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CHROMOSOME COUNTS OF FOURTEEN SPECIES FROM THE FLORA OF IRAN, BUSHEHR PROVINCE

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Abstract
Fourteen plant species belonging to Asclepiadaceae, Asteraceae, Caesalpiniaceae, Cistaceae, Mimosaceae, Poaceae, and Sapindaceae families were collected from Bushehr province. Counts of chromosomes of *Grantia aucheri* (Boiss.) Anderb. (2n=18), *Helianthemum assadii* F. Ghahrem. & Gholamian (2n=20), *H. sinuspersicum* Gholamian & F. Ghahrem. (2n=20), *H. salicifolium* var. *securitium* Gholamian (2n=20), *H. ledifolium* var. *glaberrimum* Gholamian (2n=20), *Sporobolus arabicus* Boiss. (2n=36) and *Cassia italica* (Mill.) Spreng. (2n=16) are reported for the first time. The chromosome counts of *Calotropis procera* (Aiton) R. Br. (2n=22), *Acacia albida* Delile (2n=26), *Ceratonia siliqua* L. (2n=24), *Dodonaea viscosa* Jacq. (2n=28), *Helianthemum stipulatum* (Forsk.) C. Chr. (2n=20), *H. kahiricum* Del. (2n=20) are reported for the first time from Iran. *Helianthemum aegyptiacum* (L.) Miller (2n=20) is reported for the second time for the flora of Iran.

Keywords: Chromosome number; flora; Iran; mitosis; Ploidy

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شمارش کروموزومی۱۴ گونه از فلور ایران، استان بوشهر

فاطمه غلامیان: استادیار پژوهش بخش تحقیقات جنگلها، مراتع و آبخیزداری، مرکز تحقیقات و آموزش کشاورزی و منابع طبیعی استان بوشهر، سازمان تحقیقات، آموزش و ترویج کشاورزی (AREEO)، بوشهر، ایران

چکیده: چهارده گونه گیاهی متعلق به هفت تیره Asclepiadaceae، Asteraceae، Ceasalpinaceae، Cistaceae، Mimosaceae، Poaceae و Sapindaceae از استان بوشهر جمع‌آوری گردید. شمارش کروموزومی برای گونه‌های *Grantia aucheri* (Boiss.) Anderb. (2n=18)، *Helianthemum assadii* F. Ghahrem. & Gholamian (2n=20)، *H. salicifolium* var. *securitium* Gholamian (2n=20)، *H. sinuspersicum* Gholamian & F. Ghahrem. (2n=20)، *Cassia italica* (Mill.) Spreng. (2n=16)، *Sporobolus arabicus* Boiss. (2n=36)، برای اولین بار در دنیا گزارش می‌گردند. شمارش کروموزومی گونه‌های *Calotropis procera* (Aiton) R. Br. Boiss. (2n=22)، *Acacia albida* Delile (2n=26)، *Ceratonia siliqua* L. (2n=24)،

H. stipulatum Gholamian & F. Ghahrem. و (2n=20) *Helianthemum kahiricum* Del. ،(2n=28) *Dodonaea viscosa* Jacq.
(2n=20) برای اولین بار در ایران و گونه *H. aegyptiacum* (L.) Miller (2n=20) برای دومین بار در فلور ایران گزارش می‌شوند.

INTRODUCTION

Diploid chromosome number is determined by counting the chromosomes in dividing somatic cells in cytotaxonomical analyses (Guerra 2008). Metaphase chromosomes refer to a stage in mitosis in which the chromosomes are located in the equatorial plate of the mitotic spindle and are connected to the microtubule network by their centromeres. This paper presents the results of a comprehensive study aimed at determining the chromosome numbers of Iran's flora. In this study, the chromosome numbers of five species and two varieties are reported for the first time worldwide. Additionally, chromosome numbers for six species are reported for the first time in Iran's flora, and one species is reported for the second time.

MATERIALS AND METHODS

In this study, seeds from all species were collected between 2020 and 2022 in their natural habitats (Fig. 1). The vouchers are deposited in the Herbarium of Bushehr Agricultural and Natural Resources Research and Education Center. For the somatic chromosome study, the seeds were germinated in a glass Petri dish on moist filter paper in the laboratory (ca. 25-30 ºC). The growing root tips of ca. 0.5-1.5 cm long (depending on seed size) were cut and pre-treated by 0.5% saturated α-Bromonaphthalene at 4 °C for 2 h and fixed in 10% Levitsky solution at 4 °C for 16 h. The fixed root tips were rinsed in distilled water and hydrolyzed in NaOH (1 N) at 60 ºC for 6 min. The samples were washed with distilled water, and stained with 4% hematoxylin-iron for 1 hour at room temperature, and then squashed in a droplet of a mixture of 45% acetic acid and lactic acid. For obtaining polity, the mitotic metaphase extension of samples was photographed by an Olympus (BH-2) microscope lens of 100, equipped with a monitoring system. The chromosome morphology was studied based on Levan & al. (1964) and Jalilian & al. (2023).

RESULTS

The findings of this study revealed that the optimal time for counting chromosomes in the examined plant species to achieve the highest number of somatic metaphases in the root tip is between 8:00 a.m. and 13:00 p.m. In total, the chromosome counts for 14 plant species belonging to seven examined families are as follows:

Asteraceae

Grantia aucheri (Boiss.) Anderb. (2n=18), (Fig. 1A).

Specimen examined: Iran, Bushehr province, Tangestan, Konary village, 5 m, Gholamian 2773.

This species is diploid, with a chromosome number of 2n=2x=18. This is the first report on the chromosome number of this species.

Asclepiadaceae

Calotropis procera (Aiton) R. Br. (2n=22), (Fig. 1B).

Specimen examined: Iran, Bushehr province, Borazjan, Sad Abad, 70 m, Gholamian 2741.

This species is diploid with 2n=2x=22. Two ploidy levels have been reported for the *C. procera* 2n=2x=22 and 2n=4x=44 with the basic chromosome number x=11 by Kamel & al. (2014) on populations of Egypt and Saudi Arabia, and the chromosome number 2n=22 was counted for this species by other researchers such as Bir & Sidhu (1979, 1980), and Sidhu (1983) on populations of Punjab, India. This is the first report of the chromosome count of this species for the flora of Iran.

Cistaceae

Helianthemum aegyptiacum (L.) Miller (2n=20), (Fig. 1C).

Specimen examined: Iran, Bushehr province, Borazjan, Tange Eram, 175 m, Gholamian 2936.

This species is diploid with 2n=2x=20. Two ploidy levels have been reported for the *H. aegyptiacum* 2n=2x=20 and 2n=4x=40 with the basic chromosome number x=10 by Sadeghian & Hatami (2023) on populations of Sarvestan from Fars Province. This is the second report on the chromosome count of this species for the flora of Iran.

H. assadii F. Ghahrem. & Gholamian (2n=20), (Fig. 1D).

Specimen examined: Iran, Bushehr province, Borazjan, Tange Eram, 530 m, Gholamian 2665.

H. assadii is an endemic annual species of Iran. This species was diploid with a chromosome number of 2n= 2x=20. This is the first report of the chromosome count for this species.

H. ledifolium var. ***glaberrimum*** Gholamian (2n=20), (Fig. 1E).

Specimen examined: Iran, Bushehr province, Tangestan, Delvar, Kgaje Khezrenabii, 50 m, Gholamian 2746.

H. ledifolium var. *glaberrimum* is an endemic annual variety of Iran. This species was diploid with a chromosome number of 2n=2x=20. This is the first report on the chromosome number of this variety.

H. kahiricum Del. (2n=20), (Fig. 1F).

Specimen examined: Iran, Bushehr province, Tangestan, Delvar, Kgaje Khezrenabii, 50 m, Gholamian 2750.

The chromosome count for this species is 2n=2x=20. The number of chromosomes in the present study aligns with the previous report of 2n=20 by Hernánz & al. (2023), and Lifante & al. (1992) on populations of Palearctic region and the Mediterranean, respectively. According to the available data, the chromosome number of this species is reported here for the first time for the flora of Iran.

H. salicifolium var. ***securitium*** Gholamian (2n=20), (Fig. 1G).

Specimen examined: Iran, Bushehr province, Borazjan, Sad Abad, 70 m, Gholamian 2753.

H. salicifolium var. *securitium* is an endemic annual variety of Iran. This species was diploid with a chromosome number of 2n=2x=20. This is the first report on the chromosome number of this variety.

H. sinuspersicum Gholamian & F. Ghahrem (2n=20), (Fig. 1H).

Specimen examined: Iran, Bushehr province, Kangan, Bandar Tahery, 0 m, Gholamian 2759.

H. sinuspersicum is an endemic perennial species of Iran. This species was diploid with 2n=2x=20. This is the first report on the chromosome number of this species.

H. stipulatum (Forsk.) C. Chr. (2n=20), (Fig. 1I).

Specimen examined: Iran, Bushehr province, Asaloyeh, Fomastan, 55 m, Gholamian 2859.

The studied specimens showed a diploid chromosome number of 2n=2x=20. This species showed a diploid chromosome number of 2n=2x=20. This count is consistent with previous reports by Hernánz & al. (2023) on populations of Palearctic region, while Kamel & al. (2014) reported 2n=22, 44 in the Egypt and Saudi Arabia populations. This is the first report on the chromosome number of this species in Iran.

Mimosaceae

Acacia albida Delile. (2n=26), (Fig. 1J).

Specimen examined: Iran, Bushehr province, Dashty, Razm Abad, 5 m, Gholamian, 3021.

Acacia albida is a native and endangered species in Iran, with its only known habitats located in the villages of Razmabad and Abtavil in Bushehr Province. Our results showed that this species is diploid with a chromosome number of 2n=2x=26. The observed number matches that reported by Bukhari (1997) and Mihretie & Dagne (2013) for Australian and Ethiopian populations (2n=26), respectively. This is the first report of the chromosome count of this species for the flora of Iran.

Caesalpinaceae

Cassia italica (Mill.) Spreng. L. (2n=16), (Fig. 1K).

Specimen examined: Iran, Bushehr province, Dashty, Kaki, 5 m, Gholamian 2825.

Our results showed that this species is a diploid chromosome number of 2n = 2x=16. This is the first report on the chromosome number of this species.

Ceratonia siliqua L. (2n=24), (Fig. 1L).

Specimen examined: Iran, Bushehr province, Jam, Mir Moana, 750 m, Gholamian 2786.

Our results showed that this species is diploid with a chromosome number of 2n=2x=24. This finding aligns with previous reports of 2n=24 by Bureš & al. (2004) for populations of Occupied Palestine. This study provides the first report on the chromosomal count record for this species in the flora of Iran.

Poaceae

Sporobolus arabicus Boiss. (2n=36), (Fig. 1M).

Specimen examined: Iran, Bushehr province, Tangestan, 0 m, Gholamian, 3125.

Our results showed that this species is diploid with a chromosome number of 2n=2x=36. This is the first report on the chromosome number report for this species.

Sapindaceae

Dodonaea viscosa Jacq. (2n=28), (Fig. 1N).

Specimen examined: Iran, Bushehr province, Asaloye, Nayband Gulf, 0 m, Gholamian, 3175.

Our results showed that this species is diploid with a chromosome number of 2n=2x=28. The chromosome number observed in this study (2n=28) agrees with previous reports by Dawson (2008) and Oginuma & al. (1997) for New Zealand and Australian populations, respectively. This represents the first report on the chromosomal count documented for this species in Iran.

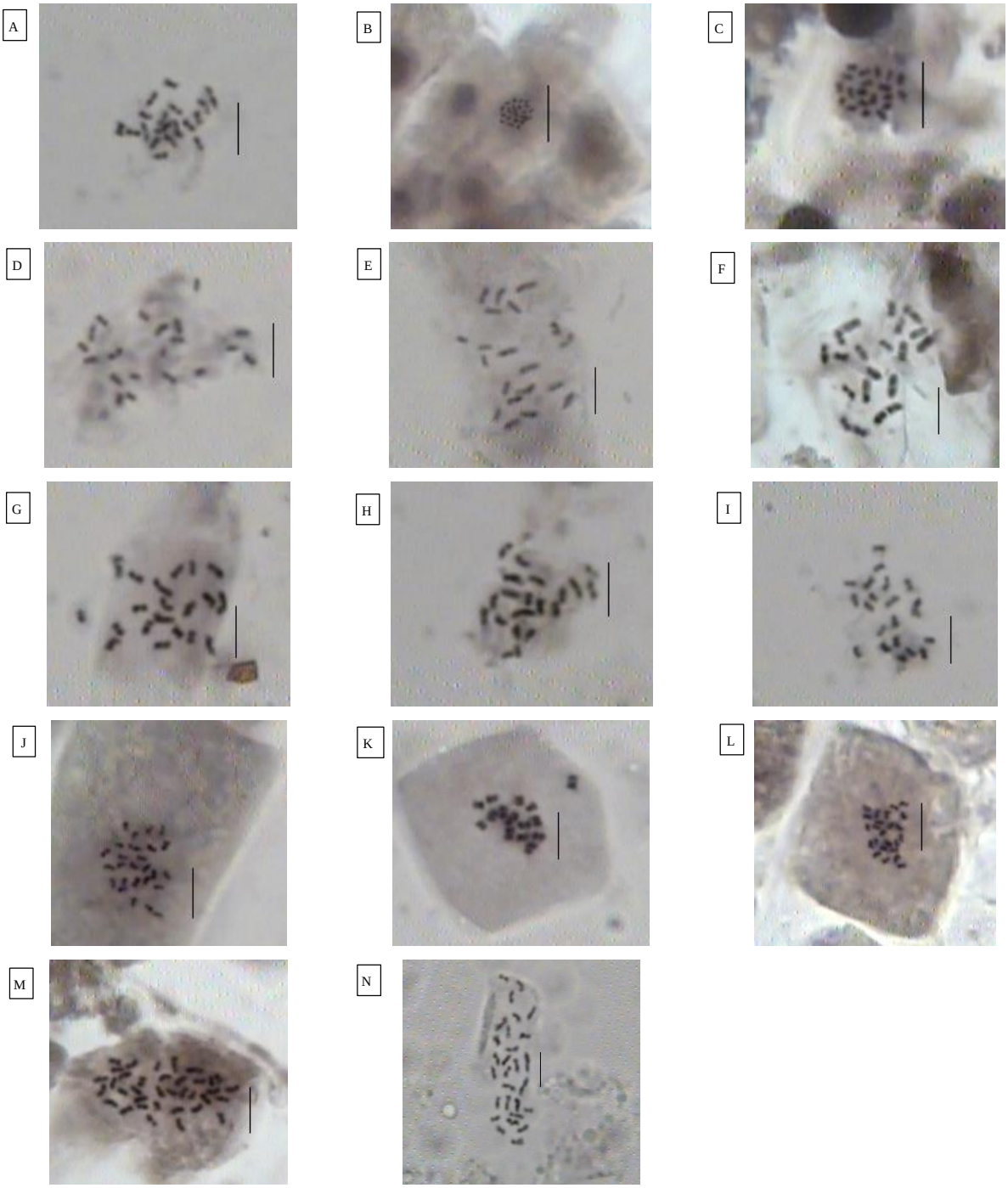

Fig. 1. A-N, Somatic metaphases of the studied species. *Grantia aucheri* (2n=2x=18); *Calotropis procera* (2n=2x=22); *Helianthemum aegyptiacum* (2n=2x= 20); *H. assadii* (2n=2x=20); *H. ledifolium* var. *glaberrimum* (2n=2x=20); *H. kahiricum* (2n=2x=20); *H. salicifolium* var. *securitium* (2n=2x=20); *H. sinuspersicum* (2n=20); *H. stipulatum* (2n=2x =20); *Acacia albida* (2n=2x=26); *Cassia italica* (2n=2x=16); *Ceratonia siliqua* (2n=2x=24); *Sporobolus arabicus* (2n=2x=36); *Dodonaea viscosa* (2n=2x=28); Scale bars=5µm.

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