1: Measurements ( $\mu\text{m}$ ) of somatic chromosomes in *Matthiola trojana* (m: metacentric; sm: submetacentric)

Chromosome pairs No.	Chromosome arms ( $\mu\text{m}$ )		Total length ( $\mu\text{m}$ )	Arm ratio (L/S)	Relative length (%)	Chromosome type
	Long arm (L)	Short arm (S)				
1	2.66	1.60	4.27	1.66	20.72	m
2	2.13	1.79	3.92	1.19	19.04	m
3	2.22	1.53	3.74	1.45	18.17	m
4	2.24	1.09	3.32	2.06	16.13	sm
5	1.96	0.95	2.91	2.07	14.11	sm
6	1.41	1.03	2.44	1.36	11.83	m

Total length of haploid complement: 20.59  $\mu\text{m}$

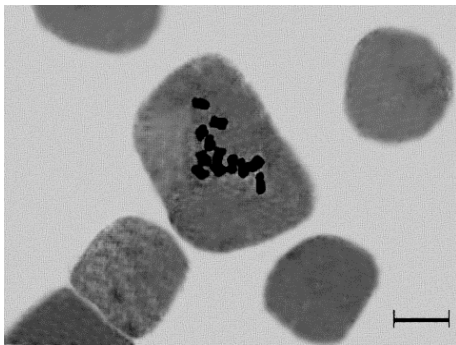


Fig. 2: Mitotic metaphase chromosomes of *Matthiola trojana*  $2n = 12$ . Scale Bar: 10  $\mu\text{m}$

## RESULTS

The somatic chromosome number of *Matthiola trojana* were determined to be  $2n = 12$  (Fig. 2). The basic chromosome number for this species is  $x = 6$ . The total chromosome length is between 2.44-4.27  $\mu\text{m}$ . Chromosomal classification was based on arm ratio and centromeric index as proposed by Levan *et al.* (1964).



Fig. 3: Karyogram of *Matthiola trojana*  $2n = 12$ . Scale Bar: 10  $\mu\text{m}$

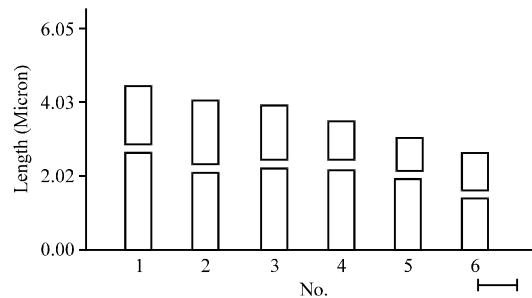


Fig. 4: Haploid idiogram of *Matthiola trojana*  $2n = 12$ . Scale Bar: 10  $\mu\text{m}$

Detailed karyomorphological features are given in Table 1. The total length of the haploid set is 20.59  $\mu\text{m}$ . As a classification result, the karyotype formula is  $4m + 2sm$ . The idiogram and karyogram are given in Fig. 3 and 4.

## DISCUSSION

The karyological research on taxa which belong to the genus of *Matthiola* showed that taxa chromosome numbers were  $2n = 10, 12$  and  $14$ . Chromosome number in *M. livida* (Del.) DC.  $2n = 10$ ; in *M. fruticulosa* (L.) Maire subsp. *fruticulosa*, *M. fruticulosa* subsp. *perennis* (Conti) Ball., *M. fruticulosa* subsp. *valesiaca* (L.) Maire,

*M. parviflora* (Schousb.) R. Br., *M. longipetala* (Vent.) DC. and *M. bolleana* Webb ex Christ.  $2n = 12$ ; in *M. incana* (L.) R. Br., *M. sinuata* (L.) R. Br., *M. tricuspidata* (L.) R. Br. and *M. arabica* Boiss.,  $2n = 14$ ; (Dahlgren *et al.*, 1971; Polatschek, 1983; Soliman and Parker, 1986; Izuzquiza, 1989; Canzobre and Castroviejo, 1993; Tiniakou, 1996; Soliman, 2002; Sánchez *et al.*, 2004). In present study, the diploid chromosome numbers of *M. trojana* shows similarity with other species in regard to the diploid chromosome numbers.

In the other karyological study on *M. odoratissima* (Pall.) R.Br. species of *Matthiola* genus the somatic chromosome number was reported as  $2n = 12$  (Martin *et al.*, 2007). In present study, the basic chromosome number is determined as  $x = 6$  and the karyotype formula of both species as  $4m + 2sm$ . In *M. odoratissima* the chromosome length ranges between 2.85-6.06  $\mu\text{m}$ , in *M. trojana* 2.44-4.27  $\mu\text{m}$ . The total haploid chromosome length of *M. odoratissima* is 25.10  $\mu\text{m}$ , of *M. trojana* 20.59  $\mu\text{m}$ . Present results are similar to those given in the literature.

Tiniakou (1996) reported *M. longipetala* to be in the family *Matthiola* genus and to have chromosome number  $2n = 14$  in his cytological study. This specie's basic chromosome number is  $x = 7$ . In present study the diploid chromosome number of *M. trojana* is  $2n = 12$  and different from the basic chromosome number of *M. longipetala* which is  $x = 6$ .

The diploid chromosome number of *Matthiola bolleana* Webb ex Christ. and *M. trojana* was reported as  $2n = 12$  (Ardévol-González *et al.*, 1993). In present study, the diploid chromosome numbers of *M. trojana* shows similarity with other species in regard to the diploid chromosome numbers.

Soliman (2002) reported the karyotypes of the genus *Matthiola*, *Eruca*, *Cakile* and *Eremobium* of the *Cruciferae* family, in his cytological study. In this study, diploid chromosome numbers of *Matthiola* is as follows; *M. arabica*  $2n = 14$ , *M. livida*  $2n = 10, 12$  and *M. longipetala*  $2n = 12$ . In present study, the diploid chromosome numbers of *M. trojana* shows similarity with other species in regard to the diploid chromosome numbers.

Soliman (2002) made a karyological study on three species belonging to genus *Matthiola* and determined the somatic chromosome number of *Matthiola arabica* species as  $2n = 14$  for. The karyotype formula of *Matthiola* is formed from 2M, 4nm, 4nsm (-), 2nsm (+) and 2nst (+) chromosome pairs. The somatic chromosome number of *M. livida* is  $2n = 10$  and its karyotype formula is declared as 2M, 4nm and 4nsm (-) and  $2n = 12$  had 2M, 4nm and 6nsm (-). The somatic chromosome number

of *M. longipetala* is  $2n = 12$  and its karyotype formula is 2M, 6nm, 2nsm (-) and 2nsm (4) (Soliman, 2002). In this research, somatic chromosome number of *M. trojana* is defined as  $2n = 12$  and its karyotype formula is  $4m + 2sm$ . This karyological results show similarities with *M. longipetala* species. When we compare the total chromosome length of *Matthiola* species, we can see some differences. For example, while the total chromosome length of *M. arabica* is 15.00  $\mu\text{m}$ , it is for *M. livida* 11.77  $\mu\text{m}$ , for *M. longipetala* 15.66  $\mu\text{m}$  and for *M. trojana* 20.59  $\mu\text{m}$ .

In this study, the chromosome number and karyomorphology of *Matthiola trojana* were determined for the first time. We hope that this study will contribute to the future karyological studies about the genus *Matthiola*.

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