A revision of chromosome number in some hybrids of *Paphiopedilum**

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パフィオペディラム属における染色体数の再検討

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Paphiopedilum is horticulturally valuable genus in Orchidaceae and includes many cultivars. There are several papers on the chromosome number of the cultivars (Francini 1934, Mehlquist 1947, 1949, Duncan 1947, Duncan & MacLeod 1948, Lenz 1960). Among these papers, Lenz has reported that some cultivars of hybrid origin in white Paphiopedilum have B-chromosomes, and he has presumed that the B-chromosomes of these cultivars derive from the autosomes of *P. spicerianum*.

On the other hand, in the most of the natural species of *Paphiopedilum* the chromosome number has been reported (Duncan 1947, Mehlquist 1947, Duncan & MacLeod 1948, 1949, 1950, Kamemoto *et al.* 1963, Tanaka 1964, 1965, Tanaka & Aoyama 1974, Karasawa 1978, 1979, 1980), while the B-chromosome has not been observed.

In the present investigation cultivars of white Paphiopedilum in which B-chromosomes were reported by Lenz (1960) and their parental species were karyomorphologically examined.

Material and Method

Six cultivars of white Paphiopedilum and their parental species investigated are shown in Table 1 and Fig. 4. All cultivars were the same clones with those which were used by Lenz (1960). In addition, all materials and one of the lineages of them were shown in Fig. 1 and 2, and all parental species of cultivars in Table 2.

The observation of somatic chromosomes were carried out according to the previous report (Karasawa 1979).

Observation and Discussion

Chromosomes of parental species

Somatic chromosomes at metaphase of parental species were shown in Fig. 1. All of the parental species, except for *P. spicerianum* and *P. druryi* with 2n=30, had the chro-

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mosome number of 2n=26. No extra chromosomes were observed as same as the all previous reports (cf. Karasawa 1979).

The metaphase chromosomes of the 2n=26 species, except for *P. insigne* var. *sanderae*, were divided into two quantitative groups; the one consisted of four large chromosomes and the other 22 small chromosomes decreasing gradually in size. The position of their centromeres were all median. The 13th and 14th chromosomes of *P. insigne* and the 15th and 16th chromosomes of *P. villosum* had an obvious satellite respectively, which was

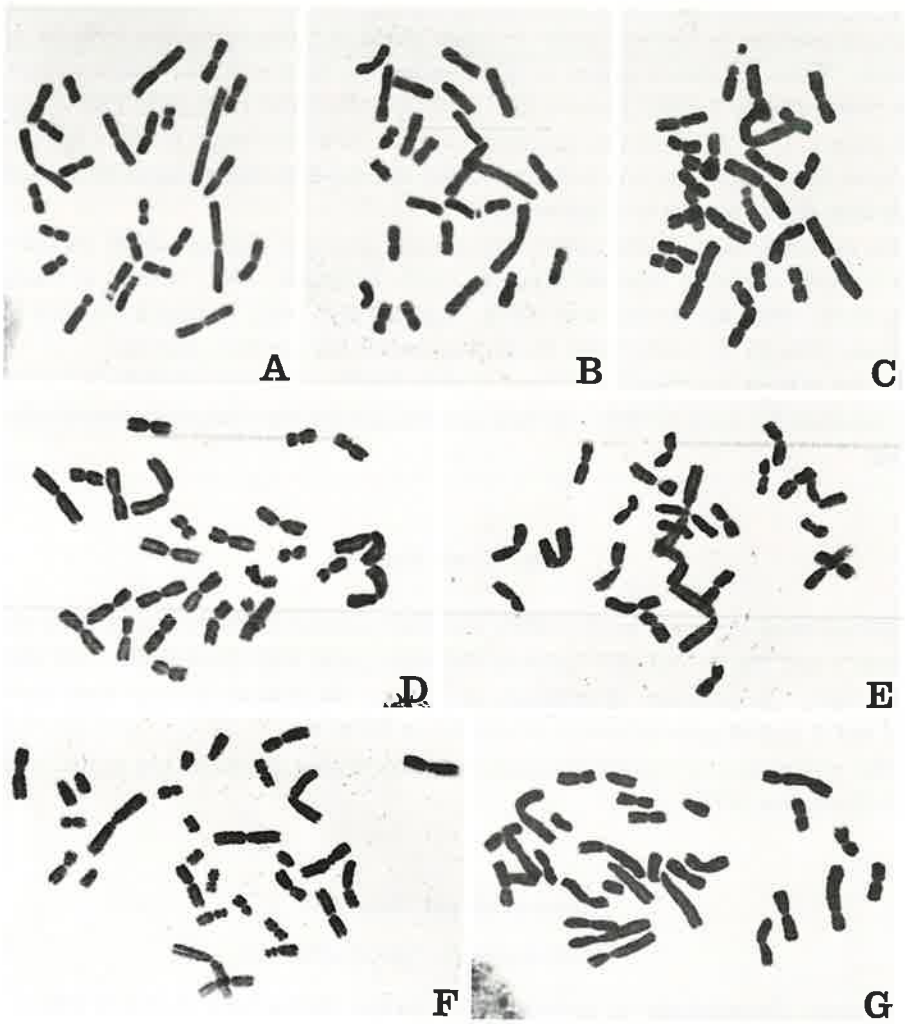

Fig. 1. Photomicrographs of the somatic chromosomes of *Paphiopedilum*.
A, *P. insigne* 2n=26. B, *P. insigne* var. *sanderae* 2n=26. C, *P. villosum* 2n=26. D, *P. niveum* 2n=26. E, *P. bellatulum* 2n=26. F, *P. spicerianum* 2n=30. G, *P. druryi* 2n=30. × 1000.

often separated from the short arm by squash technique.

The karyotype of *P. insigne* var. *sanderae* was different from that of *P. insigne* on the position of centromeres of 4th and 10th chromosome: The position of centromeres of both 4th and 10th chromosomes in *P. insigne* were median, while that in var. *sanderae* were submedian (cf. Karasawa 1978).

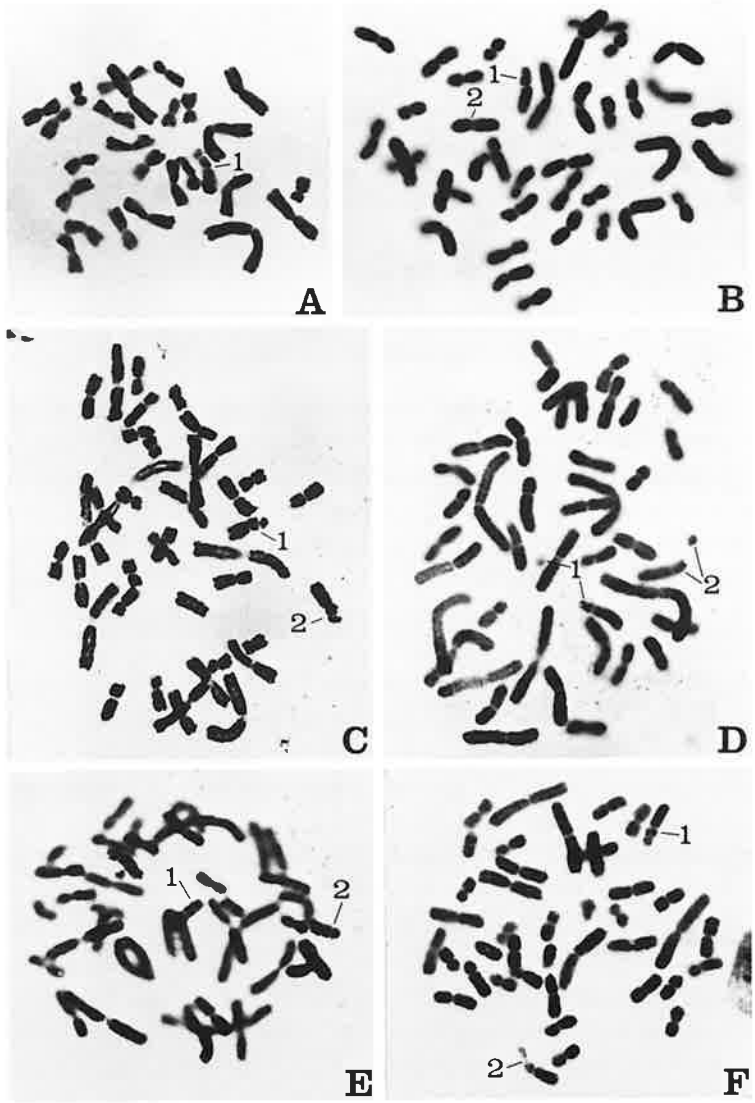

Fig. 2. Photomicrographs of the somatic chromosomes of *Paphiopedilum*.
A, *P.* Boltonii FCC/RHS 2n=26. B, *P.* Albion FCC/RHS 2n=39. C, *P.* Sumurum 'Pearl' 2n=39. D, *P.* Astarte 2n=40. E, *P.* Rosy Dawn AM/RHS 2n=40. F, *P.* F.C. Puddle FCC/RHS 2n=41. × 1000.

Table 1. Chromosome number of white Paphiopedilum

Cultivars	Chromosome number	
	Present report (2n)	Previous report (2n)
P. Boltonii FCC/RHS	26	26+1−2B
P. Albion FCC/RHS	39	39
P. Sumurum 'Pearl'	39	39+1B
P. Astarte	40	40−41+2B
P. Rosy Dawn AM/RHS	40	40+2B
P. F. C. Puddle FCC/RHS	41	Ca. 41+1−2B

Two species with the chromosome number of 2n=30, *P. spicerianum* and *P. druryi*, had 22 metacentric and 8 telocentric chromosomes. The chromosomes of *P spicerianum* had small constriction in the interstitial region of short and/or long arm.

Chromosomes of cultivars

In *P.* Boltonii FCC/RHS, a diploid cultivar, the 2n=26 chromosomes were counted (Fig. 2A). Lenz (1960) has reported that the chromosome number of this cultivar is 2n= 26+1−2B, while no extra chromosomes were found in the present investigation.

The 2n=26 chromosomes of this cultivar consisted of four large and 22 small chromosomes decreasing gradually in size. The position of centromeres of these 26 chromosomes were all median, and submetacentric chromosomes found in *P. insigne* var *sanderae* were not observed. Farthermore, the 13th chromosome had an obvious satellite which was often separated from its short arm (Fig. 3).

According to Sander's List (1945), *P.* Boltonii has been treated as a form of *P.* Muriel Hollington which had been produced by *P. insigne* and *P. niveum.*

By the karyomorphological facts described above, it is suggested that the 2n=26 chromosomes of this cultivar might be consisted of a half set of the complement of *P. insigne* and a half set of the complement of *P. niveum.*

The chromosome numbers of the other five cultivars were counted as follows: *P.* Albion FCC/RHS was 2n=39, *P.* Sumulum 'Pearl' was 2n=39, *P.* Astarte was 2n=40, *P.* Rosy Dawn AM/RHS was 2n=40 and *P.* F. C. Puddle FCC/RHS was 2n=41 (Fig. 2). All of these five cultivars did not have any extra chromosomes, while had two obvious satellites in their chromosome complements respectively, which were often separated from the short arm of their own chromosomes (arrows in Fig. 2). In mitotic prophase no chromosome showing heteropycnosis was observed. There are many parental species which have been used for the artificial hybridization in the breeding of the cultivars of white Paphiopedilum. According to the karyomorphological observations in the parental species (Karasawa 1979), only *P. insigne* and *P. villosum* were found to have satellite chromosomes. Therefore, the satellite chromosomes occurred in the five cultivars shown in Table 1 are considered to be the chromosomes of the two species. By the shape of the short

Fig. 3. Metaphase chromosomes of *Paphiopedilum*. A, *P. insigne* 2n=26. B, *P. niveum* 2n=26. C, *P.* Boltonii FCC/RHS 2n=26. × 1200.

arm of the satellite chromosomes, the four cultivars, *i.e. P.* Albion FCC/RHS, *P.* Sumulum 'Pearl', *P.* Astarte and *P.* F.C. Puddle FCC/RHS, can be presumed to have the satellite chromosome of *P. insigne* or *P. insigne* var. *sanderae*, and the cultivar, *P.* Rosy Dawn AM/RHS, to have the satellite chromosome of *P. insigne*, *P. insigne* var. *sanderae*, or *P. villosum*.

By the present karyomorphological investigations, it is clear that the small fragments in the cultivars of white Paphiopedilum are not B-chromosomes reported by Lenz (1960) but the satellites derived from *P. insigne* or *P. villosum* being their parental species.

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Summary

1. Karyomorphological investigations were carried out in the six cultivars of white Paphiopedilum in which Lenz (1960) reported B-chromosomes. The chromosome numbers of these six cultivars were counted as follows; 2n=26 in *P.* Boltonii FCC/RHS, 2n=39 in *P.* Albion FCC/RHS and *P.* Sumulum 'Pearl', 2n=40 in *P.* Astarte and *P.* Rosy Dawn AM/RHS, 2n=41 in *P.* F.C. Puddle FCC/RHS.
2. No B-chromosome was observed in the six cultivars, while one obvious satellite was observed in the diploid cultivar and two obvious satellites in the triploid cultivars. It is assumed that they derived from the *P. insigne* or *P. villosum*.
3. It was confirmed that *P.* Boltonii was a hybrid between *P. insigne* and *P. niveum*.

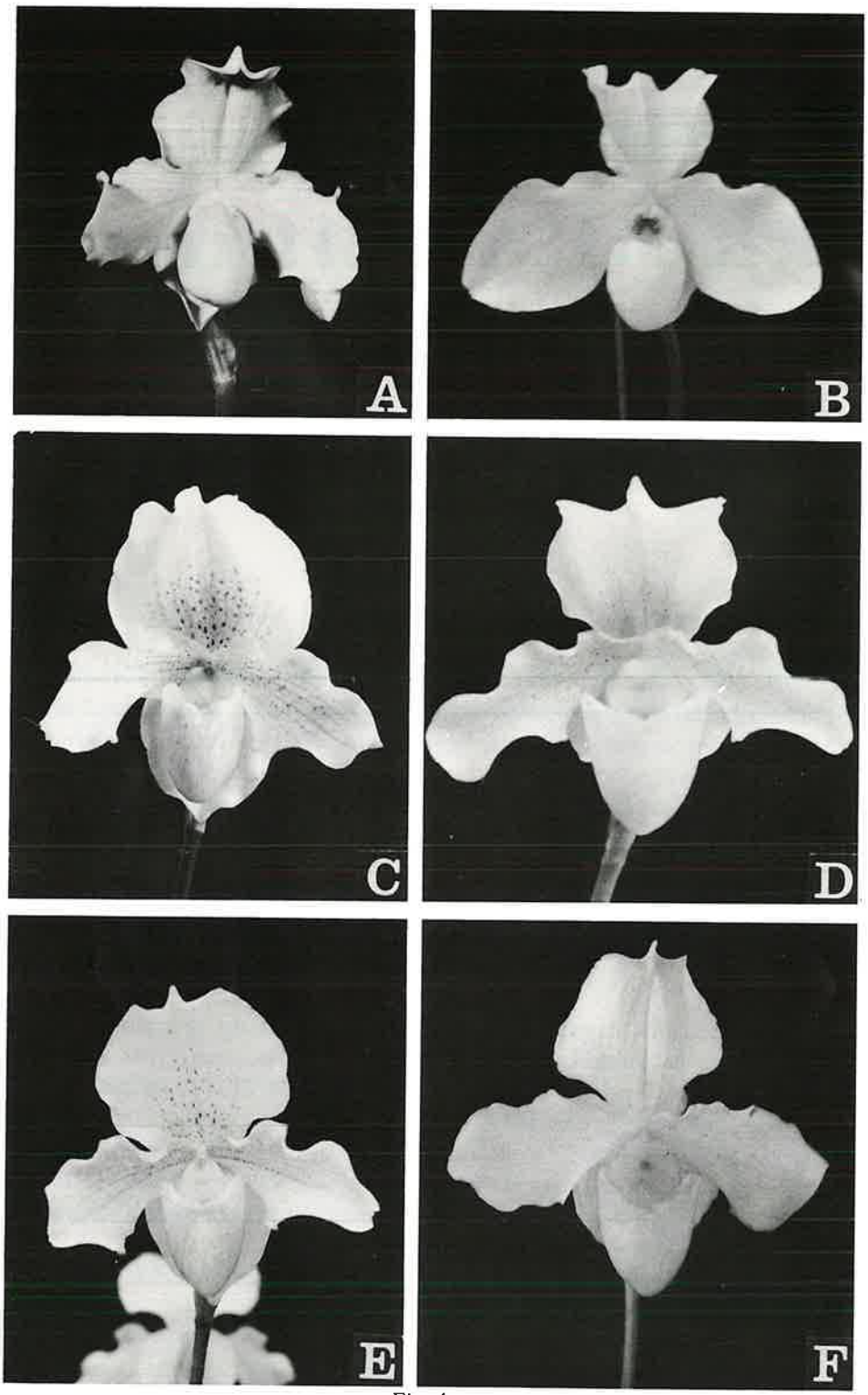

Fig. 4.

Table 2. Parental species of white Paphiopedilum

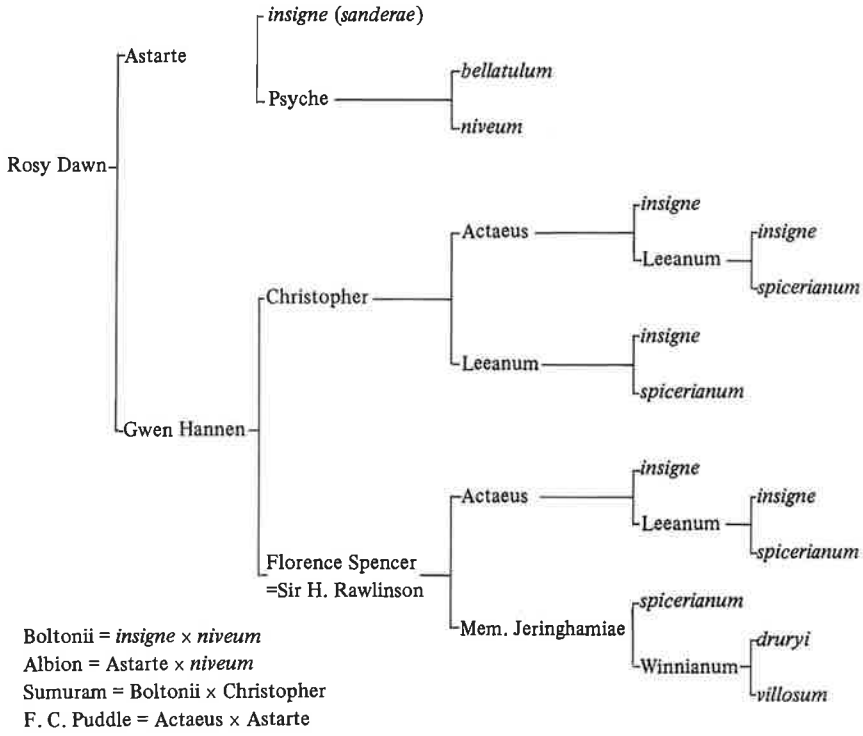

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Fig. 4. Flowers of white Paphiopedilum. A, *P.* Boltonii FCC/RHS. B, *P.* Albion FCC/RHS. C, *P,* Sumurum 'Pearl'. D, *P.* Astarte. E, *P.* Rosy Dawn AM/RHS. F, *P.* F.C. Puddle FCC/RHS. x 0. 5.

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