

## CHROMOSOME NUMBER REPORTS AND KARYOTYPE ANALYSIS OF SEVEN SPECIES FROM THE FLORA OF IRAN

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Seven plant species belonging to 5 genera of Apiaceae, Convolvulaceae, Fabaceae, Lamiaceae, and Solanaceae family were studied. The chromosome numbers for four taxa including *Pimpinella aurea*  $2n=20$ , *Convolvulus leiocalycinus*  $2n=24$ , *Astragalus jesdianus*  $2n=16$ , and *Salvia mirzayanii*  $2n=20$  are reported for the first time and the chromosome number of *Conium maculatum*  $2n=22$ , *Ziziphora tenuior*  $2n=18$  and *Datura innoxia*  $2n=24$  are reported in the flora of Iran for the first time. Karyotypic analysis of all species are presented.

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**Keywords:** Chromosome number; ideogram; karyotype; Iran

گزارش عدد کروموزومی و بررسی کاربوتایی هفت گونه از فلور ایران

سارا صادقیان: کارشناس پژوهشی بخش تحقیقات منابع طبیعی، مرکز تحقیقات و آموزش کشاورزی و منابع طبیعی استان فارس، سازمان تحقیقات، آموزش و ترویج کشاورزی، شیراز، ایران  
احمد حاتمی: کارشناس ارشد پژوهشی بخش تحقیقات منابع طبیعی، مرکز تحقیقات و آموزش کشاورزی و منابع طبیعی استان فارس، سازمان تحقیقات، آموزش و ترویج کشاورزی، شیراز، ایران  
عدد کروموزومی هفت گونه متعلق به پنج خانواده Apiaceae، Convolvulaceae، Fabaceae، Lamiaceae و Solanaceae بررسی گردید. شمارش کروموزومی برای ۴ گونه، *Pimpinella aurea* ( $2n=20$ )، *Convolvulus leiocalycinus* ( $2n=24$ )، *Astragalus jesdianus* ( $2n=16$ ) و *Salvia mirzayanii* ( $2n=20$ ) برای اولین بار گزارش می‌گردد. عدد کروموزومی گونه‌های *Conium maculatum* ( $2n=22$ )، *Ziziphora tenuior* ( $2n=18$ ) و *Datura innoxia* ( $2n=24$ ) نیز برای اولین بار برای فلور ایران گزارش می‌شود. تحلیل کاربوتایی تمام گونه‌ها بررسی و ایدیوگرام آنها رسم گردید.

### INTRODUCTION

Information about species and groups is important for taxonomic and evolutionary studies and chromosome numbers are the simplest karyotype parameters which provide valuable data in cytotaxonomical studies (Guerra 2008). Chromosomal data such as number, morphology, staining characteristics, and behavior profoundly affect the evaluation of taxonomic investigations (Stace 2000).

Chromosome number and karyotype of seven species from the flora of Iran, mostly endemics, are investigated. According to the IPCN (Index to Plant Chromosome Numbers, www.tropicos.org/Project/IPCN), chromosome numbers have been previously reported for *Conium maculatum*  $2n=22$ ; *Ziziphora tenuior* from Turkey,  $2n=2x=18$  (Selvi & al. 2015). Husaini & Iwo (1990) investigated the chromosome number of seven weedy species in three genera of

Solanaceae from Jos Plateau, Northern Nigeria, and reported the gametic chromosomes of *Datura innoxia* as  $n=12$ . Also, Badr & al. (1997) investigated karyotype analysis of *Datura innoxia* and reported the chromosome number  $2n=24$ .

In this study, we report the chromosome numbers of four species for the first time and chromosome numbers for three species are reported for the first time for the flora of Iran.

## MATERIALS AND METHODS

For the cytological study, rootlets were collected from germinated seeds on wet filter paper in Petri dishes at 22°C, rootlets were separated when they reached 1–1.5 cm in length. The root tips meristems were treated with 0.5% saturated  $\alpha$ -Bromo naphthalene at 4°C for 3–4 h. Then they were fixed in 10% formaldehyde and chromium trioxide (1:1) for 16

to 24 h at 4°C. Then the root tips were rinsed for 1 h in distilled water. Hydrolysis was carried out with NaOH (1 Normal) at 60°C for 20–35 minutes and hematoxylin-iron was used for chromosome staining for 1 h at room temperature. Root tips were squashed in a droplet of 45% acetic acid. The best metaphase plates were selected and measured by Micromesure 3.3 software (Reeves & al. 2000). In each mitotic metaphase, the arm's length of each chromosome was measured. The chromosome morphology was studied based on Levan & al. (1964). Stebbins's karyotype asymmetry levels were used to define asymmetry levels (1971). Ideograms were depicted for each species. Details regarding the studied materials are presented in Table 1. Vouchers are deposited in the Herbarium of Fars Agricultural and Natural Resources Research and Education Centre.

Table 1. Karyotype characters of the seven studied species. Abbreviations: TL: total length of the chromosome, LA: long arm, SA: short arm, AR: arm ratio, DRL: difference of relative length, CI: centromeric index, A<sub>1</sub>: intrachromosomal asymmetry index, A<sub>2</sub>: interchromosomal asymmetry index, VRC: the value of relative chromatin, TF%: total form percentage, SC: symmetry classes of Stebbins and K.F.: karyotype formula.

species	Chr. No.	TL	LA	SA	AR	DRL	CI	A1	A2	VRC	%TF	SC	K.F.
<i>Conium maculatum</i>	$2n=2x=22$	2.94	1.71	1.23	1.41	4.65	0.42	0.26	0.16	2.94	41.72	1A	9m+2sm
<i>Pimpinella aurea</i>	$2n=2x=20$	4.06	2.85	1.21	2.59	4.71	0.29	0.57	0.14	4.06	29.86	3A	1m+6sm+3st
<i>Convolvulus leiocalycinus</i>	$2n=2x=24$	2.93	1.84	1.09	1.78	5.35	0.37	0.40	0.17	2.93	37.08	2A	6m+6sm
<i>Astragalus jesdianus</i>	$2n=2x=16$	2.68	1.77	0.91	2.00	4.10	2.73	0.47	0.12	2.68	33.97	3A	2m+6sm
<i>Salvia mirzayanii</i>	$2n=2x=20$	1.99	1.34	0.65	2.11	8.63	0.33	0.49	0.26	1.99	32.81	3B	3m+7sm
<i>Ziziphora tenuior</i>	$2n=2x=18$	2.61	1.56	1.04	1.56	8.41	0.40	0.33	0.24	2.61	40.05	2A	6m+3sm
<i>Datura innoxia</i>	$2n=2x=24$	3.18	1.82	1.36	1.37	3.12	0.42	0.25	0.14	3.18	42.76	1A	12m

## RESULTS

Mitotic chromosome counts for examined species are presented as follows:

### Apiaceae

#### *Conium maculatum* L.

Specimen examined: Iran, Fars, Shiraz, 1581 m, 52 24 38 N, 29 38 14 E, Hatami 25128.

*Conium maculatum* is distributed in Europe, Central Asia, and North Africa. This specie showed a diploid chromosome number of  $2n=2x=22$  and the basic chromosome number of  $x=11$ . Our result is in agreement with the results of the previous studies (IPCN). The karyotype formulas were 9m+2sm (Fig. 1b). Most chromosomes were metacentric (m) and

were categorized in type 1A. This is the first report of the chromosome count of this species from Iran.

#### *Pimpinella aurea* DC.

Specimen examined: Iran, Fars, Dehbid site, 2437 m, 53 11 07 N, 30 41 44 E, Hatami 14453.

*Pimpinella aurea* is distributed in eastern Anatolia, Iran, Turcomania, Armenia, and Georgia. This species was diploid with  $2n=2x=20$  and the basic chromosome number was  $x=10$ . One pair of chromosomes was metacentric (m), 6 pairs were submetacentric (sm) and 3 pairs were acrocentric (st) with karyotype formulas 1m+6sm+3st (Fig. 1a). They were categorized in type 3A (Stebbins 1971). This chromosome count is reported here for the first time.

**Convolvulaceae***Convolvulus leiocalycinus* Boiss.

Specimen examined: Iran, Fars, Saadatshahr, Abolmahdi station, 1753 m, 52 58 48 N, 30 05 55 E, Hatami 15584.

*Convolvulus leiocalycinus* is an endemic species of the Iran plateau and is distributed in Iran, Afghanistan and Pakistan. This species was diploid with  $2n=2x=24$ . The chromosomes were metacentric (m) and submetacentric (sm), and the karyotypic formula was  $6m+6sm$  (Fig. 1c). They were categorized in type 2A. This chromosome count is reported here for the first time.

**Fabaceae***Astragalus jesdianus* Boiss. & Buhse

Specimen examined: Iran, Fars, Abadeh, 2085 m, 52 29 43 N, 31 19 40 E, Hatami 10500.

This taxon is an endemic species of Iran, growing in Fars, Kerman, Yazd & Zahedan Provinces. It was diploid with the chromosome number  $2n=2x=16$ . The chromosomes were mostly submetacentric (sm) and karyotypic formula was  $2m+6sm$  and are categorized in type 3A (Fig. 1d). This chromosome count is reported here for the first time.

**Lamiaceae***Salvia mirzayanii* Rech.f. & Esfand.

Specimen examined: Iran, Fars, Sarvestan, 1823 m, 53 18 46 N, 29 12 23 E, Hatami 1869.

*Salvia mirzayanii* is an endemic species of Iran and Oman (south of the Persian Gulf and Oman Sea). This species was diploid with  $2n=2x=20$ . The chromosomes were metacentric (m) and submetacentric (sm) and the karyotypic formula was  $3m+7sm$  and are categorized in type 3B (Fig. 1e). This chromosome count is reported here for the first time.

*Ziziphora tenuior* L.

Specimen examined: Iran, Fars, Dehbid site, 2437 m, 53 11 04 N, 30 41 46 E, Hatami 14275.

This taxon is distributed in Iran, Europe, Turkey, Caucasus, Central Asia, Iraq, Syria, Afghanistan and Pakistan. The studied specimens showed a diploid chromosome number of  $2n=2x=18$  and a basic chromosome number of  $x=9$ . The chromosomes were metacentric (m) and submetacentric (sm) and the karyotypic formula was  $6m+3sm$  and are categorized in type 2A (Fig. 1f). Our results are in agreement with

the previous reports of  $2n=18$  by Selvi & al. (2015). This is the first chromosome number report for the flora of Iran.

**Solanaceae***Datura innoxia* Miller

Specimen examined: Iran, Fars, Kazeroon, 833 m, 51 34 08 N, 29 48 18 E, Hatami 14927.

This taxon is distributed in Iran, Afghanistan, Pakistan, India, and South America. It was diploid with  $2n=2x=24$ . The chromosomes were metacentric (m) and the karyotypic formula was  $12m$  and are categorized in type 1A (Fig. 1g). Our results are in agreement with the previous report by Badr & al. (1997) of  $2n=24$ . This is the first chromosome number report for the flora of Iran.

**REFERENCES**

- Badr, A., Khalifa, S. F., Aboel-Atta, A. I. & Abou-ElEnain, M. M. 1997: Chromosomal criteria and taxonomic relationships in the Solanaceae. -Cytologia 62(2): 103–113.
- Guerra, M. 2008: Chromosome numbers in plant cytotaxonomy. Concepts and implications. -Cytogenetic and Genome research 120: 339-350.
- Husaini, S. W. H. & Iwo, G. A. 1990: Cytomorphological studies in some weedy species of the family Solanaceae from Jos Plateau, Nigeria. -Feddes Repert. 101: 41–47.
- Selvi, S., Satil, F., Martin, E., Celenk, S. & Dirmenci, T. 2015: Some evidence for infrageneric classification in *Ziziphora* L. (Lamiaceae: Mentheae). -Plant Biosystems 149(2): 415-423.
- Levan, A., Fredgra, K. & Sandberg, A. A. 1964: Nomenclature for centromeric position on chromosomes. -Hereditas. 52:201–220.
- Rechinger, K. H. 1982: Lamiaceae. In: Rechinger, K. H. (ed.) Flora Iranica vol. 150. Akademische Druck-und Verlagsanstalt, Graz.
- Reeves, A. & Tear, J. 2000: Micro measure software. Colorado state university. from <http://www.colostate.edu/Depts/Biology/micromeasure>.
- Stace, C. A. 2000: Cytology and cytogenetics as a fundamental taxonomic resource for the 20 (th) and 21(st) centuries. -Taxon. 49(3): 451-477.
- Stebbins, G. L. 1971: Chromosome evolution in higher plants. Edward Arnold Publisher, London.

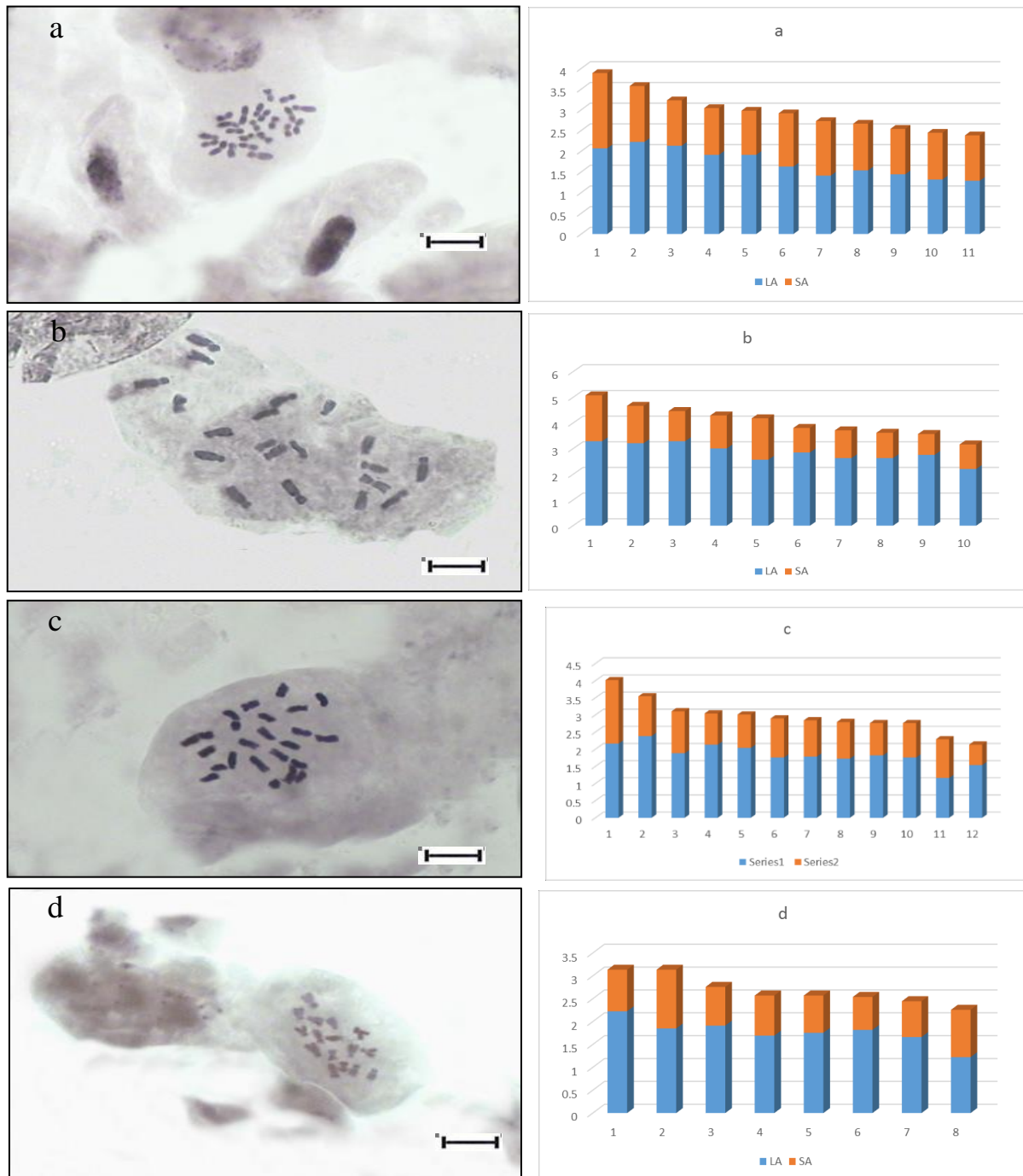


Fig. 1. (a-d): Somatic metaphases and Ideograms of the studied species: a, *Conium maculatum* (2n=22); b, *Pimpinella aurea* (2n=20); c, *Convolvulus leiocalycinus* (2n=24); d, *Astragalus jerdianus* (2n=16). Scale bars=10 μ

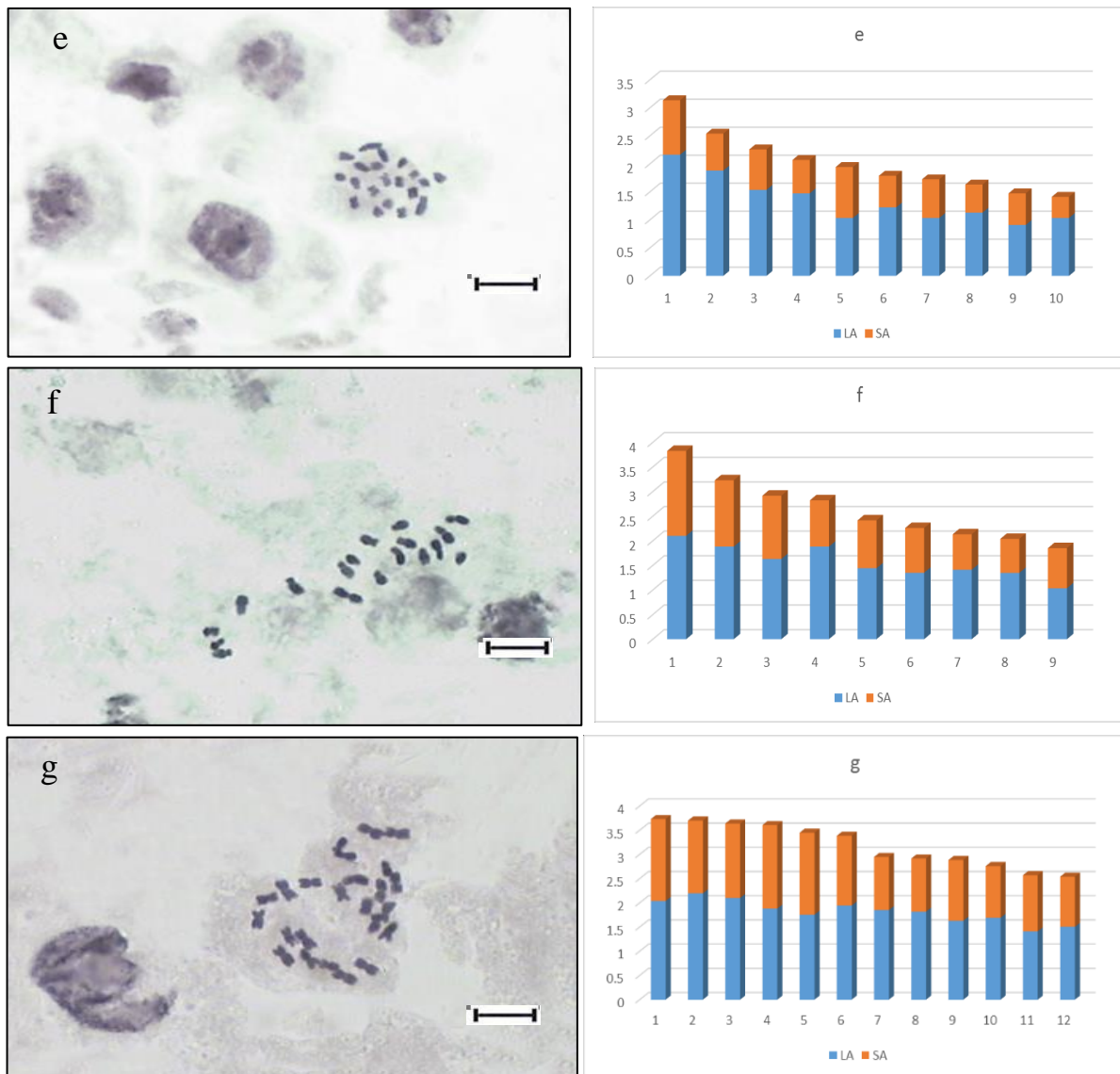


Fig. 1. Continued (e-g): Somatic metaphases and Ideograms of the studied species: e, *Salvia mirzayanii* (2n=20); f, *Ziziphora tenuior* (2n=18); g, *Datura innoxia* (2n=24), Scale bars= 10  $\mu$