Youji SHIGENOBU*: **Cytological relationship between *Swertia bimaculata* and *S. swertopsis***

重信陽二*: アケボノソウとシノノメソウの細胞学的研究

Swertia bimaculata (Sieb. et Zucc.) Hook. et Thoms. is widely distributed in Hokkaido, Honshu, Shikoku and Kyushu in Japan and is commonly found on the wet and open places of hills and mountains. On the other hand, according to Satake (1947), Hara (1948) and Ohwi (1978), *S. swertopsis* Makino is reported to occur in the recesses of mountains west of Izu in Honshu, Shikoku and Kyushu in Japan. This paper deals with karyotype and habitat analyses in two species mentioned above.

Materials and methods *Swertia bimaculata* was collected at six localities in Kochi Prefecture and two localities in Hiroshima Prefecture. *S. swertopsis* was collected near the top of Mt. Dogamori in Kochi Pref. These localities are shown in Tab. 1. All these plants were grown in pots in the Botanical Gardens, Faculty of Science, Hiroshima University or College of Child Development, Kochi Women's University. For the observation of chromosome root tips were pretreated with 0.002 M 8-hydroxyquinoline for 3 hr at about 10°C and fixed in modified Carnoy's fluid (99% ethanol: chloroform: glacial acetic acid=2: 1: 1) for over 24 hr at about 10°C. The fixed root tips were treated with 45% acetic acid for 15 min at about 10°C, hydrolyzed in mixture of 1N HCl and 45% acetic acid (2:1) for 15 sec at 60°C, and stained with 2% aceto-orcein for 20 min. Stained root tips were squashed. Voucher specimens are deposited in the Herbarium of the Botanical Institute of Hiroshima University.

Observations

1) **Swertia bimaculata** (Sieb. et Zucc.) Hook. et Thoms. The habitat of plants found in Fuji-no-kawa was an open place around a forest upon which the direct sun-light fell several hours a day and water of a mountain stream poured to the plants, or there was a moisture even in the dry season like the other seven habitats. The habitats of *S. bimaculata* in Kochi Pref. were

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Tab. 1. Localities and chromosome numbers of *Swertia bimaculata* and *S. swertopsis*.

Species	Localities where specimens were collected	No. of plants investigated	Chromosome number (2n)
S. bimaculata	Fuji-no-kawa, Nishitosa-mura, Kochi Pref.	5	26
	Mt. Yokokura, Ochi-machi, Kochi Pref.	4	26
	Ginzenji, Kochi, Kochi Pref.	2	26
	Misato, Kochi, Kochi Pref.	2	26
	Hokigamine, Tosayamada-machi, Kochi Pref.	2	26
	Nanagawa, Umaji-mura, Kochi Pref.	1	26
	Nukushina, Hiroshima, Hiroshima Pref.	2	26
	Mt. Shinnyu, Togochi-machi, Hiroshima Pref.	3	26
S. swertopsis	Mt. Dogamori, Nishitosa-mura, Kochi Pref.	14	52

situated at rather low elevations, that is, 20-400 m above the sea level. The soil where *S. bimaculata* was growing was sandy and included gravels.

Twenty-one plants shown in Tab. 1 were used for the chromosome observation. Morphological features of foliage leaves, flowers and stems of these plants were considered to be quite normal. Chromosome number in the somatic cells of all these plants was $2n=26$ in the mitotic metaphase (Fig. 2A). At metaphse, $2n=26$ chromosomes varied gradually from approximately 3.0 μm to 2.1 μm in length. The position of centromere of each individual chromosome was median or submedian. The chromosome complement was categorized to be symmetric karyotype in arm ratio. Satellites were found in four chromosomes which were medium in length.

2) **Swertia swertopsis** Makino. The present species is widely distributed in forests of *Chamaecyparis obtusa* at mountain side. It was found at the elevation about 700 m on Mt. Dogamori (Fig. 1). The soil where *S. swertopsis* was growing was dark brown in color and included brittle breccia. There

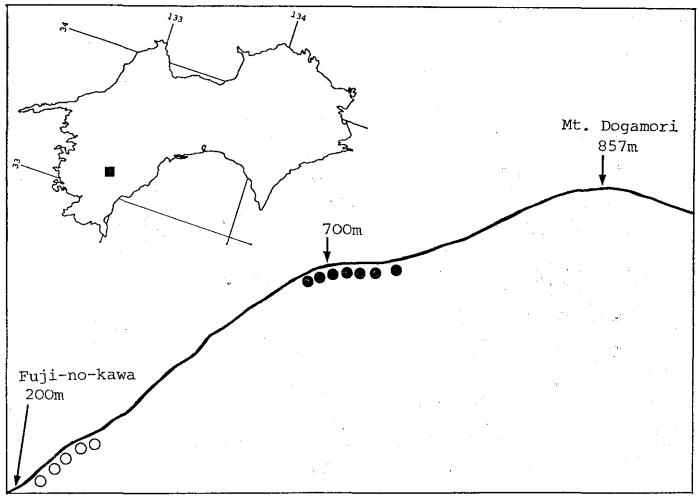

Fig. 1. The vertical distribution of *Swertia bimaculata* (○), 2n=26, and *S. swertopsis* (●), 2n=52, on Mt. Dogamori (857 m), Kochi Pref.

were no mountain stream and no standing water near the plants of *S. swertopsis*. It was quite dark because of the low intensity of radiation around these plants.

Fourteen plants of *S. swertopsis* were used for the chromosome observation. Morphological features of foliage leaves, flowers and stems of all these plants were normal. The chromosome number in the somatic cell was counted to be 2n=52 in the mitotic metaphase (Fig. 2B). At metaphase, 2n=52 chromosomes varied gradually from approximately 2.8 μm to 1.4 μm in length, and the position of centromere of each chromosome was median or submedian. The chromosomes at metaphase were found to be of the symmetric arm ratio. Satellites were found in two chromosomes.

Discussion In the present paper, 2n=26 chromosome number of *S. bimaculata* (Wada 1955, 1966; Sharma & Sarkar 1971) was verified and 2n=52 chromosome number was reported for *S. swertopsis* for the first time. In metaphase, the chromosomes of *S. swertopsis* were a little smaller than those of *S. bimaculata*. On the other hand, satellited chromosomes were 2 in *S. swertopsis*, whereas they were 4 in *S. bimaculata*. However, these two species have similar karyomorphological features because of the gradual variation in chro-

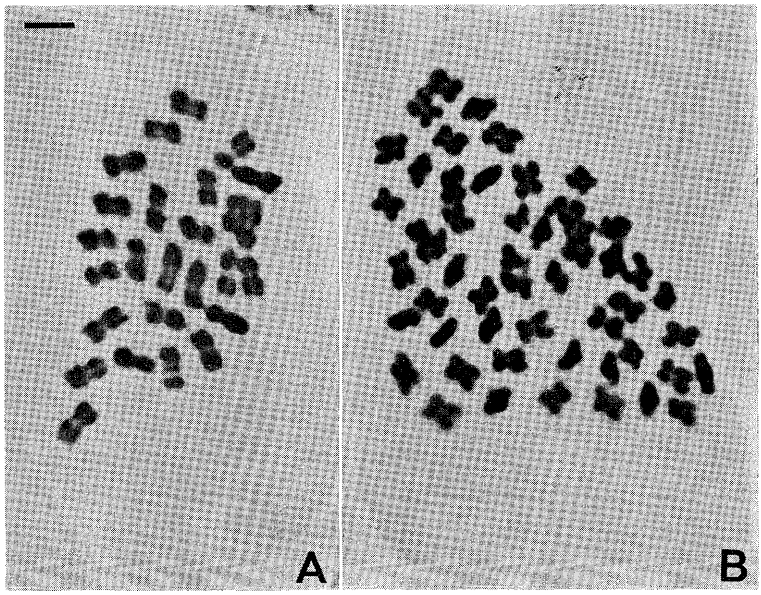

Fig. 2. Photomicrographs of somatic chromosomes at mitotic metaphase in two species of *Swertia*. A. *S. bimaculata*, 2n=26. B. *S. swertopsis*, 2n=52. Bar indicates 3 μm.

mosome length and the symmetric arm-ratio. Thus, *S. bimaculata* can be considered to be a diploid and *S. swertopsis* as a tetraploid, the basic number in these two species being x=13.

As shown in Fig. 1, *S. bimaculata* was growing in open wet places along the edges of the forests and at comparatively low elevations, whereas *S. swertopsis* was growing in dark place under the forest of *Chamaecyparis obtusa* in the recesses of mountains and at higher elevations than those of *S. bimaculata*. It may be considered that these two species have been differentiated at a little different habitats respectively.

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Literature cited

Hara, H. 1948. Enumeratio Spermatophytarum Japonicarum, 1. 300 pp. Iwanami Shoten, Tokyo. Ohwi, J. 1978. Flora of Japan. 1584 pp. Shibundo, Tokyo. Satake, Y. 1947. Species Swertiae Nipponenses (continuatio). Journ. Jap. Bot. 21: 22-30. Sharma, A. & A.K. Sarkar (ed.) 1971. Chromosome number reports of plants in Annual Report. Cytogenetics Laboratory, Department of Botany, University of Calcutta, The Research Bulletin 2: 38-48. Wada, Z. 1955. Cytological studies of four species of *Swertia* and one species of *Halenia*. Jap. Jour. Genetics 30: 191. —— 1966. Chromosome numbers in Gentianaceae. Chromosome Inf. Serv. 7: 28-30.

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Swertia bimaculata アケボノソウと *S. swertopsis* シノノメソウの核形態学的，生態学的研究を行った。前者は 2n=26 で既報告 (Wada 1955, 1966; Sharma & Sarkar 1971) のそれと一致したが，後者は 2n=52 で従来の報告にない染色体数を示した。両種の染色体は，長さと付随体染色体の数において若干の差異はあるものの，勾配的染色体長と対称的腕比において類似していた。基本数が x=13 であるとすれば，アケボノソウは2倍体，シノノメソウは4倍体であることになる。堂が森山では，アケボノソウは山麓の谷水が直接あたる砂礫の多い土壌質の明るい林縁に，シノノメソウは山頂付近の水はけのよい，もろい角礫岩を多く含む褐色土壌の光量の少ない，よく発達した古いヒノキ林床に生育していた。両植物の間には倍数関係とすみ分け関係とが存在するものと考えられる。

正 誤 Errata

	頁(Page)	行(Line)	誤(For)	正(Read)
Vol. 57 No. 10	311	33	Pedicels	Pedicelli
	311	33	glabra	glabrae
	312	5	Peop.	Pop.