Karyomorphological observations on some Aroids cultivated in the Hiroshima Botanical Garden II.

Amorphophallus *

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広島市植物公園で栽培のサトイモ科植物の核形態学的観察 II.

コンニャク属*

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Introduction

The genus *Amorphophallus*, which consists of approximately 170 species (Hetterscheid & Ittenbach 1996), is widely distributed in tropical and some subtropical Africa, Asia and Oceania, from western Africa to Polynesia and from Japan down to northern Australia. This genus is known as one of the food plants in Japan and the ornamental plants in the tropical countries. 11 taxa of *Amorphophallus* cultivated in the Hiroshima Botanical Garden were studied their chromosome morphologies.

Materials and Methods

All materials studied in this work were cultivated in the Hiroshima Botanical Garden, Hiroshima City, Japan (Table 1).

Table 1. Sources, number of plants and chromosome numbers of the species *Amorphophallus* studied.

Species	Sources	No. of plants observed	Chromosome number(2n)	
			present count	previous count
A. bulbifer (Roxb.) Bl.	India	1	39	39
A. henryi N. E. Br.	China, Taiwan	1	26	
A. hirtus N. E. Br.	China, Taiwan	1	26	
A. kiusianus (Makino) Makino	Japan, Kagoshima Pref., China, Taiwan	2	26	26
A. konjac K. Koch	China, Yunnan, Germany*	3	26	26
A. krausei Engl.	Nepal	1	26	
A. muelleri Bl.	Java	1	39	39
A. paeoniifolius (Dennst.) Nicolson	China,Taiwan, Papua New Guinea, Indonesia	3	28	28
A. pingbianensis H. Li. & C. L. Long	China, Yunnan	1	26	
A. titanum (Becc.) Becc. ex Arcang.	Japan,Tokyo Univ.Bot.Gard.,Exotic Plants Nursery*	2	26	26
A. yunnanensis Engl.	Thailand, Chiang Mai	1	26	

*localites were unknown

*Contribution from the Hiroshima Botanical Garden No. 74.

1) The Hiroshima Botanical Garden.

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The methods for the cytological observation and terminology for description of karyotype were the same as those described in the previous report (Ishida 2001).

Observations

1. ***Amorphophallus bulbifer*** **(Roxb.) Bl., 2n=39, Tables 1 and 2, Fig. 1.**
Validated specimen No. 8003.

One plant was obtained from India. External morphological characteristics of the plant were similar to those of this species described by Hetterscheid & Ittenbach (1996).

The chromosome number of the plant was 2n=39 at mitotic metaphase and confirmed the previous reports (Marchant 1971, Ramachandra 1977, Chauhan & Brandham 1985, Kuruvilla *et al.* 1989).

The chromosomes at resting stage were observed as chromomeric granules, fibrous threads and chromatin blocks scattered throughout the nucleus. Many small chromatin blocks were round-, rod-, and string-shaped and varied from 0.6-3.0 μm in diameter and showed irregular shape with rough surface. Some of the blocks aggregated into large blocks as the chromocentral aggregation.

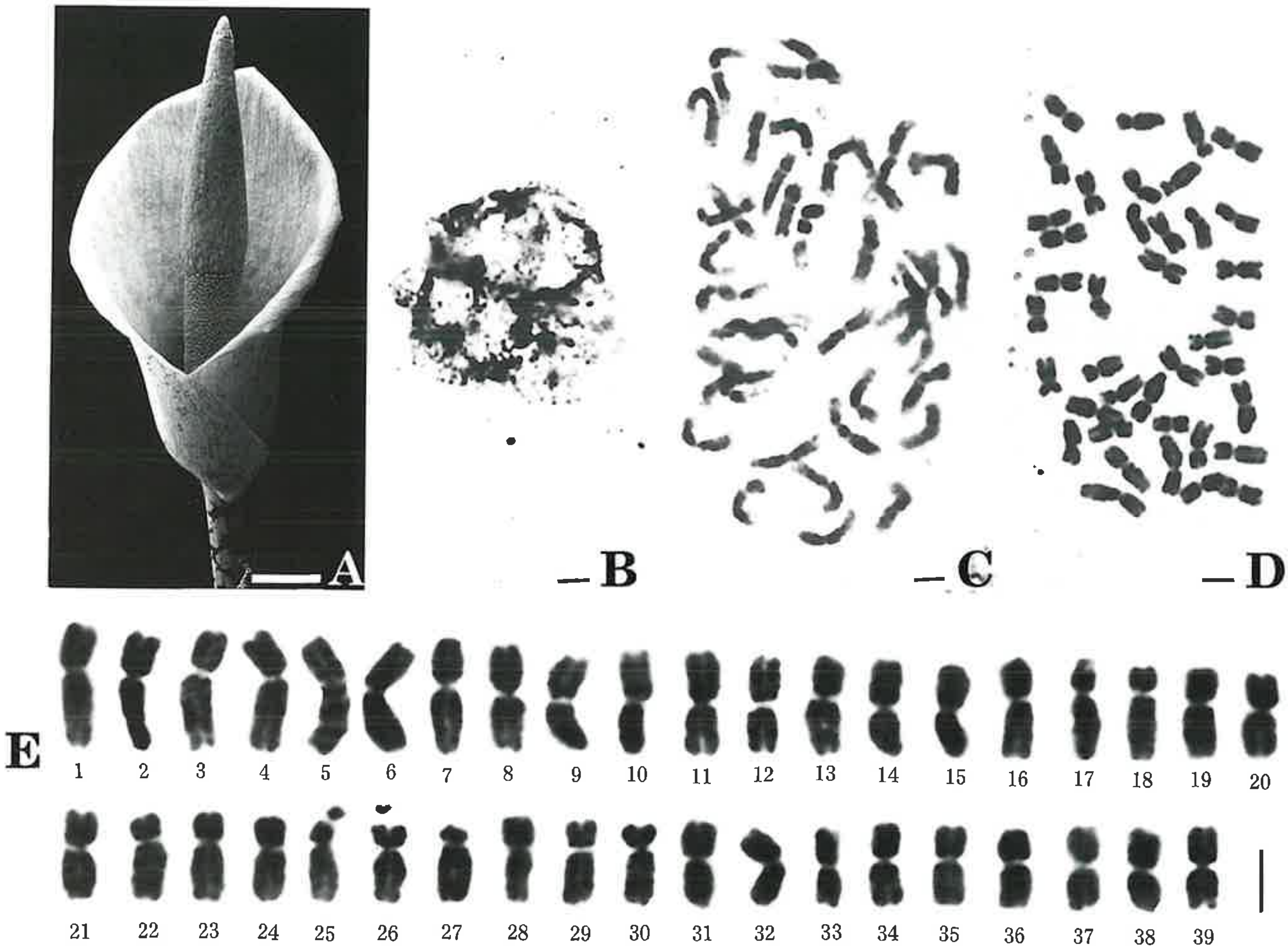

Fig. 1. *Amorphophallus bulbifer*, 2n=39. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

Thus, the description of the karyotype at the resting stage was considered to belong to the category of the complex chromocenter type proposed by Tanaka (1971).

At prophase the chromosomes formed early-condensed segments located in the proximal and interstitial regions of both arms. Late condensed segments were observed in the distal regions of the chromosomes.

Thus, the karyotype at mitotic prophase was found to be the interstitial type as proposed by Tanaka (1977).

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 6.0μm to the shortest one of 4.0μm. Among the 39 chromosomes 29 were median, while the other nine (Nos. 3, 17, 18, 22-24, 28-30) were submedian and one (No. 27) was subterminal. Two chromosomes (No. 25, 26) had secondary constrictions in their short arms.

Chauhan & Brandham (1985) reported this species was apparently autotriploid, but according to the comparison of karyotypes in detail, *A. bulbifer* seems to be an allotriploid.

2. *Amorphophallus henryi* N. E. Br., 2n=26, Tables 1 and 3, Fig. 2.
Validated specimen No. 78001.

One plant was obtained from China, Taiwan. External morphological characteristics of the plant were similar to those of this species described by Hetterscheid & Peng (1995) and Hetterscheid & Ittenbach (1996).

The chromosome number of the plant at mitotic metaphase was 2n=26, which was reported here for the first time for

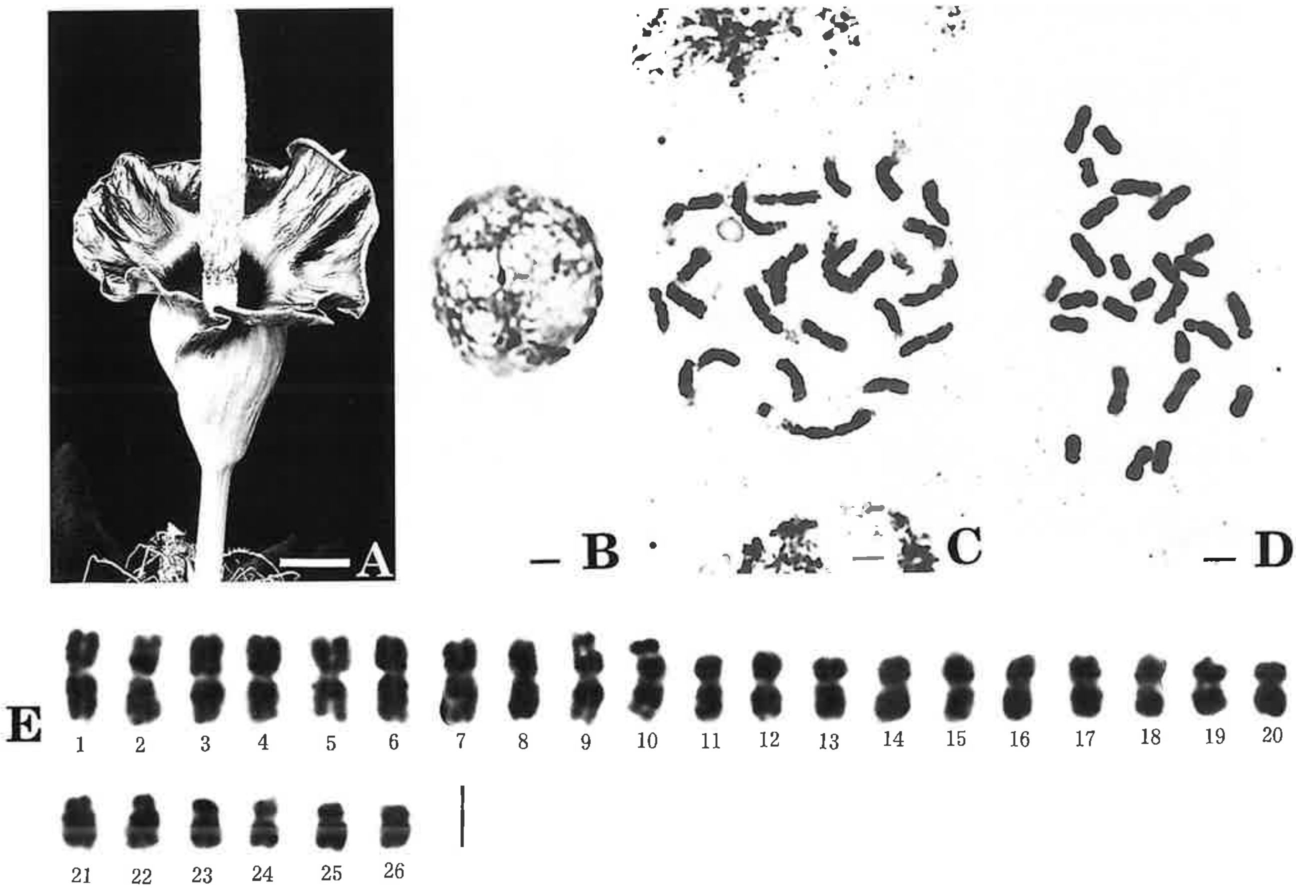

Fig. 2. *Amorphophallus henryi*, 2n=26. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

this species.

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 4.5μm to shortest one of 2.1μm , and the positions of the chromocenters were either median or submedian. Among the 26 chromosomes 20 were median, while the other six (Nos. 21-26) were submedian. Two chromosomes (Nos. 9, 10) had secondary constrictions in their short arms.

3. *Amorphophallus hirtus* N. E. Br., 2n=26, Tables 1 and 4, Fig. 3.
Validated specimen No. NF00-01.

One plant was obtained from China, Taiwan. External morphological characteristics of the plant were similar to those of this species described by Hetterscheid & Peng (1995) and Hetterscheid & Ittenbach (1996).

The chromosome number of the plant at mitotic metaphase was 2n=26,which was reported here for the first time for this species.

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

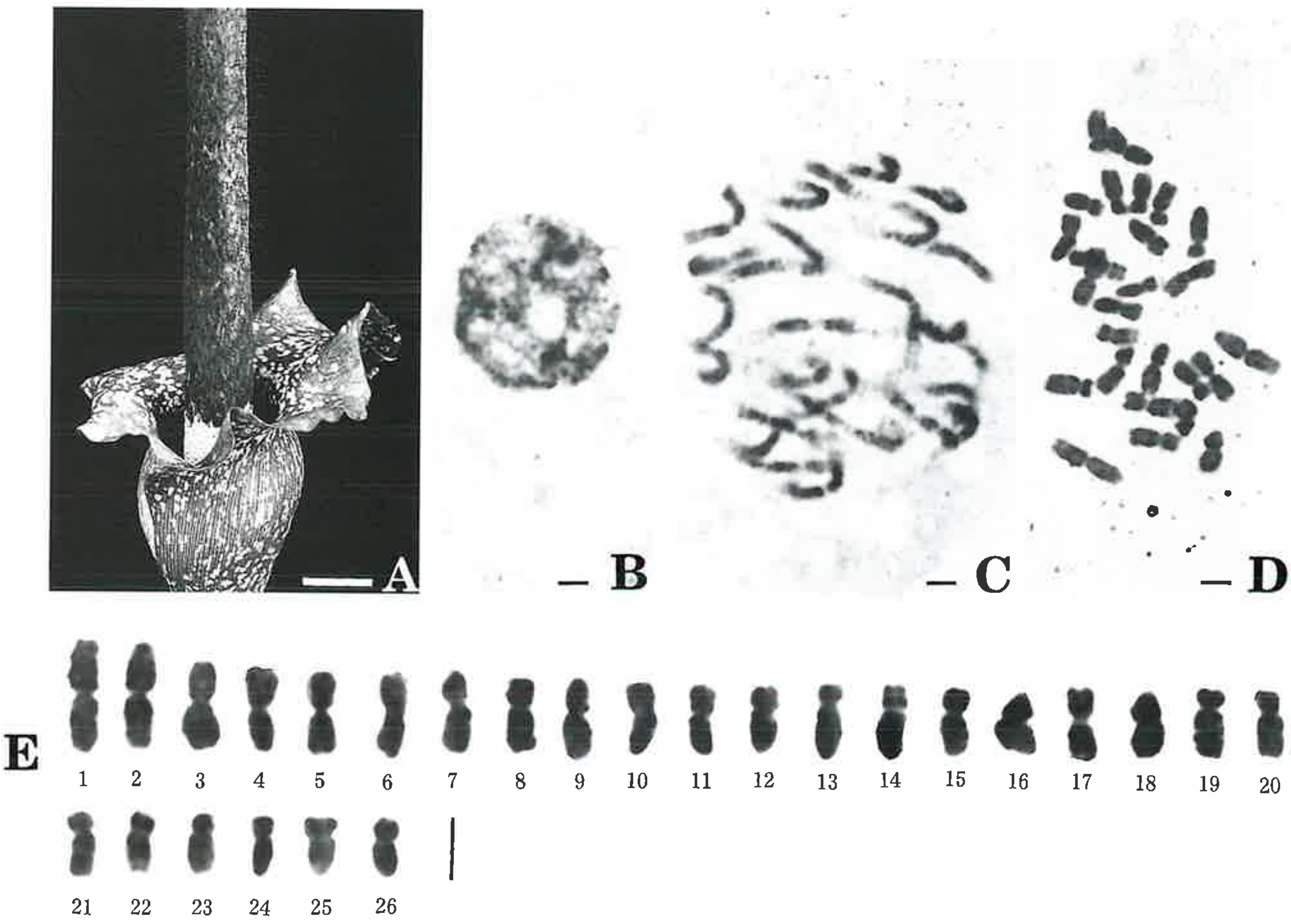

Fig. 3. *Amorphophallus hirtus*, 2n=26. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 3 cm in A and 3μm in B-E.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 5.3μm to shortest one of 2.9μm , and the positions of the chromocenters were either median or submedian. Among the 26 chromosomes 18 were median, while the other eight (Nos. 11-14, 21-24) were submedian.

4. *Amorphophallus kiusianus* (Makino) Makino, 2n=26, Tables 1 and 5, Fig. 4.
Validated specimen No. NF59-1, KIU.

Two plants were obtained from China, Taiwan and Kagoshima pref., Japan. External morphological characteristics of the plants were similar to those of this species described by Hetterscheid & Peng (1995) and Hetterscheid & Ittenbach (1996).

The chromosome number of two plants was 2n=26 at mitotic metaphase and confirmed the previous report (Ito 1942).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 4.7μm to

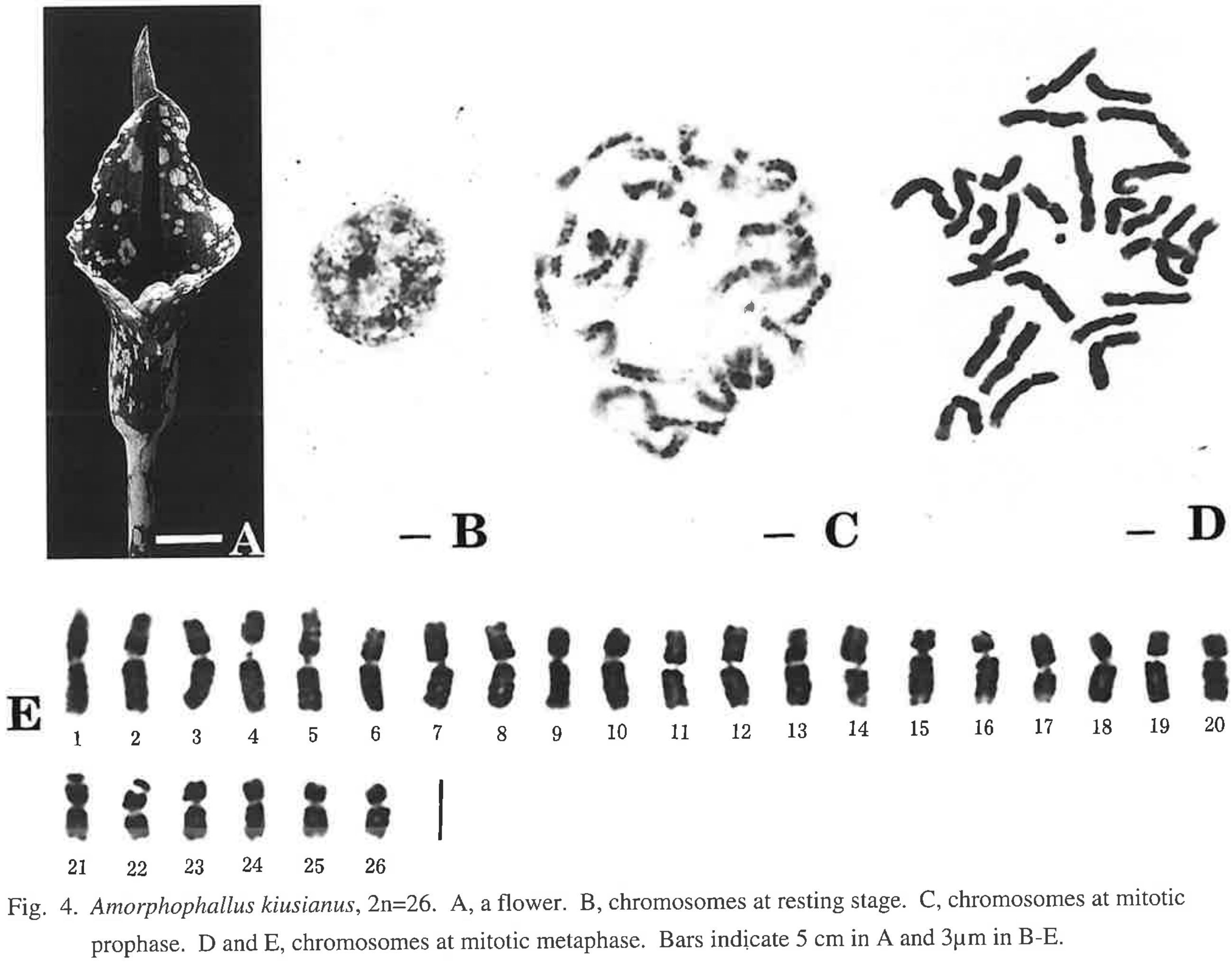

Fig. 4. *Amorphophallus kiusianus*, 2n=26. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

shortest one of 2.7μm. Among the 26 chromosomes 24 were median, while the other two (Nos. 13, 14) were submedian. Two chromosomes (Nos. 21, 22) had secondary constrictions in their short arms.

5. *Amorphophallus konjac* K. Koch, 2n=26, Tables 1 and 6, Fig. 5.
Validated specimen No. NCH-62, AH-83.

Two plants were obtained from China, Yunnan and Germany, Aachen Bot. Garden. External morphological characteristics of the plants were similar to those of this species described by Hetterscheid & Ittenbach (1996).

The chromosome number of two plants at mitotic metaphase was 2n=26 and confirmed the previous reports (Wakabayashi 1955, Larsen 1969, Gill & Chinnappa1973, Chauhan & Brandham1985, Liu *et al.* 1985, Zheng & Liu 1989, Cheng *et al.* 1991, Ishida & Akagi 2000).

The chromosomes at resting stage were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes of 2n=26 showed a gradual decrease in length ranging from the longest one of 6.4μm to shortest one

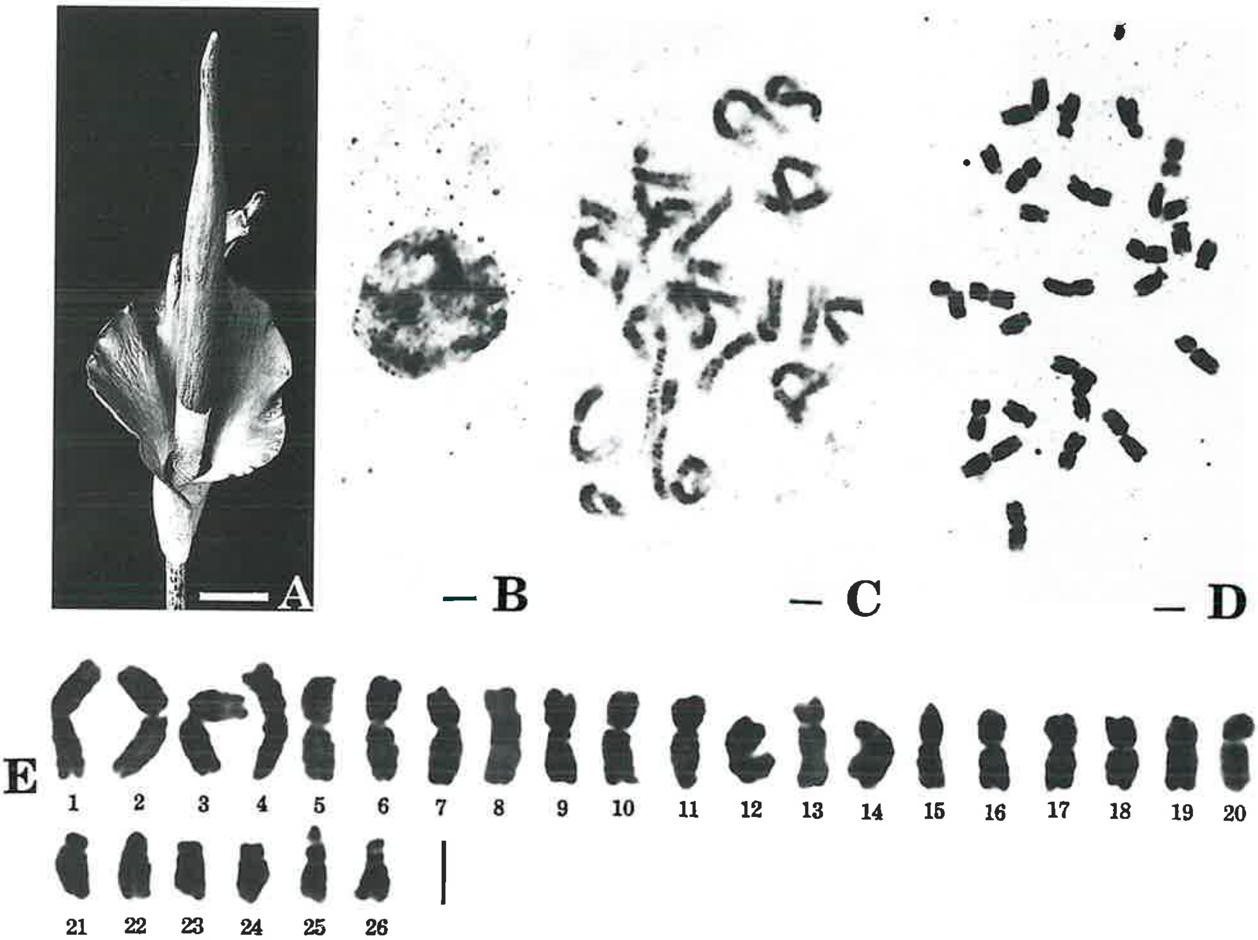

Fig. 5. *Amorphophallus konjac*, 2n=26. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 10 cm in A and 3μm in B-E.

of 2.8μm, and among the 26 chromosomes 18 were median, while the other four (Nos. 13, 14, 25, 26) were submedian and four (Nos. 21-24) were subterminal. Two chromosomes (No. 25, 26) had secondary constrictions in their short arms.

6. *Amorphophallus krausei* Engl., 2n=26, Table 1 and 7, Fig. 6.
Validated specimen No. 87H-01.

One plant was obtained from Nepal. External morphological characteristics of the plant were similar to those of this species described by Hetterscheid & Ittenbach (1996).

The chromosome number of the plant at mitotic metaphase was 2n=26 , which was reported here for the first time for this species.

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 5.6μm to shortest one of 2.8μm , and the positions of the chromocenters were either median or submedian. Among the 26 chromosomes 16 were median, while the other ten (Nos. 13, 14, 17-24) were submedian.

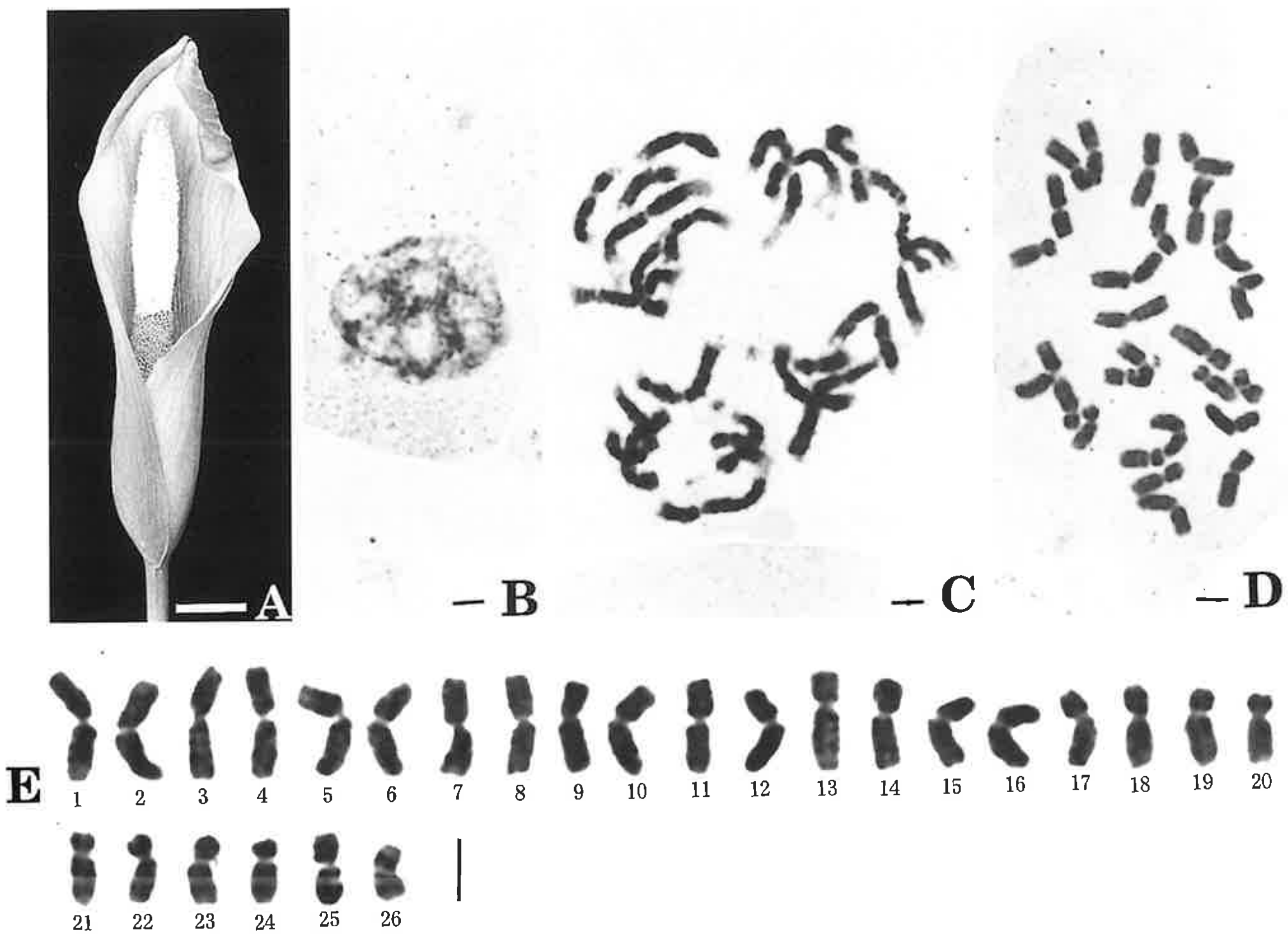

Fig. 6. *Amorphophallus krausei*, 2n=26. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 4 cm in A and 3μm in B-E.

7. *Amorphophallus muelleri* Bl., 2n=39, Table 1 and 8, Fig. 7.
Validated specimen No. ONC-1.

One plant was obtained from Java. External morphological characteristics of the plant were similar to those of this species described by Hetterscheid & Ittenbach (1996).

The chromosome number of the plant was 2n=39 at mitotic metaphase and confirmed the previous report (Chauhan & Brandham 1985).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 6.0μm to shortest one of 3.1μm. Among the 39 chromosomes 17 were median, while the other 15 (Nos. 3, 7, 8,12, 13, 19, 26, 27, 31-36, 39) were submedian and seven (Nos. 10, 11, 20, 21, 25, 37, 38) were subterminal.

According to the comparison of karyotypes in detail, *A. muelleri* was confirmed to be a allotriploid (Chauhan & Brandham 1985).

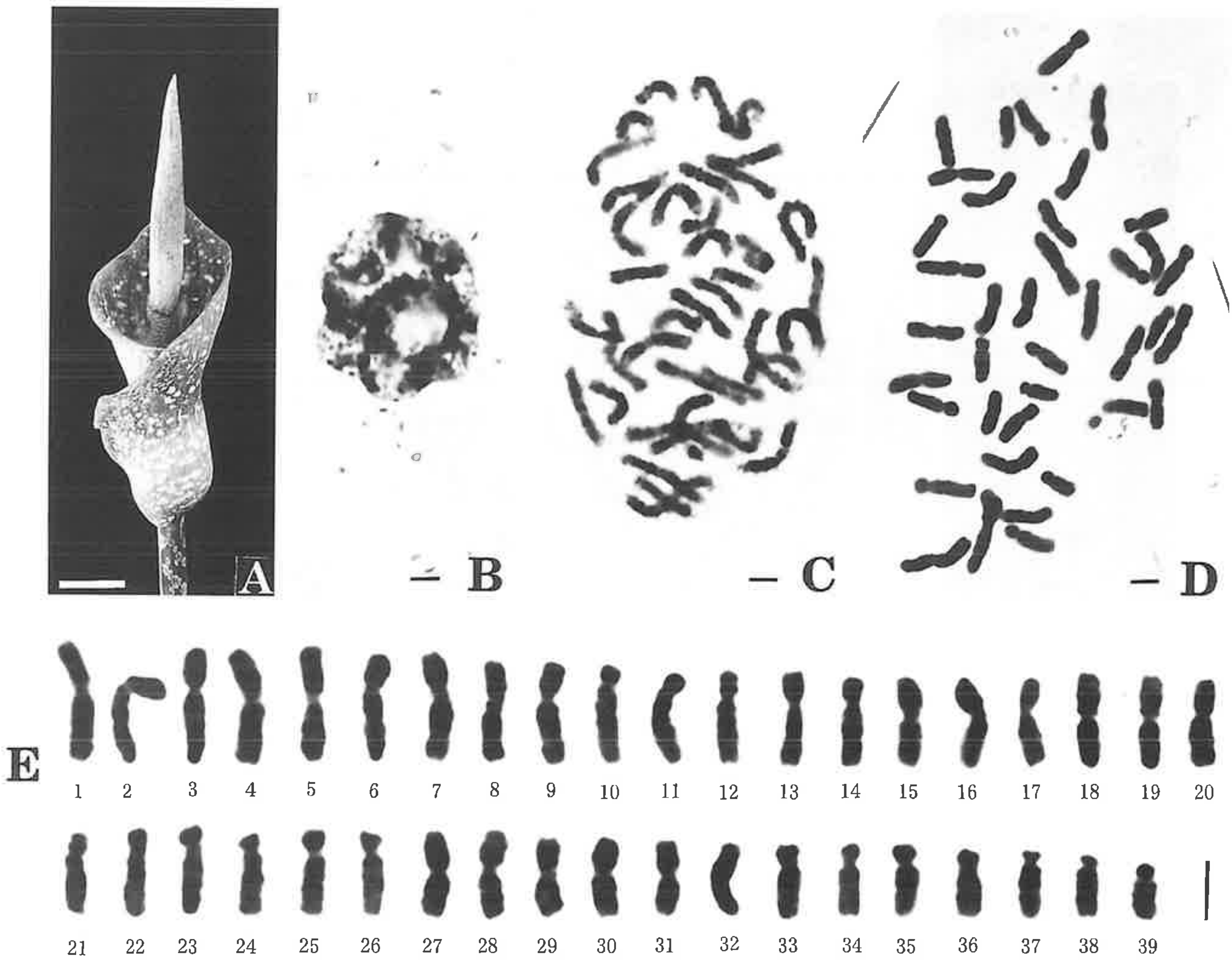

Fig. 7. *Amorphophallus muelleri*, 2n=39. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 4 cm in A and 3μm in B-E.

8. ***Amorphophallus paeoniifolius*** **(Dennst.) Nicolson, 2n=28, Table 1 and 9,Fig. 10.**
Validated specimen No. NPNG-1, NIL88, NF00-02.

Three plants were obtained from Papua New Guinea, Indonesia, Lombok Is. and China, Taiwan. External morphological characteristics of the plants were similar to those of this species described by Hetterscheid & Peng (1995) and Hetterscheid & Ittenbach (1996).

The chromosome number of three plants was 2n=28 at mitotic metaphase and confirmed the previous reports (Marchant 1971, Ramachandra 1977, Chauhan & Brandham 1985, Subramanian & Munian 1988.).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 5.1μm to shortest one of 2.6μm. Among the 28 chromosomes 18 were median, eight (Nos. 13, 14, 21, 22, 25-28) were submedian and two (Nos. 23, 24) were subterminal.

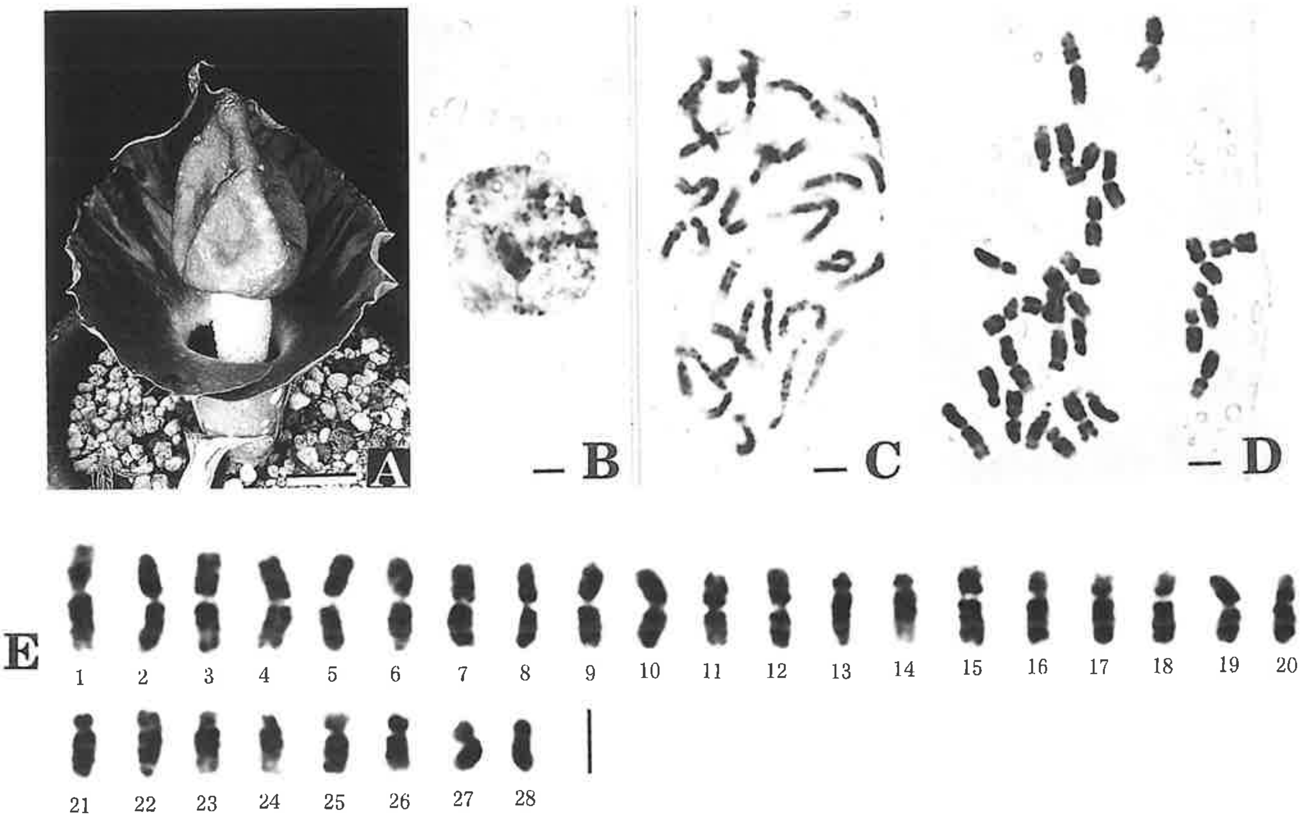

Fig. 8. *Amorphophallus paeoniifolius*, 2n=28. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 4 cm in A and 3μm in B-E.

9. ***Amorphophallus pingbianensis*** **H. Li. & C. L. Long, 2n=26, Table 1 and 10, Fig. 11.**
Validated specimen No. 98L10067.

One plant was obtained from China, Yunnan. External morphological characteristics of the plant were similar to those of this species described by Hetterscheid & Ittenbach (1996).

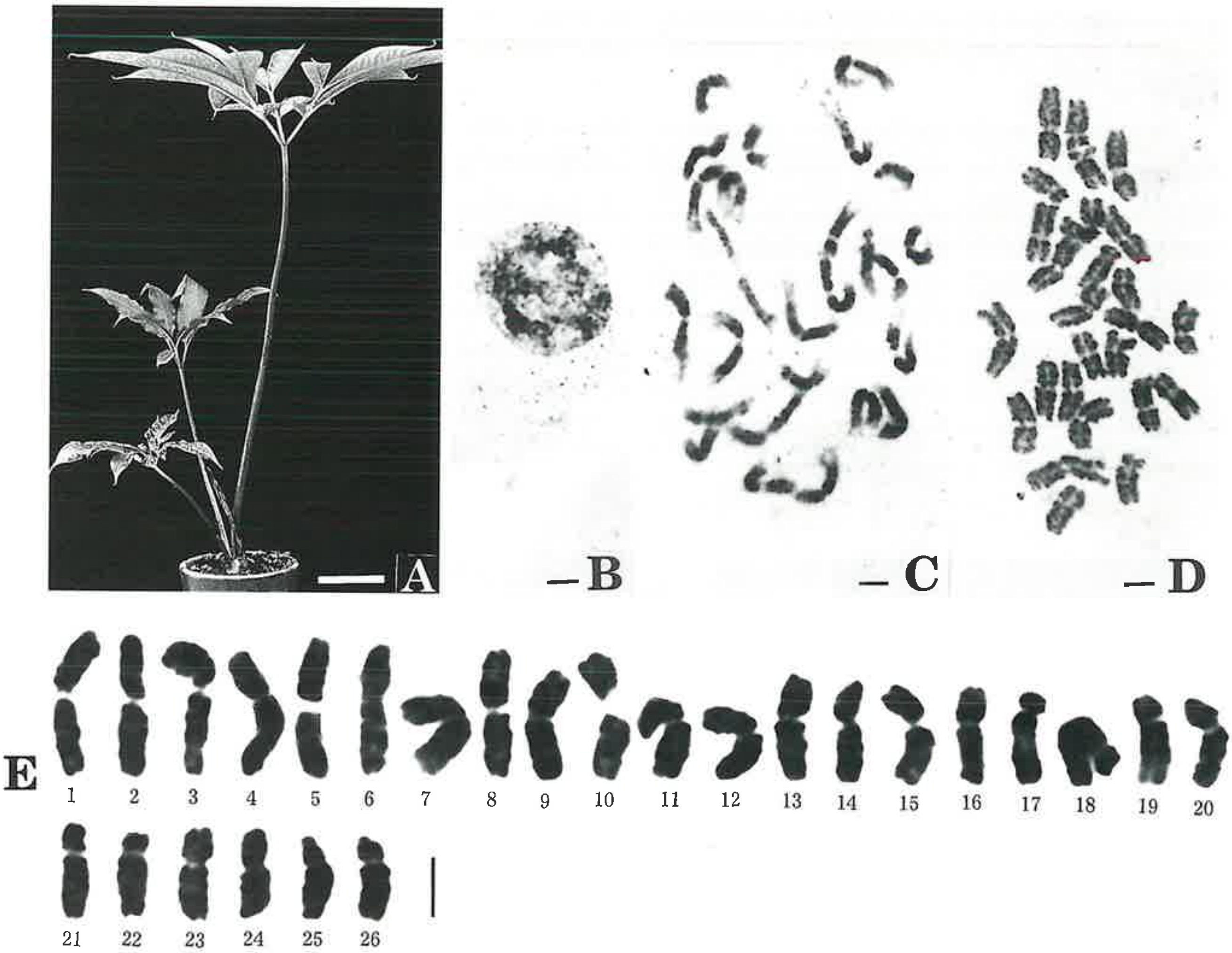

Fig. 9. *Amorphophallus pingbianensis*, 2n=26. A, a plant. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 10 cm in A and 3μm in B-E.

The chromosome number of the plant at mitotic metaphase was 2n=26,which was reported here for the first time for this species.

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 7.1μm to shortest one of 4.4μm. Among the 26 chromosomes 18 were median, while the other six (Nos. 19-22, 25, 26) were submedian and two (Nos. 17, 18) were subterminal. Two chromosomes (No. 25, 26) had secondary constrictions in their short arms.

10. ***Amorphophallus titanum*** **(Becc.) Becc. ex Arcang., 2n=26, Table 1 and 11, Fig. 12.**
Validated specimen No. TU-02, EX00-1.

Two plants were obtained from the Botanical Gardens, Faculty of Science, University of Tokyo and Exotic Plants Nursery, Japan. Their localities were unknown. External morphological characteristics of the plants were similar to those of this species described by Hetterscheid & Ittenbach (1996).

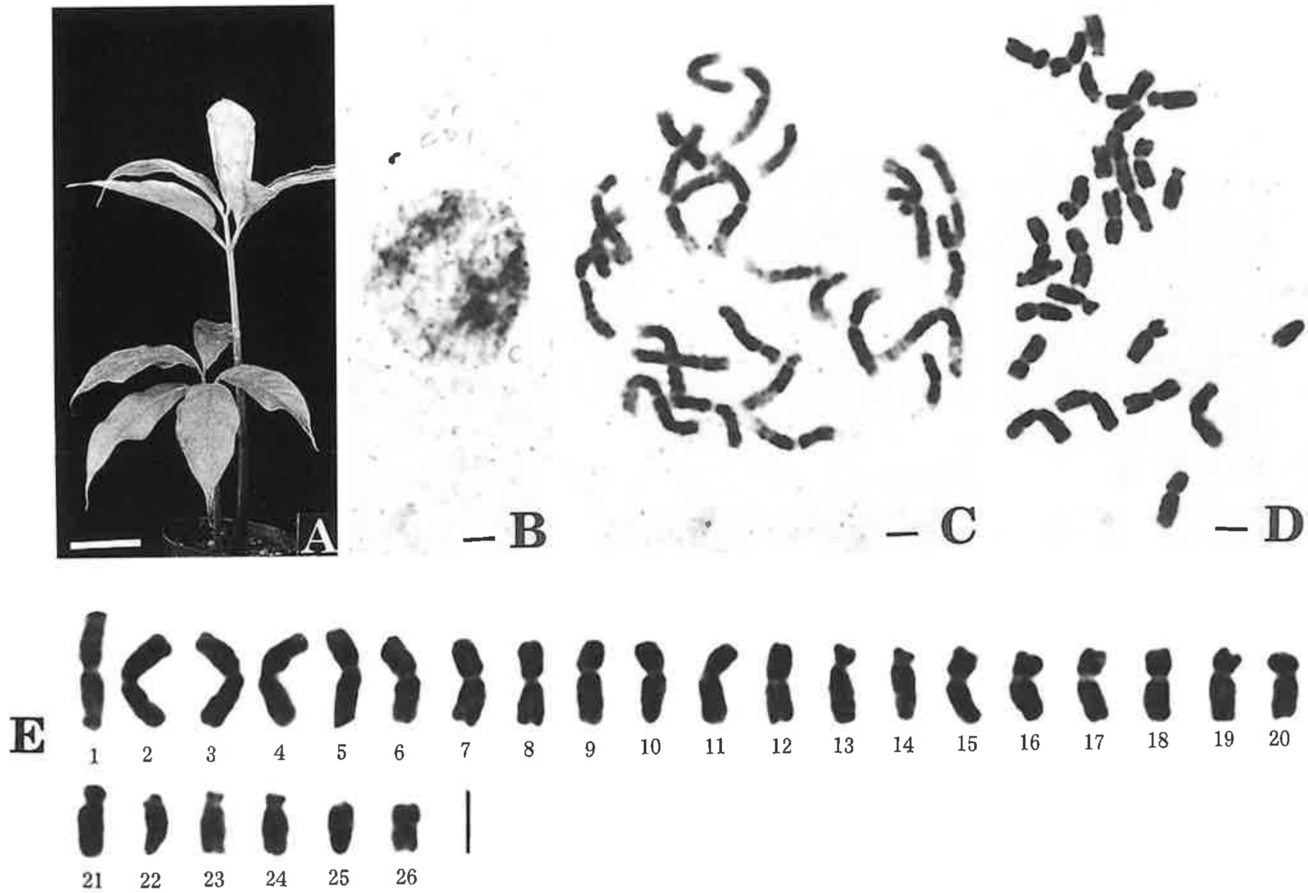

Fig. 10. *Amorphophallus titanum*, 2n=26. A, a plant. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 6 cm in A and 3μm in B-E.

The chromosome number of two plants was 2n=26 at mitotic metaphase and confirmed the previous reports (Chandler 1943, Tjio 1948, Marchant 1971.).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 5.5μm to shortest one of 2.3μm. Among the 26 chromosomes 20 were median, while the other two (Nos. 13, 14) were submedian and four (Nos. 21-24) were subterminal.

11. *Amorphophallus yunnanensis* Engl., 2n=26, Tables 1 and 12, Fig. 13
Validated specimen No. 85055.

One plant was obtained from Thailand, Chiang Mai. External morphological characteristics of the plant were similar to those of this species described by Hetterscheid & Ittenbach (1996).

The chromosome number of the plant at mitotic metaphase was 2n=26 , which was reported here for the first time for this species.

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. bulbifer* described above. The chromosome features at resting stage were of the complex chromocenter type.

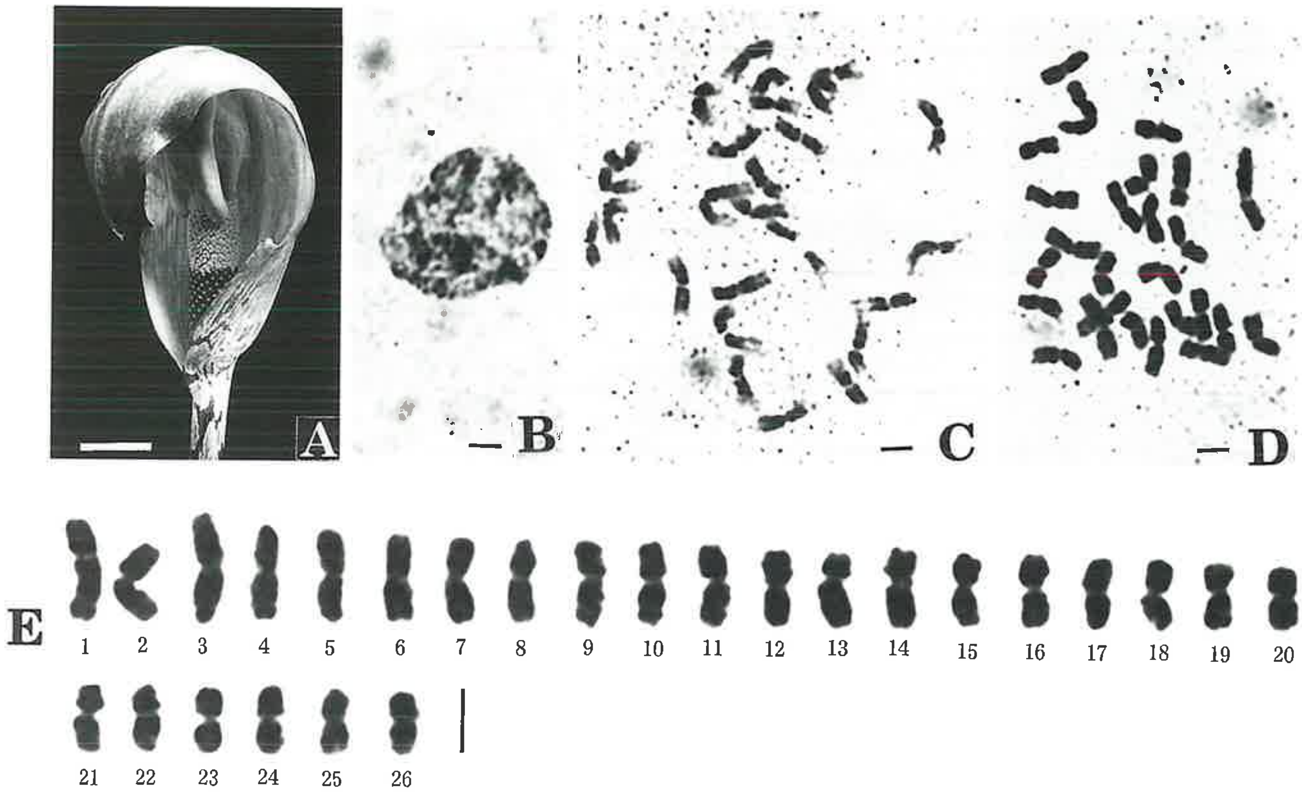

Fig. 11. *Amorphophallus yunnanensis*, 2n=26. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3µm in B-E.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 4.9µm to shortest one of 2.9µm. Among the 26 chromosomes 24 were median, while the other two (Nos. 13, 14) were submedian.

Summary

Karyomorphological observations were studied in 11 species in the genus *Amorphophallus* cultivated in the Hiroshima Botanical Garden. Five species, *A. henryi*, *A. hirtus*, *A. kurausei*, *A. pingbianensis* and *A. yunnanensis*, had the common chromosome number of 2n=26. The chromosome numbers of the five species were recorded here for the first time. The chromosome numbers of six species, *A. bulbifer* (2n=39), *A. kiusianus* (2n=26), *A. konjac* (2n=26), *A. muelleri* (2n=39), *A. paeoniifolius* (2n=28) and *A. titanum* (2n=26) were confirmed.

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Table 2. Measurements of somatic chromosomes of *Amorphophallus bulbifer* at mitotic metaphase, 2n = 39

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.3 + 3.7 = 6.0	3.4	1.6	m
2	2.3 + 3.7 = 6.0	3.4	1.6	m
3	2.1 + 3.8 = 5.9	3.3	1.8	sm
4	2.3 + 3.6 = 5.9	3.3	1.6	m
5	2.3 + 3.6 = 5.9	3.3	1.6	m
6	2.6 + 3.2 = 5.8	3.2	1.2	m
7	2.2 + 3.2 = 5.4	3.0	1.5	m
8	2.3 + 2.6 = 4.9	2.7	1.1	m
9	2.3 + 2.6 = 4.9	2.7	1.1	m
10	2.4 + 2.5 = 4.9	2.7	1.0	m
11	2.4 + 2.5 = 4.9	2.7	1.0	m
12	2.3 + 2.4 = 4.7	2.6	1.0	m
13	2.0 + 2.7 = 4.7	2.6	1.4	m
14	2.2 + 2.3 = 4.5	2.5	1.0	m
15	2.2 + 2.3 = 4.5	2.5	1.0	m
16	1.7 + 2.8 = 4.5	2.5	1.6	m
17	1.3 + 3.1 = 4.4	2.5	2.4	sm
18	1.3 + 3.1 = 4.4	2.5	2.4	sm
19	1.7 + 2.7 = 4.4	2.5	1.6	m
20	1.9 + 2.4 = 4.3	2.4	1.3	m
21	1.9 + 2.4 = 4.3	2.4	1.3	m
22	1.3 + 2.9 = 4.2	2.4	2.2	sm
23	1.3 + 2.9 = 4.2	2.4	2.2	sm
24	1.4 + 2.8 = 4.2	2.4	2.0	sm
25	0.5 + 1.0 + 2.6 = 4.1 *	2.3	1.7	m
26	0.5 + 1.0 + 2.6 = 4.1 *	2.3	1.7	m
27	1.0 + 3.1 = 4.1	2.3	3.1	st
28	1.4 + 2.7 = 4.1	2.3	1.9	sm
29	1.3 + 2.8 = 4.1	2.3	2.2	sm
30	1.3 + 2.8 = 4.1	2.3	2.2	sm
31	1.8 + 2.3 = 4.1	2.3	1.3	m
32	1.8 + 2.3 = 4.1	2.3	1.3	m
33	1.9 + 2.2 = 4.1	2.3	1.2	m
34	1.7 + 2.3 = 4.0	2.2	1.4	m
35	1.7 + 2.3 = 4.0	2.2	1.4	m
36	1.7 + 2.3 = 4.0	2.2	1.4	m
37	1.8 + 2.2 = 4.0	2.2	1.2	m
38	1.8 + 2.2 = 4.0	2.2	1.2	m
39	1.9 + 2.1 = 4.0	2.2	1.1	m

*Chromosome with secondary constriction

Table 3. easurements of somatic chromosomes of *Amorphophallus henryi* at mitotic metaphase, 2n = 26

Chromosome	Length		Relative length	Arm Ratio	Form
1	2.0 + 2.5 = 4.5		5.2	1.3	m
2	2.0 + 2.5 = 4.5		5.2	1.3	m
3	2.0 + 2.3 = 4.3		5.0	1.2	m
4	2.0 + 2.3 = 4.3		5.0	1.2	m
5	1.7 + 2.3 = 4.0		4.6	1.4	m
6	1.7 + 2.3 = 4.0		4.6	1.4	m
7	1.7 + 2.3 = 4.0		4.6	1.4	m
8	1.7 + 2.3 = 4.0		4.6	1.4	m
9	0.7 + 1.1 + 2.2 = 4.0	*	4.6	1.2	m
10	0.7 + 1.1 + 2.2 = 4.0	*	4.6	1.2	m
11	1.4 + 1.8 = 3.2		3.7	1.3	m
12	1.4 + 1.8 = 3.2		3.7	1.3	m
13	1.4 + 1.8 = 3.2		3.7	1.3	m
14	1.4 + 1.8 = 3.2		3.7	1.3	m
15	1.4 + 1.7 = 3.1		3.6	1.2	m
16	1.4 + 1.7 = 3.1		3.6	1.2	m
17	1.3 + 1.7 = 3.0		3.5	1.3	m
18	1.3 + 1.7 = 3.0		3.5	1.3	m
19	1.2 + 1.7 = 2.9		3.4	1.4	m
20	1.2 + 1.7 = 2.9		3.4	1.4	m
21	0.7 + 2.0 = 2.7		3.1	2.9	sm
22	0.7 + 2.0 = 2.7		3.1	2.9	sm
23	0.8 + 1.4 = 2.2		2.5	1.8	sm
24	0.8 + 1.4 = 2.2		2.5	1.8	sm
25	0.7 + 1.4 = 2.1		2.4	2.0	sm
26	0.7 + 1.4 = 2.1		2.4	2.0	sm

*Chromosome with secondary constriction

Table 4. Measurements of somatic chromosomes of *Amorphophallus hirtus* at mitotic metaphase, 2n = 26

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.5 + 2.8 = 5.3	5.7	1.1	m
2	2.5 + 2.8 = 5.3	5.7	1.1	m
3	2.0 + 2.3 = 4.3	4.6	1.2	m
4	2.0 + 2.3 = 4.3	4.6	1.2	m
5	1.7 + 2.5 = 4.2	4.5	1.5	m
6	1.7 + 2.5 = 4.2	4.5	1.5	m
7	1.7 + 2.5 = 4.2	4.5	1.5	m
8	1.7 + 2.5 = 4.2	4.5	1.5	m
9	1.5 + 2.1 = 3.6	3.9	1.4	m
10	1.5 + 2.1 = 3.6	3.9	1.4	m
11	1.0 + 2.5 = 3.5	3.7	2.5	sm
12	1.0 + 2.5 = 3.5	3.7	2.5	sm
13	1.0 + 2.3 = 3.3	3.5	2.3	sm
14	1.0 + 2.3 = 3.3	3.5	2.3	sm
15	1.3 + 2.0 = 3.3	3.5	1.5	m
16	1.3 + 2.0 = 3.3	3.5	1.5	m
17	1.2 + 2.0 = 3.2	3.4	1.7	m
18	1.2 + 2.0 = 3.2	3.4	1.7	m
19	1.4 + 1.7 = 3.1	3.3	1.2	m
20	1.4 + 1.7 = 3.1	3.3	1.2	m
21	0.9 + 2.0 = 2.9	3.1	2.2	sm
22	0.9 + 2.0 = 2.9	3.1	2.2	sm
23	1.0 + 1.9 = 2.9	3.1	1.9	sm
24	1.0 + 1.9 = 2.9	3.1	1.9	sm
25	1.1 + 1.8 = 2.9	3.1	1.6	m
26	1.1 + 1.8 = 2.9	3.1	1.6	m

Table 5. Measurements of somatic chromosomes of *Amorphophallus kiusianus* at mitotic metaphase, 2n = 26

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.3 + 2.4 = 4.7	4.8	1.0	m
2	2.3 + 2.4 = 4.7	4.8	1.0	m
3	1.8 + 2.7 = 4.5	4.6	1.5	m
4	1.8 + 2.7 = 4.5	4.6	1.5	m
5	2.0 + 2.3 = 4.3	4.4	1.2	m
6	1.9 + 2.3 = 4.2	4.3	1.2	m
7	1.9 + 2.3 = 4.2	4.3	1.2	m
8	1.9 + 2.3 = 4.2	4.3	1.2	m
9	1.6 + 2.3 = 3.9	4.0	1.4	m
10	1.6 + 2.3 = 3.9	4.0	1.4	m
11	1.7 + 2.1 = 3.8	3.9	1.2	m
12	1.7 + 2.1 = 3.8	3.9	1.2	m
13	1.2 + 2.5 = 3.7	3.8	2.1	sm
14	1.2 + 2.5 = 3.7	3.8	2.1	sm
15	1.7 + 2.0 = 3.7	3.8	1.2	m
16	1.7 + 2.0 = 3.7	3.8	1.2	m
17	1.5 + 2.0 = 3.5	3.6	1.3	m
18	1.5 + 2.0 = 3.5	3.6	1.3	m
19	1.3 + 2.1 = 3.4	3.5	1.6	m
20	1.3 + 2.1 = 3.4	3.5	1.6	m
21	0.6 + 1.0 + 1.6 = 3.2 *	3.3	1.0	m
22	0.6 + 1.0 + 1.6 = 3.2 *	3.3	1.0	m
23	1.2 + 1.8 = 3.0	3.1	1.5	m
24	1.2 + 1.8 = 3.0	3.1	1.5	m
25	1.0 + 1.7 = 2.7	2.8	1.7	m
26	1.0 + 1.7 = 2.7	2.8	1.7	m

*Chromosome with secondary constriction

Table 6. Measurements of somatic chromosomes of *Amorphophallus konjac* at mitotic metaphase, 2n = 26

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.9 + 3.5 = 6.4	5.7	1.2	m
2	2.9 + 3.5 = 6.4	5.7	1.2	m
3	2.8 + 3.2 = 6.0	5.4	1.1	m
4	2.8 + 3.2 = 6.0	5.4	1.1	m
5	2.3 + 2.7 = 5.0	4.5	1.2	m
6	2.3 + 2.7 = 5.0	4.5	1.2	m
7	2.0 + 2.8 = 4.8	4.3	1.4	m
8	2.0 + 2.8 = 4.8	4.3	1.4	m
9	1.9 + 2.7 = 4.6	4.1	1.4	m
10	1.9 + 2.7 = 4.6	4.1	1.4	m
11	1.7 + 2.9 = 4.6	4.1	1.7	m
12	1.7 + 2.9 = 4.6	4.1	1.7	m
13	1.3 + 3.0 = 4.3	3.8	2.3	sm
14	1.3 + 3.0 = 4.3	3.8	2.3	sm
15	1.8 + 2.3 = 4.1	3.7	1.3	m
16	1.8 + 2.3 = 4.1	3.7	1.3	m
17	1.5 + 2.3 = 3.8	3.4	1.5	m
18	1.5 + 2.3 = 3.8	3.4	1.5	m
19	1.4 + 2.3 = 3.7	3.3	1.6	m
20	1.4 + 2.3 = 3.7	3.3	1.6	m
21	0.7 + 2.3 = 3.0	2.7	3.3	st
22	0.7 + 2.3 = 3.0	2.7	3.3	st
23	0.7 + 2.2 = 2.9	2.6	3.1	st
24	0.7 + 2.2 = 2.9	2.6	3.1	st
25	0.4 + 0.6 + 1.8 = 2.8 *	2.5	1.8	sm
26	0.4 + 0.6 + 1.8 = 2.8 *	2.5	1.8	sm

*Chromosome with secondary constriction

Table 7. Measurements of somatic chromosomes of *Amorphophallus krausei* at mitotic metaphase, 2n = 26

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.7 + 2.9 = 5.6	5.3	1.1	m
2	2.7 + 2.9 = 5.6	5.3	1.1	m
3	2.4 + 2.9 = 5.3	5.0	1.2	m
4	2.4 + 2.9 = 5.3	5.0	1.2	m
5	2.0 + 2.7 = 4.7	4.5	1.4	m
6	2.0 + 2.7 = 4.7	4.5	1.4	m
7	2.2 + 2.5 = 4.7	4.5	1.1	m
8	2.2 + 2.5 = 4.7	4.5	1.1	m
9	1.8 + 2.7 = 4.5	4.3	1.5	m
10	1.8 + 2.7 = 4.5	4.3	1.5	m
11	1.8 + 2.6 = 4.4	4.2	1.4	m
12	1.8 + 2.6 = 4.4	4.2	1.4	m
13	1.6 + 2.8 = 4.4	4.2	1.8	sm
14	1.6 + 2.8 = 4.4	4.2	1.8	sm
15	1.4 + 2.4 = 3.8	3.6	1.7	m
16	1.4 + 2.4 = 3.8	3.6	1.7	m
17	1.0 + 2.3 = 3.3	3.1	2.3	sm
18	1.0 + 2.3 = 3.3	3.1	2.3	sm
19	1.0 + 2.3 = 3.3	3.1	2.3	sm
20	1.0 + 2.3 = 3.3	3.1	2.3	sm
21	1.0 + 1.9 = 2.9	2.8	1.9	sm
22	1.0 + 1.9 = 2.9	2.8	1.9	sm
23	1.0 + 1.9 = 2.9	2.8	1.9	sm
24	1.0 + 1.9 = 2.9	2.8	1.9	sm
25	1.3 + 1.5 = 2.8	2.7	1.2	m
26	1.3 + 1.5 = 2.8	2.7	1.2	m

Table 8. Measurements of somatic chromosomes of *Amorphophallus muelleri* at mitotic metaphase, 2n = 39

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.3 + 3.7 = 6.0	3.4	1.6	m
2	2.3 + 3.7 = 6.0	3.4	1.6	m
3	2.1 + 3.7 = 5.8	3.3	1.8	sm
4	2.7 + 3.1 = 5.8	3.3	1.1	m
5	2.7 + 3.1 = 5.8	3.3	1.1	m
6	2.4 + 3.1 = 5.5	3.1	1.3	m
7	1.7 + 3.7 = 5.4	3.0	2.2	sm
8	1.7 + 3.7 = 5.4	3.0	2.2	sm
9	2.0 + 3.3 = 5.3	3.0	1.7	m
10	1.0 + 4.1 = 5.1	2.9	4.1	st
11	1.0 + 4.1 = 5.1	2.9	4.1	st
12	1.4 + 3.3 = 4.7	2.6	2.4	sm
13	1.5 + 3.2 = 4.7	2.6	2.1	sm
14	1.9 + 2.8 = 4.7	2.6	1.5	m
15	1.9 + 2.8 = 4.7	2.6	1.5	m
16	2.2 + 2.5 = 4.7	2.6	1.1	m
17	2.2 + 2.5 = 4.7	2.6	1.1	m
18	2.2 + 2.5 = 4.7	2.6	1.1	m
19	1.3 + 3.2 = 4.5	2.5	2.5	sm
20	1.0 + 3.5 = 4.5	2.5	3.5	st
21	1.0 + 3.5 = 4.5	2.5	3.5	st
22	1.8 + 2.7 = 4.5	2.5	1.5	m
23	2.0 + 2.3 = 4.3	2.4	1.2	m
24	2.0 + 2.3 = 4.3	2.4	1.2	m
25	1.0 + 3.2 = 4.2	2.4	3.2	st
26	1.1 + 3.1 = 4.2	2.4	2.8	sm
27	1.1 + 3.1 = 4.2	2.4	2.8	sm
28	1.8 + 2.2 = 4.0	2.2	1.2	m
29	1.8 + 2.2 = 4.0	2.2	1.2	m
30	1.8 + 2.2 = 4.0	2.2	1.2	m
31	1.2 + 2.7 = 3.9	2.2	2.3	sm
32	1.2 + 2.7 = 3.9	2.2	2.3	sm
33	1.2 + 2.7 = 3.9	2.2	2.3	sm
34	1.0 + 2.7 = 3.7	2.1	2.7	sm
35	1.0 + 2.7 = 3.7	2.1	2.7	sm
36	1.0 + 2.7 = 3.7	2.1	2.7	sm
37	0.7 + 2.6 = 3.3	1.9	3.7	st
38	0.7 + 2.6 = 3.3	1.9	3.7	st
39	0.9 + 2.2 = 3.1	1.7	2.4	sm

Table 9. Measurements of somatic chromosomes of *Amorphophallus paeoniifolius* at mitotic metaphase, 2n = 28

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.3 + 2.8 = 5.1	5.0	1.2	m
2	2.3 + 2.8 = 5.1	5.0	1.2	m
3	2.1 + 2.4 = 4.5	4.4	1.1	m
4	2.1 + 2.4 = 4.5	4.4	1.1	m
5	2.2 + 2.3 = 4.5	4.4	1.0	m
6	2.2 + 2.3 = 4.5	4.4	1.0	m
7	1.9 + 2.0 = 3.9	3.8	1.1	m
8	1.9 + 2.0 = 3.9	3.8	1.1	m
9	1.8 + 2.0 = 3.8	3.7	1.1	m
10	1.8 + 2.0 = 3.8	3.7	1.1	m
11	1.7 + 1.9 = 3.6	3.5	1.1	m
12	1.7 + 1.9 = 3.6	3.5	1.1	m
13	1.0 + 2.6 = 3.6	3.5	2.6	sm
14	1.0 + 2.6 = 3.6	3.5	2.6	sm
15	1.3 + 2.2 = 3.5	3.4	1.7	m
16	1.3 + 2.2 = 3.5	3.4	1.7	m
17	1.3 + 2.2 = 3.5	3.4	1.7	m
18	1.3 + 2.2 = 3.5	3.4	1.7	m
19	1.7 + 1.8 = 3.5	3.4	1.1	m
20	1.7 + 1.8 = 3.5	3.4	1.1	m
21	1.0 + 2.3 = 3.3	3.2	2.3	sm
22	1.0 + 2.3 = 3.3	3.2	2.3	sm
23	0.7 + 2.3 = 3.0	2.9	3.3	st
24	0.7 + 2.3 = 3.0	2.9	3.3	st
25	1.0 + 2.0 = 3.0	2.9	2.0	sm
26	1.0 + 2.0 = 3.0	2.9	2.0	sm
27	0.9 + 1.7 = 2.6	2.5	1.9	sm
28	0.9 + 1.7 = 2.6	2.5	1.9	sm

Table 10. Measurements of somatic chromosomes of *Amorphophallus pingbianensis* at mitotic metaphase, 2n = 26

Chromosome	Length		Relative length	Arm Ratio	Form
1	3.3 + 3.8 = 7.1		5.0	1.2	m
2	3.3 + 3.8 = 7.1		5.0	1.2	m
3	2.7 + 4.0 = 6.7		4.7	1.5	m
4	2.7 + 4.0 = 6.7		4.7	1.5	m
5	3.0 + 3.3 = 6.3		4.5	1.1	m
6	3.0 + 3.3 = 6.3		4.5	1.1	m
7	3.0 + 3.3 = 6.3		4.5	1.1	m
8	3.0 + 3.3 = 6.3		4.5	1.1	m
9	2.7 + 3.3 = 6.0		4.3	1.2	m
10	2.7 + 3.3 = 6.0		4.3	1.2	m
11	2.5 + 3.0 = 5.5		3.9	1.2	m
12	2.5 + 3.0 = 5.5		3.9	1.2	m
13	2.3 + 3.0 = 5.3		3.8	1.3	m
14	2.3 + 3.0 = 5.3		3.8	1.3	m
15	2.0 + 2.8 = 4.8		3.4	1.4	m
16	2.0 + 2.8 = 4.8		3.4	1.4	m
17	1.0 + 3.7 = 4.7		3.3	3.7	st
18	1.0 + 3.7 = 4.7		3.3	3.7	st
19	1.3 + 3.3 = 4.6		3.3	2.5	sm
20	1.3 + 3.3 = 4.6		3.3	2.5	sm
21	1.3 + 3.2 = 4.5		3.2	2.5	sm
22	1.2 + 3.2 = 4.4		3.1	2.7	sm
23	1.7 + 2.7 = 4.4		3.1	1.6	m
24	1.7 + 2.7 = 4.4		3.1	1.6	m
25	0.5 + 1 + 2.9 = 4.4	*	3.1	1.9	sm
26	0.5 + 1 + 2.9 = 4.4	*	3.1	1.9	sm

*Chromosome with secondary constriction

Table 11. Measurements of somatic chromosomes of *Amorphophallus titanum* at mitotic metaphase, 2n = 26

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.7 + 2.8 = 5.5	5.5	1.0	m
2	2.7 + 2.8 = 5.5	5.5	1.0	m
3	2.7 + 2.7 = 5.4	5.4	1.0	m
4	2.7 + 2.7 = 5.4	5.4	1.0	m
5	2.1 + 2.4 = 4.5	4.5	1.1	m
6	2.1 + 2.4 = 4.5	4.5	1.1	m
7	1.9 + 2.3 = 4.2	4.2	1.2	m
8	1.9 + 2.3 = 4.2	4.2	1.2	m
9	1.7 + 2.5 = 4.2	4.2	1.5	m
10	1.7 + 2.5 = 4.2	4.2	1.5	m
11	1.8 + 2.2 = 4.0	4.0	1.2	m
12	1.8 + 2.2 = 4.0	4.0	1.2	m
13	0.9 + 2.7 = 3.6	3.6	3.0	sm
14	0.9 + 2.7 = 3.6	3.6	3.0	sm
15	1.3 + 2.1 = 3.4	3.4	1.6	m
16	1.3 + 2.1 = 3.4	3.4	1.6	m
17	1.3 + 2.0 = 3.3	3.3	1.5	m
18	1.3 + 2.0 = 3.3	3.3	1.5	m
19	1.2 + 2.0 = 3.2	3.2	1.7	m
20	1.2 + 2.0 = 3.2	3.2	1.7	m
21	0.7 + 2.5 = 3.2	3.2	3.6	st
22	0.7 + 2.5 = 3.2	3.2	3.6	st
23	0.7 + 2.4 = 3.1	3.1	3.4	st
24	0.7 + 2.4 = 3.1	3.1	3.4	st
25	1.1 + 1.2 = 2.3	2.3	1.1	m
26	1.1 + 1.2 = 2.3	2.3	1.1	m

Table 12. Measurements of somatic chromosomes of *Amorphophallus yunnanensis* at mitotic metaphase, 2n = 26

Chromosome	Length	Relative length	Arm Ratio	Form
1	2.3 + 2.6 = 4.9	5.2	1.1	m
2	2.3 + 2.6 = 4.9	5.2	1.1	m
3	1.9 + 2.8 = 4.7	5.0	1.5	m
4	1.8 + 2.7 = 4.5	4.8	1.5	m
5	2.1 + 2.2 = 4.3	4.6	1.0	m
6	2.1 + 2.2 = 4.3	4.6	1.0	m
7	1.9 + 2.0 = 3.9	4.1	1.1	m
8	1.9 + 2.0 = 3.9	4.1	1.1	m
9	1.5 + 2.1 = 3.6	3.8	1.4	m
10	1.5 + 2.1 = 3.6	3.8	1.4	m
11	1.7 + 1.9 = 3.6	3.8	1.1	m
12	1.7 + 1.9 = 3.6	3.8	1.1	m
13	1.3 + 2.3 = 3.6	3.8	1.8	sm
14	1.3 + 2.3 = 3.6	3.8	1.8	sm
15	1.6 + 1.8 = 3.4	3.6	1.1	m
16	1.6 + 1.8 = 3.4	3.6	1.1	m
17	1.5 + 1.7 = 3.2	3.4	1.1	m
18	1.5 + 1.7 = 3.2	3.4	1.1	m
19	1.3 + 1.8 = 3.1	3.3	1.4	m
20	1.3 + 1.8 = 3.1	3.3	1.4	m
21	1.3 + 1.8 = 3.1	3.3	1.4	m
22	1.3 + 1.8 = 3.1	3.3	1.4	m
23	1.3 + 1.7 = 3.0	3.2	1.3	m
24	1.3 + 1.7 = 3.0	3.2	1.3	m
25	1.3 + 1.6 = 2.9	3.1	1.2	m
26	1.3 + 1.6 = 2.9	3.1	1.2	m