スギの核型について(12)

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On the Karyotype of *Cryptomeria japonica* D. Don (XII)

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Karyotype analysis was done on the F_1 plant obtained by crossing Kumotooshi and Yabukuguri, which are the major *Cryptomeria japonica* D. Don cultivers of Kyushu district of Japan, and the following results were obtained.

1. The somatic cells of the F_1 plant had a chromosome number of $2n=22$.
2. The F chromosomes of the F_1 plant consisted of one chromosome with a secondary constriction and one chromosome showing the metacentric type. That is, the karyotype of the F_1 plant was that of the Fukuoka-syo NO. 2.
3. The karyotype of the F_1 plant was $K(22)=2A^m+2B^m+2C^m+2D^m+2E^m+1f^m+1^{sc}F^m+2G^m+2H^m+2I^m+2^{sc}J^m+2K^m$.
4. One pair of *J* chromosomes with Köpfchen, which is a characteristic of the karyotype of *Cryptomeria japonica* was also seen in the F_1 plant cells.

Further observation of the meiosis of the F_1 plant and of the morphological differences between the Obiaka type, Kumotooshi type and Fukuoka-syo NO. 2 type is necessary.

Introduction

Heretofore, I have done karyotype analysis of the major *C. japonica* cultivars of Kyushu district of Japan[5,6,7,8,12] and reported that judging from the morphology of the F chromosome, this plant species consist of 3 types of karyotypes, i. e., Obiaka type (one pair of F chromosomes with secondary constrictions), Kumotooshi type (one pair of metacentric type F chromosomes), and Fukuoka-syo NO. 2 type (one of the F chromosomes has a secondary constriction and the other shows a metacentric type).

This is a report on the karyotype analysis of the F_1 plant obtained by crossing Kumotooshi, a Kumotooshi type cultivar and Yabukuguri, an Obiaka type cultivar. A part of this report was presented at the 36th Meeting of the Kyushu Branch of the Japanese Forestry Society (1980).

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Materials and methods

The cultivars, Kumotooshi and Yabukuguri used in this study were 2-years-old cuttings raised by hydroponics and supplied by the Kyushu Branch Station, Forestry and Forest Products Research Institute. The F_1 plant obtained by crossing Kumotooshi and Yabukuguri, was offered by Shigetaka Kai, Faculty of Agriculture, Miyazaki University at Tano Experimental Forest Field (Tanocho, Miyazaki Prefecture). The meristematic cells of the root tip were used to study the karyotype of chromosomes. Preparations were made according to the following methods and the results of the observations were statistically analyzed.

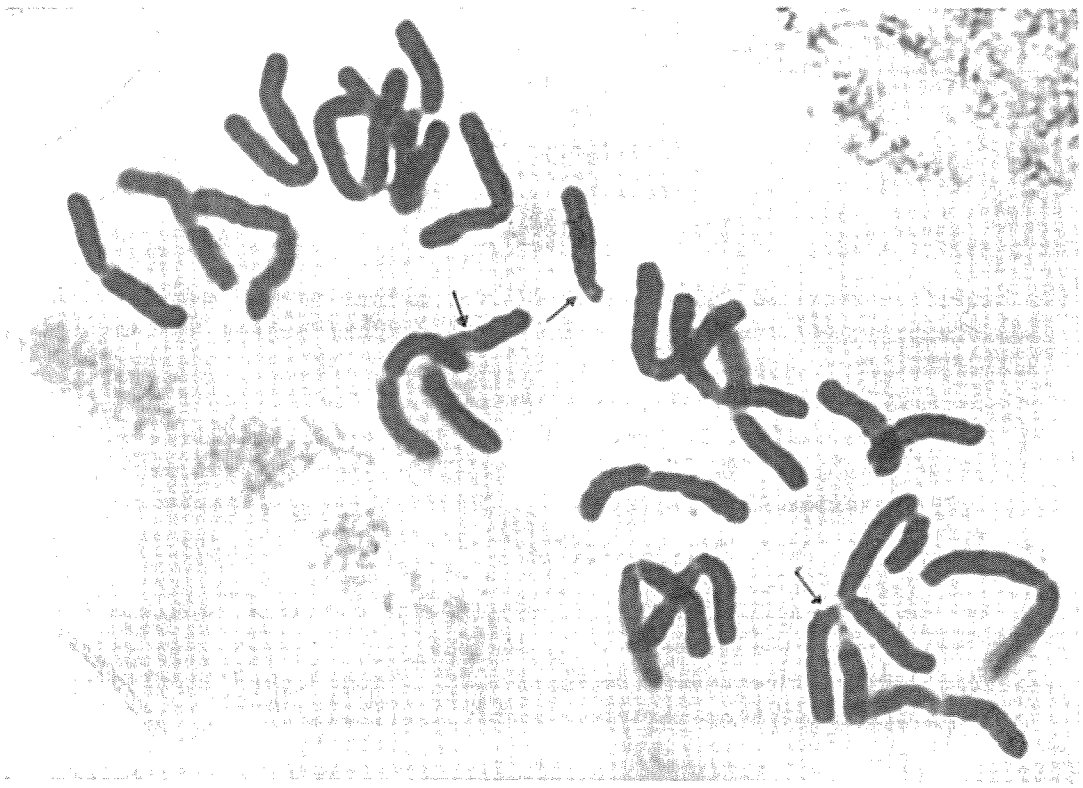

Fig. 1 Somatic chromosomes $2n=22$, of F_1 (Kumotooshi × Yabukuguri), an arrow indicating a position of constriction.

Preparation of specimen

1. Pretreatment (cold and warm treatment with 8-oxyquinoline) : The sample was immersed in a 0.002M solution of 8-oxyquinoline, and kept at 0°C for 12 hours as a cold treatment, and then at 23°C for 2-3 hours as a warm treatment.
2. Fixation : The sample was fixed in alcohol-acetic acid fluid (3 : 1).
3. Hydrolysis : The sample was hydrolyzed at 60± 2°C in 1N-HCl.
4. Staining : The sample was stained with a colorless basic Fuchsin fluid for a sufficient length of time.
5. Acetic acid treatment : The sample was immersed in a 45% acetic acid solution.

After the above treatment, specimens were prepared by squashing.

Measurement of chromosome

Micrographs in which the chromosomes were magnified 2200 times were used for measurements, the homologous chromosomes were determined from the longest one in the order of the length of the chromosome (relative length), and a diagram (homologous chromosomes were plotted according to relative length and arm ratio) made by using the method of Heneen[1] was used for reference.

The karyotypes were indicated according to the Shinoto's method, in which the longest of the homologous chromosome is assigned A, following by B, C

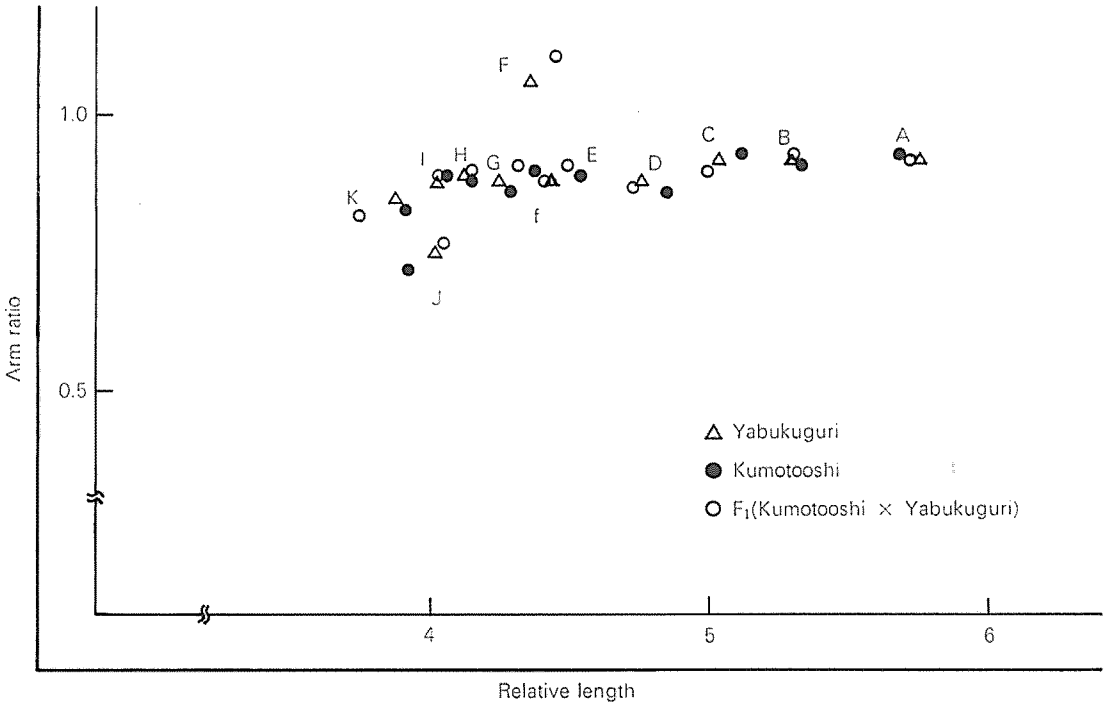

Fig. 2 Homologous chromosomes of the three cultivars

and so on, in order. But, the F chromosome showed the metacentric type, and was expressed as f.

Ten micrographs of the F_1 plant were used to determine the karyotypes and for statistical analysis. The averages of the relative lengths and arm ratios of each homologous chromosome, and their standard deviations were caliculated.

Results and Discussion

The chromosome number of the F_1 plant of the Kumotooshi × Yabukuguri was $2n=22$ (Fig. 1), which was the same as that of Kumotooshi and Yabukuguri. The relationship between the relative length and arm ratio of the homologous chromosomes in Kumotooshi, Yabukuguri and the F_1 plant is shown in Fig. 2.

The karyotype of the F_1 plant was indentified to be $K(22)=2A^m+2B^m+2C^m+2D^m+2E^m+1f^m+1^{SC}F^m+2G^m+2H^m+2I^m+2^{SC}J^m+2K^m$ as shown in Table 1 and Fig. 3.

The F chromosomes which are morphologically characteristic were intermediate between Kumotooshi and Yabukuguri, that is, they showed a Fukuoka-syo NO. 2 type, consisting of one chromosome with a secondary constriction, and one chromosome without a secondary constriction and showing the metacentric type. No statistically significant difference was detected between the relative length of the F chromosomes of Yabukuguri and that of the F chromosomes of the F_1 plant of Kumotooshi and Yabukuguri, or between that of the f chromosome of Kumotooshi and the f chromosome of the F_1 plant.

As a result of the above experiment, it seemed that

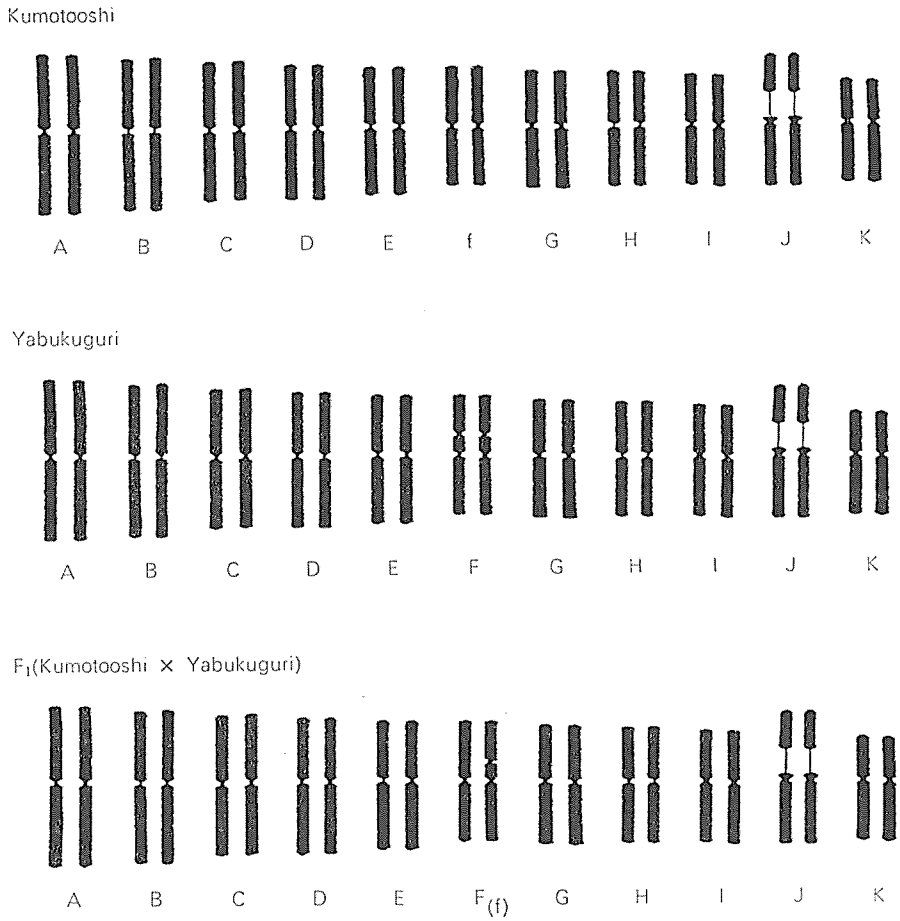

Fig. 3 Idiograms of chromosome

the Fukuoka-syo NO. 2 was obtained by crossing Kumotooshi type and Yabukuguri type.

One pair of J chromosomes (with Köpfchen), which characterize the karyotype of *Cryptomeria japonica*, was also seen in the F_1 plant of Kumotooshi and Yabukuguri. Kuroki et al.[2] determined the cone yield percentage on crosses among cultivars of *Cryptomeria japonica* in the Kyushu district, and reported 93% for Kumotooshi x Ayasugi, 100% for Kumotooshi x Measa, and 66% for Kumotooshi x Yabukuguri. The germination percentages for these crosses were 29. 8% for Kumotooshi x Ayasugi, 24. 1% for Kumotooshi x Measa, and 15. 3% for Kumotooshi x Yabukuguri. In both cases, the percentages were higher for crosses between Kumotooshi or Measa and Ayasugi than for those between Kumotooshi and Yabukuguri.

One reason for this difference may be because the karyotypes of Kumotooshi, Ayasugi and Measa show Kumotooshi type, and that of Yabukuguri is different. Further observation on the meiosis of the F_1 plant is necessary.

Table 1 Karyotype Constitution of Kumotooshi, Yabukuguri and the F_1 plant (Kumotooshi × Yabukuguri)

Chromosome	Kumotooshi		Yabukuguri		F_1 (Kumotooshi × Yabukuguri)	
	Relative length	Arm ratio	Relative length	Arm ratio	Relative length	Arm ratio
A	5.68±0.18	0.93±0.04	5.76±0.28	0.92±0.05	5.73±0.25	0.92±0.07
B	5.34±0.15	0.91±0.07	5.31±0.17	0.92±0.05	5.31±0.17	0.93±0.07
C	5.12±0.16	0.93±0.05	5.04±0.12	0.92±0.07	5.00±0.13	0.90±0.07
D	4.85±0.15	0.86±0.06	4.76±0.18	0.88±0.08	4.73±0.16	0.87±0.10
E	4.54±0.14	0.89±0.07	4.44±0.14	0.88±0.07	4.50±0.11	0.91±0.08
(f)	(4.38±0.10)	(0.90±0.06)	——	——	(4.42±0.10)	(0.88±0.08)
F	——	——	4.36±0.39	0.37±0.07 0.69±0.13	4.45±0.29	0.39±0.10 0.72±0.10
G	4.29±0.10	0.86±0.07	4.25±0.08	0.88±0.08	4.31±0.12	0.91±0.06
H	4.15±0.12	0.88±0.06	4.14±0.08	0.89±0.07	4.15±0.09	0.90±0.06
I	4.06±0.11	0.89±0.08	4.03±0.10	0.88±0.09	4.03±0.08	0.89±0.07
J	3.93±0.20	0.10±0.02 0.62±0.04	4.02±0.20	0.14±0.03 0.61±0.06	4.05±0.21	0.14±0.03 0.63±0.06
K	3.91±0.19	0.83±0.09	3.88±0.15	0.85±0.08	3.75±0.27	0.82±0.09

( ) shows the F-chromosome of Kumotooshi type

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スギの核型について (XII)

戸田義宏

九州地方の主なスギ品種であるクモトオシとヤブクグリの交配によってえた F_1 について核型を分析し，つぎの結果をえた。

1. F_1 の体細胞染色体数は $2n=22$ であった。
2. F_1 の F 染色体は二次狭窄を有するものと中部動原体型を示す染色体から構成されていた。すなわち F_1 の核型は福岡署2号型を示した。
3. F_1 の核型は $K(22)=2A^m+2B^m+2C^m+2D^m+2E^m+1f^m+1F^m+2G^m+2H^m+2I^m+2^{sc}J^m+2K^m$ であった。
4. スギの核型の特徴である Köpfchen を有する J 染色体は F_1 にもみられた。

今後さらに F_1 の減数分裂やオビアカ型，クモトオシ型，福岡署2号型間の形態的差について観察する必要がある。