Karyotype Analysis in *Tulipa* VIII

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チューリップ属植物の核型分析 VIII

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Since 1955 the present author and his collaborators have carried out observations on the karyotypes of 145 races of *T. gesneriana* and a race of *T.edulis* was reported (Takusagawa et al. 1955, '56, '57, '58, '59, '60, '62). Moreover, the author made the karyotype analysis in three races of *T. gesneriana*. The present paper deals with the resulte of this investigation.

MATERIALS AND METHODS

The materials used are listed in Table 1. All the specimens were treated by same method as described in Part Vll of this series.

Table 1. Races used as the material

Plant name	2 n	Karyotype	Figs.
I Early Flowering Tulips			
* Single Early Tulips			
1. *General de Wet*	24	B	(3)
II Late Flowering Tulips			
* Darwin Tulips			
2. *Golden Age*	24	A−1	(1)
* Parrot Tulips			
3. *Gemma*	24	A−2	(2)

RESULTS OF OBSERVATION

1. *Tulipa gesneriana* race *General de Wet* 2n=24 (B) (Fig. 3 Table 2)

This race has twenty four chromosomes in its somatic cell. As shown in Fig. 1 and Table 2, these chromosomes are composed of twelve pairs which may be classified into ten groups. The first group includes one pair of the largest chromosomes of the complment (chromosomes, nos. 1 and 2). They have

each a subterminal constriction. The second group consists of one pair of large chromosomes with subterminal constrictions (3 and 4). The third group includes one pair of subterminally constricted chromosomes (5 and 6). The fourth group includes one pair of chromosomes of middle size with subterminal constrictions (7 and 8). The fifth group includes two pairs of chromosomes of middle size with subterminal constrictions (9, 10, 11 and 12). The sixth group includes one pair of chromosomes with subterminal constrictions (13 and 14). The seventh group includes one pair of chromosomes with subterminal constrictions (15 and 16). The eighth group includes one pair of chromosomes with subterminal constrictions (17 and 18). The ninth group includes two pairs of chromosomes with subterminal constrictions (19, 20, 21 and 22). The tenth group includes one pair of chromosomes with subterminal constrictions (23 and 24).

Table 2. Measurements of length of somatic chromosomes in *Tulipa gesneriana* race *General de Wet*

Chromosomes	Long arm(μ)	Short arm(μ)	Whole length(μ)	Relative length	F%	TF%
1,2	10.8	4.0	14.8	5.5	27	
3,4	10.2	3.6	13.8	5.2	26	
5,6	9.6	3.0	12.6	4.7	24	
7,8	9.0	3.0	12.0	4.5	25	
9,10	8.4	3.0	11.4	4.3	26	
11,12	8.7	2.7	11.4	4.3	24	
13,14	8.1	2.7	10.8	4.0	25	
15,16	7.3	3.0	10.3	3.9	29	
17,18	6.9	3.0	9.9	3.7	30	
19,20	6.6	2.7	9.3	3.5	29	
21,22	6.3	3.0	9.3	3.5	32	
23,24	6.3	2.1	8.4	3.1	25	27

2. *Tulipa gesneriana* race *Golden Age* 2n=24 (A−1) (Fig. 1 Table 3)

There were twenty four chromosomes in the root-tip cell of this race. The twenty four somatic chromosomes may by classified into eleven groups by their shape, size and position of constrictions (Fig. 3 Table 4). The first group includes one pair of chromosomes with subterminal constrictions (1 and 2). The second group includes one pair of chromosomes each of which is curved and has subterminal constrictions (3 and 4). The third group includes one pair of chromosomes with subterminal constrictions (5 and 6). The fourth group includes one pair with submedian constrictions (7 and 8). The fifth group includes one pair of chromosomes with subterminal constrictions (9 and 10). The sixth group includes one pair of chromosomes with subterminal constrictions (11 and 12). The seventh group consists of one pair of chromosomes with subterminal constrictions (13 and 14). The eighth group consists of one pair of chromosomes with subterminal constrictions (15 and 16). The ninth group includes one

pair of chromosome with submedian constrictions (17 and 18). The tenth group includes two pairs of chromosomes with subterminal constrictions (19, 20, 21 and 22). The eleventh group includes one pair of chromosomes with submedian constrictions (23 and 24).

Table 3. Measurements of length of somatic chromosomes in *Tulipa gesneriana* race *Golden Age*

Chromosomes	Long arm(μ)	Short arm(μ)	Whole length(μ)	Relative length	F%	TF%
1,2	10.8	3.5	14.3	5.7	24	
3,4	9.4	3.5	12.9	5.1	27	
5,6	8.7	3.5	12.2	4.9	29	
7	7.7	4.2	11.9	4.7	35	
8	7.8	4.1	11.9	4.6	35	
9,10	8.4	3.1	11.5	4.6	27	
11,12	7.3	3.5	10.8	4.3	32	
13,14	7.3	2.8	10.1	4.0	28	
15,16	6.3	2.4	8.7	3.5	28	
17,18	5.6	3.1	8.7	3.5	36	
19,20	5.6	2.8	8.4	3.4	33	
21,22	5.9	2.4	8.3	3.3	29	
23,24	4.9	2.8	7.7	3.1	36	30

3. *Tulipa gesneriana* race *Gemma* 2n=24 (A−2) (Fig. 2 Table 4)

This race has twenty four chromosomes in its somatic cell. As shown in Fig. 2 and Table 4 these chromosomes are composed of twelve pairs which may be classified into eleven groups. The first group includes one pair of the largest chromosomes of the complement (1 and 2). They have each a subterminal constriction. The second group consists of one pair of large chromosomes with submebian constrictions (3 and 4). The third group includes one pair of subterminally constricted chromosomes (5 and 6). The fourth group includes one pair of chromosomes of middle size with submedian constrictions (7 and 8). The fifth group includes one pair of chromosomes of middle size with subterminal constriotions (9 and 10). The sixth group includes one pair of ehromosomes of middle size with subterminal constrictions (11 and 12). The seventh group includes one pair of chromosomes with subterminal constrictions (13 and 14). The eighth group includes two pairs of chromosomes with subterminal constrictions (15, 16, 17 and 18). The ninth group includes one pair of chromosomes with subterminal constrictions (19 and 20). The tenth group includes one pair of chromosomes with subterminal constrictions (21 and 22). The eleventh group includes one pair of chromosomes with submedian constrictions (23 and 24). One of which (24) is a little smaller than the other (23).

Talbe 4. Measurements of length of somatic chromosomes in *Tulipa gesneriana* race *Gemma*

Chromosomes	Long arm(μ)	Short arm(μ)	Whole length(μ)	Relative length	F%	TF%
1	10.9	2.3	13.2	5.5	17	
2	9.2	3.3	12.5	5.2	26	
3,4	7.9	4.6	12.5	5.2	37	
5,6	8.9	3.0	11.9	5.0	25	
7,8	8.6	3.0	11.6	4.8	26	
9,10	8.3	3.0	11.3	4.7	27	
11,12	7.3	3.0	10.3	4.3	29	
13,14	7.0	2.6	9.6	4.0	27	
15	6.0	3.0	9.0	3.8	33	
16	6.3	2.3	8.6	3.6	27	
17,18	6.3	2.3	8.6	3.6	27	
19,20	6.0	2.0	8.0	3.3	25	
21,22	5.3	2.3	7.6	3.2	30	
23	4.6	2.6	7.2	3.0	36	
24	3.3	2.6	5.9	2.5	44	29

CONSIDERATIONS OF THE KARYOTYPE OF THE DIPLOID RACES IN *TULIPA GESNERIANA*

The results of the observations of the present investigation on the chromosomes in three races of *Tulipa gesneriana* have revealed that the race studied were diploid, having twenty four somatic chromosomes. Of the karyological facts concerned with the karyotypes obtained, those which seem to be noteworthy may be pointed out as follows:

(1) In all the races studied there was the largest chromosome with a subterminal constriction in each chromosome set. (2) In a chromosome set of many races. chromosomes of the large size were found three or four in number. One of them had a median or submedian constriction, while the others had subterminal ones. (3) Most of the chromosomes of middle size each had a subterminal constriction. Some races had one or two chromosomes of middle size with a submedian constriction. (4) Each of the chromosomes of small size had a subterminal constriction. In some races one of the chromosomes of small size was much smaller than the others. (5) In some races all the chromosomes of a chromosome set had subterminal constrictions.

From the view point of karyotypes the races used in this study may be classified as follows:

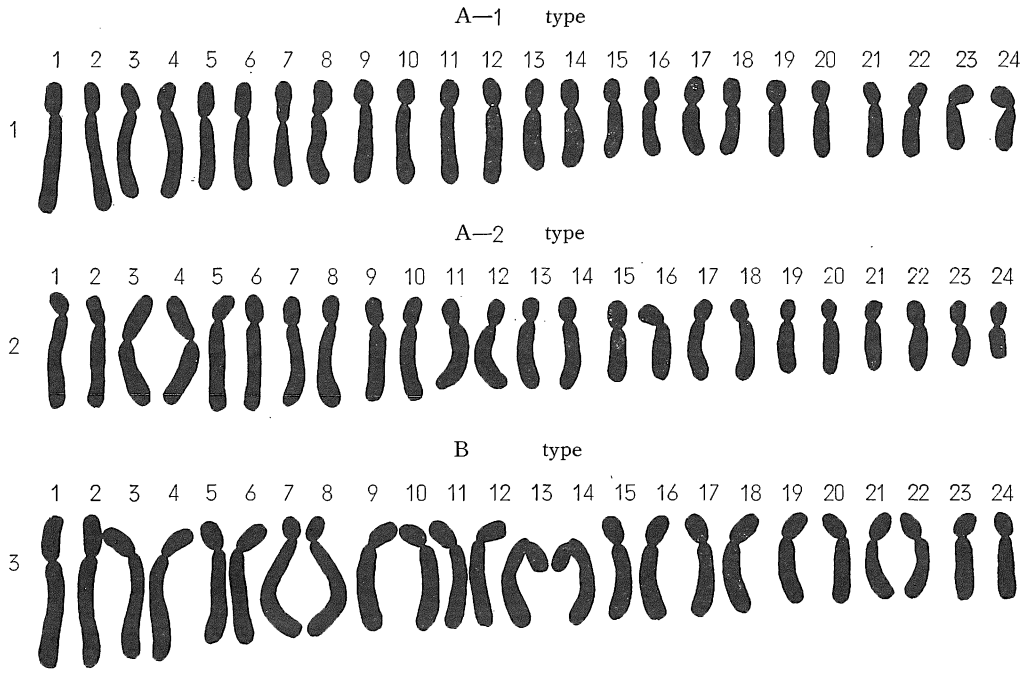
A−1 type : *Golden Age.*

A−2 type : *Gemma.*

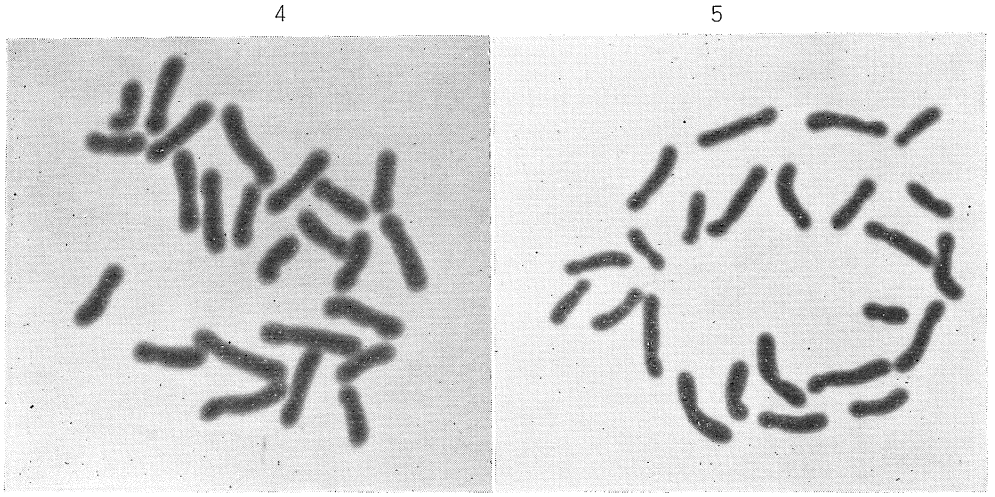
B type : *General de Wet.*

SUMMARY

1. The karyotype studies were made on three races in *Tulipa gesneriana.*
2. All the races studied were diploid, having twenty four somatic chromosomes.
3. From the standpoint of the karyotype the three races may by classified into three types. A—1 type : *Golden Age.* A—2 type : *Gemma.* B type : *General de Wet.*



Figs. 1—3. Somatic chromosomes of three races in *Tulipa gesneriana.*
1. *Golden Age.* 2 *Gemma.* 3. *General de Wet.* (ca.×1250)



Figs. 4—5. Photomicrographs of somatic chromosomes of two races in *Tulipa gesneriana.*
4. *Golden Age.* 5. *Gemma.* (ca.×950)

摘　　要

Tulipa gesneriana に属する3種類の核型分析が行われた。すべてこの3種類は二倍体であって体細胞の染色体数は24個であった。核型の上からこの3種類を分析すると，次の如くである。即ち A－1 type : *Golden Age*. A－2 type : *Gemma*. B type : *General de Wet*.

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