



УДК 581.91+576.316(55)

Chromosome numbers of some native Iranian plants

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Keywords: Apiaceae, Asteraceae, Brassicaceae, chromosome count, endemic, Fabaceae, Lamiaceae, rare species.

Summary. Chromosome numbers of 11 native species from five families (Apiaceae, Asteraceae, Brassicaceae, Lamiaceae, and Fabaceae) of Iran were investigated. Most of them are endemic or subendemic species. This study aimed to determine chromosome number and provide general information on karyotype characteristics of selected native species of Iran. For *Achillea kellalensis* ($2n = 18$), *Noccidium hastulatum* ($2n = 14$), *Phlomooides glabra* ($2n = 22$), *Astragalus gompholobium* ($2n = 16$), *Astragalus urbanus* ($2n = 16$), *Astragalus askius* ($2n = 16$), *Oxytropis iranica* ($2n = 16$), chromosome numbers are reported for the first time, for *Prangos uloptera* ($2n = 44$) for the first time based on material from Iran.

Числа хромосом некоторых видов аборигенных растений Ирана

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Ключевые слова: редкие виды, число хромосом, эндемик, Apiaceae, Asteraceae, Brassicaceae, Fabaceae, Lamiaceae.

Аннотация. Установлены хромосомные числа 11 аборигенных, преимущественно эндемичных или субэндемичных для Ирана, видов из семейств Apiaceae, Asteraceae, Brassicaceae, Lamiaceae и Fabaceae. Для *Achillea kellalensis* ($2n = 18$), *Noccidium hastulatum* ($2n = 14$), *Phlomooides glabra* ($2n = 22$), *Astragalus gompholobium* ($2n = 16$), *Astragalus urbanus* ($2n = 16$), *Astragalus askius* ($2n = 16$), *Oxytropis iranica* ($2n = 16$) числа хромосом указаны впервые, для *Prangos uloptera* ($2n = 44$) впервые на материале из Ирана.

Introduction

Our project is “Determination of chromosome numbers and ploidy levels in plant species of Iranian Flora”. This paper presents the results of studying chromosome number of 11 native Iranian species. Chromosomal characters play an important role in plant speciation (Lysak et al., 2006; Weiss-Schneeweiss, Schneeweiss, 2013) and, therefore, chromosome numbers and ploidy levels have been used to define evolutionary lineages and relationships between taxa (Blattne, 2004; Bennett, Leitch, 2011; Jang et al., 2018). Somatic chromosome number and karyotype information provide valuable characters in delimiting species and in distinguishing some closely related taxa.

Materials and methods

This study was carried out by using seeds collected from natural habitats in Iran. Voucher specimens are preserved in National Herbarium of Iran, Research Institute of Forests and Rangelands (TARI). Two samples were studied from seeds of Gene bank of Natural resources of Iran and their code numbers are mentioned. The seeds were grown in lab. Cytological studies were done by using root tips meristems. Root tips were pretreated in 1 : 1000 aqueous *alphabromonaphthalene* for two hours and then fixed in a cold mixture of ethanol and acetic acid (3 : 1) for 4 hours. Temporary slides were made by squashing the cut and stained meristems in 1 % hematoxylin. Chromosome examination and photography were conducted by using a microscope (Olympus BX53) under 1000× magnification.

Results

Apiaceae

Prangos uloptera DC., $2n = 4x = 44$

“Iran, Tehran province, Tehran, Kan, Suleghan valley, Sangam, 2084 m, 35°52'N, 51°14'E. 28 VI 2019. Amini Rad. TARI-106270” (Fig. 1A).

Perennial. The species dispersed in the Turkey, Iran, Caucasia, Central Asia, Afghanistan and N. Iraq.

This species grows in the north, northwest, west and center of Iran (Azarbayegan, Mazandaran, Lorestan, Esfahan, Kohgiluyeh and BoyerAhmad, Bakhtiari, Fars, Tehran and Markazi provinces) (Mozaffarian, 2007).

The former report of *P. uloptera* is $n = 11$ from South East of Van (Kamari, 2004). Chromosome

number of this species was reported for the first time for the flora of Iran.

Asteraceae

Achillea kellalensis Boiss. et Hausskn., $2n = 2x = 18$

“Lordegan. Natural resources of gen bank of Iran, Code no: 46751” (Fig. 1B).

Perennial. An endemic species that grows in the center and west of Iran (Esfahan and Fars provinces). Chromosome number of this species was reported for the first time.

The basic chromosome number of this genus is $x = 9$ and most of the species are diploid with great ecological ranges from desert to water-logged habitats (Dabrowska, 1992). Our result confirms this.

Brassicaceae

Arabis caucasica Willd., $2n = 2x = 16$

“Iran, Tehran province, Tehran, Kan, Suleghan valley, Sangam, 2204 m, 35°53'N, 51°13'E. 28 VI 2019. Amini Rad. TARI-106292” (Fig. 1C).

Perennial. The species is dispersed in the Europe, Turkey, Iran, Caucasia, Central Asia, Iraq and Syria. It grows in the north, northwest, west, center and northeast of Iran. Chromosome number of this species was reported for the second time for flora of Iran. The first time gametophytic count of this species was reported $n = 8$ (Massoumi, 1980). The former report from Madeira had same result (Dalgaard, 1985). It is in agreement with former reports.

Matthiola farinosa Bunge ex Boiss., $2n = 2x = 12$

“Iran, Tehran province, Tehran to Firouzkuh, Absard to Eyvanaki, Saran, Sefidkuh, 1611 m, 35°30'N, 52°10'E. 25 VI 2019. Amini Rad. TARI-106342” (Fig. 1D).

Perennial. The species is dispersed in the Central Asia, Iran and Afghanistan.

This species grows in the north, center and northeast of Iran. Chromosome number of this species was reported for the second time. The first time gametophytic count of this species was reported $n = 6$ (Massoumi, 1980).

Noccidium hastulatum (DC.) F. K. Mey., $2n = 2x = 14$

“Masouleh. Natural resources of gen bank of Iran, Code no: 47415” (Fig. 1E).

Annual. Subendemic. The species is dispersed in the Caucasus and Iran.

This species grows in the north, and northwest of Iran (Golestan, Mazandaran and Azarbayejan provinces) (Assadi et al., 2017). Chromosome number of this species was reported for the first time.

Fabaceae

Astragalus L. spp.

Astragalus is the most prominent genus in Iran according to the number of species (Maassoumi, 1998). According to previous studies, New World

Astragalus species (Neo-Astragalus) have diverse basic chromosome numbers ($x = 11, 12, 13, 14, 15$) while in the Old World the majority of *Astragalus* species has $x = 8$, which is considered to be the ancestral basic number (Ledingham, 1963, 1964; Wojciechowski, 1999). Iran plays as a migratory corridor between countries of the Old-World that has many common species with other countries. The Irano-Anatolian hotspot covered the most areas of the three metrics (SR-WE-CWE), followed by the Caucasus, Mountains of Central Asia, Himalayas,

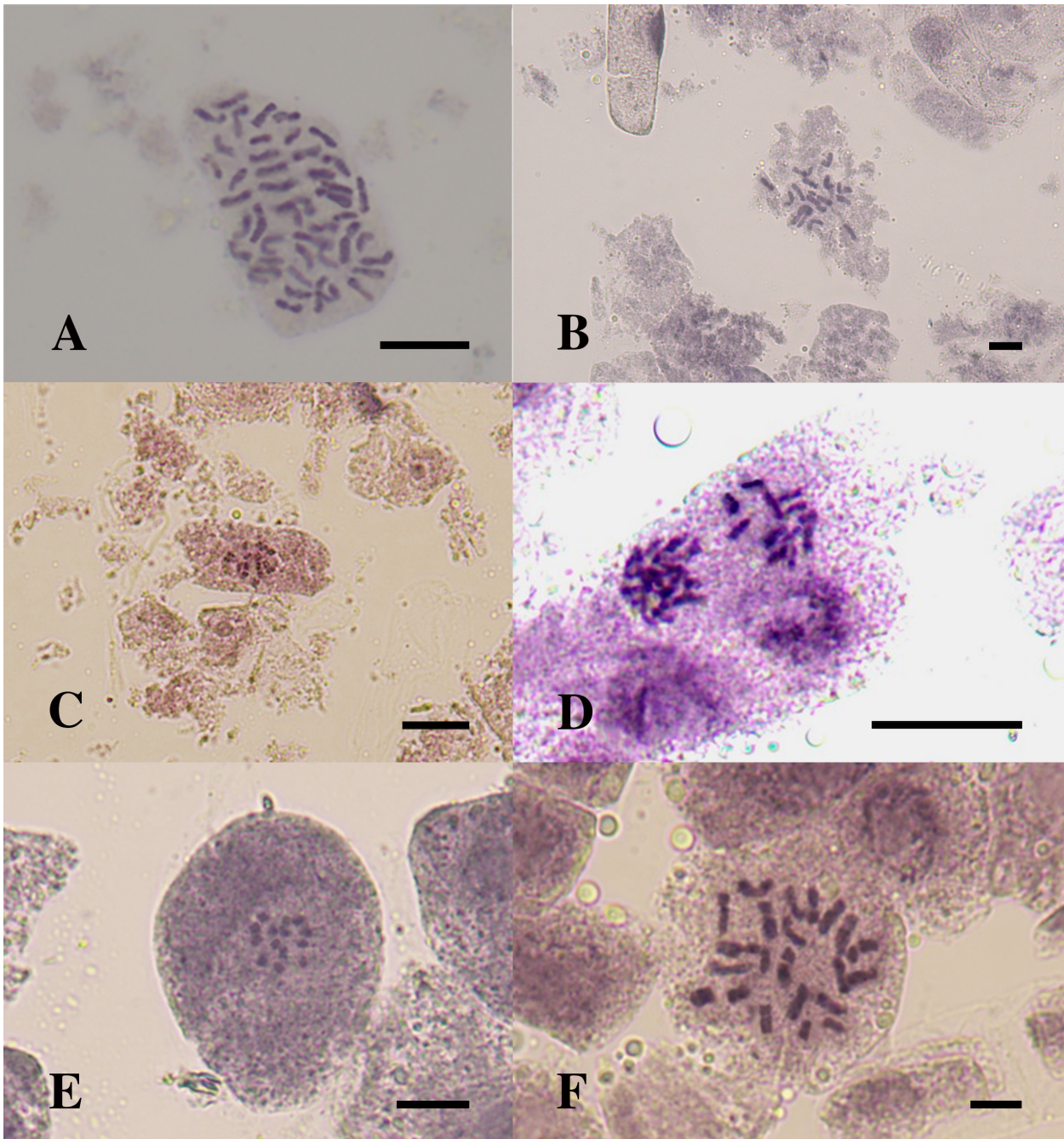


Fig. 1. Somatic metaphases: A – *Prangos uloptera* ($2n = 44$); B – *Achillea kellalensis* ($2n = 18$); C – *Arabis caucasica* ($2n = 16$); D – *Matthiola farinosa* ($2n = 12$); E – *Noccidium hastulatum* ($2n = 14$); F – *Phlomoides glabra* ($2n = 22$). Scale bar: 10 μ m.

and Mediterranean Basin (Maassoumi, Ashouri, 2022).

***A. askius* Bunge, $2n = 2x = 16$**

“Iran, Alborz province, Karaj to Chalus, at first of Dizin road, 2247 m, $36^{\circ}06'N$, $51^{\circ}19'E$. 15 VII 2018. Amini Rad. TARI-105727” (Fig. 2H).

Perennial. An endemic species that dispersed in the north of Iran (Tehran and Mazandaran provinces) (Maassoumi, 2018). Chromosome number of this species was reported for the first time.

***A. gompholobium* Benth. ex Bunge, $2n = 2x = 16$**
“Iran, Tehran province, Absard to Eyvanaki, after Kilan, 1706 m, $35^{\circ}32'N$, $52^{\circ}10'E$, 25 VI 2019. Amini Rad. TARI-106331” (Fig. 2I).

Perennial. The species is dispersed in Iran, Afghanistan and Pakistan (Maassoumi, 2003).

This species grows in the northeast and center of Iran (Khorasan, Semnan and Tehran provinces). Chromosome number of this species was reported for the first time.

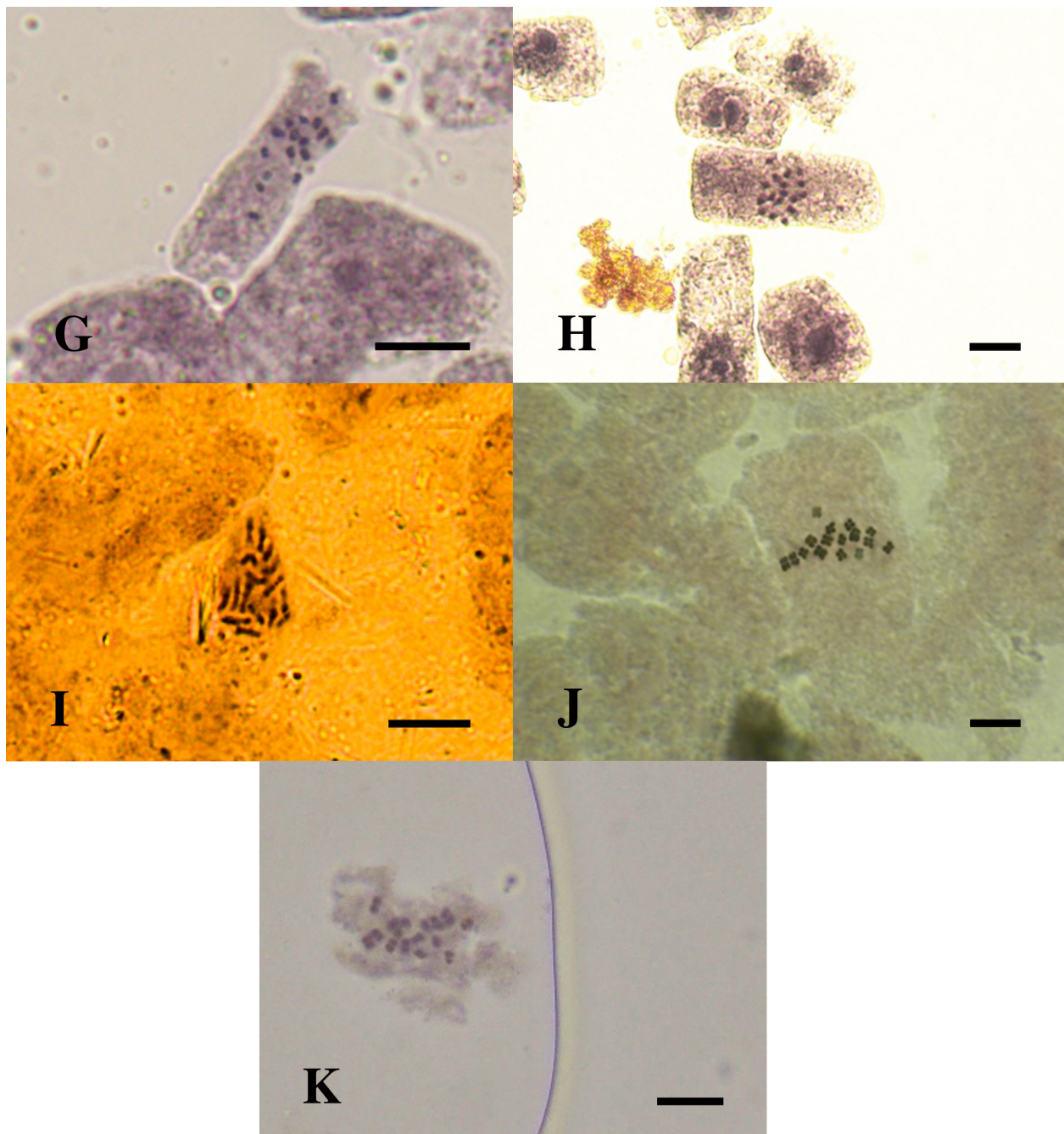


Fig. 2. Somatic metaphases: G – *Nepeta cephalotes* ($2n = 16$); H – *Astragalus askius* ($2n = 16$); I – *Astragalus gompholobium* ($2n = 16$); J – *Astragalus urbanus* ($2n = 16$); K – *Oxytropis iranica* ($2n = 16$). Scale bar: 10 μ m.

A. urbanus Podlech et Maassoumi, $2n = 2x = 16$
“Iran, Tehran province, Gilavand, between Varjeh and Khorramdarreh, 1720 m, 35°38'N, 52°00'E, 25 VI 2019. Amini Rad. TARI-106353” (Fig. 2J).

Perennial. An endemic species that grows in the center of Iran (Tehran province) (Maassoumi, 2003). Chromosome number of this species was reported for the first time.

Oxytropis iranica Vassilcz., $2n = 2x = 16$

“Iran, Tehran province, Absard to Eyvanaki, after Kilan, 1706 m, 35°32'N, 52°10'E. 25 VI 2019. Amini Rad. TARI-106321” (Fig. 2K).

Perennial. An endemic species that grows in the north of Iran (Mazandaran and Tehran provinces) (Vasilchenko, 1984; Maassoumi, 2013). Chromosome number of this species was reported for the first time.

Lamiaceae

Phlomoides glabra (Boiss. ex Benth.) Kamelin et Makhm., $2n = 2x = 22$

“Iran, Tehran province, Tehran, Kan, Suleghan valley, Sangan, 2204 m, 35°53'N, 51°13'E. 28 VI 2019. Amini Rad. TARI-106417” (Fig. 1F).

Perennial. The species is a subendemic, and native range of this species is East of Turkey, Iran and probably Armenia. Chromosome number of this species was reported for the first time.

Nepeta cephalotes Boiss., $2n = 2x = 16$

“Iran, Tehran province, Absard to Eyvanaki, after Kilan, 1706 m, 35°32'N, 52°10'E. 07 VIII 2019. Amini Rad. TARI-106727” (Fig. 2G).

Perennial. An endemic species that grows in the northwest and center of Iran (Azarbayegan, Tehran and Semnan provinces) (Jamzad, 2012). Chromosome number of this species was reported for the second time. The first time was reported $2n = 18$ for this species (Hasaninejad et al., 2021). The genus *Nepeta* L. has a large variation of chromosome number that ranges from 12 to 54 with the most common basic chromosomes of $x = 8$ and $x = 9$ (Baden, 1984; Saggoo et al., 2011; Kharazian et al., 2013). Our investigations agree with previous counts.

Conclusion

In this study 11 native species from the flora of Iran were investigated. Some of them (five species) are endemic and two species are subendemic. Studied species, except *Prangos uloptera*, have polyploidy level, other species are diploids. Valuable chromosome counts (seven species) were presented in this research for the first time. One species were reported for the first time for the flora of Iran.

Acknowledgements

This research was supported by Research Institute of Forests and Rangelands of Iran, Grant No. 09-09-031990582. We thank our colleagues Mrs Fereshteh Assadi and Rouhangiz Azimi who provided insight and expertise that greatly assisted the research.

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