

CHROMOSOME NUMBER AND KARYOTYPE ANALYSIS OF *KALIDIOPSIS WAGENITZII* AELLEN

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Abstract

The endemic halophyte plant *Kalidiopsis wagenitzii* Aellen is the only species of *Kalidiopsis* genus of Turkey. The diploid chromosome number of *K. wagenitzii* was determined as $2n=18$. Mitotic chromosomes from root tips of *K. wagenitzii* were analyzed cytologically. Nine pairs of chromosomes were numbered from 1 to 9 on the basis of their descending order of length. The average length of metaphase chromosomes was $3.202 \mu\text{m}$, varying from $2.653 \mu\text{m}$ to $3.866 \mu\text{m}$. Total chromosome length was $31.786 \mu\text{m}$. There were no satellite chromosomes. The arm ratio ranged from 0.609 to $0.825\mu\text{m}$. Eight of nine chromosome pairs had median chromosomes while only one (the third) had submedian chromosome.

Introduction

The monotypic endemic genus *Kalidiopsis* Aellen of the family Chenopodiaceae is represented with only one species in Turkey. *Kalidiopsis wagenitzii* Aellen is an endemic halophyte plant of Turkey prov. Nigde, south west of Tuz Gölü (Davis, 1967). Forty years ago it was collected from south of Tuz Gölü for the first time. There is no report about chromosome number and karyotype of this species, which would have considerable value for future cytological and cytogenetical studies in this species.

The existence of previous chromosome counts for the studied species of *Chenopodiaceae* family has been checked in the indexes of plant chromosome numbers by Federov (1974), Goldblatt & Johnson (2000), Lange *et al.*, (1997), Sankary (1986), Wolff & Jefferies (1987). While the karyotype concept has been extensively used in characterizing and distinguishing chromosomes of various organisms, the aim of this study was to determine chromosome numbers and to contribute to the karyological characteristic of the species *Kalidiopsis wagenitzii* Aellen.

Materials and Methods

The seeds of the material were collected from south west of Tuzgölü by Haşim Altınözlü in 2000. The seeds were germinated on wet filter paper at room temperature ($18-20^{\circ}\text{C}$). The study was performed on primary root tip meristems. Roots in other words radicle were excised when 1.5-2 mm long. retreatment was made by α -monobromonaphthalene 16 hours at 4°C , fixed in Glacial Acetic Acid (GAA) for half an hour and refrigerated in 70° ethanol. Hydrolization was carried out with 1 N HCl (hydrochloric acid) for 11 minutes at 60°C and then the root tips were stained in Schiff's reagent. Permanent preparations were made in Canada balsam. Important metaphase plates were photographed.

The detection of the homologous chromosomes and the determination of their position in the karyograms were carried out following the method of Levan *et al.*, (1964).

The measurements were obtained from 10 metaphase plates. Relative length in proportion to total genome length, arm ratio (short arm length/long arm length) with their respective standard errors and centromeric index (length of the short arm/total length of the chromosome X 100) were calculated for each chromosome (Arano & Sattio, 1980). Karyotype was constructed from photograph of a well spread chromosome preparation.

Chromosomes were observed under Prior microscope on Ilford Pan film 50 ASA.

Results and Discussion

Chromosome numbers were obtained from somatic mitosis of root tips of the radicle. The diploid chromosome number of *Kalidiopsis wagenitzii* was found to be $2n=18$ (Fig. 1). Nine pairs of homologues were identified from the morphology of the chromosomes (Fig. 2).



Fig. 1a. Somatic metaphase chromosomes of *Kalidiopsis wagenitzii*



Fig. 2. Karyogram of *K. wagenitzii*.

The basic morphometric data on *Kalidiopsis wagenitzii* chromosomes are presented in Table 1. The relative values of the average of each chromosome are included to facilitate the comparison of chromosome among cells. None of the chromosomes displayed satellite. An idiogram of haploid chromosomes exhibiting the average morphological features and similarities in size of chromosomes shown in Fig. 3.

Table 1. Basic morphometric data on chromosomes of *K. wagenitzii*.

| Chromosome Pairs | Long arm length | Short arm length | Total length | Relative length | Arm ratio S/L | Centromeric index | d=L-S | Centromere position ^a |
|------------------|---------------------------|------------------|--------------|-----------------|---------------|-------------------|-------|----------------------------------|
| I | 2,323 ± 0,25 ^b | 1,543 ± 0,21 | 3,866 ± 0,15 | 6,732 | 0,675 ± 0,14 | 39,91 | 2,017 | m |
| II | 2,030 ± 0,18 | 1,460 ± 0,23 | 3,490 ± 0,06 | 6,105 | 0,729 ± 0,14 | 41,83 | 1,502 | m |
| III | 2,223 ± 0,12 | 1,245 ± 0,13 | 3,468 ± 0,07 | 5,767 | 0,609 ± 0,10 | 34,73 | 2,728 | sm |
| IV | 1,773 ± 0,10 | 1,536 ± 0,14 | 3,309 ± 0,07 | 5,710 | 0,871 ± 0,12 | 37,68 | 2,668 | m |
| V | 1,885 ± 0,10 | 1,378 ± 0,11 | 3,263 ± 0,07 | 5,678 | 0,735 ± 0,09 | 42,23 | 0,917 | m |
| VI | 1,821 ± 0,07 | 1,303 ± 0,14 | 3,124 ± 0,11 | 5,365 | 0,717 ± 0,06 | 40,59 | 1,553 | m |
| VIII | 1,673 ± 0,12 | 1,196 ± 0,15 | 2,869 ± 0,05 | 4,987 | 0,825 ± 0,15 | 41,69 | 0,907 | m |
| VII | 1,536 ± 0,13 | 1,253 ± 0,14 | 2,789 ± 0,07 | 5,019 | 0,722 ± 0,14 | 44,93 | 1,660 | m |
| IX | 1,465 ± 0,65 | 1,188 ± 0,10 | 2,653 ± 0,09 | 4,625 | 0,803 ± 0,08 | 44,78 | 1,659 | m |

^a m= median ; sm= sub-median^b Mean and standard deviation

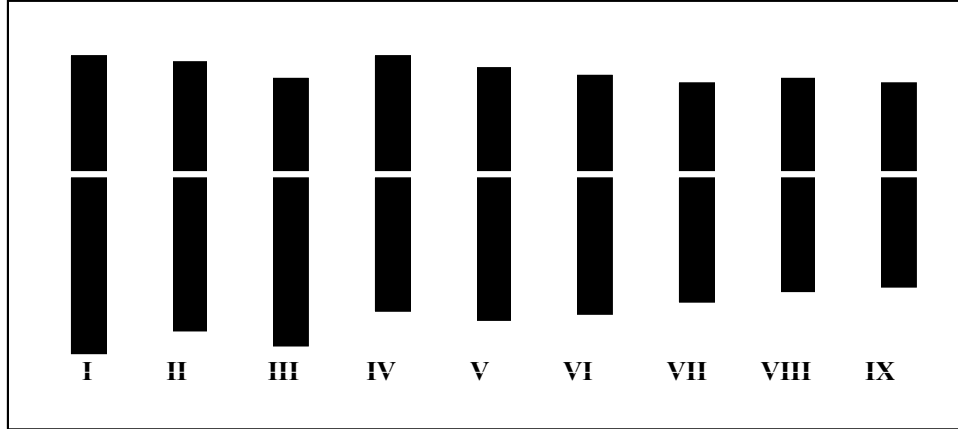


Fig. 3. Idiogram of *K. wagenitzii*.

Total chromosome length was 31.786 μm . The average length of chromosomes was 3.202 μm , ranging from 2.653 μm (the shortest) to 3.866 μm (the longest). The ratio of the longest to the shortest chromosome in the complement was 1.45:1, with 1.213 μm difference between the longest and the shortest chromosomes. The difference in total length and arm ratios of the longest and the shortest chromosome was rather small (Table 1). This suggested that *K. wagenitzii* possesses nearly symmetrical karyotype. Only one chromosome pair, the third chromosome could be considered as sub median (sm), where as the other eight chromosome pair median (m).

Chromosome number and karyotype analysis of *Kalidiopsis wagenitzii* Aellen is reported for the first time. The basic chromosome number of *Chenopodiaceae* family is $x=9$ (Runemark, 1996, Federov, 1974, Lange *et al.*, 1997, Sankary, 1986, Wolff & Jefferies 1987, Subramanian, 1988, Snogerup, 1995, Goldblatt & Johnson, 2000.). Most species of the *Chenopodiaceae* have $2n=18$ chromosome number, while $2n=36$, $2n=54$ and $2n=72$ also be present. Our results confirm the presence of $2n=18$ chromosome number like the most other species of *Chenopodiaceae* family.

It is not possible to compare *K. wagenitzii* with the other species of the genus while *Kalidiopsis Aellen* is monotypic endemic genus and represents with only this endemic species in Turkey. So we compared *K. wagenitzii* with the other genus and species. Subramanian (1988) reported that three *Chenopodiaceae* species have $2n=18$ chromosomes. Total chromosome length of *Suaeda maritime*, *Suaeda monoica*, and *Arthrocnemum fruticosum* were 25, 22 and 60.4 μm respectively. *S. maritime* have 2 medium sized (2.0 μm -2.9 μm) chromosomes and the rest are short (1.0 μm -1.9 μm) and *S. monoica* have all short chromosomes (1.0 μm -1.9 μm). Chromosome length of *A. fruticosum* varies from 2.0 μm to 5 μm so this species have long and longer chromosomes. In our study total chromosome length of *K. wagenitzii* was 31.786 μm and chromosome length varies from 2,653 μm to 3,866 μm . According to the length and total length of chromosomes, *K. wagenitzii* is more close to *S. maritime* and *S. monoica*, than *Arthrocnemum fruticosum*.

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