A CYTOLOGICAL STUDY OF SOME ACANTHOLIMON (PLUMBAGINACEAE) SPECIES FROM IRAN

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Chromosome number of 14 *Acantholomon* species from the flora of Iran were counted and reported, of which 13 are the new reports. Based on the results of this study two basic chromosome numbers i.e., x = 7 & 8 can be suggested for the species studied.

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Key words. *Acantholimon*, chromosome number, Iran.

بررسی‌های سلول شناسی برخی گونه های جنس **Acantholimon (Plumbaginaceae)** از ایران

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شمارش کروموزومی ۱٤ گونه از جنس *Acantholimon* گزارش می‌شود که همگی آنها متعلق به ایران بوده و۱۳ گونه برای اولین بار گزارش می‌شوند. بر اساس مطالعه انجام یافته اعداد ۷ و۸ به عنوان اعداد پایه کروموزومی معرفی می‌شود

Introduction

The genus *Acantholimon* including 22 species was first described by Boissier (1846). In his account Bunge (1872) increased the number of species to 83 from which 45 were reported from Iran. In his monograph, Mobayen (1964) recognized 119 *Acantholimon* species all around the world and 84 in Iran. Assadi (2005) in his treatment for the Flora of Iran subdivided the genus into 8 sections with 79 species from which 65 are endemic to the flora of Iran.

Cytologically, the chromosome numbers of five species have been counted and reported in this genus as follow: *A. scorpius*, 2n = 30 (Ghaffari 1988); *A. lepturoides*, 2n = 30 (Daniela 1997); *A. diapensioides*, 2n = 32 (Zakharjeva 1993); *A. aremenum*, 2n = 30 (Nazarova 1984); and *A. aristulatum*, n = 15 (Ghaffari 1988). This study is aimed to investigate the chromosome number and karyotypic diversity among some *Acantholimon* species occurring in Iran.

Materials and Methods

A total of 20 accessions belonging to 14 *Acantholimon* species (Table 1) were investigated in this study. Voucher specimens are preserved in TARI, herbarium of Shahid Bahonar University of Kerman and the herbarium of Isfahan University. Taxonomic treatments were based on Assadi (2005). Chromosome numbers were counted from the root tips pretreated and stained following Agayev (1996) with some modifications. Depending on the accessions, 2-5 chromosome spreads were examined for the each species studied and at least 10 metaphases were counted for each chromosome spread. All chromosomal sizes were measured with computer aided program Image Tool 3.0. Karyotypic analyses were performed using parameters: TF% (Total Form percent, Huziwara 1962) and S% (Stebbines Coefficient, Stebbins 1971). And chromosomes were named and classified after Levan et al. (1965).

Results and Discussion

Our investigations showed that three diploid numbers 2n = 28; 30; and 32 occur among the species studied (Figs. 1, 2. 3). Regarding the literature, chromosome counting on 13 species was done and reported for the first time in this study from which 2n = 28 in *A. senganense* subsp. *senganense* is a new number for the genus. As Figs. 1-3 and Table 2 show the chromosomes observed among the species studied are mostly of sub-acrocentric and metacentric. The TF% calculated (Table 2) in this study indicated that the karyotypes of the species studied are asymmetric and the S% in Table 2 implies high chromosomal variability in this genus.

Table 1: List of *Acantholimon* species used in this study.

Species	Alt./m	Locality
A. olivieri (Jaub. & Spach) Boiss.	2200	Lorestan: Borujerd toward Arak, Zaliyan pass, S. Moradpoor 16456 (TARI).
A. cymosum Bge.	1300	Semnan: beginning of the road from Semnan to Firouzkuh, S. Moradpoor. 16472.
A. festucaceum (Jaub. & Spach) Boiss.	2402	Kogilouyeh and Boirahmad: Yasuj, Babameydan, S. Moradpoor 16464 (TARI).
A. atropatanum Bge.	1800	Azerbaijan: Bostan-abad toward Myaneh, S. Moradpoor & N. Jaliliyan. 16467 (TARI).
A. curviflorum Bge.	1598	Esfahan: Kashan toward Natanz, S. Moradpoor.
A. aspadanum Bge.	1700	Esfahan: Sofe, S. Moradpoor 16461(TARI).
A. aspadanum Bge.	1846	Esfahan: Shahreza, S. Moradpoor. 16469 (TARI).
A. hohenackeri (Jaub. & Spach) Boiss.	1200	Azerbaijan:Ardebil, Khalkhal, Aznav S. Moradpoor 16466 (TARI).
A. hohenackeri (Jaub. & Spach) Boiss.	2165	Mazandaran, Larijan, S. Moradpoor.16453 (TARI)
A. erinaceum (Jaub. & Spach) Lincz.	1700	Khorasan: Ghuchan toward Daregaz, Assadi & Abouhamzeh 43365 (TARI).
A. erinaceum (Jaub. & Spach) Lincz.	2100	Gorgan, Khosh-yeylagh, S. Mpradpoor 16465 (TARI).
A. erinaceum (Jaub. & Spach) Lincz.	2872	Lorestan: Tangduzan, Hastad mountains, S. Moradpoor, N. Jaliliyan. 16468(TARI).
A. erinaceum (Jaub. & Spach) Lincz.	2900	Esfahan: Kashan, S. Moradpoor, N. Jaliliyan 16470 (TARI).
A. gillliatii Turril.	1800	Azerbaijan: Ardebil, Khalkhal road, Leard, S. Moradpoor 16460 (TARI).
A. scorpius (Jaub. & Spach) Boiss.	1727	Esfahan: Shahreza, Lashotor, S. Moradpoor .
A. scorpius (Jaub. & Spach) Boiss.	1700	Esfahan: Sofeh, S. Moradpoor 16459 (TARI).
A. senganense (Jaub. & Spach) Boiss. subsp. *senganense*	2160	Hamadan: Razan toward Avadj, S. Mopradpoor 16471 (TARI).
A. esfandiarii Rech. f. & Schiman-Czeika	1700	Theran: Bomehen, S. Moradpoor 16458 (TARI).
A. spinicalyx Koeie & Rech. f.	1500	Khorasan, Torbate-heydariye toward Mashhad, M. Mirtadzaddinii 83220.
A. zaeifii Assadi	2800	Kerman: Lalehzar toward Rabor, Mirtadzaddini 83219.

Table 2. Chromosome number and formula of 14 Iranian *Acantholimon* species counted in this study.

species	Number of chromosomes counted (2n)	Kind of chromosomes	TF%	S%
A. olivieri	32	5 subtelocentric; 3 metacentric; 6 submetacentric; 2 telocentric	27/40	32/25
A. cymosum	30	8 submetacentric; 3 subtelocentric; 2 telocentric; 2 metacentric	26/84	39/45
A. festucaceum	30	1 subtelocentric; 2 metacentric; 2 telocentric; 10 submetacentric	28/77	40/93
A. atropatanum	30	5 subtelocentric; 2 telocentric; 7 submetacentric; 1 metacentric	23/83	24/51
A. curviflorum	32	8 telocentric; 6 metacentric; 2 submetacentric	21/36	40/48
A. aspadanum	30	8 subtelocentric; 3 telocentric; 3 submetacentric; 1 meta centric	21/42	51/37
A. hohenackeri	30	4 meta centric; 3 submetacentric; 4 subtelocentric; 4 telocentric	24/33	28/10
A. erinaceum	30	9 submetacentric; 4 metacentric; 2 subtelocentric	36/12	43/90
A. gilliatii	32	8 submetacentric; 5 telocentric; 2 metacentric; 1 subtelocentric	24/45	36/73
A. scorpius	30	5 subtelocentric; 3 metacentric; 5 submetacentric; 2 telocentric	20/27	45/09
A. senganense subsp *senganense*	28	6 submetacentric; 3 metacentric; 3 subtelocentric; 2 telocentric	28/46	33/33
A. esfandiarii	30	6 telocentric; 2 submetacentric; 5 subtelocentric; 2 meta centric	16/81	38/93
A. spinicalyx	30	9 submetacentric; 4 metacentric; 2 subtelocentric	34/46	55/47
A. zaeifii	30	6 subtelocentric; 6 submetacentric; 3metacentric	27/64	42/82

Since based on the observed chromosome counts (2n = 28, 30 & 32) no monobasic chromosome number can be concluded then it can be suggested that all the species studied are tetraploids based on x = 7 & 8 and 2n = 30 can be considered as a dibasic allotetraploid integrated from x = 7 & 8. This study showed no correlation between sectional treatments which necessities further taxonomic studies on the genus.

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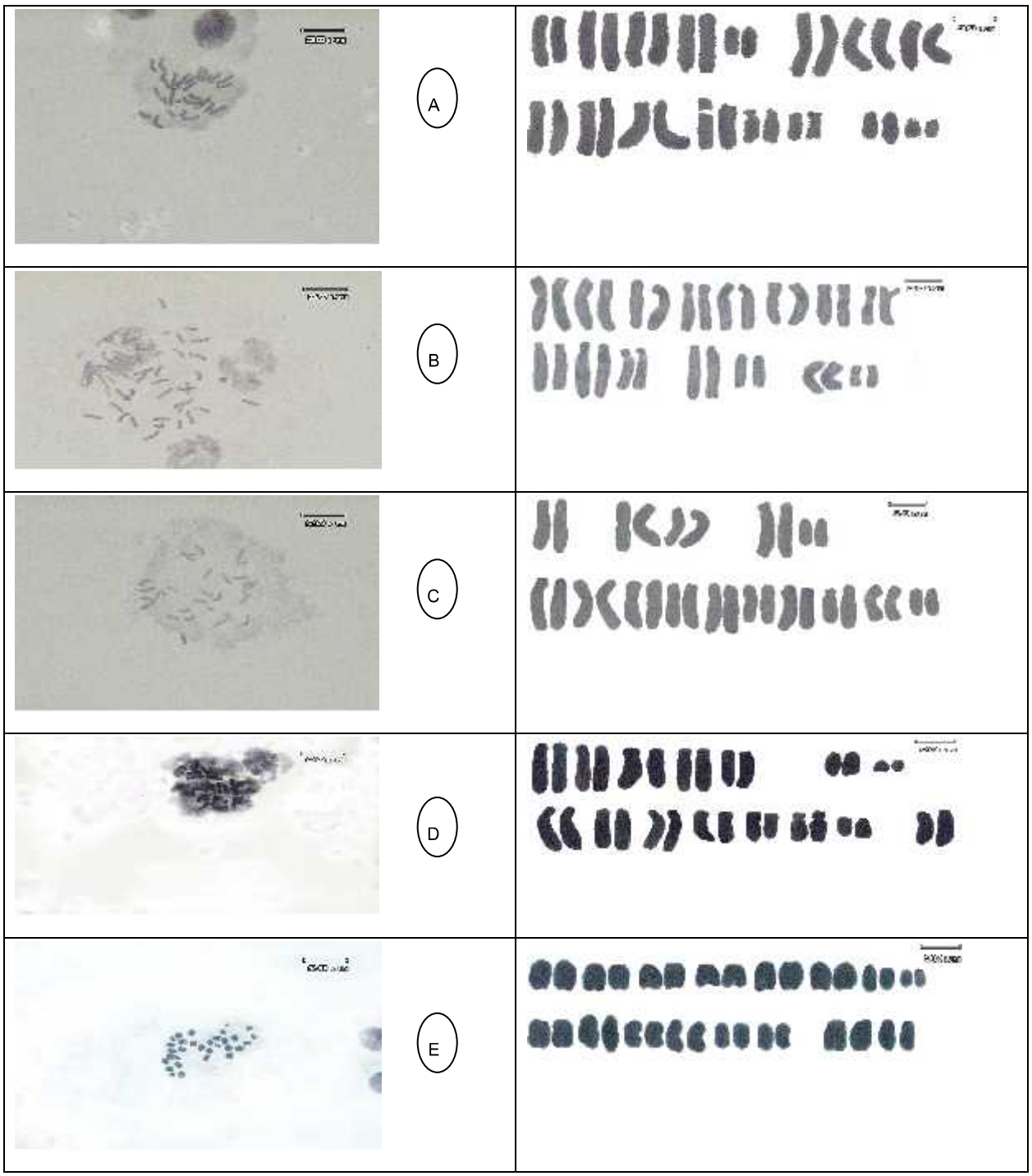

Fig.1. Chromosomes of Iranian *Acantholomon* species. A*, olivieri* (2n=32); B, *A. cymosum* (2n=30); C, *A. festucaceum* (2n=30); D, *A. atropatanum* (2n=30); E, *A. curviflorum* (2n=30). Scale bars=20 µm.

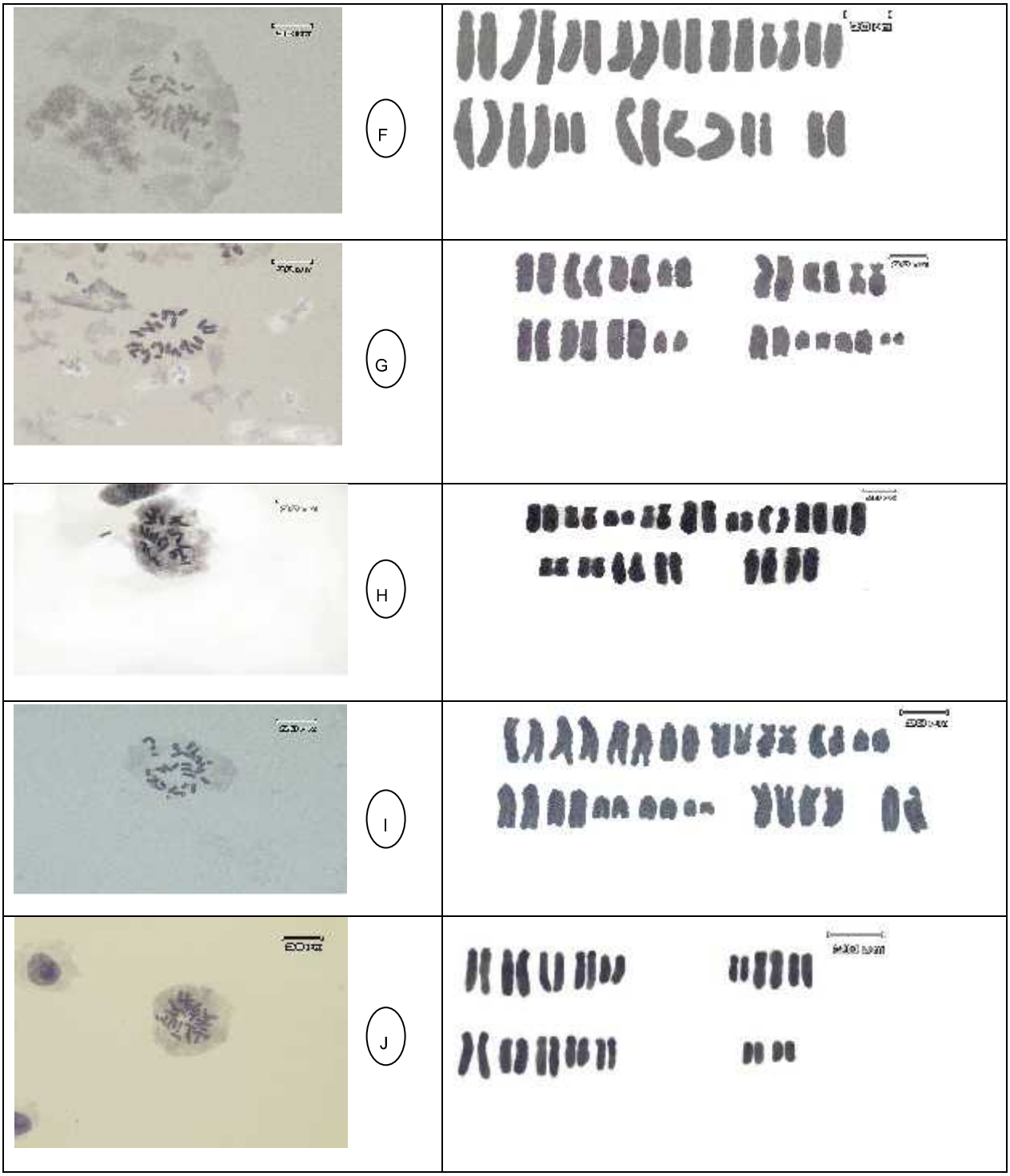

Fig. 2. Chromosomes of Iranian *Acantholomon* species. F, *A. aspadanum* (2n=30); G, *A. hohenackeri* (2n=30); H, *A. erinaceum* (2n=30); I, *A. gilliatii* (2n=32); J, *A. scorpius* (2n=30). Scale bars=20 µm.

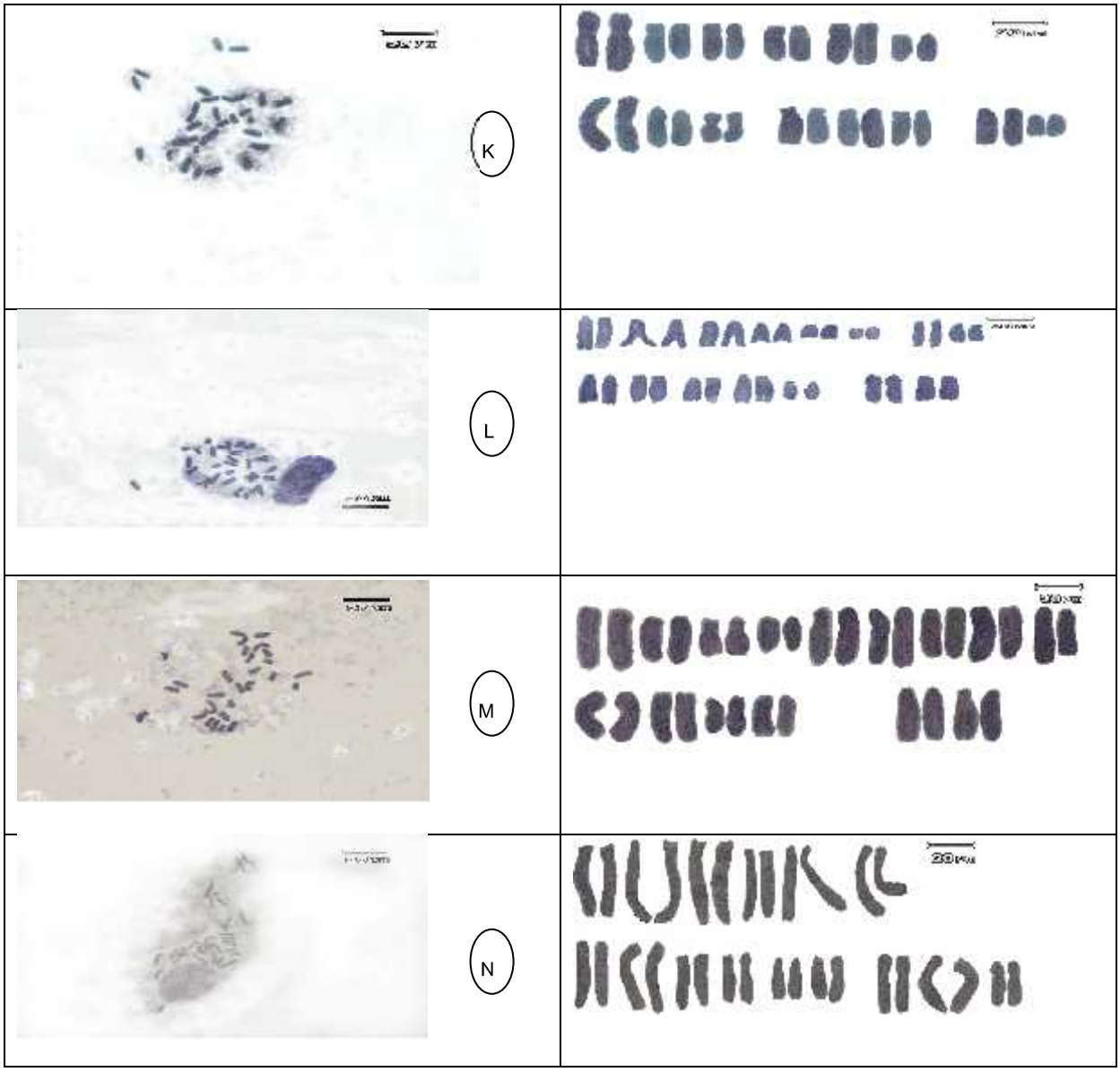

Fig.3. Chromosomes of Iranian *Acantholomon* species. K, *A. senganense* subsp. *senganense* (2n=28); L, *A. esfandiarii* (2n=30); M, *A. spinicalyx* (2n=30); N, *A. zaeifii* (2n=30). Scale bars=20 µm.