

三种药用车前的染色体数目和核型的研究

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关键词 车前属; 药用植物; 染色体数目; 核型

车前为常用中药材, 《神农本草经》和明李时珍的《本草纲目》中列为上品, 以干燥全草及种子入药, 有清热、明目、利尿、止泻、降低血压和镇咳祛痰等功效^[1]。

本文报道了作为“车前”中药材的三种车前属 *Plantago* L. 植物: 大车前 *P. major* L., 车前 *P. aslatica* L. 和平车前 *P. depressa* Willd. 染色体数目和核型的资料, 旨在为探讨车前属内的分类和进化及为提高车前中药材的产量和质量的研究提供必要的细胞学资料。

材 料 和 方 法

一、材料 本试验所用材料如下:

材 料 来 源	凭 证 标 本 号	中 名	学 名
宁夏(吴忠县)	葛传吉830058	大车前	<i>Plantago Major</i> L.
广东(梅 县)	葛传吉830060	平车前	<i>P. depressa</i> Willd.
山东(广 饶)	葛传吉830005	车 前	<i>P. aslatica</i> L.

二、方法 种子萌发后, 取长约0.3厘米的根尖用0.002 M的8-羟基喹啉溶液预处理2~4小时, 然后用卡诺氏(carnoy)液固定24小时, 染色时先用1 N HCl在60℃恒温下解离3—5分钟, 经水冲洗后在改良石碳酸品红中压片、镜检, 取染色体分散良好的中期分裂标本照相, 在放大的照片上剪下染色体, 进行同源染色体配对, 测量其长度、臂比和着丝点位置等, 并依次排列于细胞分裂图象之下, 染色体的分类根据 Levan 等^[10]的标准, 核型的不对称性按 Stebbins^[15]的分类标准。

结 果

三种车前的染色体形态见图1:a、b、c; 图2:a、b和图3; 核型分析见表1、2和3; 核型模式图见图4:a、b和图5。

1. 大车前 *Plantago major* L. 根尖细胞染色体数为 $2n=12$ 。核型公式为 $K(2n)=12=12m$, 其6对染色体全为中部着丝点染色体, 大车前染色体的绝对长度在3.75—5.99微米之间; 染色体组总长度为27.44微米, 相对长度在13.66—21.82之间(表1), 最长染色体为最短染色体的1.59倍, 臂比的变异范围为1.01—1.50, 按不对称性标准, 大车前属于最对称的“1A”型。

2. 平车前 *Plantago depressa* Willd. 根尖染色体数为 $2n=12$, 核型公式为 $K(2n)=12=12m$, 在其6对染色体中也全为中部着丝点染色体, 染色体组总长度为20.97微米, 平车前染色体的绝对长度在2.68—4.17微米之间; 相对长度在12.78—19.88之间(表2)。

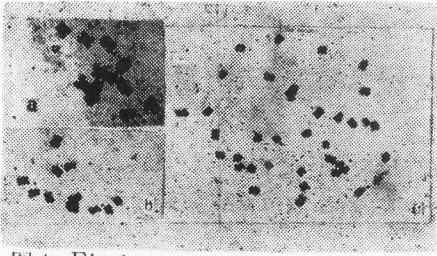


图1 Fig.1

- a. 大车前根尖体细胞中期示 $2n=12$
The growing tip metaphase of *Plantago major* showing $2n=12$
b. 平车前根尖体细胞中期示 $2n=12$
The growing tip metaphase of *Plantago depressa* showing $2n=12$
c. 车前根尖体细胞中期示 $2n=36$
The growing tip metaphase of *Plantago asiatica* showing $2n=36$
箭头所示为随体染色体 (The arrows indicates sat-chromosome)



图2 Fig.2

- a. 大车前染色体核型
a. The karyotype of *Plantago major*
b. 平车前染色体核型
b. The karyotype of *Plantago depressa*

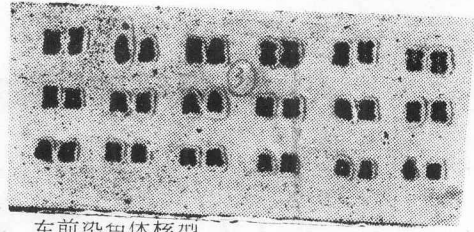
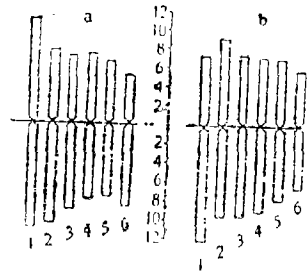


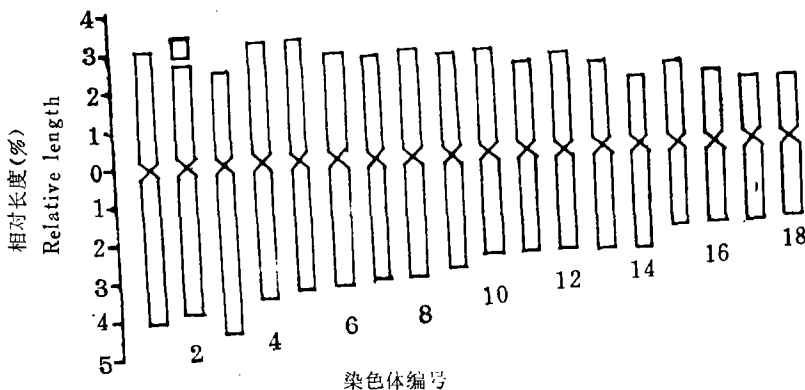
图3 车前染色体核型

Fig.3 The karyotype of *Plantago asiatica*

染色体编号

图4 Fig.4

- a. 大车前染色体核型模式图
a. Idiogram of *Plantago major*
b. 平车前染色体核型模式图
b. Idiogram of *Plantago depressa*

图5 车前染色体核型模式图 Fig.5 Idiogram of *Plantago asiatica*

最长染色体为最短染色体的1.55倍, 臂比的变异范围在1.11—1.55之间, 按不对称标准, 平车前与大车前一样也属于“1A”型。

3. 车前 *Plantago asiatica* L. [*P. major* L. var *asiatica* (L.) Decne.] 根尖细胞染色体数为 $2n=36$, 核型组成为 $K(2m)=36=32m+2m(\text{SAT})+2sm$, 除第3对为近中部着丝点染色体外, 其余17对均为中部着丝点染色体, 第2对为随体染色体(SAT), 染色体组总长度为58.60微米, 车前染色体的绝对长度在2.21—4.03微米之间; 相对长度在3.77

—7.33之间(表3), 最长染色体为最短染色体的1.94倍, 臂比变异范围在1.04—1.72, 按不对称性标准, 车前也属于“1A”型。

表1. 大车前的染色体核型分析

Table 1. Results obtained through an analysis of the karyotype of *Plantago major*

染色体编号 Chromosome No.	相对长度(%) (长臂+短臂=全长) Relative length (long arm+short arm=total length)	臂比 Arm ratio	类型 Classification
1	10.96+10.86=21.82	1.01	m
2	10.64+7.87=18.51	1.25	m
3	9.11+7.39=16.51	1.23	m
4	7.90+7.36=15.26	1.07	m
5	7.50+6.71=14.21	1.11	m
6	8.19+5.47=13.66	1.50	m

表2. 平车前的染色体核型分析

Table 2. Results obtained through an analysis of the karyotype of *plantago depressa*

染色体编号 Chromosome No.	相对长度(%) (长臂+短臂=全长) Relative length (long arm+short arm=total length)	臂比 Arm ratio	类型 Classification
1	12.20+7.68=19.88	1.55	m
2	9.58+8.59=18.17	1.11	m
3	9.72+7.54=17.26	1.29	m
4	9.16+7.62=16.78	1.20	m
5	7.96+7.15=15.11	1.11	m
6	6.82+5.96=12.78	1.14	m

表3. 车前染色体核型分析

Table 3. Results obtained through an analysis of the karyotype of *Plantago asiatica*

染色体编号 Chromosome No.	相对长度(%) (长臂+短臂=全长) Relative length (long arm+short arm=total length)	臂比 (长短) Arm ratio	类型 Classification
1	4.11+3.22=7.33	1.27	m
2	3.82+3.33=7.13	1.15	m*
3	4.47+2.59=7.06	1.72	sm
4	3.65+3.31=6.96	1.10	m
5	3.49+3.28=6.77	1.06	m
6	3.36+2.79=6.15	1.20	m
7	3.24+2.86=6.10	1.13	m
8	3.05+2.81=5.86	1.08	m
9	2.95+2.66=5.61	1.10	m
10	2.76+2.62=5.38	1.05	m
11	2.87+2.34=5.21	1.22	m
12	2.62+2.50=5.12	1.04	m
13	2.67+2.25=4.92	1.18	m
14	2.71+1.68=4.39	1.60	m
15	2.20+2.01=4.21	1.09	m
16	2.09+1.92=4.01	1.08	m
17	2.15+1.74=3.89	1.23	m
18	2.01+1.76=3.77	1.14	m

* 随体的长度未计算在内

The length of satellite is not included
Chromosome length

讨 论

一、染色体数目 大车前、平车前和车前的染色体数目, 前人已有许多报道^[3, 4, 5, 7, 8, 12, 13, 14]。本文关于前两种的研究结果($2n=12$)与这些报道相符。但关于车前的染色体数目, 大多数报道为 $2n=36$, 仅有少数报道为 $2n=24$ ^[9, 10], 而本文的研究结果为 $2n=36$ (也有极少数为 $2n=12$)与房淑敏等^[2]的报道一致。

如果车前属的染色体基数为 $x=6$ ^[6], 则大车前和平车前都是二倍体种, 而车前则是六倍体种, 但 McCullagh^[11]在论及与车前近缘的 $2n=36$ 的日本车前 *P. japonica* Franch & Savat 时倾向于认为它更可能是个四倍体种($n=9$), 而不是六倍体, 可能是由 $n=5$ 和 $n=4$ 的祖先种杂交后多倍化所产生的(见图6)。

但车前内同时存在 $2n=36$ 、24和12的情况表明, 把6作为该种的染色体基数或许更为可取。

二、核型 McCullagh^[11]报道的大车前和平车前的核型组成 $2n = 12 = 2m + 2sm + 6st + 2t$ (SAT), 与 Jain^[7]报道的大车前的核型组成 $2n = 12 = 2m + 6sm + 2sm$ (SAT) + $2st$, 与我们观

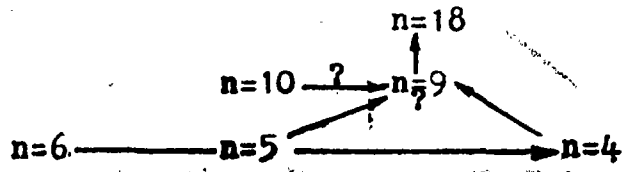


图6 车前的多倍化过程

察的两个种的车前全部染色体都具中部着丝点的情况相距甚远, 房淑敏等^[2]关于泰和车前*核型的报道同我们关于车前核型的观察结果基本相似。

大车前是一个形态和生态分化极其复杂的世界种, Jain^[7]对来自克什米尔喜马拉雅地区的野生材料的研究结果表明, 大车前种内存在着大量的、可遗传的形态变异体(morphological variant), 而这些变异体都未显示任何染色体形态上的差异, 他因而认为导致变异体产生的因素是基因水平的差异。但我们的观察结果表明: 中国大车前的核型与 Jain 的材料很不一样, 这说明大车前种内的核型分化也是存在的。

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* 学名与车前同

CHROMOSOME NUMBER AND KARYOTYPE STUDY IN THREE SPECIES OF THE MEDICINAL PLANTAIN

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Abstract The medicinal plantain, including *Plantago major* L., *P. asiatica* L. and *P. depressa* Willd., is a traditional Chinese medicine having been used since very ancient times. The present paper deals with a study of the chromosome numbers and karyotypes for the above three species.

1. *Plantago major* and *P. depressa*.

Seeds used for examination were from Wuzhong of Ningxia Autonomous Region for *P. major*, and from Meixian of Guangdong Province for *P. depressa*. The somatic chromosome number of both species is $2n=12$, in accord with those reported by many previous authors [3, 4, 5, 7, 8, 12, 13, 14]. Their somatic complements are nearly all of the metacentric chromosomes (Tables 1 and 2; Figs. 2: a, b and 4: a, b), and belong to Stebbins' [15] "1A" type of karyotypic asymmetry.

According to McCullagh [11], the somatic complements of *P. major* and *P. depressa* are both $2n=12=2m+2sm+6st+2t$ (SAT). The karyotype formula for the same species reported by Jain [7] is $2n=12=2m+6sm+2sm$ (SAT) + 2st. The present finding is not in accord with their results.

Jain [7] held that the infraspecific, genetically different variants of *P. major* did not show any specific differences in chromosome morphology. He, then, arrived at the point that the diversity distinguishing the variants had been produced by simple gene differences. But the fact that the karyotype of Chinese *P. major* being strikingly different from those reported by McCullagh [11] and Jain [7] shows clearly that the existence of karyotype differentiation within the species in question.

2. *Plantago asiatica*.

Seeds used for examination were from Guangrao of Shandong Province. The somatic chromosome number is $2n=36$ (scarcely $2n=12$), in accord with most of the previous reports. But a few authors [9, 10] reported $2n=24$. If take $n=6$ to be the basic chromosome number of *Plantago* [6], *P. asiatica* will be a hexaploid. But McCullagh [11] took the basic number of *P. japonica* Franch. et Savat, a closely allied species of *P. asiatica*, to be $n=9$, which probably arose from the allopolyploidy of $n=5$ and $n=4$. However the occurrence of $2n=24$ and 12 within *P. asiatica* seems to us that taking 6 to be the basic number of the species is more desirable.

Key words *Plantago*; Medicinal plantain; Chromosome number; Karyotype