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Determination of chromosome numbers in Kuwaiti flora II

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ABSTRACT: This paper deals with the somatic (sporophytic) and gametic chromosome numbers of some indigenous wild species of Kuwaiti flora. All samples were collected from the wild. Some values are reported for the first time such as *Aaronsohnia factorovskyi,* 2n=18 and n=9, *Carduus pycnocephalus*, 2=26 and n=13*, Centaurea bruguierana* 2n=16*, Rhanterium epapposum*, 2n=12 and n=6, *Horwoodia dicksoniae,* 2n=26*, Bassia muricata,* n=9, *Alhagi graecorum,* 2n=16, *Salvia spinosa*, n=10, *Rumex vesicarius*, n=9, *Lycium shawii*, n=12 and *Nitraria retusa*, n=12.

KEYWORDS: chromosome numbers, meiosis, flowering plants, Kuwait.

Introduction

Chromosome numbers and morphology of species can provide useful information for various fields of research including karyotaxonomy, genetics, cytogenetics, plant breeding, ecology, biogeography and molecular biology. A number of workers have been involved in reporting the chromosome numbers of wild and cultivated plant species (DARLINGTON & WYLIE 1955; BOLKHOVSKIKH & al. 1969; LÖVE & LÖVE 1974, 1975; MOORE 1973, 1974, 1977; MEIKLE 1977; BEUZENBERG & NAIR 1983; GOLDBLATT 1981, 1984, 1985, 1988; GOLDBLATT & JOHNSON 1990, 1991, 1994, 1996, 1998; WEBB & BEUZENBERG 1987; MÁJOVSKÝ

& MURÍN 1987; RAO & CHANDEL 1991; MURÍN & al. 1999). On the basis of such information it has often been possible to interpret the genetic interrelationships existing within species (BERDAHLE & BARKER 1991; BROCHMANN 1992; ŠTEPÁNKOVÁ 1993).

This paper is a continuation of our karyological research on Kuwaiti flora (MALALLAH & al. 1996, 1997; MALALLAH & BROWN 1999) and the plant species reported here are the second sample in the investigation.

Materials and methods

26 species from 10 different families were examined for chromosome number. The families and the species examined are shown in Table.1. The nomenclature and synonyms are in accordance with DAOUD (1985), AL-RAWI (1987), and BOULOS & AL-DOSARI (1994). The selection of the species was made according to the most well prepared and spread sample.

Seeds and buds were collected from at least three different plants growing at various localities in Kuwait. The seeds were germinated in a controlled growth chamber at 16°C on moist filter paper enclosed in Petri dish. Actively growing root tips were pretreated either with 0.05% colchicine for 4h or with 20h cold water at 5°C in order to have C-metaphases and then fixed in Carnoy's fixative (1:3 glacial acetic acid alcohol) until use. For slide preparation, the excised root tips were washed with distilled water for 4-5 min., hydrolyzed in 1N hydrochloric acid for 10-12 min. at 60°C and finally rinsed with distilled water for 4-5 min. Young buds were kept in Carnoy's fixative till use. The anthers or root tips were squashed in a drop of 1-% aceto-carmine stain and covered with a clean cover glass. Microscopic analysis was carried out with an Olympus BH-2 photomicroscope. Micrograghs were taken when necessary at 1000X magnification from temporary preparation. Several well-spread metaphases were counted to confirm the validity of the chromosome number.

Results and discussion

Due to the low annual rainfall, shortage of water, grazing animals and many other factors, the wild vegetation in Kuwait was observed to be very poor particularly the period of 1992-2000. During the time of 1997-1999 (the period of the present study), many species were hardly seen in many localities. The observation on the scarily vegetation was reported in a study extended two periods: 1974-1978 and 1987-1990 (HALWAGY & EL-SAADAWI 1992). In the first period around 133 species of annuals and biennials and 26 species of perennials were recorded. In the second period only 16 and 12, respectively were observed. The authors explained that the reduction in the number of plant species, annuals and perennials, was due mainly to successive years of drought. Because of the poor vegetation, it was difficult to obtain many plant species (as flower buds or seeds or mature plant) in adequate amount for the present research studies.

According to this situation, and to preserve the diversity of indigenous plant species we felt that it is very important to involve part of the present work (not included) in preservation of some endangered Kuwaiti plant species. In this text, data obtained in present work (starting with *) are compared with the relevant data from literature in individual style for each species.

Asteraceae (Compositae)

Aaronsohnia factorovskyi WARD & EIG
Kuwaiti data: It is an annual herb that grows in sandy and loamy soil. There are only individual plants scattered in many localities. The flowering time is March-April.
* 2n = 18 n = 9
Literature data and comments:
No data available for this species in the published Indexes to Plant Chromosome Numbers-Missouri Botanical Garden (IPCN) or elsewhere. However, one reference showed that the another species of the same genus, *A. pubescens* (DESF.) BREMER & HUMPHRIES have somatic number of 18 (VOGT & OBERPRIELER 1993, sec. GOLDBLATT & JOHNSON 1996), demonstrating the probability that the basic number for this genus is 9. The somatic and gametic numbers of the Kuwaiti species are the first to be reported. Fig. 1 shows several events during meiosis demonstrating the behavior of the bivalents. In the cells, there are nine bivalents (Fig. 1 B), three of which are with two chiasmata, one in each arm and thus forming three ring bivalents and the rest of the bivalents has one terminal chiasma forming six rods. The chiasmata are terminalized one by one (Fig. 2 A & B).

Carduus pycnocephalus L.
Syn.: *C. tenuiflorus* CURT var. *pycnocephalus* (L.) DC.
Kuwaiti data: It is a common annual herb that is found in dry sandy soil in many places. The flowering time is April-May.
* 2n = 26 n = 13
Literature data and comments:
The somatic and gametic values of Kuwaiti species are the first to be reported. This species demonstrated a variable somatic counts such as follows: 2n = 64 (MOORE 1974; DEVESA 1981, sec. GOLDBLATT 1984; BELLOMARIA & HRUSKA 1983, sec. GOLDBLATT 1988), 2n = 62-64 (MOORE 1977), 2n = 60 (MOORE 1977; DIAZ LIFANTE & al. 1992) OBERPRIELER & VOGT 1993, sec. GOLDBLATT & JOHNSON 1996), 2n = 54 (KUZMANOV & al. 1986, sec. GOLDBLATT & JOHNSON 1990; KUZMANOV & al. 1991, sec. GOLDBLATT & JOHNSON 1996), 2n = 32 (KLIPHUIS & BARKOUDAH 1977, sec. GOLDBLATT 1981; KUZMANOV & al. 1991, sec. GOLDBLATT & JOHNSON 1996.), and 2n = 18 (LOON & JONG 1978, sec. GOLDBLATT 1981). There was one gametic value reported as n = 31 (GHAFFARI 1989, sec. GOLDBLATT & JOHNSON 1991). These values were also found in other studies for the same species (BOLKHOVSKIKH & al. 1969, MOORE 1973, 1974, 1977). It is

interesting to notice that this species with the synonym *C. tenuiflorus* CURT was treated as different species and was shown with 2n=54 (MORTON 1977, sec. GOLDBLATT 1981; DEVESA 1981, sec. GOLDBLATT 1984; PAJARON SOTOMAYOR 1982, sec. GOLDBLATT 1985) and n = 27 (DEVESA 1981, sec. GOLDBLATT 1984; MATHEW & MATHEW 1988, sec. GOLDBLATT & JOHNSON 1991). With the new somatic and gametic values from Kuwaiti flora, it is important to clarify whether we are dealing with one or two different species.

Carthamus oxyacantha M. BIEB.
Kuwaiti data: It is a common annual herb that grows in sandy soil and flowers during April-July.
* 2n = 24 n = 12
Literature data and comments:
The chromosome counts of this species have been reported in many references as 2n = 24 (ESTILAI & al 1976, sec. GOLDBLATT 1981; BIR & SIDHU 1980, TONIAN 1980, sec. GOLDBLATT 1984; SIDHU & BIR 1983, sec. GOLDBLATT 1988) and n = 12 (MEHRA & REMANANDAN 1976, and ARYVAND 1977, sec. GOLDBLATT 1981; SIDHU 1979, sec. GOLDBLATT 1984; GUPTA & GILL 1989, and GHAFFARI 1989, sec. GOLDBLATT & JOHNSON 1991). The somatic and gametic Kuwaiti values are consistent with other values. The chromosomes of this species are very small and cannot be characterized.

Centaurea bruguierana (DC.) HAND.-MAZZ.
Syn.: *C. phyllocephala* BOISS.
Kuwaiti data: It is an annual herb that grows in sandy soil. Many plants were found only in one locality (Al-Salmi - Kuwait border with S. Arabia). The flowering time is April-May.
* 2n =16 n = ?
Literature data and comments:
This somatic value 16 is another different value for this species. The other values were 2n = 20 (GHAFFARI 1984, sec. GOLDBLATT 1988) and 2n=22 (MOORE 1973) This could reflect the role of geographical distribution of the species. One reference showed that n=10 (GHAFFARI & al. 1989, sec. GOLDBLATT & JOHNSON 1991).

Rhanterium epapposum OLIV.
Kuwaiti data: aromatic perennial subshrub that grows commonly in many areas. The flowering time is February-July.
* 2n =12 n = 6
Literature data and comments:
This species has no reported chromosomal counts. The gametic and somatic chromosome numbers in this investigation are the first to be reported. Fig. 3 shows the twelve chromosomes of this species for the first time.

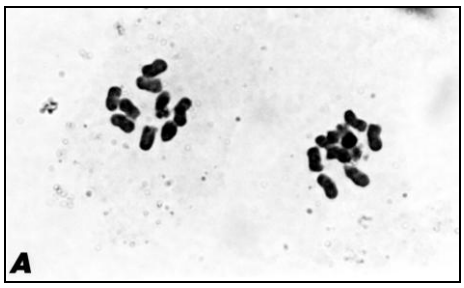

Fig. 1. *Aaronsohnia factorovskyi*, showing events during meiosis; A – the nine bivalents, B – 3 ring- and 6 rod-bivalents.

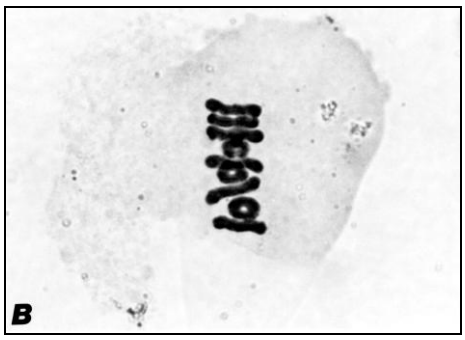

Fig. 2. A&B – showing the process of terminalization of the chiasmata in *Aaronsohnia factorovskyi.*

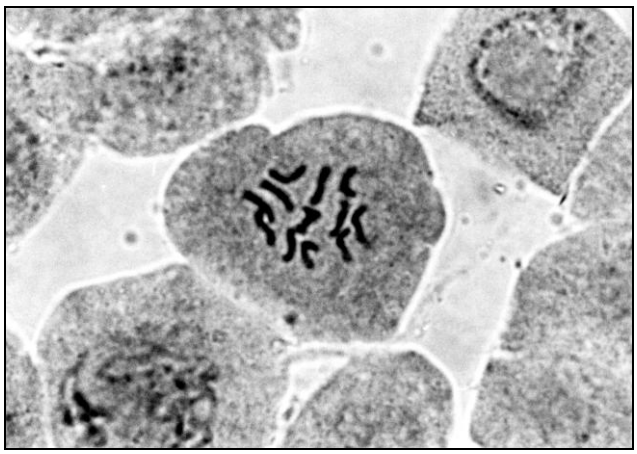

Fig. 3. A cell of *Rhanterium epapposum* shows the 12 chromosomes.

Table 1. Families and species studied in this work and their chromosome numbers.

Family	Species	Gametic no.	Somatic no.
Asteraceae	*Aaronsonia factorovskyi*	9	18
	Carduus pycnocephalus	13	26
	Carthamus oxyacantha	12	24
	Centaurea bruguierana	–	16
	Rhanterium epapposum	6	12
Brassicaceae	*Brassica tournefortii*	10	20
	Cakile arabica	9	–
	Horwoodia dicksoniae	13	26
	Schimpera arabica	7	14
	Sisymbrium irio	14	–
Chenopodiaceae	*Bassia eriophora*	–	18
	Bassia muricata	9	18
	Chenopodium murale	9	18
Fabaceae	*Alhagi graecorum*	–	16
	Hippocrepis areolata	7	14
	Medicago rotata	8	16
	Trigonella anguina	8	16
	Trigonella hamosa	8	16
	Trigonella stellata	8	16
Geraniaceae	*Erodium laciniatum*	–	20
Iridaceae	*Gynandriris sisyrinchium*	–	24
Lamiaceae	*Salvia spinosa*	10	–
Polygonaceae	*Emex spinosa*	–	20
	Rumex vesicarius	9	18
Solanaceae	*Lycium shawii*	12	–
Zygophyllaceae	*Nitraria retusa*	12	–

Brassicaceae (Cruciferae)

Brassica tournefortii GOUAN
Syn.: *B. sisymbrioides* (FISCHER) GROSSH., *Erucastrum minutiflorum* PAU & FONT QUER., *Sinapis caspica* WILLD. ex LEDEB.
Kuwaiti data: it is a common annual herb that grows in sandy soil in many places.
* 2n = 20 n = 10
Literature data and comments:
The somatic count of this species was shown to be 2n = 20 (2 ref. in BOLKHOVSKIKH & al. 1969; COLOMBO & al 1983, sec. GOLDBLATT & JOHNSON

1990) and Kuwaiti data are consistent with reported values. The gametic value here is also consistent with the other values (2 ref. in MOORE 1974).

Cakile arabica VELEN. & BORNM.
Kuwaiti data: It is common annual herb that grows in sandy and sand dunes. Flowering time is February-March.
* 2n = ? n = 9
Literature data and comments:
The gametic value of the Kuwaiti species is consistent with other values (RODMAN & BHARGAVA 1976, RODMAN 1978, sec. GOLDBLATT 1981; AL-SHEHBAZ 1978, sec. GOLDBLATT & JOHNSON 1990). The somatic count has not been recorded yet.

Horwoodia dicksoniae TURRILL
Syn.: *Malcolmia musilii* VEL.
Kuwaiti data: It is an annual herb that is found in sandy soil. This species is extinct because just two individual plants were seen in the 1999-2000. DAOUD (1985) mentioned that this species is distributed in many places, but in 1998 only one sample was found and we took the seeds from it to determine the chromosome number.
* 2n = 26 n = 13
Literature data and comments:
This is the first time to report the somatic number of this species. The gametic number was found to be n = 13 (RODMAN 1978, sec. GOLDBLATT 1981; AL-SHEHBAZ 1978, sec. GOLDBLATT & JOHNSON 1990), and the Kuwaiti values is the third to be reported.

Schimpera arabica HOCHST. & STEUD.
Syn.: *S. persica* BOISS., *S. arabica* HOCHST. & STEUD. subsp. *persica* (BOISS.) HADAČ & CHRTEK , *S. arabica* HOCHST & STEUD. var. *persica* (BOISS.) BORNM.
Kuwaiti data: it is annual herb that grows commonly in sandy soil. The flowering time is February-March.
* 2n =14 n = 7
Literature data and comments:
The gametic chromosome number for this species in this study is consistent with other values where n = 7 (AL-SHEHBAZ & AL-OMAR 1982, 1983, sec. GOLDBLATT 1985). Only one reference showed that 2n = 14 (KLIPHUIS & BARKOUDAH 1977, sec. GOLDBLATT 1981) and the Kuwaiti value is the same and the second to be reported.

Sisymbrium irio L.
Syn.: *S. austriacum* JACQ. subsp. *multisiliquosum* (HOFFM.) ROUY & FOUC., *S. multisiliquosum* HOFFM.
Kuwaiti data: It is an annual herb that distributed in many places in hard sandy soil. Flowering time: March-April.

* 2n = ? n = 14
Literature data and comments:
Many references showed values for the somatic number, i.e. 2n = 14, 21, 28, 42 and 56 (3 ref. in BOLKHOVSKIKH & al. 1969; 1 ref. in MOORE 1973; MICELI & al 1978, sec. GOLDBLATT 1981; BIR & SIDHU 1980, SIDHU 1979, NATARAJAN 1981, LESSANI & CHARIAT-PANAHI 1979, sec. GOLDBLATT 1984; CARRIQUE & MARTINEZ 1984, sec. GOLDBLATT 1988; DALGAARD 1986, sec. GOLDBLATT & JOHNSON 1990; GHAFFARI & al. 1987a, sec. GOLDBLATT & JOHNSON 1991; NATARAJAN 1988, sec. GOLDBLATT & JOHNSON 1994). For the gametic count, there were two values i.e. n=7, 14 (ARYAVAND 1977a, sec. GOLDBLATT 1981; AL-SHEHBAZ & AL-OMAR 1982 and WARD 1983, sec. GOLDBLATT 1985; ARYAVAND 1987, sec. GOLDBLATT & JOHNSON 1990). The basic number for this species seems to be 7. The Kuwaiti gametic number implies the presence of the species with higher level of ploidy. So far the Kuwaiti somatic count has not been determined yet. The chromosomes of this species are very small and difficult to characterize.

Chenopodiaceae

Bassia eriophora (SCHRAD.) ASCHERS.
Syn.: *Kochia eriophora* SCHRAD.; *K. latifolia* FRESEN.
Kuwaiti data: it is a common annual herb, which is found in sandy soil in many places.
* 2n = 18 n = ?
Literature data and comments:
For this species, 2n =18 (WULF 1963, sec. BOLKHOVSKIKH & al. 1969 and MOORE 1973). The gametic count is to be detected.

Bassia muricata (L.) ASCHERS.
Syn.: *Salsola muricata* L.; *Kochia muricata* (L.) SCHRAD.
Kuwaiti data: It is uncommon annual herb, which found in sandy soil in many places. The flowering time: March-April.
* 2n = 18 n = 9
Literature data and comments:
The somatic value for this species is the second to be reported. The first value was reported in one reference (REESE 1957, sec. BOLKHOVSKIKH & al. 1969). The gametic number for this species is the first to be reported from Kuwaiti flora showing that the basic number is 9.

Chenopodium murale L.
Kuwaiti data: it is a common annual herb. The flowering time: February-April.
* 2n = 18 n = 9
Literature data and comments:
The Kuwaiti somatic count 18 is consistent with many other counts (7 ref. in BOLKHOVSKIKH & al. 1969; 1 ref. in MOORE 1974; 3 ref. in MOORE 1977; 4 ref. in GOLDBLATT 1981; 4 ref. in GOLDBLATT 1984; 1 ref. in GOLDBLATT 1985; 2 ref. in

GOLDBLATT & JOHNSON 1990; 1 ref. in GOLDBLATT & JOHNSON 1991). There were two references giving the gametic count and both showed the same as Kuwaiti value i. e. n = 9 (1 ref. in MOORE 1973; 1 ref. in GOLDBLATT 1984). This species is well established as diploid state with the basic number of 9.

Fabaceae (Leguminosae)

Alhagi graecorum BOISS.
Syn.: *A. mannifera* JAUB. & SPACH, *A. tournefortii* HELDR.
Kuwaiti data: It is an uncommon perennial shrub that germinates in hard sandy soil in many places. The flowering time: April-May.
* 2n = 16 n = ?
Literature data and comments:
This value of somatic count of Kuwaiti species is the first to be reported. The value of 2n = 28 was previously reported (BOLKHOVSKIKH & al. 1969) Kuwaiti species shows the diploid state and the chromosomes are small.

Medicago rotata BOISS.
Kuwaiti data: It was introduced as weed and became constant element in one locality (Failka - Kuwaiti island) but no information was found regarding the description of this species in Kuwaiti records.
* 2n = 16 n = 8
Literature data and comments:
The somatic count of this species was found to be 16 (KLIPHUIS & BARKOUDAH 1977, sec. GOLDBLATT 1981; AGARWAL & GUPTA 1983, sec. GOLDBLATT 1985; DIAZ LIFANTE & al. 1992, sec. GOLDBLATT & JOHNSON 1996) which are consistent with the Kuwaiti value. For the gametic count there was only one reported count (AGARWAL & GUPTA 1983, sec. GOLDBLATT 1985) which is 8 and the Kuwaiti value is the second to be reported. The genus *Medicago* showed that the basic number x =7, 8 (MÁJOVSKÝ & MURÍN 1987).

Hippocrepis areolata DESV.
Syn.: *H. bicontorta* LOISEL., *H. cornigera* BOISS.
Kuwaiti data: It is a common annual herb that grows in sandy soil. The flowering time is March.-April.
* 2n = 14 n = 7
Literature data and comments:
For this species there is only one reference (DOMINGUEZ 1976, sec. GOLDBLATT 1981) with 2n = 14 and n = 7. The Kuwaiti values are the second to be recorded. The chromosomes are very small. The literature data showed that the basic number, x, of the genus *Hippocrepis* is 7 and the diploid state is the dominant.

Trigonella anguina DELILE
Trigonella hamosa L.
Trigonella stellata FORSSK.

Kuwaiti data: They are generally common annual herbs that grow in sandy silt soil in many places. The flowering time is March-April.
The somatic and gametic chromosome numbers are the same for the above three species.
* 2n =16 n = 8
Literature data and comments:
For *T. anguina*, there is only one reported somatic value showing that 2n = 16 (BOLKHOVSKIKH & al. 1969). For *T. hamosa* there is also reported somatic value of 2n = 16 (BOLKHOVSKIKH & al. 1969, AGARWAL & GUPTA 1983). For the gametic count, the value was n = 8 (1 ref. MOORE 1973; 2 ref. 1977). The somatic value of *T. stellata* was shown to be 2n = 16 (BOLKHOVSKIKH & al. 1969; MOORE 1973). The somatic and gametic values of the Kuwaiti species are consistent with other values and showed the diploid state.

Geraniaceae

Erodium laciniatum (CAV.) WILLD.
Syn.: *Geranium laciniatum* CAV.
Kuwaiti data: It is a common annual or biennial herb, which is found in sandy soil in many places. Flowering time: March-April.
* 2n = 20 n = ?
Literature data and comments:
Several references showed that 2n = 20 (BOLKHOVSKIKH & al.1969; MOORE 1977; PAVONE & al. 1981, sec. GOLDBLATT 1985; LUQUE & DEVESA 1985, sec. GOLDBLATT 1988; and BADR & HAMOUD 1985, sec. GOLDBLATT & JOHNSON 1991). One reference in the previous indexes showed that 2n = 40.

Iridaceae

Gynandriris sisyrinchium (L.) PARL.
Syn.: *Iris sisyrinchium* L.
Kuwaiti data: A perennial herb that grows uncommonly in dry sandy soil. Flowering time: February-March.
* 2n = 24 n = ?
Literature data and comments:
The somatic number of this species was shown to be 2n = 12 (GOLDBLATT 1980a, sec. GOLDBLATT 1984), 24 (QUEIROS 1980, GARBARI & CRISMAN 1988, PEREZ & PASTOR 1994, SNOGERUP 1995, and VOSS & al. 1994, sec. GOLDBLATT 1985; GOLDBLATT & JOHNSON 1991, 1998, respectively), and 48 (MONTMOLLIN & al. 1986, sec. GOLDBLATT & JOHNSON 1991). The somatic chromosome number of Kuwaiti species, 24, seems to be the tetraploid value as the basic number x = 6. The gametic number has not been detected yet.

Lamiaceae (Labiatae)

Salvia spinosa L.
Kuwaiti data: it is a perennial herb that grows in calcareous soil. The flowering time is March-April.
* 2n = ? n = 10
Literature data and comments:
The gametic chromosome number for this species n = 10 is the first to be reported. The somatic count was found to be 2n = 20 (BOLKHOVSKIKH & al 1969, PATUDIN & al. 1975, KLIPHUIS & BARKOUDAH 1977, sec. GOLDBLATT 1981).

Polygonaceae

Emex spinosa (L.) CAMPD.
Syn.: *Rumex spinosus* L.
Kuwaiti data: it is a common annual herb that distributes in many sandy places.
Flowering time: March-April.
* 2n = 20 n =?
Literature data and comments:
The somatic value was recorded to be 2n = 20 (6 ref. in BOLKHOVSKIKH & al. 1969; PUTIEVSKY & al. 1980a, QUEIROS 1983a, DALGAARD 1986, QUEIROS 1991b, sec. GOLDBLATT 1984, 1985; GOLDBLATT & JOHNSON 1990, 1994 respectively). The somatic number of Kuwaiti species is consistent with other studies and showed the diploid level.

Rumex vesicarius L.
Kuwaiti data: It is a common annual herb that grows in sandy soil in many places. Flowering time: March-April.
* 2n = 18 n = 9
Literature data and comments:
The Kuwaiti value is consistent with many studies which showed that 2n = 18 (4 ref. in BOLKHOVSKIKH & al. 1969; also HUMPHRIES 1978, DALGAARD 1986, BRULLO & al. 1990, and BALTISBERGER & al. 1990, DIAZ LIFANTE & al. 1992, sec. GOLDBLATT 1981; GOLDBLATT & JOHNSON 1990; 1994, 1996 respectively). However, another value of 2n = 20 was recorded (BOLKHOVSKIKH & al.1969). The gametic number in this study is the first time to be reported.

Solanaceae

Lycium shawii ROEM. & SCHULT.
Syn.: *L. arabicum* SCHWEINF. ex BOISS., *L. albiflorum* DAMM., *L. persicum* MIERS
Kuwaiti data: It is thorny shrub that is found in sandy stone ridges in one locality.
The flowering time: March-April.
* 2n = ? n = 12

Literature data and comments:
MÁJOVSKÝ & MURÍN (1987) showed that the basic number, x, of *Lycium* L. is = 6. This suggests the polyploidy nature of this genus. No somatic value has been reported during the period from 1981 - 1998.

Zygophyllaceae

Nitraria retusa (FORSSK.) ASCHERS.
Syn.: *Peganum retusum* FORSSK., *N. senegalensis* LAM.; *N. tridentata* DESF.
N. sericea JAUB. & SPACH
Kuwaiti data: It is a halophytic shrub that can be found in salt marshes. The flowering time is March-May.
* 2 n =? n = 12
Literature data and comments:
The gametic chromosome number for this species is reported for the first time in this investigation. The somatic count was recorded to be 2n =24 (HILU 1979, sec. GOLDBLATT 1984; BOLKHOVSKIKH & al. 1969) which confirm the diploid level of this species.

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References

Because the full list of references would enlarge this paper, we had to shorten this part and refer to the original sources such as BOLKOVSKIKH & al. 1969 and MOORE 1973, 1974, 1977 (indexes of plant chromosome number IPCN - Regnum Vegetabile 90, 91 and 96) for the relevant data for a particular species. References from elsewhere were mentioned.

AGARWAL K. & GUPTA P. K. (1983): Cytological studies in the genus Trigonella Linn. – Cytologia 48: 771-779.

AL-RAWI A. (1987): Flora of Kuwait. Vol. 2., Kuwait University. Oxford I-XIII: 225-455.

BERDAHLE J. D. & BARKER R. E. (1991): Characterization of autotetraploid Russian wild rye produced with nitrous oxide. – Crop Sci. 31: 1153-1155.

BENZENBERG E. J. & NAIR J. B. (1983): Contribution to chromosome atlas of New Zealand flora; 25 miscellaneous species. – New Zealand J. Bot. 21: 13-20.

BOLKHOVSKIKH Z., GRIF V., MATVEYEVA O. & ZAKHARYEVA O. (1969): Chromosome numbers of flowering plants. (ed. A. A. FEDOROV). – Nauka, Leningrad, 926 pp.

BOULOS L. & AL-DOSERI M. (1994): Checklist of the flora of Kuwait. – J. Univ. Kuwait (Sci.) 21; 203-218.

BROCHMANN C. (1992): Pollen and seed morphology of Nordic draba (Brassicaceae): Phylogenetic and ecological implications. – Nord. J. Bot. 21: 13- 20.
DAOUD S. (1985): Flora of Kuwait. Vol. I: Dicotyledoneae. (Publisher K. P. I England).
DARLINGTON C. D. & WYLIE A. P. (1955): Chromosome atlas of flowering plants. – George Alen & Unwin, London.
GOLDBLATT P. (1981): Index to plant chromosome numbers 1975-1978. – Missouri Botanical Garden, pp. 58, 84, 85, 154, 161, 238, 247, 276, 293, 422.
GOLDBLATT P. (1984): Index to plant chromosome numbers 1979-1981. – Missouri Botanical. Garden, pp. 66, 67, 124, 125, 173, 201, 206, 317, 365.
GOLDBLATT P. (1985): Index to plant chromosome numbers 1982-1983. – Missouri Botanical Garden, 38, 67, 97, 105, 107, 165.
GOLDBLATT P. (1988): Index to plant chromosome numbers 1984-1985. – Missouri Botanical Garden, pp. 43, 77, 117.
GOLDBLATT P. & JOHNSON D. E. (1990): Index to plant chromosome numbers 1986-1987. – Missouri Botanical Garden, pp. 35, 59, 61, 63, 158.
GOLDBLATT P. & JOHNSON D. E. (1991): Index to plant chromosome numbers 1988-1989. – Missouri Botanical Garden, pp. 47, 76, 113, 117, 181, 182.
GOLDBLATT P. & JOHNSON D. E. (1994): Index to plant chromosome numbers 1990-1991. – Missouri Botanical Garden, pp. 70, 90, 181, 182.
GOLDBLATT P. & JOHNSON D. E. (1996): Index to plant chromosome numbers 1992-1993. – Missouri Botanical Garden, pp. 38, 45, 82, 124, 188.
GOLDBLATT P. & JOHNSON D. E. (1998): Index to plant chromosome numbers 1994-1995. – Missouri Botanical Garden, pp. 78, 94.
HALWAGY M. & EL-SAADAWI W. (1992): Drought and changes in the bryoflora and angiosperm flora in Kuwait in the years 1974-1990. – Acta Bot. Neerl. 41: 183-195.
LÖVE A. & LÖVE D. (1974): Cytotaxonomical atlas of Slovenian flora. Lehre, 1241 pp.
LÖVE A. & LÖVE D. (1975): IOPB Chromosome number reports XLVIII. – Taxon 24: 367-372.
MÁJOVSKÝ J. & MURÍN A. (eds.) (1987): Karyotaxonomický prehľad flóry Slovenska. Veda, Bratislava, 436 pp.
MALALLAH G., AFZAL M., ATTIA T., & ABRAHAM D. (1996): Tapetal cell nuclear characteristics of some Kuwaiti plants. – Cytologia 61: 259-267.
MALALLAH G., AFZAL M., MURÍN G., MURÍN A. & ABRHAM D. (1997): Genetoxicity of oil pollution on some species of Kuwaiti flora. – Biologia, Bratislava, 52: 61-70.
MALALLAH G. & BROWN G. (1999): Determination of chromosome number of Kuwaiti flora I. – Cytologia 64:181- 196.
MEIKLE R. D. (1977): Flora of Cyprus. – Bentham-Moxon Trust, Royal Botanic Gardens, Kew.
MOORE R. J. (1973): Index to Plant Chromosome Numbers 1967-71. – Regnum Veg. 90.
MOORE R. J. (1974): Index to Plant Chromosome Numbers 1972. – Regnum Veg. 90.
MOORE R. J. (1977): Index to Plant Chromosome Numbers 1973-1974. – Regnum Veg. 90.
MURÍN A., SVOBODOVÁ Z., MÁJOVSKÝ J., & FERÁKOVÁ V. (1999): Chromosome numbers of some species of the Slovak flora. – Thaiszia- J. Bot. 9: 31-40.
RAO S. R. & CHANDEL K. P. (1991): Karyomorphological studies in the cultivated and wild *Vigna* species in Indian Gene Centre. – Cytologia 56: 47-57.
ŠTĚPÁNKOVÁ J. (1993): Ploidy variation in the group of Myosotis palustris and M. laxa in the Czech Republic and Slovakia. – Folia Geobot. Phytotax. 28: 113-128.

WEBB C. J. & BEUZENBERG E. J. (1987): Contribution to a chromosome atlas of the New Zealand flora – corrections and additions to number 21 Umbeliferae (Hydrocotyle). – New Zealand J. Bot. 25: 371-372.

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