

CHROMOSOME STUDIES OF SOME SPECIES OF CENTAUREA SECTION ACROCENTRON (ASTERACEAE) FROM IRAN

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Abstract

Original chromosome observations of seven species of the genus *Centaurea* (Sect. *Acrocentron*) are reported. Of these, counts for 3 taxa viz. *C. irritance* Wagenitz, *C. persica* Boiss, and *C. sosnovskyi* Grossh., are new to science. Meiotic behaviour of chromosomes and chiasmata frequency are noted here for the first time. Basic chromosome numbers for section are $x = 10$ and $x = 11$.

Introduction

Centaurea section *Acrocentron* (Cass.) DC., is one of the sections comprising of c. 70 species distributed in different parts of the world. In *Flora Iranica* 10 species of this section are reported from Iran out of which 5 are endemic (Wagenitz, 1980). Relatively high number of species in S and E Turkey and adjacent Iran in SW Asia are distributed (Wagenitz, 1986). Karyological studies of the western species of section *Acrocentron* have been reported (Guinochet & Foissac, 1962; Georgiadis & Christodoulakis, 1984; Routsis, 1993; Routsis & Georgiadis, 1994; Garcia-Jacas & Susanna, 1992, 1997) whereas chromosome information of the oriental species of the section is scarce and limited to a few reports (Ghaffari, 1984, 1986, 1988, 1989, 1997). The present study describes the meiotic chromosome number of seven species where main chiasmata frequency and meiotic behaviour are reported for the first time.

Materials and Methods

Floret buds of materials (Table 1) were collected and immediately fixed in Pienar's fluid (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 microspocytes. All slides were made permanent by the vantian 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

Chromosomes counting and chiasmata frequency is given in Table 2. The details of each species is given below:

Table 1. Origin of material used in chromosome studies (Gh. = Ghaffari).

Taxon	Altitude (m)	Locality
<i>C. carduiformis</i> DC. subsp. <i>Iranica</i> Wagenitz	1500	Tehran: Mt. Sorkh-Hesar, Gh. 1667
<i>C. irritance</i> Wagenitz	1410	Kermanshah: Tagh-Bostan, Gh. 170
<i>C. kandavanensis</i> Wagenitz	2700	Siah-Bisheh, Gh. 7667
<i>C. persica</i> Boiss	1380	Between Mahabad and Orumiyeh
<i>C. pseudoscabiosa</i> Boiss. & Buhse subsp. <i>pseudoscabiosa</i>	2040	Azerbaijan: Mishodagh Mt., Gh. 4367
<i>C. pseudoscabiosa</i> Boiss. & Buhse subsp. <i>pseudoscabiosa</i>	2240	Avaj: 15km to Hamadan, Gh. 6667
<i>C. pseudoscabiosa</i> Boiss. & Buhse Sub. sp. <i>pseudoscabiosa</i>	1540	Between Salmas & Khoy, Gh. 4667
<i>C. sintensiana</i> Gand.	1400	Bodjnourd, Gh. 5711
<i>C. sosnovskyi</i> Grossh.	1650	N. of Khorramabad, Gh. 2767
<i>C. sosnovskyi</i> Grossh.	1620	Khorramabad: 20Km towards Dorud, Gh. 1077.

1. *Centaurea carduiformis* DC. subsp. *iranica* Wagenitz. n = 10 II (Fig.1.)

Two subspecies of *C. carduiformis* are recorded in flora of Iran, Turkey and Syria (Wagenitz, 1975; Post, 1933): *C. carduiformis* subsp. *carduiformis*; 2n = 20+B (see Fedorov, 1974) and *C. carduiformis* subsp. *iranica*. The subsp. *iranica* is endemic to a limited area (Mt. Sorkh-e-hesar) of Iran. It seems that this subspecies is disappearing. Previous report for this subspecies is n = 10 (Ghaffari, 1986, 1988). Meiosis in this taxon was regular and showed ten bivalents at first metaphase. Occasionally in some

Table 2. Chromosome counts and chiasmata frequency.

Taxon	n	No. of B-chromosome	Chiasma frequency per bivalent (mean)
<i>C. carduiformis</i> subsp. <i>iranica</i>	10	-	1.25
<i>C. irritance</i>	10	0 - 2B	1.34
<i>C. kandavanensis</i>	10	0 - 3B	1.28
<i>C. persica</i>	10	-	1.13
<i>C. pseudoscabiosa</i> subsp. <i>pseudoscabiosa</i>	11	0-7B	1.42
<i>C. sintensiana</i>	10	-	1.28
<i>C. sosnovskyi</i>	10	-	1.20

cells lagged chromosomes and chromatid bridge were observed. Mean number of chiasmata was calculated as 1.25.

2. *Centaurea irritance* Wagenitz. $n = 10 \text{ II} + 0-2\text{B}$ (Fig.2).

This taxon is endemic to Iran and Iraq. Ten bivalents at first metaphase and diakinesis were observed. Most of the bivalents had two chiasmata, which were terminally located. Chiasmata average is calculated as 1.34. Chromosome segregation at first anaphase was (10-10). In some cells one to two B-chromosomes were observed.

3. *Centaurea kandavanensis* Wagenitz. $n = 10 \text{ II}$ (Fig.3,4).

This species is endemic to Iran. According to previous report (Ghaffari, 1998) this species has $2n = 20$ chromosomes with 0 to 3B. Analysis of chromosome behaviour at meiosis showed that the increase in number of B-chromosomes increased the mean chiasma frequency of A-chromosomes in pollen mother cells.

4. *Centaurea persica* Boiss. $n = 10 \text{ II}$ (Fig.5).

This taxon belongs to the Irano-Turanian region, and is distributed in western parts of Iran and eastern parts of Turkey. Meiosis was regular with ten bivalents at first metaphase, mostly in the form of rod. Chiasmata average was calculated as 1.13 at first metaphase. This is the first report on chromosome number for this taxon.

5. *Centaurea pseudoscabiosa* Boiss & Buhse. subsp. *pseudoscabiosa* $n = 11 \text{ II} + 0-7\text{B}$ (Fig.6).

This subspecies belongs to the Irano-Turanian region, and is distributed in Iran, Turkey and Caucasia. Three collections of this subspecies were studied and all had $n = 11$. Mean chiasmata was estimated as 1.42 at first metaphase. In many cells one to seven B-chromosomes were observed, and more of them were formed univalents. Univalent B-chromosomes showed a tendency to lag at first anaphase, metaphase II and anaphase II. This is the first on report chromosome number for this taxon.

6. *Centaurea sintensiana* Gand. $n = 10 \text{ II}$ (Fig.7,8).

This species is endemic to Iran and Turkamanistan. Previous report for this taxon (syn. *C. esfandiari* Rech. f. & Aellen) is $2n = 20$, $n = 10$ (Ghaffari, 1984, 1989). Meiosis in this taxon was regular with ten bivalents, three of them were associated with nucleolus. Chiasmata average is calculated 1.28 for each bivalent.

7. *Centaurea sosnovskii* Grossh. $n = 10 \text{ II}$ (Fig.9).

This taxon is distributed in Iran, Talysh and Transcaucasia. Two collections of this species were studied and both of this had ten bivalents at first metaphase. Occasionally in some cells tetravalents were observed. Mean chiasmata frequency for each bivalent was 1.20 at first metaphase. This is the first on report chromosome number for this taxon.

Discussion

Cytological studies on pollen mother cells of seven species (except one) of section Acrocentron showed that they are diploid with basic chromosome number $X = 10$. The only exception was *C. pseudoscabiosa* subsp. *pseudoscabiosa* with $X = 11$. According to the literature the basic chromosome numbers in the section Acrocentron are $X = 10$ and $X = 11$. Garcia-Jacas & Susanna (1992) believed that the trend in section Acrocentron has been from $X = 11$ to $X = 10$, and Acrocentron follows the general trend in

Centaurea of aneuploid reduction of the basic number, which is correlated with morphological evolution. They also noted that the pattern of the geographic distribution of the two basic numbers suggests a more archaic character with $X = 11$. In addition they observed that the E Mediterranean is older center of diversification than SW Mediterranean.

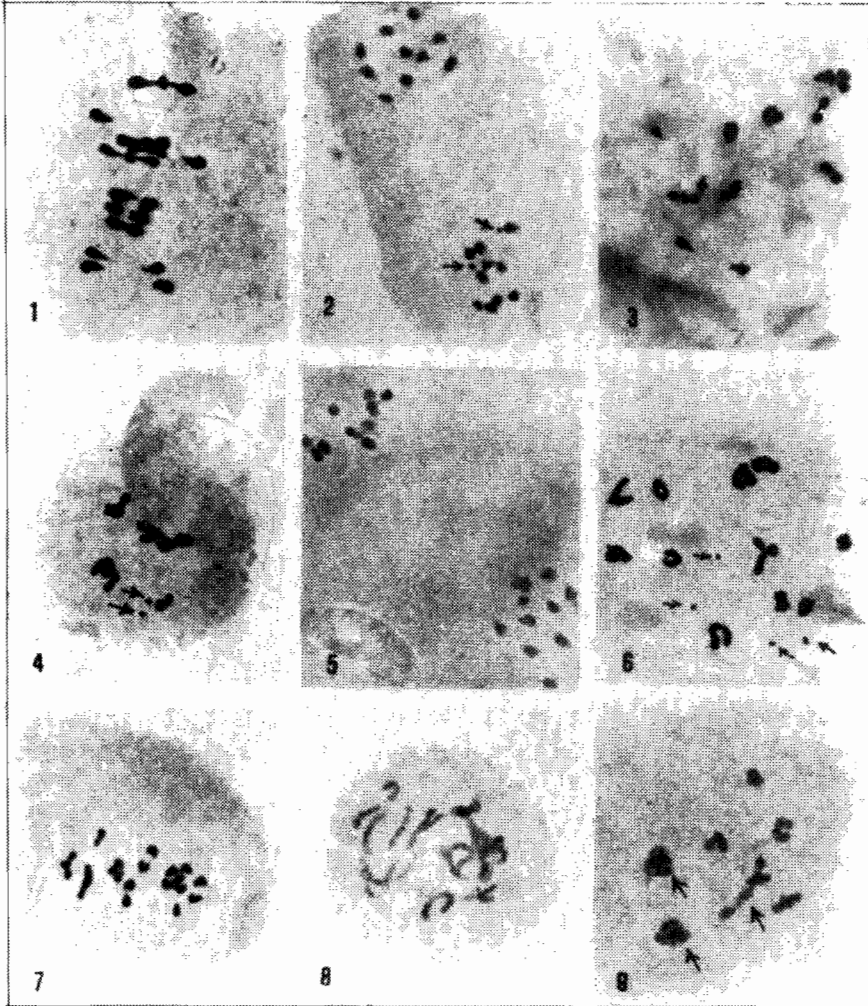


Fig. 1-9: Meiosis: 1) *C. carduiformis* ssp. *Iranica* (metaphase-I): $n = 10$, 2) *C. irritance* (anaphase-I) $n = 10$ showing two B-chromosomes (arrows), 3) *C. kandavanensis* (metaphase-I): $n = 10$, 4) *C. kandavanensis* (metaphase-I): showing two B-chromosomes (arrows), 5) *C. persica* (anaphase-I): $n = 10$, 6) *C. pseudoscabiosa* ssp. *Pseudoscabiosa* (metaphase-I): $n = 11$ showing 4 B-chromosomes, 7) *C. sintensiana* (metaphase-I): $n = 10$, 8) *C. sintensiana* (diplotene): $n = 10$ showing three bivalents associated with nucleolus, 9) *C. sosnovski* (metaphase-I): $n = 10$ showing three tetravalents (arrows).

The results of these studies are in agreement with the hypothesis of Garcia-Jacas & Susanna (1992) because most of the species of Iran have basic number $X = 10$, which as stated above advanced species. The presence of *C. pseudoscabiosa* subsp. *pseudoscabiosa* in the west of Iran indicates that this species is closer to the E Mediterranean area and is distributed up to the west of Iran. Moreover the resulting evidence of shape and behaviour of chromosomes in the pollen mother cells and occurrence of B-chromosomes confirm inter-relationships of the species in the Acrocentron.

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