植物研究雑誌
J. Jpn. Bot.
67: 330–334 (1992)

Chromosome Numbers of Some Species of the Orchidaceae from China (1)

Mikio AOYAMA[a], Sing-chi CHEN[b], Da-ming ZHANG[b], Ryuso TANAKA[c] and Masashi NAKATA[d]

[a]Hiroshima Prefectural Agricultural Research Center, Hachihonmatsu-cho, Higashihiroshima, 739-01 JAPAN;
[b]Laboratory of Systematic and Evolutionary Botany, and Herbarium, Institute of Botany, Academia Sinica, Xiangshan, Beijing, 100093 The People's Republic of CHINA;
[c]Hiroshima University, Higashisenda-machi, Naka-ku, Hiroshima, 730 JAPAN;
[d]Botanical Institute, Faculty of Science, Hiroshima University, Kagamiyama, Higashihiroshima, 724 JAPAN

中国産ラン科植物数種の染色体数 (1)

青山幹男[a], 陳　心啓[b], 張　大明[b], 田中隆荘[c], 中田政司[d]

[a]広島県立農業技術センター　739−01 東広島市八本松町原 6869
[b]中国科学院植物研究所　100093 中華人民共和国北京市香山
[c]広島大学　730 広島市中区東千田町 1−1−89
[d]広島大学理学部植物学教室　724 東広島市鏡山 1−3

(Received on March 30, 1992)

The chromosome numbers of four species of the Orchidaceae from China are studied: 2n = 40 in *Ania hookeriana* (King et Pantl.) Tang et Wang and 2n = 60 and ca.120 in *Odontochilus yunnanensis* Rolfe are reported here for the first time, while 2n = 42 in *Goodyera procera* (Ker-Gawl.) Hook. and 2n = 30 in *Spiranthes sinensis* (Pers.) Ames confirm the previous reports. Polyploidy is observed in *Odontochilus yunnanensis*.

The Orchidaceae is one of the most advanced groups of the flowering plants and is widely distributed in the world. Many species are cultivated as ornamental plants, and some are used as medicinal plants. In China, 166 genera and approximately 1100 species of the Orchidaceae are known (Institute of Botany, Academia Sinica 1985). Only a few cytological studies in Chinese orchids have been made in the most standard references [Cheng et al. (1985) and Yang et al. (1984): *In* Li and Chen (1987)]. In the present paper, the chromosome numbers of four orchid species collected in China are reported.

Materials and methods

Four orchid species studied were collected in Ding Hu Shan, He Mu Shan and Nan Kun Shan in Guangdong Province, China. The voucher

specimens were deposited in Laboratory of Systematic and Evolutionary Botany, and Herbarium, Institute of Botany, Academia Sinica. Somatic chromosomes were observed in meristematic cells of root tips. Growing root tips were cut into small pieces and immersed in 2mM 8-hydroxyquinoline for five hours at about 20°C. They were fixed in the Farmer's fixative (3:1 mixture of ethanol and acetic acid) for one day at 10°C. Then, they were preserved in 70% ethanol. The root tips were hydrolyzed in a 2:1 mixture of 1N hydrochloric acid and 45% acetic acid for 20 seconds at 60°C, and were stained and squashed in 1% aceto-orcein.

Results and discussion

1. *Ania hookeriana* (King et Pantl.) Tang et Wang, Fig. 1.

A plant was collected in Ding Hu Shan, alt. ca.300m, Zhao Qing Shi-qu, Guangdong Province, China. The chromosome number of the plant was $2n=40$ at mitotic metaphase, which was reported here for the first time.

The chromosome features at resting stage were of the complex chromocenter type according to Tanaka's classification (Tanaka 1971) based on morphology of chromatin blocks (Fig. 1B). The chromosomes at mitotic prophase formed early condensed segments located in the interstitial and proximal regions (Fig. 1C). The $2n=40$ chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.1 μm) to the shortest (1.7 μm) chromosomes. The centromere positions of these chromosomes were obscure (Fig. 1D).

2. *Odontochilus yunnanensis* Rolfe, Fig. 2.

Two plants were collected in He Mu Shan, alt. ca.800m, Lian Xian, Guangdong Province, China. The chromosome numbers of these plants were $2n=60$ and $2n=$ca.120 at mitotic metaphase, respectively, which were reported here for the first time. Their external morphological characters were not different from each other.

The chromosome features at resting stage were of the prochromosome type (Fig. 2B and E). The chromosomes at mitotic prophase formed early condensed segments located in the proximal regions (Fig. 2C). The $2n=60$ chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (2.6 μm) to the shortest (1.0 μm) chromosomes (Fig. 2D). The $2n=$ca.120 could be an autotetraploid induced from the diploid (Fig. 2F).

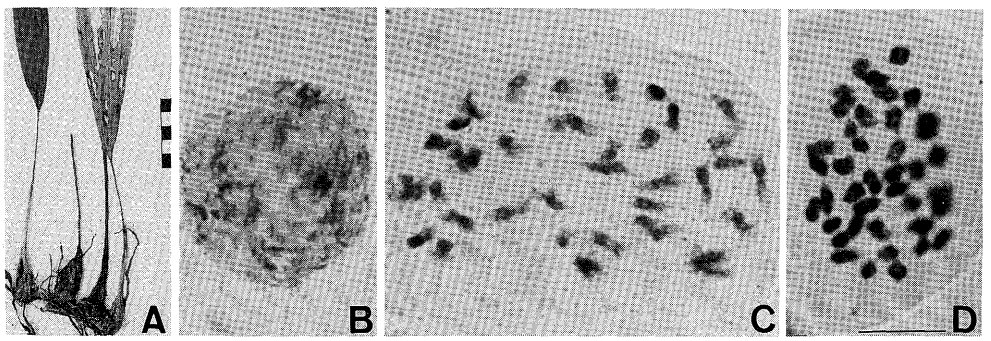

Fig. 1. *Ania hookeriana*, $2n=40$. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D, chromosomes at mitotic metaphase. A, ruler is graduated in 1cm. B–D, bar represents 10 μm.

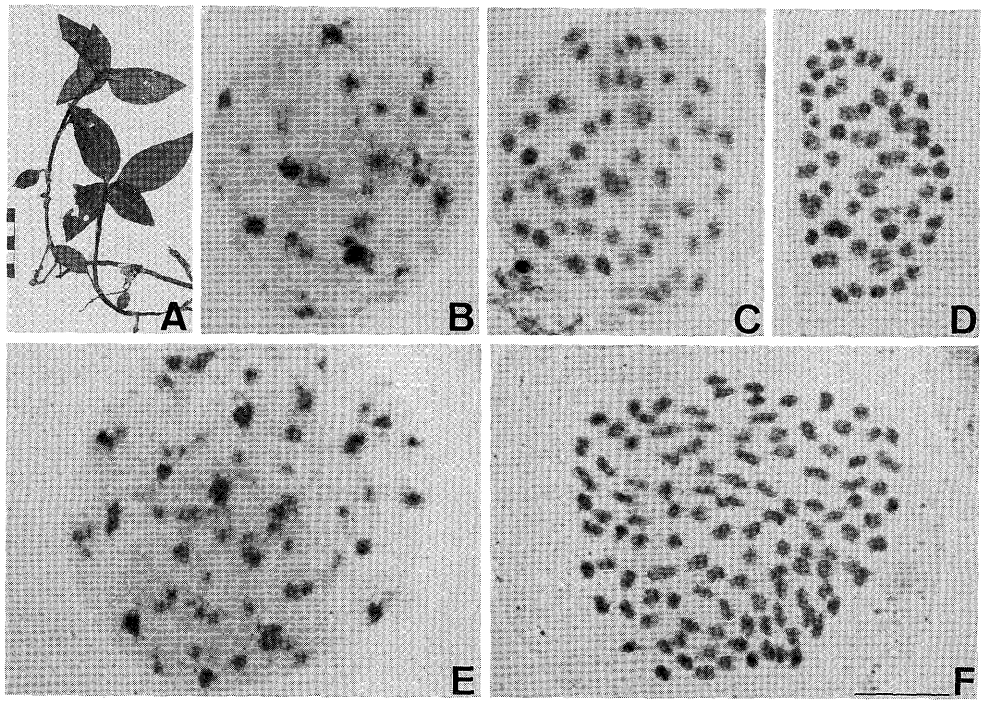

Fig. 2. *Odontochilus yunnanensis*, 2n=60 (A–D) and 2n=ca.120 (E and F). A, a specimen. B and E, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and F, chromosomes at mitotic metaphase. A, ruler is graduated in 1cm. B–F, bar represents 10 μm.

3. *Goodyera procera* (Ker-Gawl.) Hook., Fig. 3.

A plant was collected in Ding Hu Shan, alt. ca.300m, Zhao Qing Shi-qu, Guangdong Province, China. The chromosome number of the plant was 2n=42 at mitotic metaphase, which confirmed Miduno (1939), Tanaka (1965) and Sera (1990), but was different from the previous counts of n=11 (Afzelius 1943) and 2n=38 (Li and Chen 1987).

The chromosome morphological characters at resting stage and mitotic prophase were similar to those of *Odontochilus yunnanensis* (Fig. 3B and C). The 2n=42 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (2.3 μm) to the shortest (0.9 μm) chromosomes (Fig. 3D).

4. *Spiranthes sinensis* (Pers.) Ames, Fig. 4.

A plant was collected in Nan Kun Shan, alt. ca.700m, Long Men Xian, Guangdong Province, China. The chromosome number of the plant was 2n=30 at mitotic metaphase, which confirmed the previous reports (cf. Tanaka and Kamemoto 1984).

The chromosome features at resting stage were of the prochromosome type (Fig. 4B). At mitotic prophase, among the 30 chromosomes of the complement 22 formed early condensed segments in the interstitial and proximal regions (Fig. 4C). The other eight chromosomes had no early condensed segment. The 2n=30 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.6 μm) to the shortest (1.0 μm) chromosomes. Among the 30 chromosomes, six were median centromeric with arm ratios between 1.1 and 1.7, 14 submedian centromeric with arm ratios between 1.8 and 2.8, and ten subterminal centromeric with arm ratios between 3.0 and 7.0

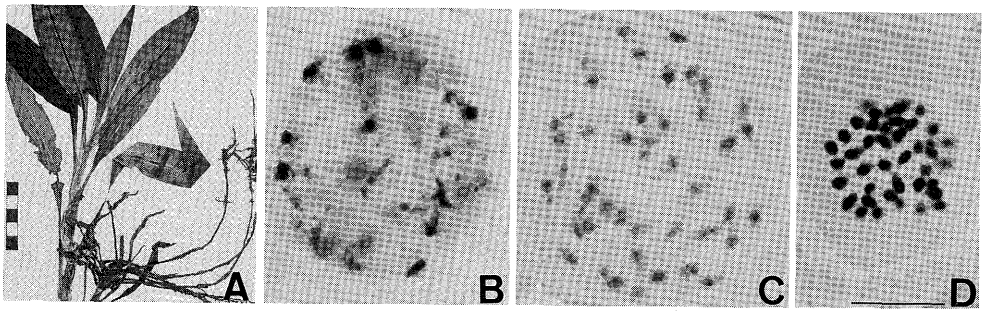

Fig. 3. *Goodyera procera*, 2n=42. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D, chromosomes at mitotic metaphase. A, ruler is graduated in 1cm. B–D, bar represents 10 μm.

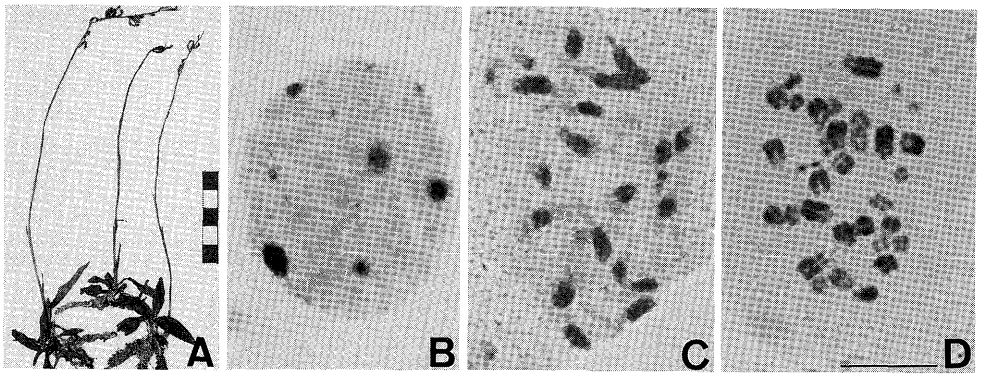

Fig. 4. *Spiranthes sinensis*, 2n=30. A, specimens. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D, chromosomes at mitotic metaphase. A, ruler is graduated in 1cm. B–D, bar represents 10 μm.

(Fig. 4D).

We wish to express our cordial thanks to Dr. Katsuhiko Kondo, Professor of Hiroshima University, for his valuable criticism during the preparation of this manuscript. Cordial thanks are extended to respect people who involved and guided us for field and collecting trip to Guangdong Province, The People's Republic of China. This study was financially supported by the Grant-in-Aid for the Monbusho International Research Program – Joint Research 01044099 for 1989–1991 (the representative; Ryuso Tanaka) of the Ministry of Education, Science and Culture of Japan.

This paper was contributed from Laboratory of Plant Chromosome and Gene Stock, Hiroshima University (Contribution no. 24).

References

Afzelius K. 1943. Zytologische beobachtungen an einigen Orchidazeen. Sv. Bot. Tidskr. **37**: 266-276.

Institute of Botany, Academia Sinica 1985. Iconographia Cormophytorum Sinicorum, Tomus V. Science Press, Beijing.

Li X. L. and Chen R. Y. 1987. Studies on chromosomes of Orchidaceae in China, p.301–307. *In*: D. Y. Hong (ed.), Plant Chromosome Research 1987. Organizing Committee of the Sino-Japanese Symposium on Plant Chromosomes, Beijing and Hiroshima.

Miduno T. 1939. Chromosomenstudien on Orchidazeen, II. Somatischen chromosomenzahlen einiger Orchideen.

Cytologia **9:** 447-451.
Sera T. 1990. Karyomorphological studies on *Goodyera* and its allied genera in Orchidaceae. Hiroshima Bot. Gard. Bull. **12:** 71-144.
Tanaka R. 1965. Chromosome numbers of some species of Orchidaceae from Japan and its neighbouring areas. Jour. Jap. Bot. **40:** 65-77.
———1971. Types of resting nuclei in Orchidaceae. Bot. Mag. Tokyo **84:** 118-122.
——— and Kamemoto H. 1984. Chromosomes in orchids: Counting and numbers, p.323–410. *In*: J. Arditti (ed.), Orchid Biology – Reviews and perspectives, III. Cornell Univ. Press, London.

要旨

中国産ラン科植物4種について染色体数の算定を行った．*Ania hookeriana* 2n = 40, *Odontochilus yunnanensis* 2n=60, ca. 120は今回初めて報告された染色体数で，キンギンソウ（*Goodyera procera*）2n = 42, ネジバナ（*Spiranthes sinensis*）2n=30は従来の報告と一致した．*Odontochilus yunnanensis*では倍数体が観察された．