

青海南部三种紫菀属植物的核型研究*

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摘 要 报道了青海南部三种紫菀属植物的核型, 染色体间期和前期染色体分别为复杂型和中间型, 染色体数目均为 $2n=18$, 基数为 $x=9$, 中期染色体主要由中部与亚中着丝点染色体组成。

关键词 紫菀属; 染色体数目; 核型

KAROMORPHOLOGICAL CHARACTERISTICS OF THREES ASTER SPECIES FROM SOUTHERN QING HAI

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Abstract The chromosome numbers of three species of *Aster* L. from Southern Qinghai Province, are reported here for the first time; all of them were found to be diploids with $2n=18$. Three species have the common characteristics of the resting nucleus of the complex chromocenter type and the prophase chromosome of the interstitial type. Found in three species are mainly similar median - and submedian - centromeric chromosomes. *A. yunnanensis* Franch var. *labrangensis* displays three sat - chromosomes while *A. diplostephioides* displays two sat - chromosomes.

Key words *Aster* L.; Chromosome number; Karyomorphology

The genus *Aster* L. in its broad sense, comprising about 250 species over the world, occurs across Eurasia and throughout North American^[1]. Most of the species are native to the North American^[2] and about 70 species are found in China^[3]. The karyomorphological information about this genus was centered on the Europe and American species, which indicated that in the genus exist a great variation of the basic chromosome numbers from $x=4$ to $x=9$ ^[4~9]

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Both morphological and molecular evidences implied the primitive base number of the genus is $x = 9$ and those lower numbers, which were mainly found in North American species, evolved from $x = 9$ ^[8~10] (Semple et al., 1992, 1993; Xiang et al., 1996). According to their comprehensive studies, Semple et al.^[8,9] pointed out the genus *Aster* evolved in Eurasian, possibly in the region adjacent to the Indian Ocean. However, in this region, karyomorphological characteristics of the *Aster* species, especially those distributed in China, are poorly recorded in most standard references. The present paper reports the karyomorphological observations on three species of *Aster* in the arid plateau area of Southern Qinghai, China. These materials are very difficult to collect. The result was used to test the chromosome number evolution suggestion put up by Semple et al.^[8,9]

1. Materials and Methods

The plants of three species were collected in Southern Qinghai (Table 1). The root tips were pretreated in 0.1% colchicine for two hours, and then fixed overnight in Carnoy's fixative (1:3 glacial acetic acid and absolute alcohol). They were macerated in 1 mol/L hydrochloric acid at 60°C for five minutes, and stained and squashed in Carbol Fuschin solutions before observation. The karyotype formula was based on the measurements of mitotic metaphase chromosomes. The karyomorphological classifications of the resting and mitotic prophase introduced by Tanaka^[11], the symbols for centromeric positions defined by Levan et al.^[12] and the classification of Karyotype asymmetry of Stebbins^[13] were followed.

Table 1 Localities of three *Aster* species studied

Species	Locality	Voucher Specimens
<i>A. souliei</i>	Yushu, 3950m	H. B. G. 2244
<i>A. diplostephoides</i>	Yushu, 3850m	H. B. G. 1777
<i>A. yunnanensis</i> Franch. var. <i>labrangensis</i> (Hand. Mazz.) Ling	Yushu, 3600m	H. B. G. 2279

2. Result

The karyomorphological type of the resting nucleus of three species was of the complex chromocenter type and that of the mitotic prophase chromosome was the interstitial type (Plate I, 1 and 2)

2.1 *Aster souliei* Franch. Plate I: 3~4; Table 2

This species showed the chromosome number of $2n = 18$. The metaphase chromosomes graded from the longest chromosome to the shorted chromosome without distinct bimodality. Twelve chromosomes (six pairs) were median - centromeric and six (three pairs) were submedian - centromeric. The karyotype was formulated as $2n = 18 = 12m + 6sm$. The karyotype belonged to Stebbins' 2A type.

Table 2 Parameters of three *Aster* species

Number	Relative length(%)	Arm ratio (L/S)	Classification
1	6.99 + 8.57 = 15.56	1.23	m
2	4.31 + 7.83 = 12.14	1.81	sm
3	4.89 + 7.15 = 12.04	1.46	m
4	3.31 + 7.62 = 10.93	2.30	sm
3.1 5	4.36 + 6.26 = 10.62	1.44	m
6	4.68 + 5.78 = 10.46	1.24	m
7	3.31 + 6.94 = 10.25	2.10	sm
8	4.36 + 5.15 = 9.51	1.18	m
9	3.31 + 5.10 = 8.41	1.54	m
1	3.99 + 9.39 = 13.30	2.33	sm(2SAT)
2	5.76 + 7.13 = 12.89	1.24	m
3	3.48 + 8.15 = 11.63	2.34	sm(1SAT)
4	5.56 + 5.86 = 11.42	1.05	m
3.2 5	3.20 + 8.01 = 11.21	2.50	sm
6	4.53 + 6.21 = 10.74	1.37	m
7	2.80 + 7.60 = 10.40	2.71	sm
8	3.65 + 5.93 = 9.58	1.62	m
9	4.06 + 4.77 = 8.83	1.17	m
1	6.15 + 8.61 = 14.76	1.40	m(2SAT)
2	5.40 + 8.98 = 14.38	1.66	m
3	3.50 + 8.16 = 11.68	2.34	sm
4	5.10 + 5.35 = 11.45	1.05	m
3.3 5	4.98 + 5.23 = 10.21	1.05	m
6	3.07 + 6.88 = 9.95	2.24	sm
7	3.38 + 6.46 = 9.84	1.91	sm
8	2.95 + 6.64 = 9.59	2.25	sm
9	3.57 + 5.59 = 9.16	1.57	m

3.1 *A. souliei* 3.2 *diplostephioides* 3.3 *A. yunnanensis* Franch. var. *labrangensis*

2.2 *Aster diplostephioides* (DC.) C. B. Clarke Plate I: 5~6; Table 2

This species showed the chromosome number of $2n = 18$. The metaphase chromosomes were relatively long and graded from the longest chromosome to the shorted chromosome without distinct bimodality. Ten chromosomes (five pairs) were median - centromeric and eight were submedian - centromeric. The first pair showed two satellites while the third showed one satellite. The karyotype was formulated as $2n = 18 = 10m + 8sm(3SAT)$. The asymmetry of the karyotype was categorized to be 2A type.

2.3 *Aster yunnanensis* Franch. var. *labrangensis* (Hand. Mazz.) Ling. Plate I: 7~8; Table 2.

This species showed the chromosome number of $2n = 18$. The metaphase chromosomes graded from the longest chromosome to the shorted chromosome without distinct bimodality. Ten chromosomes (five pairs) were median - centromeric and eight (four pairs) were submedian - centromeric. The first pair was satellited. The karyotype was formulated as $2n = 18 = 10m(2SAT) + 8sm$. The karyotype belonged to Stebbins' 2A type.

3. Discussion and Conclusion

All of three species studied in the present paper were found to have the same chromosome number of $2n = 18$. The base chromosome number should be $x = 9$. Their karyomorphological characteristics of the resting nucleus and the prophase chromosome were commonly the complex chromocenter type and the interstitial type. The karyotype formulae were similar, mainly comprising median - centromeric and submedian - centromeric chromosomes. The asymmetry of the karyotypes was 2A type. Although a further study of more species is needed, the present results seem to support the suggestion put up by Semple et al. [8,9,14] the primitive base chromosome number of *Aster* should be $x = 9$, and the genus might evolve from the region adjacent to the Indian Ocean, so the species distributed in this region (including mainland of China) should have the primitive chromosome number of $x = 9$.

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Explanation of Plates

1~4. *A. souliei*; 5~6 *A. diplostephioides*; 7~8. *A. yunnanensis* Franch. var. *labrangensis* (Hand. Mazz.) Ling