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# KARYOTYPIC VARIATION IN TWO SPECIES OF THE GENUS CERCIS IN IRAN

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*Cercis* L. belongs to *Caesalpinaceae* family. Two species of the genus grow in Iran. Four populations of two *Cercis* species namely *C. siliquastrum* (one population) and *C. griffithii* (three populations) were selected based on their morphological characteristics to investigate their karyotypes. The results confirm no differences among the different species for the number of chromosomal stocks (x=7). All species were diploid with 2n=2x=14.

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**Key words:** *Cercis*; *Caesalpinaceae*; Chromosome numbers; karyology; Iran

**تنوع کاریوتیپی در گونه های جنس ارغوان در ایران**

**سارا صادقیان:** کارشناس پژوهشی مرکز تحقیقات و آموزش کشاورزی و منابع طبیعی فارس، سازمان تحقیقات، آموزش و ترویج کشاورزی
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گیاه ارغوان (Cercis) متعلق به خانواده Caesalpinaceae است. دو گونه از این جنس به نامهای C. siliquastrum, C. griffithii در ایران حضور دارند. در این پژوهش ۴ جمعیت از گونه‌های C. siliquastrum (۱ جمعیت) و C. griffithii (۳ جمعیت) مورد مطالعه سیتوژنتیکی قرار گرفت و پارامترهای کروموزومی در هر جمعیت بررسی شد. کلیه جمعیت‌ها با عدد پایه کروموزومی n=۷ دیپلوئید و دارای فرمول کاریوتایپی ۲n =۲x=۱۴ بودند.

## INTRODUCTION

*Cercis* species are ornamental plants widely cultivated in the world. The genus includes about 10 species which are distributed in Mediterranean region, Atlantic, N-America to Mexico and Asia (Rechinger 1986). In flora of Iran, it is represented with two species. It contains small deciduous trees or large shrubs commonly known as Redbuds. The bright white to reddish pink flower of different plant cultivars is especially attractive to gardeners and garden lovers in early spring. This genus is distinctive in showing the cauliflory, the flowers appear directly on the stem or trunk before the growth of leaves. They are characterized by simple, rounded to heart-shaped leaves (Fatih 2009). The chromosom numbers for the *Cercis* species growing in Iran have not been reported yet. So in this study we investigate the karyotypes of *C. griffithii* and *C. siliquastrum* from Iran.

## MATERIALS AND METHODS

Four populations of two *Cercis* species: *C. griffithii*, with three populations and *C. siliquastrum* with one population were selected. The studied populations are listed in table 1. Vouchers deposited in the Herbarium of Fars Agricultural and Natural Resources Research and Education Centre. The mature seeds of the two taxa were taken from the herbarium materials.

Table 1. Karyotypic characters of different *Cercis* taxa and populations. 2n: Diploid chromosome numbers $A_1$: intrachromosome asymmetry index, $A_2$: interchromosome asymmetry index, TF%: total form percentage, DRL: difference of relative length, VRC: value of relative chromatin, symmetry classes (SC) of Stebbins and karyotype formula (K.F.).

| Taxon (population) | Locality | 2n | $A_1$ | $A_2$ | %TF | DRL | VRC | SC | K.F. |
|---|---|---|---|---|---|---|---|---|---|
| *C. griffithii* Boiss. (1) | Iran, Fars, Abadeh,Khoun khoreh | 14 | 0.500 | 0.137 | 32.890 | 5.933 | 2.135 | 3A | 7 sm |
| *C. griffithii* (2) | Iran, Fars, Shiraz | 14 | 0.492 | 0.155 | 33.206 | 6.255 | 2.694 | 2A | 1m+6sm |
| *C. griffithii* (3) | Iran, Fars, Sarvestan | 14 | 0.550 | 0.132 | 30.543 | 5.559 | 2.411 | 3A | 7sm |
| *C. siliquastrum* L. | Iran, Ilam | 14 | 0.531 | 0.160 | 31.219 | 6.636 | 3.196 | 3A | 1m+6sm |

For cytological study, rootlets were collected from germinated seeds on wet filter paper in petri dishes at 22°C temperature, when they reached 1–1.5 cm in length, rootlets were collected. The root tips meristems treated with 0.5% saturated α-Bromo naphthalene at 4°C for 4-5 h, fixed in 10% formaldehyde and chromium trioxide (1:1) for 16 to 20 h at 4°C. Then the root tips were rinsed for 3 h in distilled water. Hydrolysis was carried out with NaOH (1 Normal) at 60ºC for 25-30 min and used hematoxylin-iron for chromosome staining for 1-2 h at room temperature. Root tips were squashed in a droplet of 45% acetic acid and lactic acid (10:1). The preparations were observed with an optical microscope (BH2 Olympus supplemented Digital color video camera) at a magnification of 2000x.

## RESULTS

There was no difference between basic chromosome number of the species (x=7). The somatic chromosome numbers (2n), karyotype formulae and parameters for the studied species are summarized in table 2. All species were diploid with 2n=2x=14. The chromosomes were mostly sub-metacentric (sm) in all populations (table 1). It means that there is karyotypic asymmetry among them. According to the Stebbin's bilateral table, populations of *C. griffithii* (Pop. 3) included the highest value regarding the intra-chromosomal asymmetry index (0.55 µm) and was classified as group 3A and population of *C. griffithii* (Pop. 2) included the lowest value regarding the intra chromosomal asymmetry index (0.49 µm) and was classified as group 2A. The mean value of chromosome's long arm varied from 2.19 µm in *C. siliquestrum* to 1.43 µm in *C. griffithii* (Pop. 1). Averages of chromosome's short arm were different from 0.99 µm in *C. siliquestrum* to 0.70 µm in *C. griffithii* (Pop. 1). The total length of the chromosome varied from 3.19 µm in *C. siliquestrum* to 2.13 µm in *C. griffithii* (Pop. 1) and the mean value of chromosome's arm ratio was in range from 2.28 in *C. griffithii* (Pop. 3) to 2.03 in *C. griffithii* (Pop. 2) (table 2). Symmetry type of Stebbins (1971) and asymmetry indices of Romero-Zarco (1986) are given in (table 1).

The results showed that the highest VRC amongst all populations was obtained for *C. siliquestrum* and the lowest was obtained for *C. griffithii* (Pop. 1). Based on intra-chromosomal asymmetry, some populations had the most asymmetrical karyotype. According to inter-chromosomal asymmetry, *C. siliquestrum* had the most asymmetrical karyotype in all populations.

Table 2. Mean of chromosomes analysis of *Cercis* populations. TL: total length of chromosome, LA: long arm, SA: short arm, AR: arm ratio, CI: centromeric index, DRL: difference of relative length, TF%: total form percentage, $A_1$: intra-chromosome asymmetry index, $A_2$: inter-chromosome asymmetry index.

| Populations | TL | LA | SA | AR | CI | A1 | A2 | DRL | %TF |
|---|---|---|---|---|---|---|---|---|---|
| *C. griffithii* (1) | 2.135 c | 1.433 c | 0.702 c | 2.044 a | 0.329 a | 0.500a | 0.137a | 5.933 a | 32.890 a |
| *C. griffithii* (2) | 2.694 b | 1.798 b | 0.897 ab | 2.031 a | 0.332 a | 0.492a | 0.155a | 6.255 a | 33.206 a |
| *C. griffithii* (3) | 2.411 bc | 1.675 bc | 0.736 bc | 2.282 a | 0.305 a | 0.550a | 0.132a | 5.559 a | 30.543 a |
| *C. siliquastrum* | 3.196 a | 2.199 a | 0.997 a | 2.209 a | 0.312 a | 0.531a | 0.160a | 6.636 a | 31.219 a |

Difference in the relative length percentage (DRL) of the highest and the smallest chromosomes varied from 6.58 µm in *C. siliquestrum* to 5.55 µm in *C. griffithii* (Pop. 3). According to table 1, *C. griffithii* (Pop. 3) was placed in 3A and had the highest values of intra-asymmetry chromosomal index. It had the lowest TF%. The TF% and $A_1$ values had inverse ratio (table 1). It presented different scheme of symmetry for the populations. The lower DRL showed more symmetric karyotypes (fig. 1, table 1).

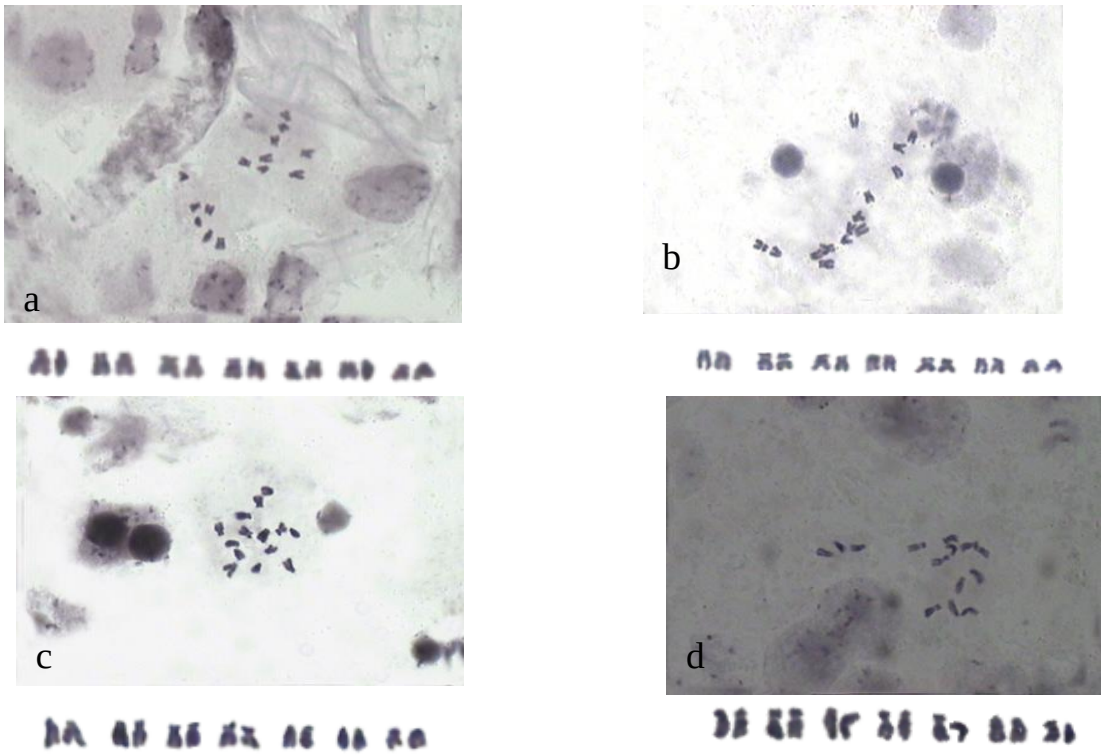


Fig. 1. Somatic metaphases in *C. griffithii* (a,b.c) and *C. siliquastrum* (d).

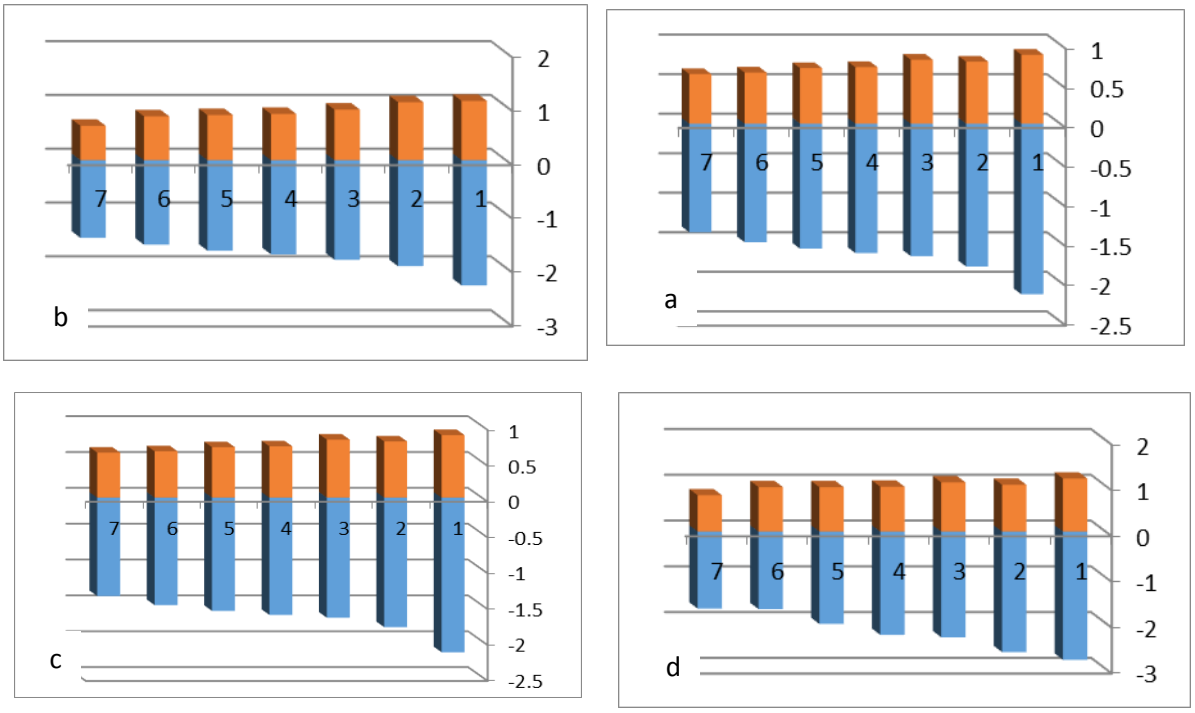


Fig 2. Idiograms of *C. griffithii* (a,b.c) and *C. siliquastrum* (d).

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