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石蒜新核型及染色体数目在安徽的发现

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摘 要：对安徽省马鞍山的石蒜居群进行了核型分析，发现了石蒜的一种新的染色体数目及核型。按 Levan 等(1964)标准，核型公式为 2n=24=6m+8sm+6st+4t，为 3A 核型(Stebbin,1971)。与目前国内外学者的观察结果差异很大。马鞍山居群的新染色体数目及核型均为首次报道。

关键词：石蒜；新核型；新染色体数目；发现

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A new chromosome number and karyotype in *Lycoris raāiata* in Anhui Province

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Abstract: Ma'anshan population of *Lycoris radiata* from Anhui was studied cytologically. A new chromosome number and karyotype were found for the first time. The karyotype of *L. radiata* was formulated as 2n=24=6m+8sm+6st+4t, belonging to Stebbin's (1971) 3A type. This new karyotype and chromosome number of *L. radiata* were reported firstly in the world.

Key words: *Lycoris radiata*; new karyotype; new chromosome number; discovery

Lycoris radiata Herb. belonging to the genus *Lycoris* of Amaryllidaceae, is a characteristic species in East Asia, which is well-known for a bulb flower. Cytological studies on *L. radiata* have been carried out by a lot of researchers in the past, but several arguments and problems still remained. The present paper discovers a new chromosome number and karyotype in the *L. radiata* from Ma'anshan population, when making cytological studies on the *L. radiata* from different populations in Anhui Province. This new chromosome number and karyotype in *L. radiata* can offer some basic cytological data for discussing the karyotype evolution of the genus *Lycoris*.

1 Materials and methods

The material comes from the natural population in Ma'anshan, Anhui Province. Pretreated root tips (in P-Dichlorobenzene solution for 4 hours) were fixed in acetic acid-alcohol solution (1 : 3) for 20 hours. After being washed in distilled water, root tips were macerated in 1 N HCl at 60 ℃ for about 2 min, then they were immersed into advanced Phenol-Fuchsin solution for 2 h. Well stained root tips were tapped in 45% acetic acid,

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then took microphotographs with Olimpus. The karyotype analyses was based on Li Mao-xue & Chen Rui-yang(1985)'s criterion, and the chromosome classification referred to Levan *et al.* (1964). The vouchers was preserved in the herbarium of the college of life science, Anhui Normal University.

2 Results and discussion

The chromosome number of Ma'anshan population is : 2n=24. The karyotype is formulated as 2n=24=6m+8sm+6st+4t, consists of 6m(chromosomes with constrictions in median region), 8sm (chromosomes with constrictions in submedian region), 6st(chromosomes with constrictions in subterminal region) and 4t (chromosomes with constrictions in terminal region). The ratio of the longest to the shortest chromosome is 1.80, belonging to Stebbin's(1971)3A type. See Table 1. Fig. 1, 2.

Table 1 The parameters of chromosomes in *L. radiata*

Chromosome	C. L (S+L=T)	R. L(%)	A. R	Form
1	4.95+5.10=10.05	11.01	1.03	m
2	4.42+4.55=8.97	9.83	1.03	m
3	4.10+4.63=8.73	9.57	1.13	m
4	2.95+5.48=8.43	9.24	1.86	sm
5	1.83+5.82=7.65	8.38	3.18	st
6	0.42+6.99=7.39	8.12	16.64	t
7	2.04+5.23=7.27	7.97	2.56	sm
8	1.74+5.38=7.12	7.80	3.09	st
9	0.64+6.12=6.76	7.41	9.56	t
10	2.03+4.66=6.69	7.33	2.30	sm
11	1.45+5.13=6.58	7.21	3.54	st
12	1.73+3.85=5.58	6.12	2.23	sm

C. L: Chromosome Length; S+L=T: Short+long=total; R. L: Relative Length; A. R: Arm Ratio.

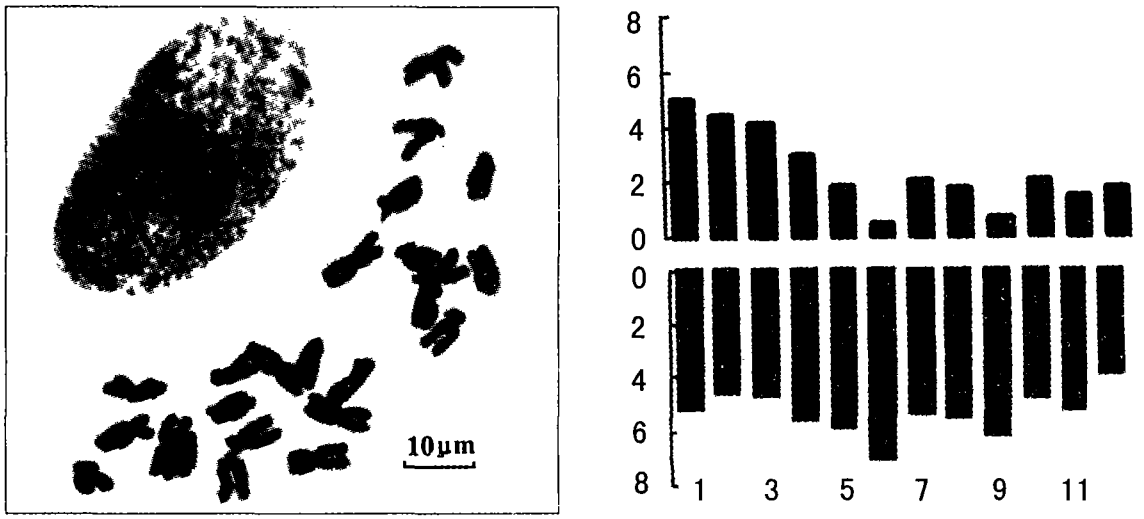

Fig. 1 The morphology of somatic chromosome and the idiogram of *L. radiata*

Fig. 2 The karyotype of *L. radiata*

As so far, a abundance of researchers all over the world have made some deep cytological studies on *L. radiata* (Nishiyama, 1928; Inariyama, 1931, 1933, 1951a, b; Mookerjea, 1955; Takemura, 1962a, b; Bose & Flory, 1963; Yoshida, 1972; Nishikawa *et al.*, 1979; Kurita, 1987a, b; 1989; Hsu *et al.*, 1984; Chen & Li, 1985; Liu & Hsu, 1989; Shao *et al.*, 1994; Sun *et al.*, 1998). The results show that: *L. radiata* is a complex which not only includes the diploid (2n=22=22t), but also the triploid (2n=

33=33t). The usual karyotype of *L. radiata* only consists of rod chromosomes with subterminal or terminal constrictions (with only one arm). The basic chromosome number of the genus is X=11. But several workers (Mookerjea, 1955; Bose, 1963; Kurita, 1987a, b; Hsu *et al.*, 1984; Chen & Li, 1985; Shao *et al.*, 1994) have found some abnormal karyotypes of *L. radiata*, such as 2n=33=1m+31t+1B, 2n=32=1m+31t (Bose, 1963; Kurita, 1987a, b); 2n=22=4st+18t (Chen & Li, 1985; Sun *et al.*, 1998); 2n=33=15t+18st (Hsu *et al.*, 1984); 2n=23=6st+14t+2T+1B, 2n=22=1m+12st+8t+1B (Shao *et al.*, 1994) etc. The new chromosome number and karyotype (2n=24=6m+8sm+6st+4t) found in our studies is quite different from those in other reports. In a word, the chromosome numbers and karyotypes of *L. radiata* may be varied in different populations.

According to the opinions of most researchers, the karyotype evolution of the genus *Lycoris* is mainly decided by Fusion Theory, and this theory which believes that the basic chromosome number of the genus is X=11, the plants with rod chromosome (2n=22t or 2n=33t) are primitive taxa. Two rod chromosomes (t) with terminal constrictions format a m chromosome (large V chromosome) through the fusion of constrictions and reciprocal translocation of Robertson Change. In this way some plants with both m and t chromosomes have evolved. On the contrary, a few researchers agree that the karyotype evolution of the genus Lycoris is mainly decided by Fission Theory, and this theory which believes that the chromosome group of the original species of the genus *Lycoris* should be 2n=12M, which consists of 12 large V chromosomes with median constrictions. It also believes that the basic chromosome number of the genus is X=6, and one V chromosome could be devided into two t or T chromosome through the fission of constrictions and reciprocal translocation of Robertson Change, In this way the plants with both m and t chromosomes have evolved. One crucial index to testify Robertson Change is that the groups of chromosomes with different chromosome numbers whether have the same number of the long arms or not. Nowadays, most workers agree that although the chromosome numbers and karyotypes are very varied in *Lycoris*, the total number of arms of a chromosome complement of any species is always multiples of 11. But the new formula of Ma'anshan population is 2n=24=6m+8sm+6st+4t, the 6 m chromosomes could not derive from 12t chromosomes through the fusion of constrictions, and it is more difficult to use the Fusion Theory or the Fission Theory to explain the origin of the 8 sm chromosomes. The theory of the *L. radiata* triploid's origin is challenged by the new discovery in this paper. There are two key hypotheses on the origin of the triploids in the genus *Lycoris*: (1) It derives from the hybridization of diploids with tetraploids, although the tetraploids have never been found in *Lycoris* before. (2) It derives from the combination between an unreduced gamete of a diploid and a normal gamete of another diploid. Because *L. radiata* has been proved to be an autotriploid by Inariyama (1931), nowadays most researchers agree with the latter one. But the latter one is also questioned by the new discovery in Ma'anshan population. Further studies are needed to find out the exact origin of triploids in *L. radiata*. Mookerjea (1955) has found that the chromosome number of *L. radiata* is very variable from 2n=15; 22; 25 to 2n=32, and it also consists of m chromosomes (with median of submedian constrictions) and the chromosomes with satellite chromosomes. Because she can not explain the great variability on the chromosome number of *L. radiata*, her opinion did not gain sufficient attention at that time.

This present paper agrees with Mookerjea, A's opinion, believing that the chromosome number and karyotype in *L. radiata* have great variability among different population. We think the origin of the karyotype of Ma'anshan population (2n=24=6m+8sm+6st+4t), is the gene mutation by the external environment or other reasons, in my opinion numerous further resrearches and discussions

are needed in the future. This paper can offer some basic data for the karyotype's evolution and its nature in the genus *Lycoris*.

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