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CHROMOSOME NUMBERS FOR SOME STELLARIA L. (CARYOPHYLLACEAE) SPECIES AND RELATED TAXA IN IRAN

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Choromosome counts are reported from 23 population representing three genera and 8 taxa of the subfamily *Alsinoideae* (Caryophyllaceae) from Iran. Chromosome numbers are given for 6 taxa of *Stellaria* (Caryophyllaceae) and some related genera in Iran: *Stellaria pallida* (2n=2x=22), *S. holostea* (2n=2x=26), *S.gaminea* (2n=2x=26), *S. persica* (2n=28), *S. alsinoides* (2n=2x=30), *S. media* (2n=4x=40,42,44); *Myosoton aquaticum* (2n=28) and *Mesostemma kotschyanum* subsp. *kotschyanum* (2n=32). The chromosome counts for the following species are reported for the first time: *S. persica*, *S. alsinoides* and *Mesostemma kotschyanum* subsp. *kotschyanum*
The species of the genus *Stellaria* are divided into tetraploid and diploid groups. Observed chromosome numbers are mainly in concordant with previous data for the world.

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Key words. Chromosome counts, *Stellaria*, Iran

شمارش کروموزومی برخی گونه های *Stellaria* L. (Caryophyllaceae) و بعضی تاکسونهای مرتبط در ایران

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شمارش کروموزومی ۲۳ جمعیت متعلق به ۳ جنس و ۸ آرایه از تیره میخک (زیر تیره ***Alsinoideae***) از ایران گزارش می شود. اولین گزارش کروموزومی برای گونه های *S. persica* (2n=28)، *S. alsinoides* (2n=2x=30) و *Mesostemma kotschyanum* subsp. *kotschyanum* (2n=32) ارائه می شود. گونه های جنس ***Stellaria*** به دو گروه تتراپلوئید و دیپلوئید تقسیم بندی می شوند. شمارش کروموزومی برای شش تاکسون از ***Stellaria*** (*Caryophyllaceae*) و برخی از تاکسونهای مرتبط با آن به شرح زیر گـــــزارش می شود: *S. pallida* (2n=2x=22)، *S. holostea* (2n=2x=26)، *S. graminea* (2n=2x=26)، *S. persica* (2n=28)، *S. alsinoides* (2n=2x=30)، *S. media* (2n=4x=40,42,44)، *Myosoton aquaticum* (2n=28) و *Mesostemma kotschyanum* subsp. *kotschyanum* (2n=32). شمارشهای کروموزومی این پژوهش با یافته های قبلی در دنیا مطابقت دارد.

INTRODUCTION

The family Caryophyllaceae comprised about 86 genera and 2200 species (Bittrich 1993). According to Flora Iranica 9 *Stellaria* species have been known from Iran (Rechinger 1988). *Stellaria* Species are classified in two sections as *Stellaria* L. and *Pseudalsine* Boiss. but some species as *S. blatteri* Mattf., *S. scaturiginella* Rech.f., are grouped in an uncertain section (Rechinger 1988). *Stellaria* L. species are common herbs, preferred humid mountainously slopes, but some grew in desert. Main center of diversification for *Stellaria* is Eurasia, with a center of distribution in the mountains of E. central Asia. Some species are also cosmopolitan (Bittrich 1993).

There are limited chromosome records for *Stellaria* in the world. Basic Chromosome numbers of x=10, 11,

12 and 13 have been reported for the genus, but almost all the native north American species that have been examined have a base number of 13 (Federov 1969, Moore 1973, Goldblatt 1981). Aryavand & Favarger (1980) studied the meiotic condition of some Caryophyllaceae in Iran taxa including *Stellaria kotschyanum* (n=16) which is now considered as *Mesostemma kotschyanum*.

A new basic chromosome number of 15 for the genus *Stellaria* (Morton 1984) were recorded. Chromosome counts as x=13 and 2n=26, 39, 40, 42 and 52 for *S. graminea* L. are observed which indicated the presence of polyploidy in this genus. *Stellaria graminea* has diploid (2n = 26) and tetraploid (2n = 52) cytotypes in Europe where it is a native species. All the populations that have been examined from North America, where it is an aggressive introduced rhizomatous weed, are tetraploid with the exception of a sterile triploid (2n = 39) colony in Newfoundland. Only the diploid cytotype is known to occur in the British Isles (Blackburn & Morton 1957, Stace 1997). In *S. holostea* L. x=13 and 2n= 26, and *Myosoton aquaticum* (L.) Moench. 2n= 28, 29 and x= 11 and 2n=22, 40 for *S. pallida* (Dumort.) Pire. A chromosome number of 2n=40 has been reported from the Queen Charlotte Islands (Taylor & Mulligan 1968) and from Ontario (Mulligan 196l).

Reports of chromosome numbers of *S. media* (L) Vill. and *S. pallida* are given in Negodi, (1935); Peterson (1935) and Lovkvist (1963); Löve & Löve (1956 & 1961), Mulligan (1961) and Blackburn and Morton (1957).

The present study describes mitotic chromosome number of 23 collections in Iran representing 8 species form which three is recorded for the first time.

MATERIALS AND METHODS

For this research 23 populations of 6 Stellaria L. species of *Pseudalsine* (*S. alsinoides*), *Stellaria* (*S. media*, *S. pallida*, *S. holostea*, *S. persica* and *S. graminea*) sections and two species of the related genera (*Mesostemma kotschyanum* (Fenzl in Boiss.) Vved and *Myosoton aquaticum* (L.) Moench.) were collected during the years 2012-2013 from their natural habitats (Table 1). *Mesostemma kotschyanum* is considered as the basionym of *Stellaria* kotschyanum Fenzl in Boiss., but Rechinger in 1988 considered this taxon as *Mesostemma* Vved. On the other hand *Myosoton aquaticum* is sometimes treated as *Stellaria aquaticum* (L.) Scop. Recent molecular studies show that *M. aquaticum* nested within *Stellaria* clades (Mahdavi & al. 2012). *S. nemorum* L. was incorrectly recorded from Iran (Mahdavi & al. 2012) so it was not considered. Unfortunately accessions of *S.blatteri* and *S.scaturiginella* were not available so were not studied.

For somatic chromosome study, the seeds were soaked for 24 hours in running water and then germinated on moist filter paper in the laboratory (ca. 21º-24º). The growing root tips of ca. 1.0-1.5 cm long were cut between 9-11 AM and pretreated in 0.002M 8-hydroxyquinoline (4hours) and fixed in a cold mixture of ethanol and acetic acid (3:1) for 24 hours. Root tips were macerated in 1N HCl for 10 minutes (Cold Hydrolysis) at room temperature. Temporary slides were made by squashing the segments and staining in 2% Fe-acetocarmin for 10 hours. The Voucher specimens are deposited in the herbarium of the Department of Biology of Herbarium of Alzahra University (AUH), Iran.

RESULTS AND DISCUSSION

Results of present study showed that studied species have different ploidy levels in Iran. In this study two populations of *S. media* show a tetraploid level, 2n=40 (Fig. 1A), five populations show a tetraploid level, 2n=42 (Fig. 1B) and six populations show a tetraploid level, 2n=44 (Fig. 1C) is in accordance with previous report (Morton 2005 & Runemark 1996). In Iran there are high morphological variations in populations of *S. media* so that in some references subspecies have been defined for these taxa. The observations show that such variations have chromosome number differences in Iran as most morphological variations were considered from different parts of Iran for this study.

In *S. media* 2n=28, 36, 40, 42 and 44 have been reported from Eurasia with 2n=40 predominating (Federov 1974, Löve & Löve 1975, Moore 1973). This species shows a high phenotypic plasticity and genotypic flexibility. In our morphological observations this species show considerable similarities with *S. pallida* (Esfandani, 2013). However here we found some differences in chromosome counting between these two morphologically similar taxa. There are confusions in the basic chromosome numbers of *S. media* and *S. pallida* whether it is ten and/or eleven. *S. pallida* appear to be diploid and *S. media* with n =22 to be an allo-tetraploid. Negodi believed that its possible ancestors might be *S. pallida* and *S. neglecta.*

Mitotic metaphase showed chromosome compliment of 2n=28 in *S. persica* Boiss (Fig. 1F), 2n=30 in *S. alsinoides* Boiss & Buhse (Fig. 1D) and 2n=32 in *Mesostemma kotschyanum* subsp. *kotschyanum* Fenzl in Boiss (Fig. 1J). Apparently, it is a first mitotic chromosome number report for this species which is in concordance with Aryavand & Favarger (1980) results of meiotic chromosome number. *S. persica* is morphological similar to *S. graminea* but present results provide a proper separation by having different chromosome numbers.

Table 1. Chromosome numbers of *Stellaria* species and relative genera examined in this study from Iran.

Species	Locality	Previous Chromosome Number and some selected references	Replications	Present Chromosome Number
S. media (L) Vill.	Tehran: Enghelab sq., 1100m , Esfandani 998	18, 40, 42, 44 Sharma, 1970; Scholte, 1978; Bir, & Sidhu, 1979; Jav-ourkova-jarolimova, 1992; Probatova, Rudyka & Sokolovskaya, 1996	22	40
	Alborz: Karaj, 1300m, Esfandani 1000		18	42
	Isfahan: City center, 1500m, Esfandani 1010		25	44
	Markazi: Arak, Senejan, 1800m, Esfandani 1011		20	40
	Tehran: Darband, 1600m , Esfandani 1012		12	42
	Azerbaijan: Tabriz, 1450m, Habibi Tirtash 1013		11	44
	Azerbaijan: Tabriz, University tabriz, 1400m, Habibi Tirtash 1014		17	44
	Golestan: Gorgan, 134m, Esfandani 1015		12	42
	Tehran: Shahriyar, 1600m, Esfandani 1016		13	44
	Golestan: Gorgan, Ramian, 200m, Esfandani 1017		25	44
	Tehran: Pasdaran street, 1500m, Esfandani 1018		27	42
	Mazandaran: Sari, 40m, Esfandani 1019		21	44
	Alborz: Karaj- Mardabad, 1280m, Esfandani 1020		14	44
	Alborz: Karaj, Chalus road, 1400m, Esfandani 1021		13	42
S. pallida (Dumort) Pire	Golestan: Gorgan, Ramian, 200m, Esfandani 1030	22, 40 Amin, 1979; Runemark, 1996	19	22
	Golestan: Gorgan, Gonbadkavous, 24m, Habibi Tirtash 1031		12	22
S. holostea L.	Alborz: Karaj, Chalus road, Siah bisheh, 2200m, Esfandani 1032	26 Lovkvist, & Hultgard, 1999	16	26
	Gilan: Jirandeh, , Dadmehr1043		15	26
S. alsinoides Boiss.& Buhse	Mazandaran: Haraz road, Emam Zad-e-Hashem, 2700-2800m, Esfandani 1038	-	13	30
S. graminea L.	Alborz: Karaj, Chalus road, Kandovan north slopes, 2750-2800m, Esfandani 1036	26,39,40,42,52 Gadella, 1977; Jav-ourkova-jarolimova, 1992; Harmaja,1992; Lovkvist, & Hultgard, 1999; Morton, 2005	10	26
S. persica Boiss.	Alborz: Karaj, Chalus road, Kandovan Tunnel north slopes, 2750-2800m, Esfandani 1035	-	15	28
Myosoton aquaticm (L.) Moench	Gilan: Rezvanshahr, Khoshabireh, 50m, Esfandani 1040	28,29 Jav- ourkova-jarolimova, 1992; Lovkvist, & Hultgard, 1999	12	28
Mesostemma kotschyanum (Fenzl in Boiss) subsp. *kotschyanum*	Tehran: Mountain of Tuchal, near fifth station of Tuchal Telecabin, 2900m, Esfandani 1041	16 Aryavand, & Favarger, 1980	11	32

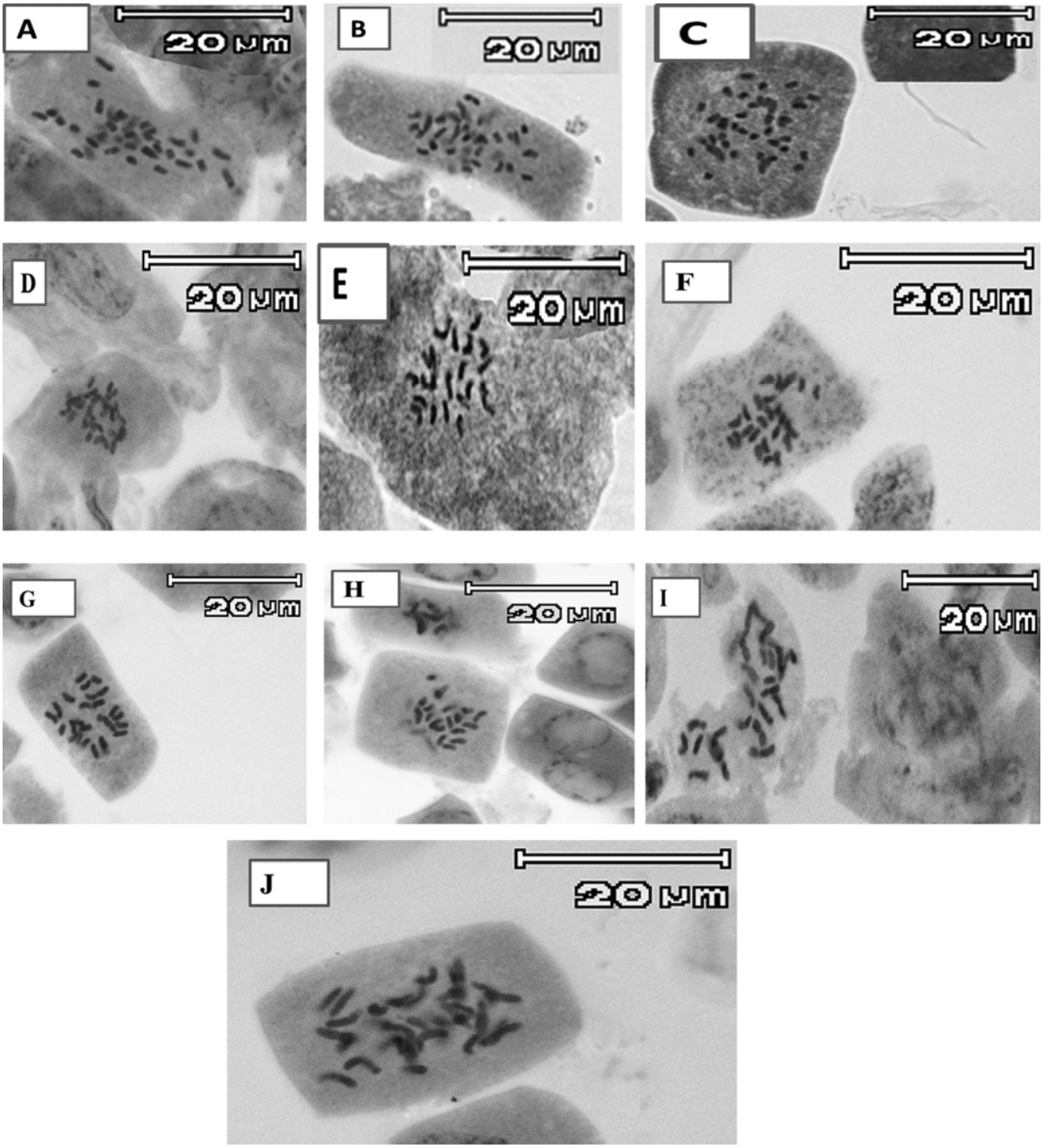

Fig. 1. Micrographs of chromosomes of root tips in studied species. A) *S. media* (2n=40), B) *S. media* (2n=42), C) *S. media* (2n=44), D) *S. alsinoides* (2n=30), E) *S. pallida* (2n=22), F) *S. persica* (2n=28), G) *S. holostea* (2n=26), H) *S. graminea* (2n=26), I) *Myosoton aquaticum* (2n=28), J) *Mesostemma kotschyanum* subsp. *kotschyanum* (2n=32).

Two studied populations from the *S. pallida* show a diploid level, 2n=22 (Fig. 1E) is in accordance with previous report of this species (Runemark 1996). The collection of *Myosoton aquaticum* were studied, that all were diploid with 2n=28 (Fig. 1I) which is in agreement with the previous report (Jav-ourkova 1992). Two studied collections of *S. holostea* were diploid with 2n=26 (Fig. 1G) this is as same as previous reports (Lovkvist & Hultgard 1999). The studied population from the *S. graminea* show a diploid level, 2n=26 (Fig. 1H) is not different from previous reports of Montgomery & al. 1997. Present study provides some information about *Stellaria* chromosome numbers and some related taxa. Some morphologically similar

species are separated due to the differences in chromosome number.

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