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DISTRIBUTION AND CHROMOSOME STUDIES ON SOME SPECIES OF *COUSINIA* CASS., (SECTION CYNAROIDEAE) FROM IRAN

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Abstract

Cytological study of 8 Iranian species of *Cousinia* section *Cynaroideae* (*Asteraceae*) was carried out. The basic chromosome number is x=12 and all of the studied plants were diploid. The western parts of Iran seems to be the center of diversity and origin of *Cousinia* section *Cynaroideae*.

Introduction

Section *Cynaroideae* Cass., with 77 species is the largest section in the genus *Cousinia* (Rechniger, 1972, 1979; Ghahreman *et al.*, 1999; Chernova, 1962). Of these, 57 are represented in Iran of which 46 species are endemic. To date, chromosome studies on the section have been carried out on nine species which are listed in Table 2 (Afzal-Rafii, 1980; Aryavand, 1975, Chykasanova in Fedorov, 1974; Ghaffari 1984, 1986, 1987; Tschernova, 1985). Cytological studies of the section *Cynaroideae* is given in the present report.

Material and Methods

Floral buds of plants found in nature (Table 1) were collected and immediately fixed in piennar's fluid containing ethanol 96%: chloroform: propionic acid, 6:3:2, V/V. Anthers were squashed and stained in acetocarmine. Chromosome counts were carried out from the meiotic microsporocytes. All slides were made permanent by the ventian turpentine (Wilson, 1945). Photographs of chromosomes were taken on an Olympus photomicroscope at initial magnification of 330 X. Voucher specimens are preserved in the Central Herbarium of Tehran University (TUH).

Results

The results of the study are summarized in Table 2 and details of each species is given below:

Cousinia calocephala Jabu. & Spach

This species is endemic to Iran and is found in the Azarbaijan, Tehran, Qazvin, Semnan, Hamadan, Loristan and Bakhtiari Provinces. Meiosis was observed in 3 collections (Table 1), all of which have 12 bivalents at first metaphase (Fig. 1). Our result agree with a previous report of n=12 by Ghaffari (1987). Occasionally in some cells one or two quadrivalents was observed. The chiasma frequency determined from 51 cells were 1.40 per bivalent.

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Table 1. The origin of material used in chromosome studies.

Taxon	Altitude (m)	Locality
C. calocephala	2090	Tehran: Kuh-Dashteh,
C. calocephala	2150	Tehran: Damavand: Chenar
C. calocephala	2300	Lorestan: Aligudarz to Shulabad: Cheshme Par
C. cymbolepis	2200	Markazi: Tafresh,
C. hamadanensis	1800	Hamadan: Nahavand: mt. Garrin: Gamasab
C. khorramabadensis	1740	Lorestan: Between Azna & Durud: Darreh Takht,
C. lactiflora	2000	Lorestan: Aligudarz,
C. phyllocephala	1930	Lorestan: Borujerd to Khorramabad: near Zagheh: Razan,
C. phyllocephala	1870	Lorestan:Road of Keshvar:before Nujian pass:
C. sagittata	2150	Lorestan: Borujerd: 45 km to towards Arak:
C. sagittata	1900	Arak: 10 km to Senejan
C. verbascifolia	1000	Khorassan: Between Mashhad and Fariman

Table 2. Chromosome number and chiasma average in *Cousinia* section *Cynaroideae*.

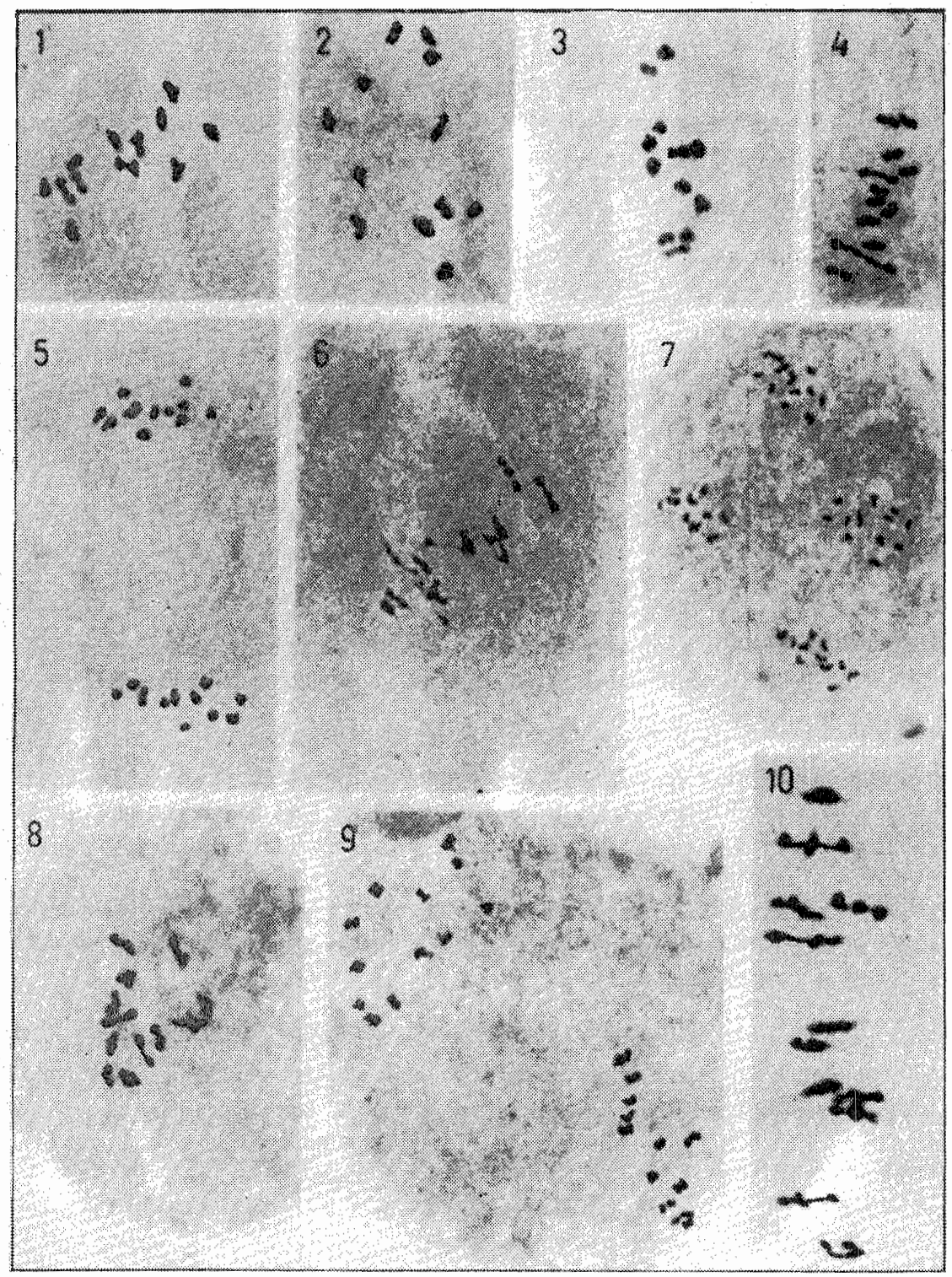
Taxon	No. of cells analyzed	Mean chiasma frequency per bivalent	Present count (n)	Previo	Count	
C. bekeri					18	Chykasanova
C. calocephala	51	1.40	12	12	24	Ghaffari, 1986, 1987
C. cymboleips	22	1.40	12	-	-	
C. hamadanensis	15	1.49	12	-	-	-
C. khorramabadensis	39	1.41	12	-	-	-
C. kirrindica	-	-	-	-	24	Afzal-Rafi, 1980
C. kornhuberi	-	-	-	-	24	Afzal-Rafi, 1980
C. kotschyi	-	-	-	-	24	Afzal-Rafi, 1980
C. lactiflora	31	1.26	12	-	-	
C. lyrata	-	-	-	-	24	Tscherneva, 1985
C. onopordioides	-	-	-	-	24	Tschenrneva, 1985
C. phyllocephala	14	1.43	12	-	-	
C. sagittata	11	1.41	12	-	-	
C. subinflata	-	-	-	-	24	Afzal-Rafi, 1980
C. verbascifolia	5	1.39	12		24	Ghaffari, 1984

***Cousinia cymbolepis* Boiss.**

This species is found in Iran and Iraq. Meiosis in this species was regular and shows 12 bivalents at metaphase 1 (Fig. 2). Chiasma frequency determined from 22 cells was 1.40 per bivalent. This is the first chromosome count for this taxon.

***Cousinia hamadanensis* Rech. f.**

This species is found in a restricted area of the Hamadan province. Meiosis was regular and showed 12 bivalents at first metaphase, most of which appeared in a ring conformation (Fig. 3). Occasionally in some cells one quadrivalent was observed. Chiasma frequency in 15 cells gave a mean of 1.49 per bivalent. This is the first chromosome number report for this taxon.



Figs. 1-10 Meiosis Fig. 1. *C .calocephala*, metaphase I. Fig. 2. *C. cymbolepis*, metaphase I. Fig. 3. *C. hamadanensis*, metaphase I. Figs. 4-5. *C. khorramabadensis*, metaphase I and anaphase. I. Figs. 6-7. *C. lactiflora* , metaphase I and anaphase II. Fig. 8. *C. phyllocephala*, metaphase I. Fig. 9. *C. sagittata*, metaphase II. Fig. 10. *C. verbascifolia*, metaphase I.

***Cousinia khorramabadensis* Bornm.**

This species is endemic to Iran and found in a restricted area of Loristan province. Meiosis in this species was regular and showed 12 bivalents at first metaphase (Fig. 4). Chromosome segregation at anaphase 1 was also regular (12-12) (Fig.5). Chiasma frequency in 39 cells gave a mean of 1.41 per bivalent. This is the first chromosome count for this species.

***Cousinia lactiflora* Rech. f.**

This species is endemic to Iran and found in a restricted area of Daran. Meiosis in this taxon was regular with 12 bivalents at first metaphase (Fig. 6). Chromosome segregation at anaphase II was 12 monads at each pole of pollen mother cells (Fig. 7). Chiasma frequency in 31 cells gave a mean of 1.26 per bivalent. This is the first chromosome count for this species.

***Cousinia phyllocephala* Bornm. & Gauba**

This species is endemic to Iran and found in a restricted area of Loristan province. Meiosis was observed in two collections (Table 1), both of which have 12 bivalents at first metaphase (Fig. 8). Occasionally in some cells one quadrivalent was observed. Chiasma frequency determined from 14 cells was 1.43 per bivalent. This is the first chromosome count for this species.

***Cousinia sagittata* C. Winkl. & Str.**

This species is endemic to Iran and found in the Markazi, Esfahan and Loristan provinces. Meiosis was observed in two collections (Table 1), both of which have 12 bivalents at first metaphase. Second metaphase showed 12 regular dyad chromosomes at each pole (Fig. 9). Chiasma frequency in 11 cells gave a mean of 1.41 per bivalent. This is the first chromosome count for this taxon.

***Cousinia verbascifolia* Bunge**

This species is endemic to eastern parts of Iran. Meiosis in this species was regular and showed 12 bivalents at first metaphase (Fig. 10). Our result is similar to the previous report of 2n=24 (Ghaffari, 1984). Chiasma frequency determined from 5 cells was 1.39 per bivalent.

Discussion

The section *Cynaroideae* with 77 species is the largest section of *Cousinia* in which most of the species are concentrated in the central parts of the Elbourz and Zagros mountains and the high altitude areas of central deserts of Iran. As shown in Table 3, Iraq has the most species after Iran (17 species, of which 10 are endemic). Turkey has 8 species, of which 4 are shared with Iran (*C. grandis, C. eriocephala, C. hakkarica* and *C.*

canescens) and one with Iraq (*C. arbelensis*). The other three species are endemic to Turkey. Azarbaijan has four species of which *C. macrocephala* is endemic (Huber-Morath, 1975). Turkmenistan and Pakistan have two species. As is shown in Table 3, the density and variation of the section decreases in the east of the Flora Iranica region where only *C. lyrata* occurs in Afghanistan. Most species are concentrated in western Iran, for example: Alvand, Shahzand, Oraman and Shahoo. Considering that from 77 species in the section, 46 of 57 species that occur in Iran are endemic (Table 3). It appears that western parts of Iran are the center of diversity and origin of *Cousinia* scection *Cynaroideae*.

Table 3. Frequency of species *Cousinia* (sect. *Cynaroideae*) in the world.

Country	No. of species	No. of endemic species
Iran	57	44
Iraq	17	10
Turkey	8	3
Azarbaijan	4	1
Turkmenistan	2	-
Pakistan	2	-
Afghanistan	1	-

Chromosome studies of pollen mother cells show the same basic chromosome number (x=12) in all species. From a cytological point of view, the similarity in shape and size of bivalents and eventually the similarity of chiasma frequency average for each bivalent (except *C. lactiflora*), verify the affinity of these species to each other (Table 2). Therfore, it appears that the placement of these species in section *Cynaroideae* based on the Rechinger classification (Rechinger, 1972) is in accordance with their cytological affinities. There is only one base chromosome number in section *Cynaroideae*, i.e. x=12. The presence of x=9 seems to be contradictory (Table 2). Chykasanova (see Fedorov, 1974) gave the chromosome count of *C. beckeri* as 2n=18. In this species, it seems that the error in the chromosome count is either due to the misidentification of the species or simply a wrong chromosome count. Besides, in the other cases on chromosome reports, Chykasanova disagrees with other investigator's opinion (Ghaffari, 1998). Consequently, the base chromosome number in section *Cynaroideae* follows a general trend of stability. It also appears that an important role was played by the heterozygotic translocation in the evolution of this section.

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