

Full Length Research Paper

Cytotaxonomical studies on some *Crocus L.* taxa in Turkey

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The present study investigated the chromosome number and morphology of *Crocus fleischeri* Gay, *C. pallasii* Goldb subsp. *pallasii*, *C. cancellatus* Herbert subsp. *lycius* Mathew, *C. pulchellus* Herbert which are all belong to the *Crocus L.* taxa showing distribution in Western Anatolia in Turkey. Powder preparation was used as study method. Chromosome numbers and morphologies of the taxa were determined by examining the mitosis preparations. Furthermore, karyograms of taxa studied were made and examined in a detailed manner. In this study, it was found that the chromosome numbers of *C. fleischeri*, *C. pallasii* subsp. *pallasii*, *C. cancellatus* subsp. *lycius* and *C. pulchellus* were $2n = 20$, $2n = 14$, $2n = 16$ and $2n = 12$, respectively.

Key words: Chromosome number, chromosome morphology, *Crocus* taxa, Turkey.

INTRODUCTION

Crocus species (about 85 species) show distribution only in northern hemisphere. Most *Crocus* species are found in Mediterranean basin. Most of the taxa defined are in Balkans and Turkey (Mathew, 1984). Of the *Crocus*, 73 taxa show distribution in Turkey (Mathew, 1982, 1984, 2000, 2002; Kerndorff and Pasche, 2004a, 2004b, 2006; Yüzbaşıoğlu and Varol, 2004). Some cytological studies on this species were done by Pathak (1940), Karasawa (1932, 1956), Darlington and Wylie (1955), Bolkhovskikh et al. (1969), Brighton et al. (1973) and Brighton (1977).

Chromosome number within the genus shows great variation ($2n = 6, 8, 10, 11, 12, 14, 16, 18, 20, 22, 23, 24, 26, 27, 28, 30, 32, 34, 44, 48$ and 64) and at occasion, B chromosomes of which numbers ranges between 0 and 11 are encountered (Brighton et al., 1973). Furthermore, infra-specific variation is seen in some species and some groups have significant and steadily increasing taxonomic characteristics.

In this study, chromosome number and morphology of *C. fleischeri* ($2n = 20$), *C. pallasii* subsp. *pallasii* ($2n = 14$), *C. cancellatus* subsp. *lycius* ($2n = 16$) and *C. pulchellus* ($2n = 12$) were found out clearly. This work has

been done to distinguish species based on using knowledge of chromosome of species and in addition using morphological properties.

MATERIALS AND METHODS

Information on the localities from which the plants have sampled for the study materials is as follows:

- C. fleischeri*: Manisa, Kırkağaç, N 39°08' EO 27°39', 240 m, 31.01.2005.
- C. pallasii* subsp. *pallasii*: İzmir, Bergama, Yukarıbey village, N 39°13' EO 27°08', 472 m, 27.11.2004.
- C. cancellatus* subsp. *lycius*: Muğla, Fethiye, İnce village, N 36°44' EO 29°00', 30 m, 28.11.2004.
- C. pulchellus*: Çanakkale, Çan, Etili village, N 39°58' EO 26°53', 120 m, 21.11.2004.

For identification of the plants, the book "Flora of Turkey" was used (Mathew, 1984).

Root tips of the plants were used for observing the mitotic chromosomes under microscope. Pretreatment was applied for 3 h in 8 - hydroxyquinoline solution and root tips were placed into carnoy solution containing alcohol and glacial acetic acid with a rate of 3:1. Materials stored at +4°C were stained with acetoorcein. Preparations that were prepared with squashed method were examined with Carl Zeiss Jena research microscope and photogram of the cells chosen were taken and chromosome number of these cells were counted and their karyotypes were prepared by measuring length indexes of the chromosomes.

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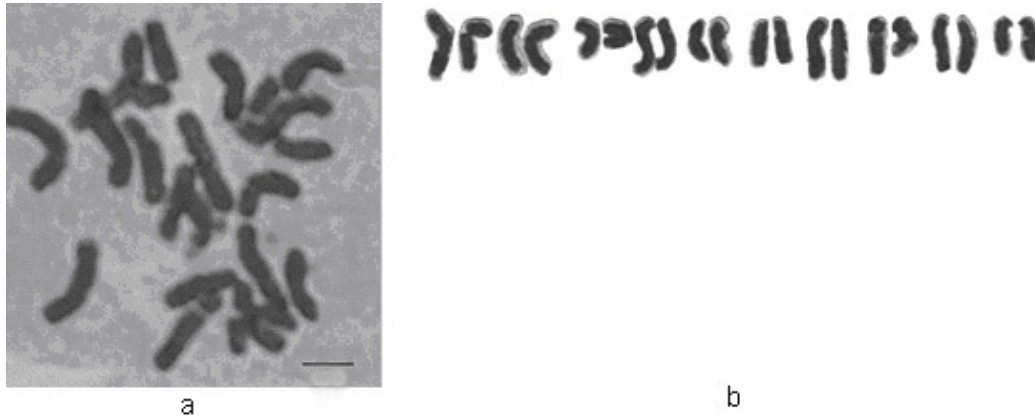


Figure 1. (a) Metaphase stage of mitosis division, $2n = 20$. (b) Karyogram of the species *C. fleischeri*. Bar: 10 μm .

RESULTS AND DISCUSSION

The chromosomes were observed to be large and low in number in the cytological studies on root tips of four species belonging to *Crocus* genus which was the subject of the current study. During the metaphase stage of mitosis division, chromosomes were counted, their karyograms, were prepared and chromosome morphologies were compared. Furthermore, chromosome behavior was also examined during division stages. The chromosomes were usually found to be submetacentric and chromosome distribution to be regular (Figures 1a, 2a, 3a, 4a). Karyogram photographs are shown as a consequence of karyologic analyses in Figures 1b, 2b, 3b, and 4b.

The following features were observed in the examinations on the taxa examined in this study.

- i. Number of chromosomes of the *C. fleischeri* was found to be $2n = 20$. This species which is endemic was previously reported to have chromosome number $2n = 20$ [Mathew, 1984]. Chromosome distribution is regular. All of the chromosomes are submetacentric except for 3 metacentric chromosomes (Figures 1a, b).
- ii. Number of chromosomes of the *C. pallasii* subsp. *pallasii* was found to be $2n = 14$. It was found that most chromosomes were submetacentric and 1 pair of chromosomes was metacentric (the 7th pair). Chromosome distribution was regular (Figures 2a, b).
- iii. Number of chromosomes of the *C. cancellatus* subsp. *lycius* was found to be $2n = 16$. All chromosomes were observed to be submetacentric. Additionally, chromosome distribution was observed to be regular (Figures 3a, b).
- iv. Number of chromosomes of the *C. pulchellus* was found to be $2n = 12$. All chromosomes were found to be submetacentric (Figures 4a, b).

The fact that *Crocus* species which have a wide geographic distribution around the world exhibits wide morpho-

logical variations because of cytological heterogeneity, they have been known for a long time. It is natural to experience problems at occasion in taxonomic distribution of the taxa because of diverse morphological variations in the genus with chromosome spectrum beginning from 6 and reaching to high polyploidy values (that is, $2n = 64$). Despite all these variations, in Flora of Turkey (Mathew, 1982, 1984, 2000) such as cytological, chemotaxonomic and other features (palinological and micromorphological) wasn't mentioned at all. When the taxa examined in the current study were reviewed, chromosome numbers were found to be as follows: *C. fleischeri* $2n = 20$; *C. pallasii* subsp. *pallasii* $2n = 14$; *C. cancellatus* subsp. *lycius*, $2n = 16$ and *C. pulchellus*, $2n = 12$.

One can say that polyploidy was not observed because the taxa examined in the present study were usually of low chromosome number. It was studied in the studies of Brighton (1977) that they found that the basic chromosome number for gender (n) begins from 6, 8 and 10. Our samples were seen to have lowest number of chromosome at the lowest level of these Figures.

As known well, the chromosomes are metacentric is unique to karyograms of elements of the former floras. When karyograms of the species were examined, species of *C. fleischeri* has 7 pair of submetacentric chromosomes ($2n = 20$), taxon of *C. pallasii* subsp. *pallasii* has 6 pair of submetacentric chromosomes ($2n = 14$), and all chromosomes of *C. cancellatus* subsp. *lycius* and *C. pulchellus* are submetacentric (respectively, $2n = 16$ and $2n = 12$). For this reason, it was considered the idea that they could be new flora elements.

As known, adaptation of the species to the environmental conditions is good when B chromosomes are less whereas sterility increases despite good environmental adaptation when B chromosomes number increased. The fact that there are several studies reporting B chromosome in the samples collected from Aegean Islands suggests that this chromosome represents an accom-

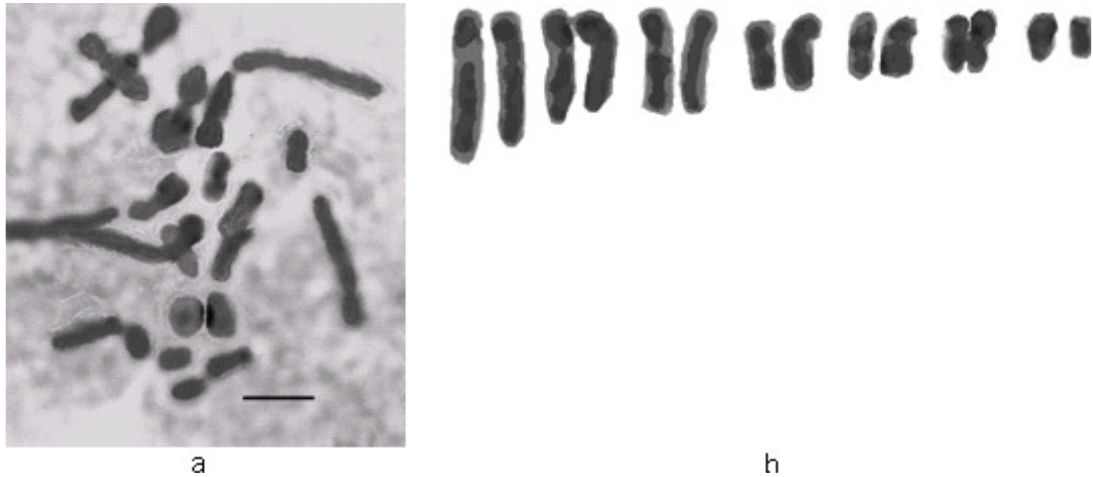


Figure 2. (a) Metaphase stage of mitosis division, $2n = 14$. (b) Karyogram of the subspecies *C. pallasii* subsp. *pallasii*. Bar: 10 μm .

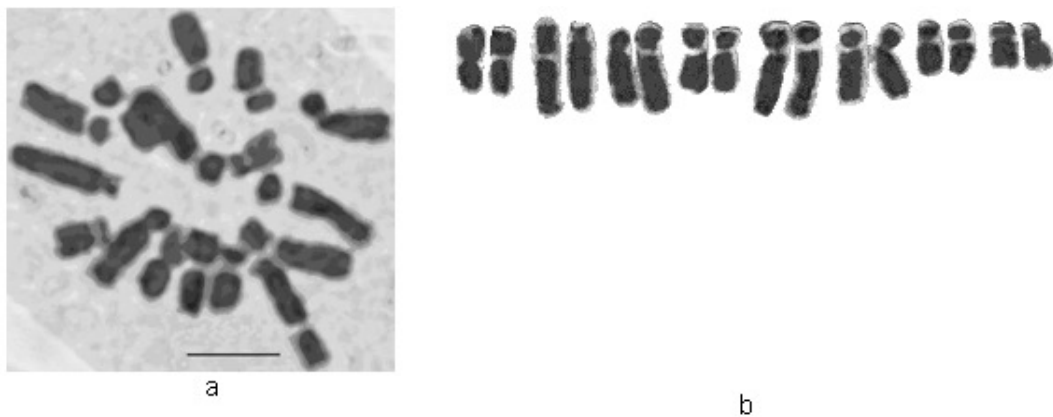


Figure 3. (a) Metaphase stage of mitosis division, $2n = 16$. (b) Karyogram of the subspecies *C. cancellatus* subsp. *lycius*. Bar: 10 μm .

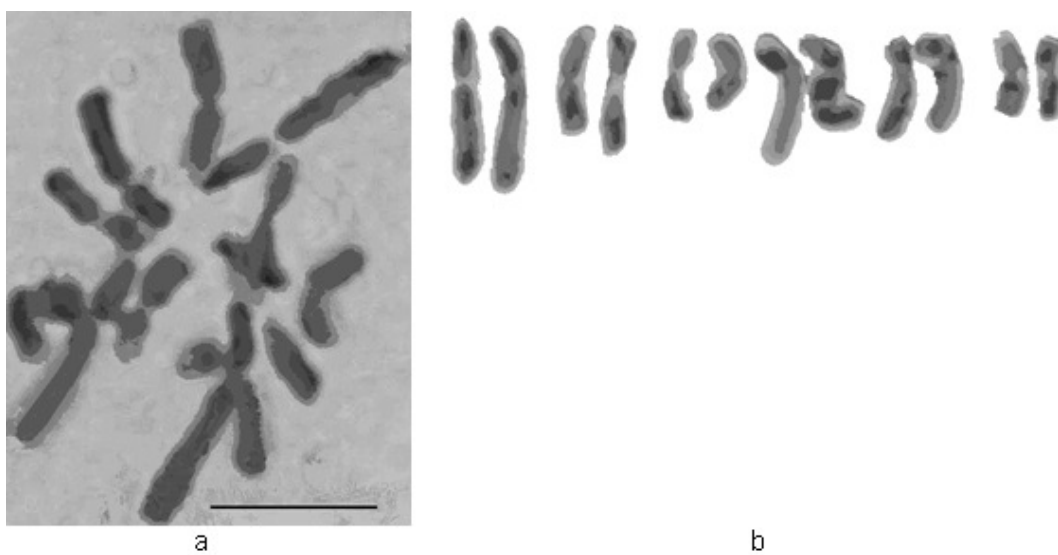


Figure 4. (a) Metaphase stage of mitosis division, $2n = 12$. (b) Karyogram of the species *C. pulchellus*. Bar: 10 μm .

modative process to the extreme environmental conditions in these Islands. It was interesting that no B chromosome was observed in the species examined in the current study.

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