Chromosomal observation of *Papaver nudicaule* L. (Papaveraceae) from the Lake Baikal Region, Siberia*

Genjiro Ishida[1)]

バイカル湖地域産アイスランドポピーの染色体観察 *

石田　源次郎[1)]

Introduction

Papaver nudicaule L. is native to Siberia. It is grown as an annual flower in the name of the Iceland poppy in the horticulture field, although it is a perennial. This species was observed during a floral investigation conducted in August, 2005 at two locations of the Lake Baikal region (Investigation Point : Serge Gessera Hill, south slope at a ridge of Mt. Khamar-Daban, 4km south-west from the Ulan-Ude Airport, Buryat Republic; Investigation Point : Zharchiha, Tarbagatayskiy District, Buryat Republic) . The plants in both locations were out of bloom and had already fruited in the beginning of August. However, for some plants, a few flowers of 5-6cm diameter in light or bright yellow color were still recognized at the tip of the extended stalks. Some seeds were collected successfully from the fruits.

Chromosome numbers of *P. nudicaule* have been reported by Meiscek & Sojak (1969), Hanelt (1970, 1973), Belaeva & Siplivinsky (1975) , Petrovsky & Zhukova (1981) , Safonova (1991) , Zhukova & Petrovsky (1985).

Mesicek & Sojak (1969) studied the papaver native to Mongolia and reported its chromosome numbers as 2n=42. In contrast, Belaeva & Siplivinsky (1975) reported the chromosome numbers to be 2n=28 for the plant collected from the Lake Baikal region. In order to clarify the discrepancy between the two reports, I analyzed the chromosome numbers for the *P. nudicaule* native to the Lake Baikal region. For this purpose, the seeds collected from the region were germinated and the seedlings were examined. The results are as follows.

Materials and Methods

The seeds collected at the 6th investigation point were sown on October 21 and the seedlings were used as materials for chromosome analysis in mid-December.

Somatic chromosomes were observed by staining the meristematic cells from root tips according to the aceto-orcein squash method by Tanaka (1959), with a slight modification: Growing root tips were cut into small pieces in about 3-5 mm thickness. The pieces were immersed in 2mM 8-hydroxyquinoline for 4hr at 5℃, fixed in 45% acetic acid for 10 min at 5℃, hydrolyzed (treated) in a mixture of 1N hydrochloric acid and 45% acetic acid (2:1) for 30sec at 60℃, and then, they were stained and squashed in a 1% aceto-orcein solution.

Chromosomes at resting stage were studied morphologically by observing their condensed figures and classified into the types as defined and proposed by Tanaka (1971, 1980). The chromosomes at mitotic metaphase were arranged in descending order in length and numbered starting from 1, thus grading the chromosomes from the longest to the shortest. Long and short arm lengths for each chromosome were measured and the ratios of the long- to the short-arm lengths were calculated. According to Levan *et al.* (1964), the arm ratios from 1.0 to 1.7 are median, those from 1.8 to 3.0 are submedian, and those from 3.1 to 7.0 are subterminal. The karyotype formulas were based on the chromosome lengths and positions of centromeres according to Tanaka(1980).

---

*Contribution from the Hiroshima Botanical Garden No. 83

1) Hiroshima Botanical Garden

Bulletin of the Hiroshima Botanical Garden, No. 24・25 : 11-14, 2007.

Results

The chromosome number of *P. nudicaule* from the Lake Baikal region at mitotic metaphase was determined as 2n=42 (Fig. 1).

This nucleus was 11μm in diameter, and one nucleolus was observed in the nucleus.

The chromosomal length was measured and the results are shown in Table 1. The chromosome features at a resting stage were observed as numerous chromomeric granules, fiberous threads and chromatin blocks scattered throughout the nucleus. The features were found to be an intermediate between the simple chromocenter type and the complex chromocenter type according to Tanaka's classification (1971). In contrast, the chromosomes at a mitotic prophase shaped several early condensed segments located in the interstitial, proximal and terminal regions of both arms.

The 2n=42 chromosomes during a mitotic metaphase showed a gradual decrease in length from the longest (2.5μm) to the shortest (1.3μm). Total 32 among them had arm ratios from 1.1-1.7 and had centromeres at the median regions, whereas 8 Nos. 1-2, 23-26, 33-34 had the ratios from 2.0-2.1 and their centromeres at the submedian regions. Other two chromosomes (Nos. 41, 42) gave the ratio of 3.3 having the centromeres at the subterminal regions. No satellite was observed.

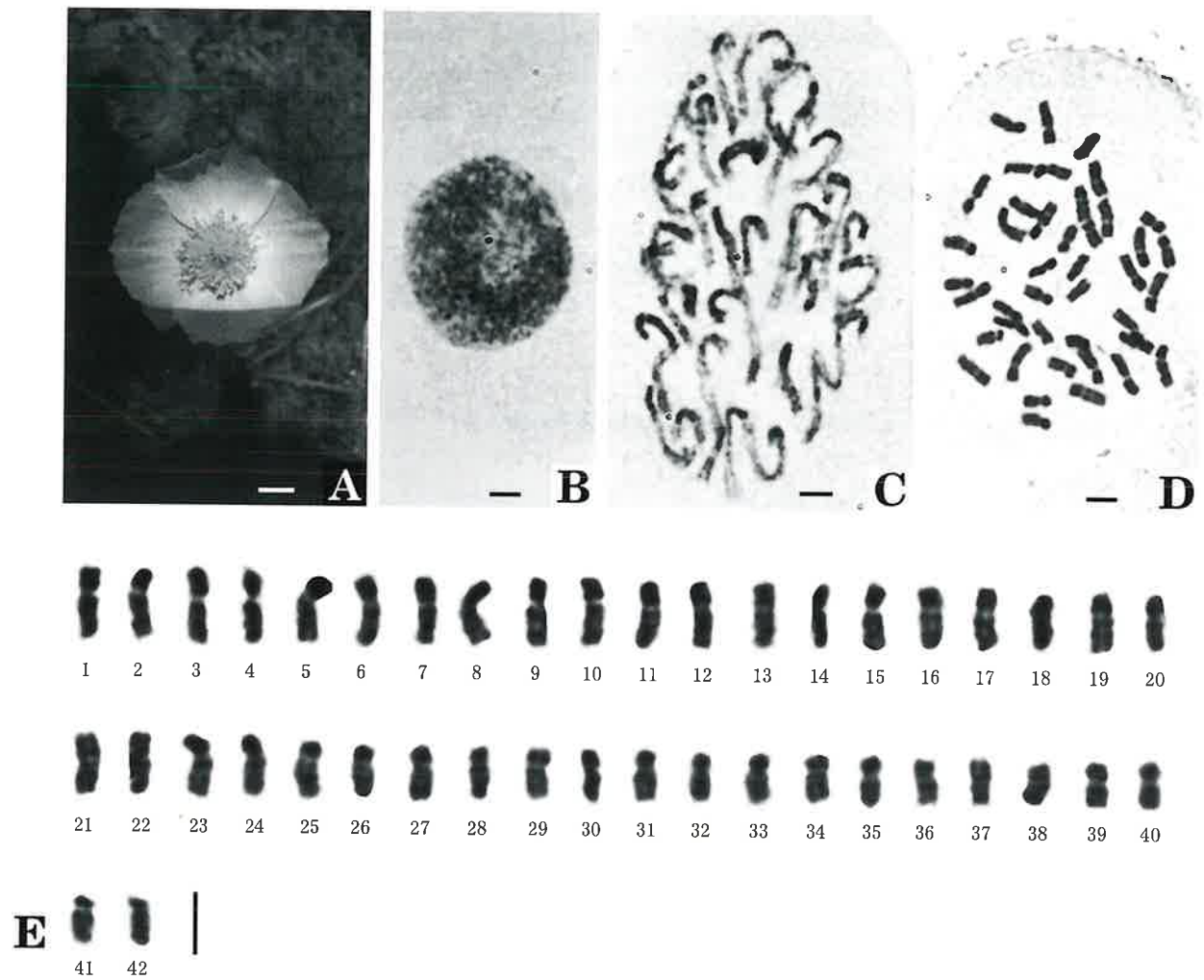

Fig. 1. *Papaver nudicaule* L., 2n=42. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 1.0cm in A and 2.0μm in B-E.

The examined *P. nudicaule* (2n=42) is concluded to be n= 21, because 42 chromosomes showed 21 sets of normal pair which generated normal seeds.

The papavers from Mongolia (Mesicek & Sojak, 1969) and those used in this study are considered to have the same genes according to a geographical element and similar growth environment. The relationship between them would be clarified if karyotypes of both *P. nudicaule* subsp. *insulare* (2n=42, hexaploid) in the Wrangel Island of the Russia Arctic and *P. nudicaule* (2n=42, hexaploid) native to the Lake Baikal region can be compared in detail.

Summary

The chromosome number of *Papaver nudicaule* L. native to the Lake Baikal region at mitotic metaphase was calculated to be 2n=42 (hexaploid) based upon total 21 pairs which produced normal seeds.

Acknowledgements

I am cordial thanks to Professor Katsuhiko Kondo, Laboratory of Plant Chromosome and Gene Stock, Graduate School of Science, Hiroshima University, for giving me a chance to study the plants of the Lake Baikal Region.I would like to thank Dr. Noriko Murakami for her advices on the manuscript. This study was supported by Grant-in-Aid for Scientific Research Program (A) 14255014 (Representative: Katsuhiko Kondo) of the Japan Society for the Promotion of Science.

Literature Cited

Belaeva, V. A. & V. N. Siplivinsky 1975. Chromosome numbers and Taxonomy of some species of Baikal flora (In Russian). Bot. Zurn. SSSR60, 6:864-872.

Hanelt, P.1970. Die Typisierung von *Papaver nudicaule* L. und die Einnordnung von *P. nudicaule* hort. non L. Kulturpflanze 18: 73-88.

Hanelt, P.1973. *In* IOPB chromosome numbers reports XLII. Taxon 22: 647-654.

Levan, A., K. Fredge and A.A.Stanberg 1964. Nomenclature for centromeric position of chromosomes. Hereditas 52:201-220.

Mesicek, J. & J. Sojak 1969. Chromosome counts of some Mongolian plants. Folia Geobot. Phytotax., Praha 4:55-86.

Petrovsky, V. V. & P. G. Zhukova 1981. Chromosome numbers and taxonomy of some plant species of Wrangel Island(In Russian). Bot. Zurn. 66(3): 380-387.

Safonova, I. N. 1991. Chromosome numbers in some species of the family Papaveraceae. Bot. Zurn. 76:904-905.

Tanaka, R. 1959. On the speciation and karyotypes in diploid and tetraploid species of *Chrysanthemum* I, Karyotypes in *Chrysanthemum boreale* (2n=18). Jour. Sci. Hiroshima Univ. Ser. B, Div. 2, 9:1-16.

Tanaka, R. 1971. Types of resting nuclei in Orchidaceae. Bot. Mag. Tokyo 84: 118-122.

Tanaka, R. 1977. Recent karyotype studies, p.293-325. *In* K. Ogawa (ed.), Plant Cytology. Asakura Book Co. Tokyo.

Tanaka, R. 1980. The karyotype, p.335-358. *In* H. Kihara (ed.), Plant Genestics I. Shokabo Book Co., Tokyo.

Zhukova, P. G. & V. V. Petrovsky 1985 Cytotaxonomic study in the species of the genus *Papaver* (Papaveraceae) from north-easten Asia (In Russian). Bot. Zurn. SSSR. 70(3): 362-368.

Table 1. Measurements of somatic chromosomes of *Papaver nudicaule* at mitotic metaphase, 2n=42

Chromosome	Length					Relative length	Arm ratio	Form
1	0.8	+	1.7	=	2.5	3.2	2.1	sm
2	0.8	+	1.7	=	2.5	3.2	2.1	sm
3	0.9	+	1.3	=	2.2	2.9	1.4	m
4	0.9	+	1.3	=	2.2	2.9	1.4	m
5	0.8	+	1.4	=	2.2	2.9	1.7	m
6	0.8	+	1.4	=	2.2	2.9	1.7	m
7	0.8	+	1.3	=	2.1	2.7	1.6	m
8	0.8	+	1.3	=	2.1	2.7	1.6	m
9	0.8	+	1.3	=	2.1	2.7	1.6	m
10	0.8	+	1.3	=	2.1	2.7	1.6	m
11	0.8	+	1.3	=	2.1	2.7	1.6	m
12	0.8	+	1.3	=	2.1	2.7	1.6	m
13	0.8	+	1.2	=	2.0	2.6	1.5	m
14	0.8	+	1.2	=	2.0	2.6	1.5	m
15	0.8	+	1.2	=	2.0	2.6	1.5	m
16	0.8	+	1.2	=	2.0	2.6	1.5	m
17	0.8	+	1.2	=	2.0	2.6	1.5	m
18	0.8	+	1.2	=	2.0	2.6	1.5	m
19	0.8	+	1.1	=	1.9	2.5	1.4	m
20	0.8	+	1.1	=	1.9	2.5	1.4	m
21	0.8	+	1.0	=	1.8	2.3	1.3	m
22	0.8	+	1.0	=	1.8	2.3	1.3	m
23	0.6	+	1.2	=	1.8	2.3	2.0	sm
24	0.6	+	1.2	=	1.8	2.3	2.0	sm
25	0.6	+	1.2	=	1.8	2.3	2.0	sm
26	0.6	+	1.2	=	1.8	2.3	2.0	sm
27	0.6	+	1.0	=	1.6	2.1	1.7	m
28	0.6	+	1.0	=	1.6	2.1	1.7	m
29	0.6	+	1.0	=	1.6	2.1	1.7	m
30	0.6	+	1.0	=	1.6	2.1	1.7	m
31	0.6	+	1.0	=	1.6	2.1	1.7	m
32	0.6	+	1.0	=	1.6	2.1	1.7	m
33	0.5	+	1.0	=	1.5	1.9	2.0	sm
34	0.5	+	1.0	=	1.5	1.9	2.0	sm
35	0.6	+	0.9	=	1.5	1.9	1.5	m
36	0.6	+	0.9	=	1.5	1.9	1.5	m
37	0.7	+	0.8	=	1.5	1.9	1.1	m
38	0.7	+	0.8	=	1.5	1.9	1.1	m
39	0.6	+	0.8	=	1.4	1.8	1.3	m
40	0.6	+	0.8	=	1.4	1.8	1.3	m
41	0.3	+	1.0	=	1.3	1.7	3.3	st
42	0.3	+	1.0	=	1.3	1.7	3.3	st
					77.0	100.0		