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Karyomorphological observations on some Aroids cultivated in the Hiroshima Botanical Garden l. *Alocasia.* *

Genjiro Ishida[1)]

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１.

アロカシア属*

石田　源次郎[1)]

Introduction

The family Araceae, which consists of 106 genera and 2,950 species (Huxley 1997), is widely distributed mostly in the tropics, subtropics and a few in the Temperate zone. Aroid is important as one of the ornamental and food plants.

They have been collected approximately 49 genera and 192 species at the Hiroshima Botanical Garden. It enhances value of the specimen to examine the karyotype of these aroids cultivated in the Hiroshima Botanical Garden. The cytological information is believed to be useful for the botanical and horticultural purposes in the future.

For the first report of this observation series, the chromosome morphology is studied 14 taxa of *Alocasia* cultivated in the Hiroshima Botanical Garden.

The genus *Alocasia*, which is known as one of the ornamental aroids with about 70 species, is widely distributed in tropical and eastern Asia, and Oceania.

Much general information regarding the chromosome numbers of *Alocasia* has been reported by various workers including Ito (1942), Pfitzer (1957), Sharm (1970), Marchant (1971), Hsu (1972), Bhattacharya (1974) and Ankei (1987). However, morphological study of the somatic chromosome is poorly made in most of the standard references.

Materials and Methods

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

Cytological observations were made in somatic chromosome of root tip cells. Chromosomes were observed by an aceto-orcein squash method as follows : Growing root tips were cut into small pieces

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1) The Hiroshima Botanical Garden.
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Table 1. Sources, numbers of plants and chromosome numbers of the species *Alocasia* studied

Species	Source	No. of plants observed	Chromosome number (2n)	
			present count	previous count
A. cucullata (Lour.) G. Don f.	China, Taiwan	2	28	28
A. cuprea (Koch & Bouche) Koch.	Borneo	1	28	28
A. gageana Engl. & K. Krause	Borneo	1	28	
A. 'Green Shield' hort.	Philippine	1	28	
A. lowii Hook. f	Malaysia	2	28	28
		1	70	70
A. macrorrhiza (L) G. Don.	Thailand	2	28	28
A. micholitziana Sander	Philippine	1	28	28
A. odora (Lodd.) Spach.	Japan, Kagoshima, Okinawa Pref.	3	28	28
A. plumbea (K.Koch) Van Houtte.	Java	1	28	
A. porphyroneura H.G. Hallier ex Engl.	Borneo	1	28	
A. portei Schott.	Philippine	1	28	
A. sanderana Bull.	Philippine	2	28	28
A. wentii Engl & Kurt Krause.	Philippine	1	42	
A. zebrina C. Koch & Veitch.	Philippine	1	28	28

1.0-2.0mm long and were immersed in 0.002M 8-hydroxyquinoline for four hours at 18 ℃. They were then fixed in 45% acetic acid for 10 minutes at 5 ℃; They were macerated in the mixture of one part of 45% acetic acid and two parts of 1N hydrochloric acid for about one minute at 60℃; Then, they were stained and squashed in 1% aceto-orcein.

The results of the observations in the resting nuclei and somatic prophase chromosomes and the karyotype formulas at mitotic metaphase were described and classified according to Tanaka (1971, 1977, 1980) .

The chromosomes at mitotic metaphase were measured by lengths of the long and short arms. Arm ratio was calculated by the long arm length / the short arm length, and expressed by the value of arm ratio 1.0 to 1.7 as "median cetromere", 1.8 to 3.0 as "submedian centromere", 3.1 to 7.0 as "subterminal centromere" according to Levan *et al.* (1964) . The chromosomes were basically aligned in descending order from the longest to the shortest chromosomes and were given numbers 1, 2, 3,..., respectively.

Observations

1) *Alocasia cucullata* (Lour.) G. Don f., 2n=28, Tables 1 and 2, Fig. 1. Validated specimen No. 167, NF5301.

Two plants were obtained from China, Taiwan. External morphological characteristics of the plants were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of two plants was 2n=28 at mitotic metaphase and confirmed the previous reports (Ito 1942, Marchant 1971, Ankei 1987).

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 0.6-2.0 μ m in diameter and showed irregular shape with rough surface. Some of the blocks aggregated into large blocks as the chromocentral aggregation.

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.

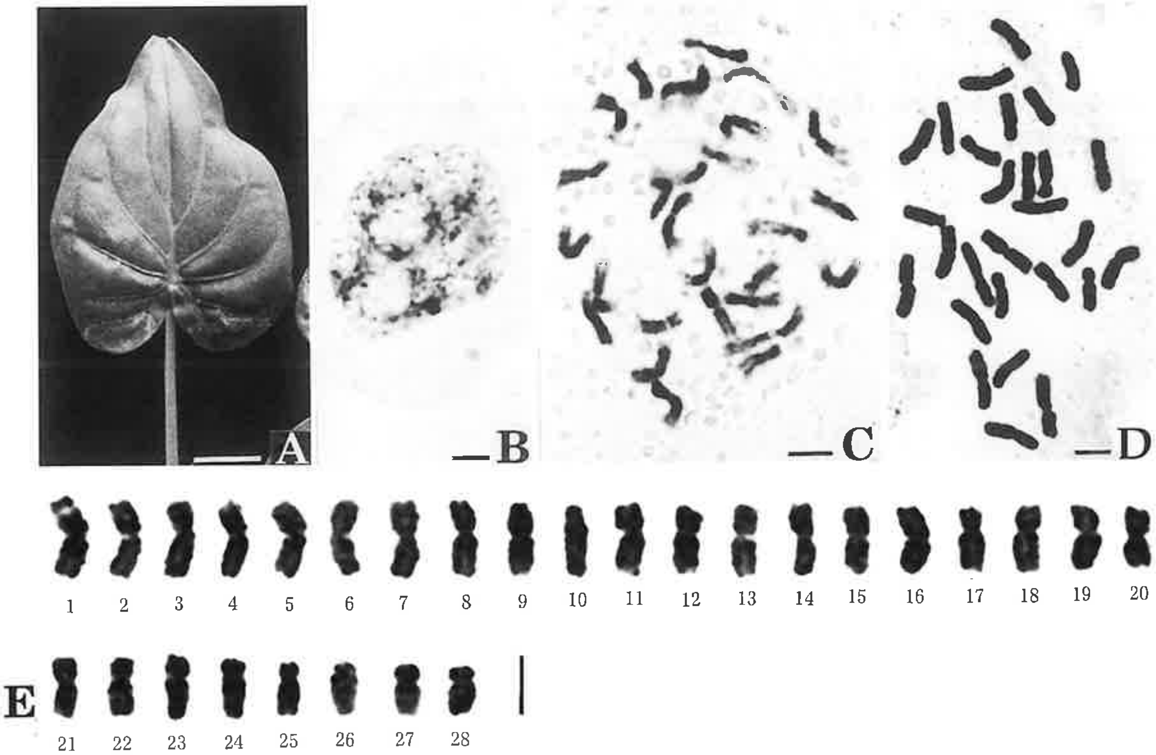

Fig.1. *Alocasia cucullata*, 2n=28. A, a leaf. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

Thus, the 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 4.3 μm to the shortest one of 2.7 μm, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 22 were median, while the other six (Nos. 23-28) were submedian. One chromosome (No. 26) had secondary constriction in the short arm.

According to the definition of the karyotype proposed by Tanaka (1980), this species showed a homogeneous and gradual karyotype due to chromosome length and a symmetric karyotype due to arm ratio.

2) *Alocasia cuprea* (Koch & Bouche) Koch., 2n=28, Tables 1 and 3, Fig. 2. Validated specimen No. 166.

One plant was obtained from Borneo. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant was 2n=28 at mitotic metaphase and confirmed the previous

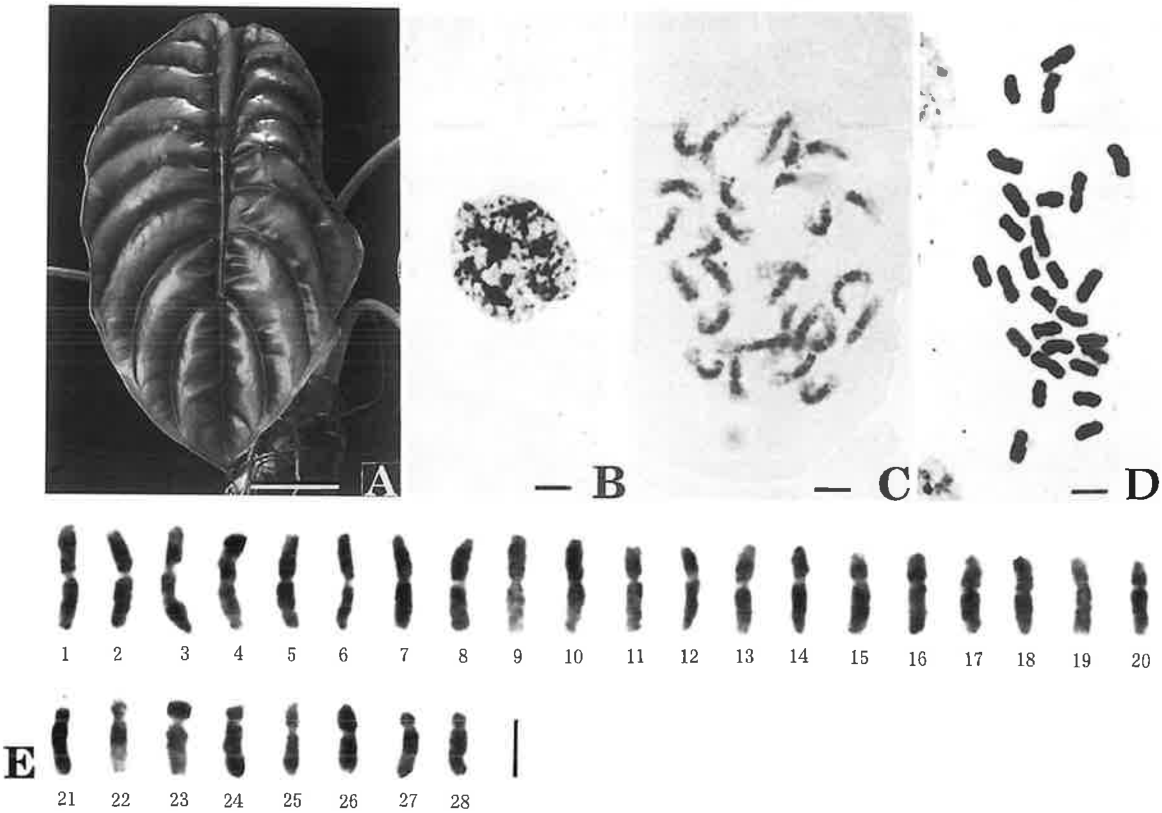

Fig.2. *Alocasia cuprea*, 2n=28. A, a leaf. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

reports (Jones 1957. Pfitzer 1957, Marchant 1971).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. cucullata* 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 5.7 μ m to the shortest one of 3.6 μ m, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 18 were median, while the other ten (Nos. 19-28) were submedian. Two chromosomes (Nos. 21, 22) had secondary constrictions in their short arms, and eight chromosomes (Nos.1, 4-6, 9-11,17) had secondary constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

3) *Alocasia gageana* Engl. & K. Krause, 2n=28, Tables 1 and 4, Fig.3.
Validated specimen No. 85038.

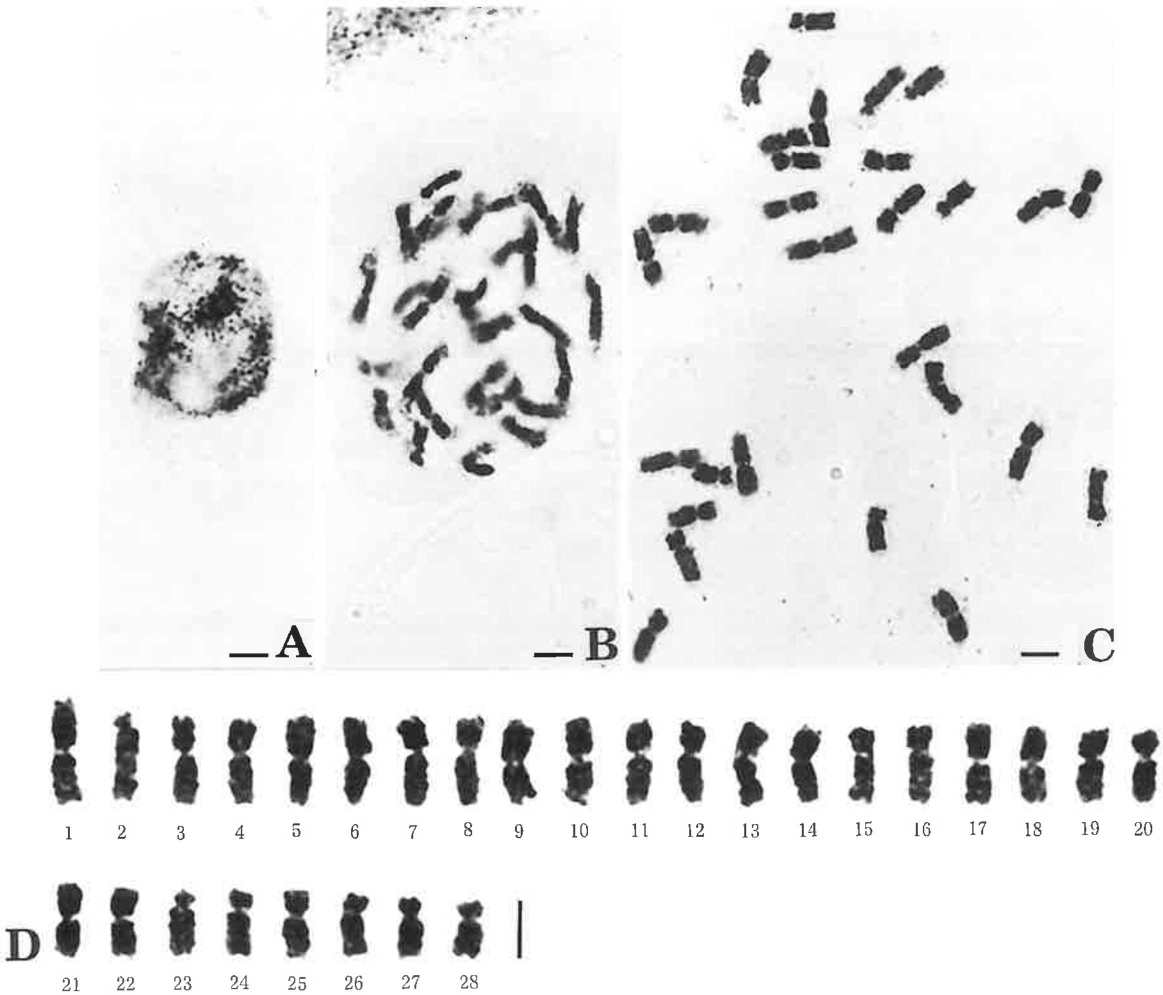

Fig.3. *Alocasia gageana*, 2n=28. A, choromosomes at resting stage. B, chromosomes at mitotic prophase. C and D, chromosomes at mitotic metaphase. Bars indicate 3μm in A-D.

One plant was obtained from Borneo. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant at mitotic metaphase was 2n=28, 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. cucullata* 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 5.0 μ m to the shortest one of 2.9 μ m, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 20 were median, while the other eight (Nos. 13, 14, 23-28) were submedian.

This species showed a homogeneous, gradual and symmetric karyotype.

4) *Alocasia* 'Green Shield' hort., 2n=28, Tables 1 and 5, Fig. 4. Validated specimen No. 85026.

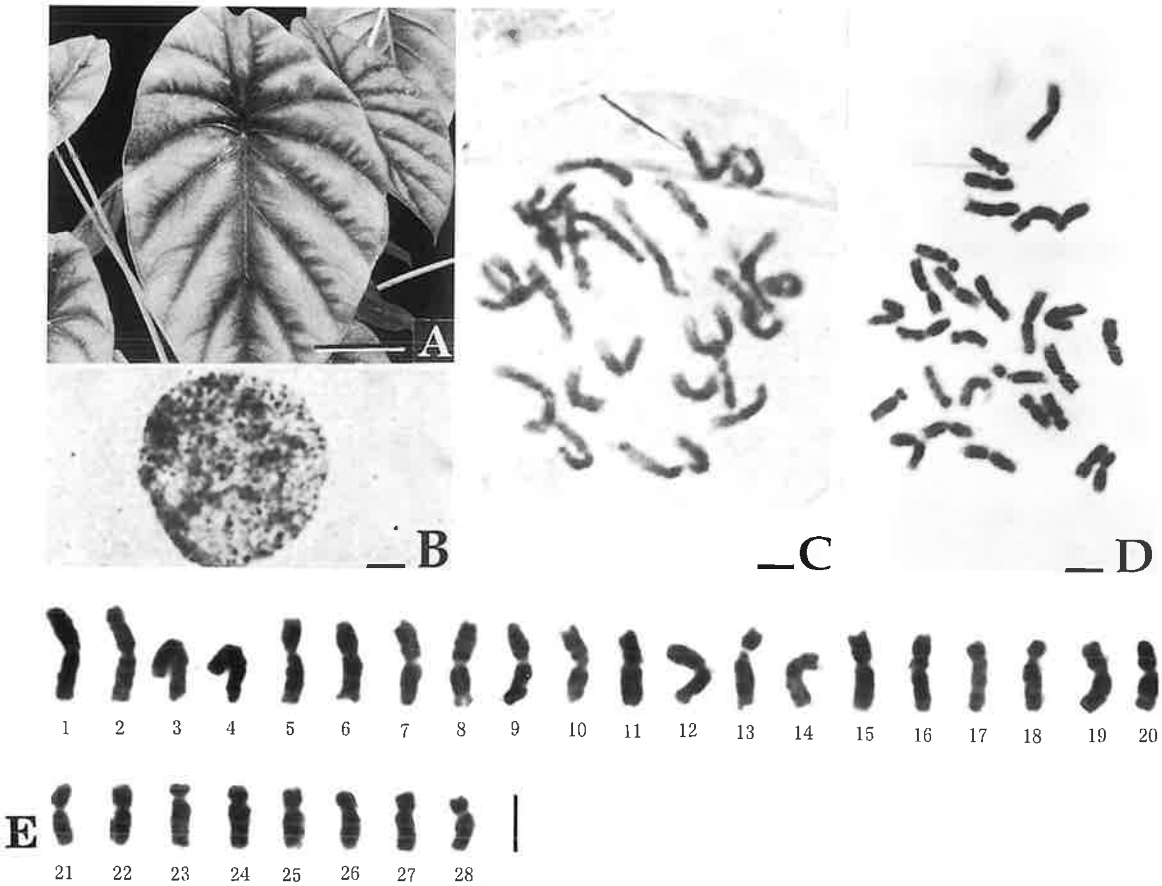

Fig.4. *Alocasia* 'Green Shield', 2n=28. A, leaves. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

This plant is not given a scientific name, but this aroid is known as 'Green Cuprea' in horticulture.

One plant was obtained from Philippine. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant at mitotic metaphase was 2n=28, 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. cucullata* 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 5.1 μ m to the shortest one of 3.0 μ m. Among the 28 chromosomes 18 were median, six (Nos. 13, 14, 25-28) were submedian and four (Nos. 19, 20, 23, 24) were subterminal.

Five chromosomes (Nos.8, 9, 12, 19, 20) had small constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

5) *Alocasia lowii* Hook.f., 2n=28 and 2n=70, Tables 1 and 6, Figures. 5 and 6. Validated specimen No. 158, 159, 160.

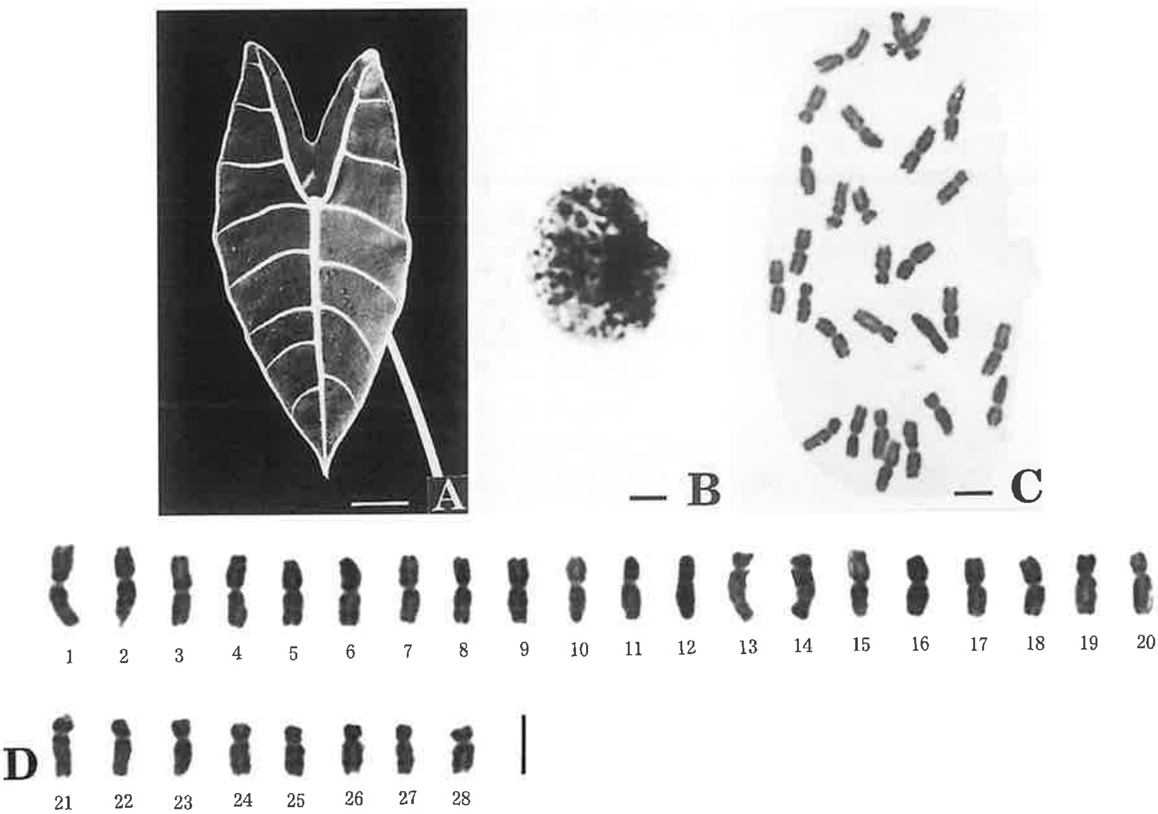

Fig.5. *Alocasia lowii*, 2n=28. A, a leaf. B, chromosomes at resting stage. C and D, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-D.

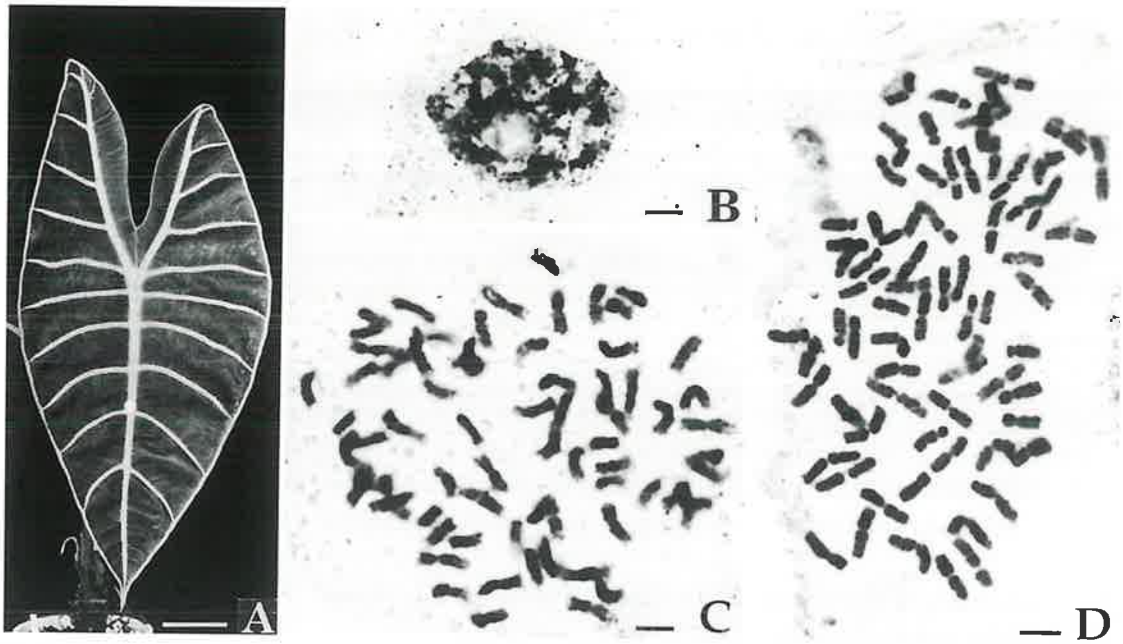

Fig.6. *Alocasia lowii*, 2n=70. A, a leaf. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-D.

Three plants were obtained from Malaysia. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of two plants of them was 2n=28 at mitotic metaphase and confirmed the previous report (Jones 1957, Marchant 1971,).

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

The chromosomes of 2n=28 showed a gradual decrease in length ranging from the longest one of 4.2 μm to the shortest one of 2.7 μm, and the positions of the chromocenters were either median or submedian. Among the 28 the chromosomes 20 were median, while the other eight (Nos. 13, 14, 19-24) were submedian. One chromosome (No.21) had secondary constriction in the short arm.

This species showed a homogeneous, gradual and symmetric karyotype.

The chromosome number of the other plant was 2n=70 at mitotic metaphase and confirmed the previous report (Marchant 1971).

6) *Alocasia macrorrhiza* (L.) G. Don., 2n=28, Table 1 and 7, Fig. 7. Validated specimen No. 85033, 170.

Two plants were obtained from Thailand. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

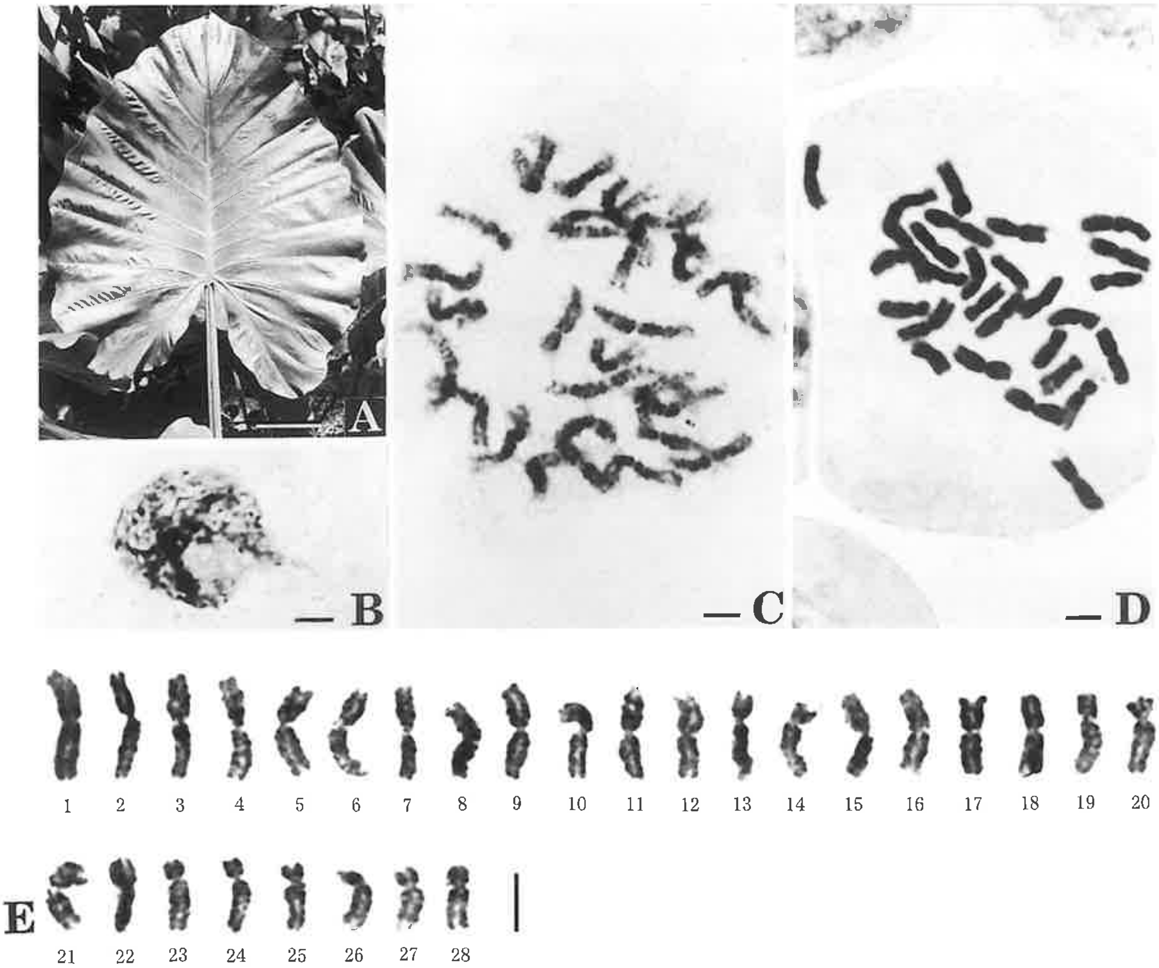

Fig.7. *Alocasia macrorrhiza*, 2n=28. A, a leaf. B, chomosomes at resting stage. C, chomosomes at mitotic metaphase. Bars indicate 10 cm in A and 3μm in B-E.

The chromosome number of two plants was 2n=28 at mitotic metaphase and confirmed the previous reports (Ito 1942, Sharma 1970, Hsu 1972).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. cucullata* 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 the shortest one of 3.3μm, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 18 were median, while the other ten (Nos. 13, 14, 18, 19, 23-28) were submedian. Five chromosomes (Nos.9, 13-15, 21) had small constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

7) *Alocasia micholitziana* Sander., 2n=28, Table 1 and 8, Fig. 8. Validated specimen No. 154.

One plant was obtained from Philippine. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant was 2n=28 at mitotic metaphase and confirmed the previous report (Marchant 1971).

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

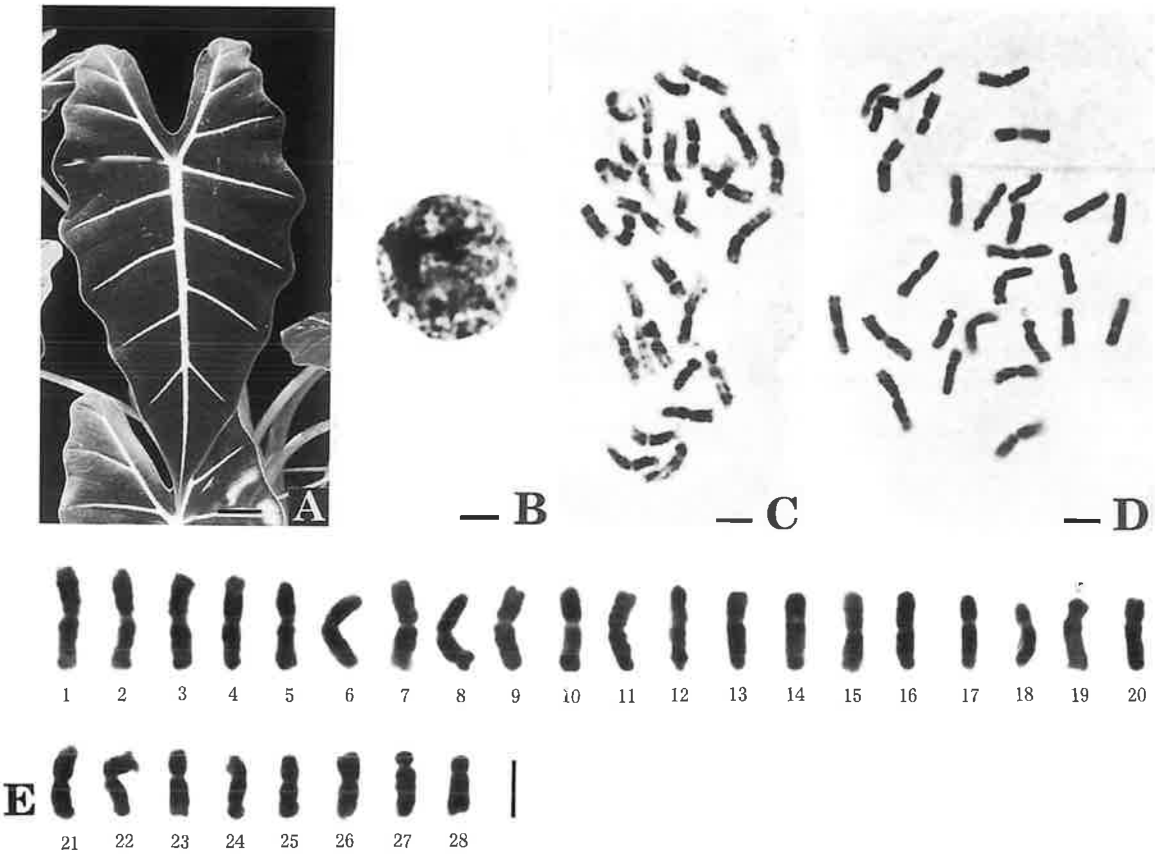

Fig.8. *Alocasia micholitziana*, 2n=28. A, leaves. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 5.7 μ m to the shortest one of 3.1 μ m, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 22 were median, while the other six (Nos. 13, 14, 19, 20, 27, 28) were submedian. One chromosome (No. 19) had secondary constriction in the short arm, and five (Nos. 1, 2, 8, 24, 25) had small constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

8) *Alocasia odora* (Lodd.) Spach., 2n=28, Table 1 and 9, Fig. 9.
Validated specimen No. 171, 172, 185.

Three plants were obtained from Kagoshima Pref. and Okinawa pref., Japan. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984)

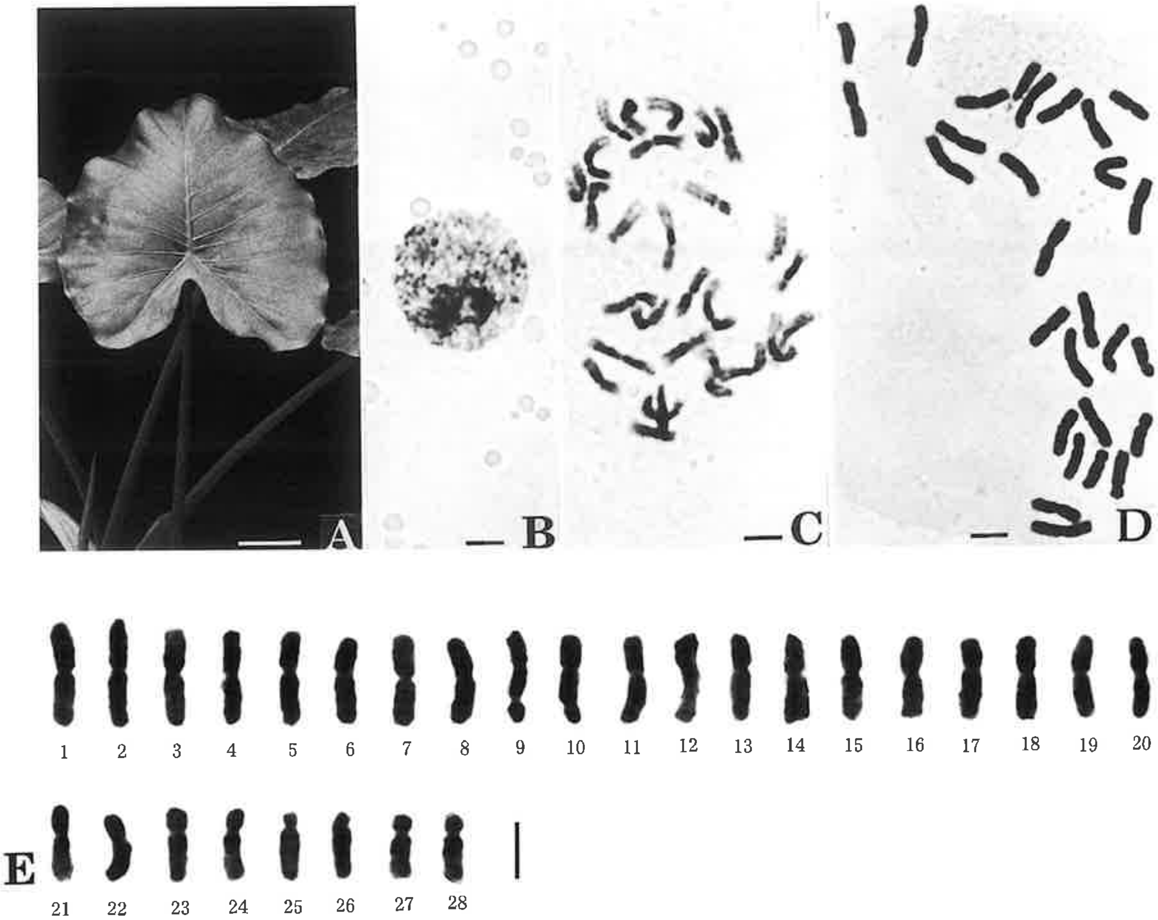

Fig.9. *Alocasia odora*, 2n=28. A, leaves. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 10 cm in A and 3μm in B-E.

The chromosome number of three plants was 2n=28 at mitotic metaphase and confirmed the previous reports (Marchant 1971, Bhattacharya 1974, Ankei 1987.).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. cucullata* 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 5.6 μm to the shortest one of 3.4 μm. Among the 28 chromosomes 24 were median, four (Nos. 23, 24, 27, 28) were submedian and two (Nos. 25, 26) were subterminal.

Two chromosomes (Nos.9, 10) had small constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

9) *Alocasia plumbea* (K. Koch) Van Houtte., 2n=28, Table 1 and 10, Fig. 10. Validated specimen No. 85035.

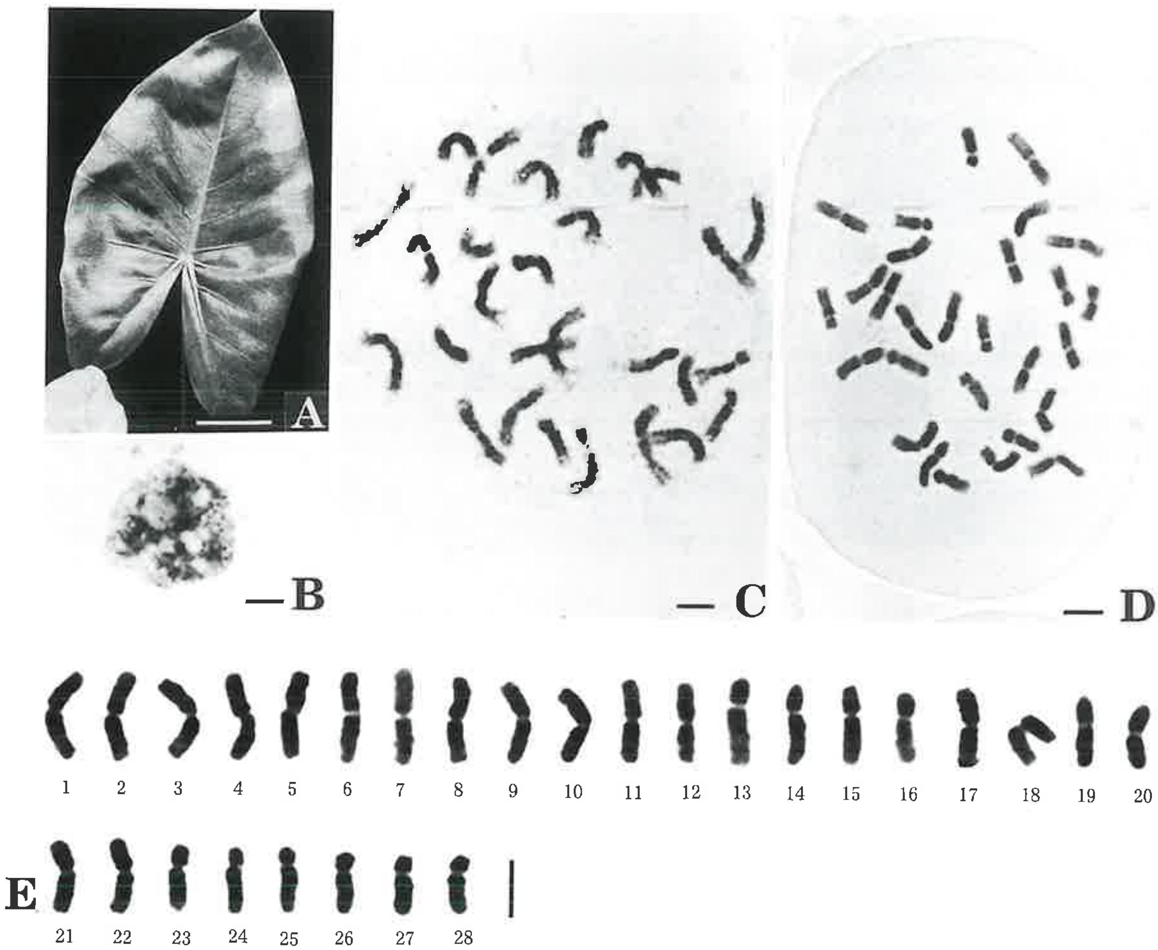

Fig.10. *Alocasia plumbea*, 2n=28. A, a leaf. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

One plant was obtained from Java. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant at mitotic metaphase was 2n=28, 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. cucullata* 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 4.8 μ m to the shortest one of 3.7 μ m, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 18 were median, while the other ten (Nos. 13, 14, 19, 20, 23-28) were submedian. Three chromosomes (Nos. 3, 6, 8) had small constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

10) *Alocasia porphyroneura* H. G. Hallier ex Engl., 2n=28, Table 1 and 11, Fig.11. Validated specimen No. 157.

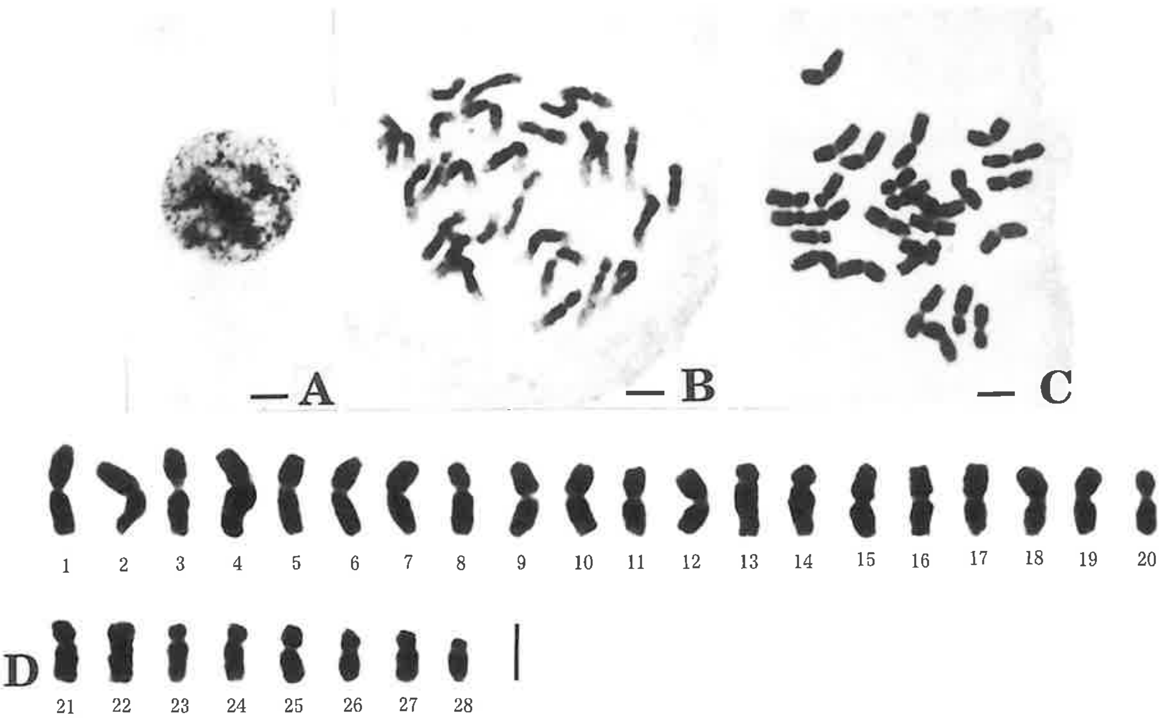

Fig.11. *Alocasia porphyroneura*, 2n=28. A, chromosomes at resting stage. B, chromosomes at mitotic prophase. C and D, chromosomes at mitotic metaphase. Bars indicate 3μm in A-D.

One plant was obtained from Borneo. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant at mitotic metaphase was 2n=28, 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. cucullata* 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 4.6 μm to the shortest one of 2.5 μm, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 22 were median, while the other six (Nos. 13, 14, 23, 24, 27, 28) were submedian.

This species showed a homogeneous, gradual and symmetric karyotype.

11) *Alocasia portei* Schott., 2n=28 , Table 1 and 12, Fig. 12.
Validated specimen No. 177.

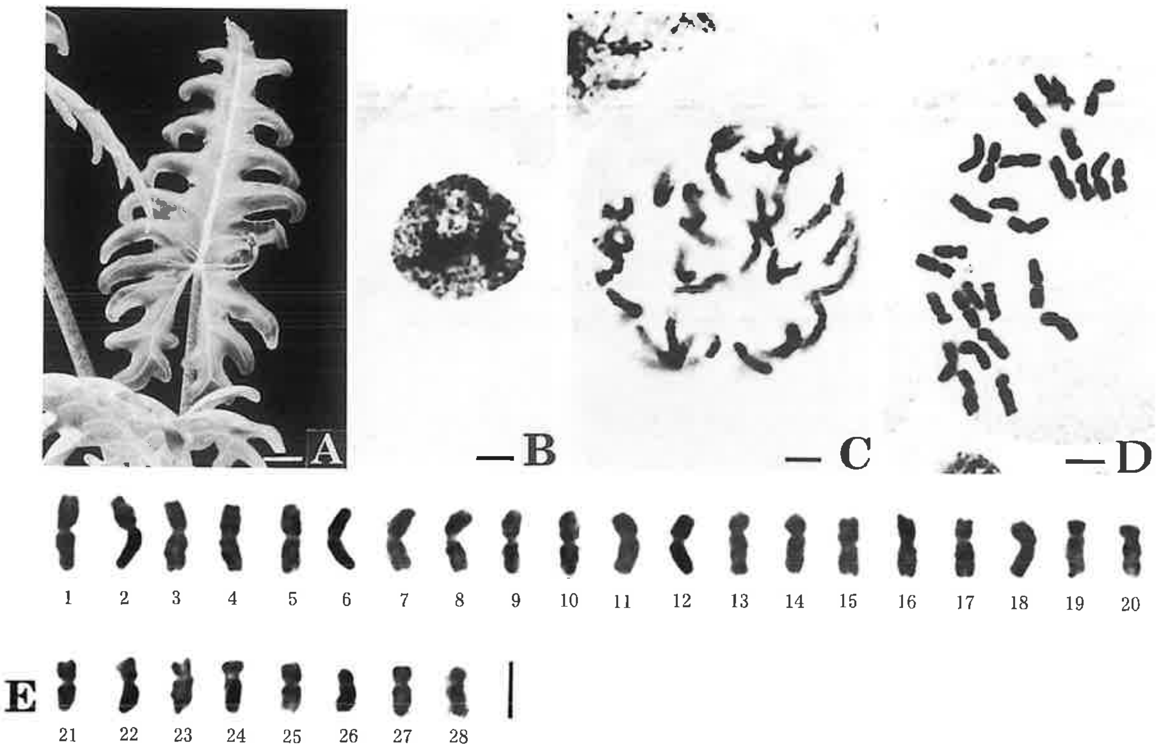

Fig.12. *Alocasia portei*, 2n=28. A, leaves. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

One plant was obtained from Philippine. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant at mitotic metaphase was 2n=28, 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. cucullata* 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 4.1 μ m to the shortest one of 2.5 μ m, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 20 were median, while the other eight (Nos. 13, 14, 19, 20, 23, 24, 27, 28) were submedian. One chromosome (No.2) had secondary constriction in the short arm.

This species showed a homogeneous, gradual and symmetric karyotype.

12) *Alocasia sanderana* Bull., 2n=28, Table 1 and 13, Fig. 13.
Validated specimen No. 85023, 20001.

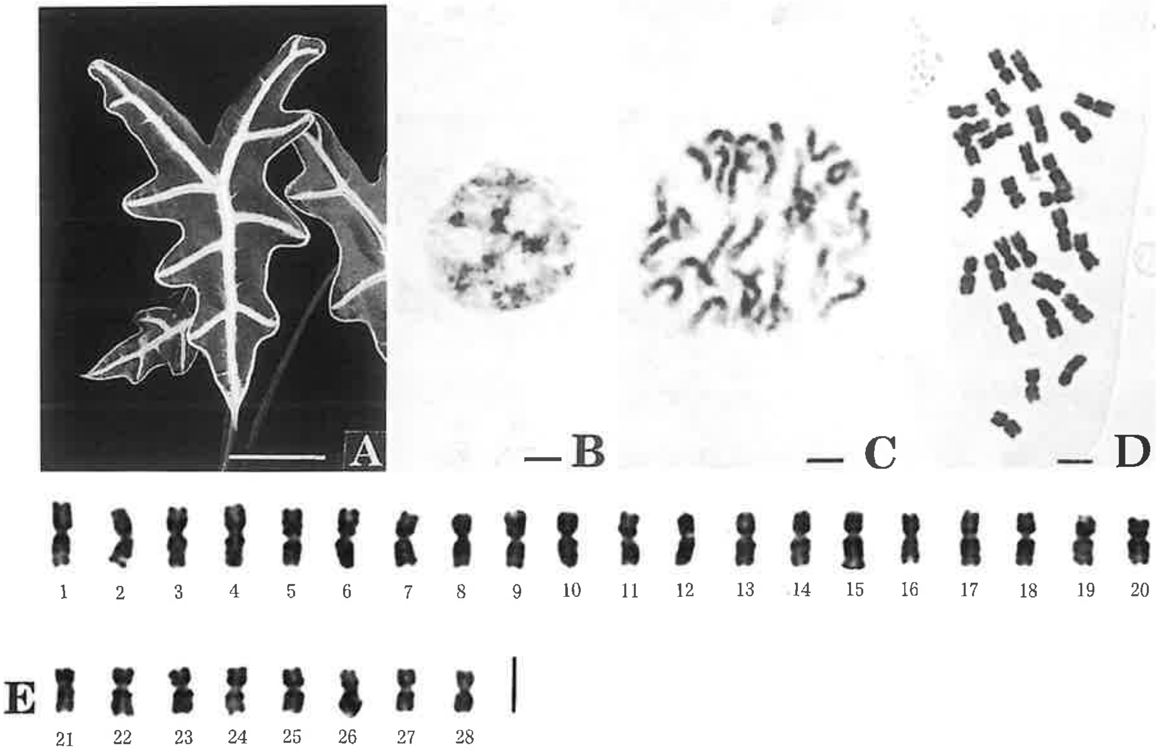

Fig.13. *Alocasia sanderana*, 2n=28. A, leaves. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

Two plants were obtained from Philippine. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984) .

The chromosome number of two plants was 2n=28 at mitotic metaphase and confirmed the previous report (Pfitzer 1957) .

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

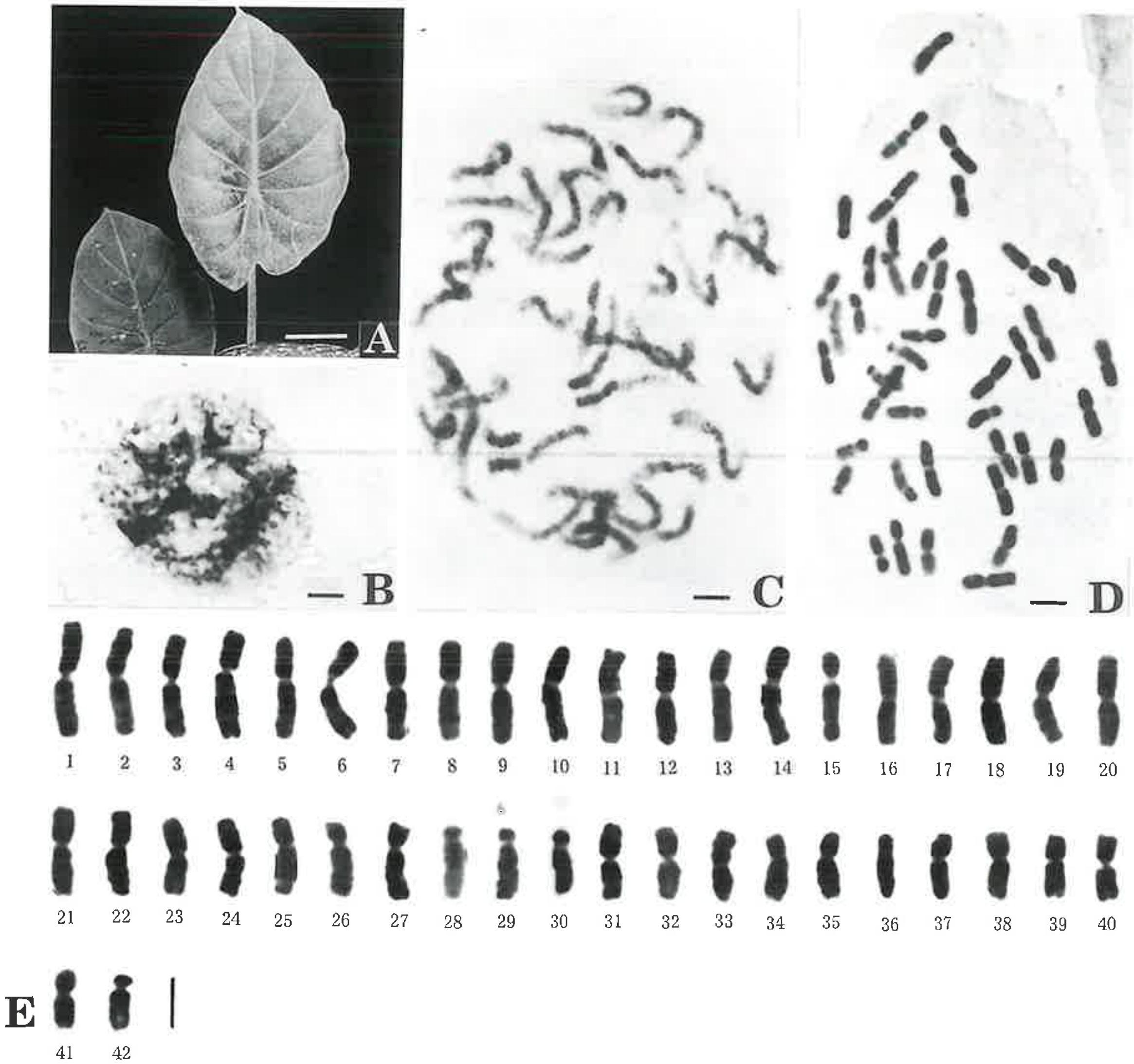

Fig.14. *Alocasia wentii*, 2n=42. A, leaves. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and $3 \mu m$ in B-E.

chromocenter type.

The chromosomes at mitotic metaphase showed a gradual decrease in length ranging from the longest one of 3.6 μm to the shortest one of 2.5 μm. Centromeres were median in all the 28 chromosomes. One chromosome (No.21) had secondary constriction in the short arm, and two (No.1, 2) had small constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

13) *Alocasia wentii* Engl. & Kurt Krause, 2n=42, Table 1 and 14, Fig.14. Validated specimen No. 85032.

One plant was obtained from Philippine. External morphological characteristics of leaves were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant at mitotic metaphase was 2n=28, 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. cucullata* 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 6.2 μm to the shortest one of 3.1 μm, and the positions of the chromocenters were either median or submedian. Among the 42 chromosomes 34 were median, while the other 8 (Nos. 15, 26-30, 36, 42) were submedian. Two chromosomes (Nos. 29, 30) had secondary constrictions in their short arms, and four (Nos. 7, 8, 14, 15) had small constrictions in their long arms.

This species showed a homogeneous, gradual and symmetric karyotype.

14) *Alocasia zebrina* C. Koch & Veitch., 2n=28, Table 1 and 15, Fig. 15. Validated specimen No. 155.

One plant was obtained from Philippine. External morphological characteristics of leaves and petioles were similar to those of this species described by Leedy *et al.* (1984).

The chromosome number of the plant was 2n=28 at mitotic metaphase and confirmed the previous report (Sharma 1970).

The chromosomes at resting stage and mitotic prophase were morphologically similar to those of *A. cucullata* 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 4.2 μm to the shortest one of 3.0 μm, and the positions of the chromocenters were either median or submedian. Among the 28 chromosomes 20 were median, while the other eight (Nos. 21-28) were submedian. Three chromosomes (Nos. 21, 22, 26) had secondary constrictions in their short arms.

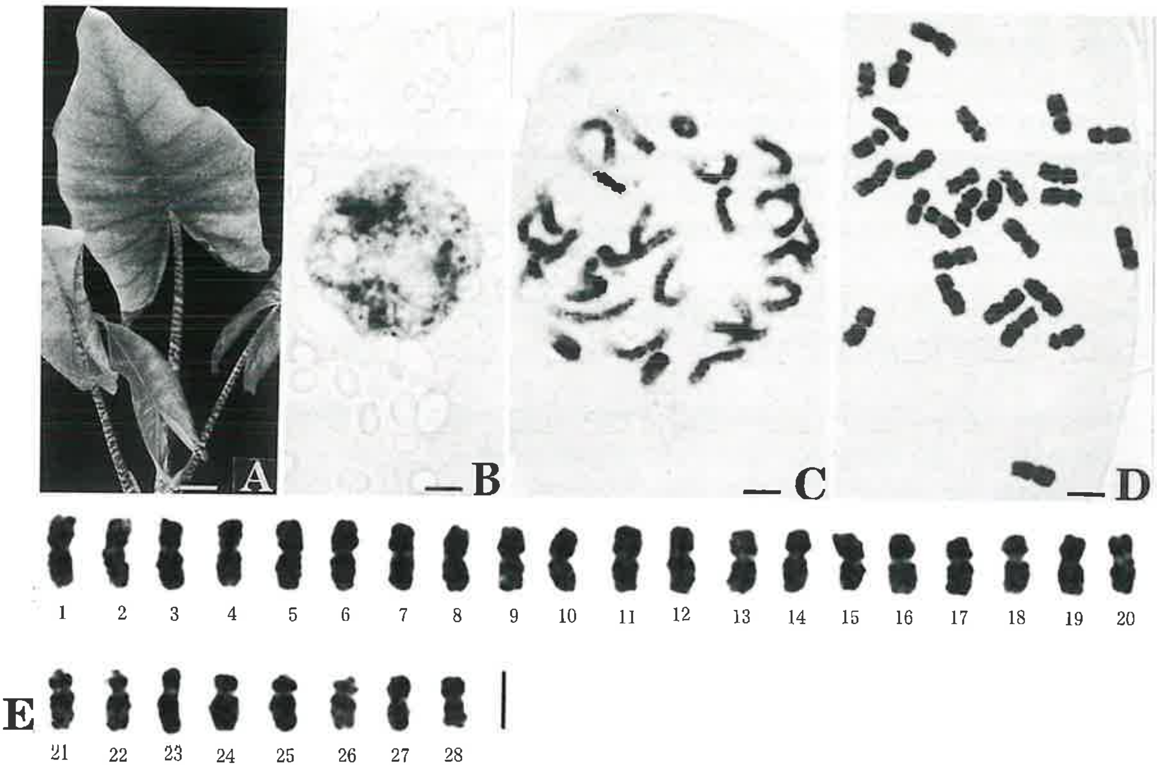

Fig.15. *Alocasia zebrina*, 2n=28. A, leaves. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 5 cm in A and 3μm in B-E.

This species showed a homogeneous, gradual and symmetric karyotype.

Summary

1. Karyomorphological observations were carried out on 14 taxa in the genus *Alocasia* cultivated in the Hiroshima Botanical Garden.
2. Chromosome numbers of the 14 taxa were found to be either 2n=28, 42 or 70.
3. Chromosome numbers of six taxa, *A. gageana* (2n=28), *A.* 'Green Shield' (2n=28), *A. plumbea* (2n=28), *A. porphyroneura* (2n=28), *A. portei* (2n=28) and *A. wentii* (2n=42) were reported for the first time and eight species, *A. cucullata* (2n=28), *A. cuprea* (2n=28), *A. lowii* (2n=28 and 2n=70), *A. macrorrhiza* (2n=28), *A. micholitziana* (2n=28), *A. odora* (2n=28), *A. sanderana*

(2n=28) and *A. zebrina* (2n=28) were redocumented.

4. Chromosome numbers of 13 taxa of the genus *Alocasia* observed were 2n=28, and each chromosome complement was consisted of 14 pairs of chromosomes. Thus, the basic chromosome number of the genus *Alocasia* could be x=14. *Alocasia wentii* with the chromosome number of 2n=42 could be recognized to be triploid, and *A. lowii* with 2n=70 to be pentaploid.

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Table 2. Measurements of somatic chromosomes of *Alocasia cucullata* at mitotic metaphase, 2n=28

Chromosome	Length(μ m)	Relative length	Arm ratio	Form
1	2.0+2.3=4.3	4.3	1.2	m
2	2.0+2.3=4.3	4.3	1.2	m
3	1.7+2.5=4.2	4.2	1.5	m
4	1.7+2.5=4.2	4.2	1.5	m
5	1.9+2.3=4.1	4.1	1.2	m
6	1.9+2.3=4.1	4.1	1.2	m
7	1.8+2.3=4.1	4.1	1.3	m
8	1.8+2.3=4.1	4.1	1.3	m
9	1.8+2.0=3.8	3.8	1.1	m
10	1.8+2.0=3.8	3.8	1.1	m
11	1.5+2.3=3.8	3.8	1.5	m
12	1.5+2.3=3.8	3.8	1.5	m
13	1.7+2.0=3.7	3.7	1.2	m
14	1.7+2.0=3.7	3.7	1.2	m
15	1.7+2.0=3.7	3.7	1.2	m
16	1.7+2.0=3.7	3.7	1.2	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	1.4+1.8=3.2	3.2	1.3	m
20	1.4+1.8=3.2	3.2	1.3	m
21	1.4+1.8=3.2	3.2	1.3	m
22	1.4+1.8=3.2	3.2	1.3	m
23	1.0+2.2=3.2	3.2	2.2	sm
24	1.0+2.2=3.2	3.2	2.2	sm
25	1.0+1.9=2.9	2.9	1.9	sm
26	0.2+0.8+1.9=2.9*	2.9	2.4	sm
27	0.8+1.9=2.7	2.7	2.4	sm
28	0.8+1.9=2.7	2.7	2.4	sm

*Chromosome with secondary constriction

Table 3. Measurements of somatic chromosomes of *Alocasia cuprea* at mitotic metaphase, 2n=28

Chromosome	Length(μ m)	Relative length	Arm ratio	Form
1	2.7+3.0=5.7	4.4	1.1	m
2	2.7+3.0=5.7	4.4	1.1	m
3	2.2+3.3=5.5	4.3	1.5	m
4	2.2+3.3=5.5	4.3	1.5	m
5	2.6+2.7=5.3	4.1	1.0	m
6	2.6+2.7=5.3	4.1	1.0	m
7	2.5+2.7=5.2	4.0	1.1	m
8	2.5+2.7=5.2	4.0	1.1	m
9	2.3+2.8=5.1	4.0	1.2	m
10	2.3+2.8=5.1	4.0	1.2	m
11	1.8+3.0=4.8	3.7	1.7	m
12	1.8+3.0=4.8	3.7	1.7	m
13	2.0+2.7=4.7	3.7	1.4	m
14	2.0+2.7=4.7	3.7	1.4	m
15	1.7+2.9=4.6	3.6	1.7	m
16	1.7+2.9=4.6	3.6	1.7	m
17	2.0+2.3=4.3	3.3	1.2	m
18	2.0+2.3=4.3	3.3	1.2	m
19	1.3+2.7=4.0	3.1	2.1	sm
20	1.3+2.7=4.0	3.1	2.1	sm
21	0.3+0.7+3.0=4.0*	3.1	3.0	sm
22	0.3+0.7+3.0=4.0*	3.1	3.0	sm
23	1.0+2.9=3.9	3.0	2.9	sm
24	1.0+2.9=3.9	3.0	2.9	sm
25	1.3+2.3=3.6	2.8	1.8	sm
26	1.3+2.3=3.6	2.8	1.8	sm
27	0.9+2.7=3.6	2.8	3.0	sm
28	0.9+2.7=3.6	2.8	3.0	sm

*Chromosome with secondary constriction

Table 4. Measurements of somatic chromosomes of *Alocasia gageana* at mitotic metaphase, 2n=28

Chromosome	Length (μ m)	Relative length	Arm ratio	Form
1	2.5+2.5=5.0	4.4	1.0	m
2	2.3+2.5=4.8	4.3	1.1	m
3	2.0+2.7=4.7	4.2	1.4	m
4	2.0+2.7=4.7	4.2	1.4	m
5	2.2+2.4=4.6	4.1	1.1	m
6	2.2+2.4=4.6	4.1	1.1	m
7	1.7+2.7=4.4	3.9	1.6	m
8	1.7+2.7=4.4	3.9	1.6	m
9	2.1+2.3=4.4	3.9	1.1	m
10	2.1+2.3=4.4	3.9	1.1	m
11	1.6+2.5=4.1	3.6	1.6	m
12	1.6+2.5=4.1	3.6	1.6	m
13	1.3+2.7=4.0	3.6	2.1	sm
14	1.3+2.7=4.0	3.6	2.1	sm
15	1.7+2.3=4.0	3.6	1.4	m
16	1.7+2.3=4.0	3.6	1.4	m
17	1.8+2.1=3.9	3.5	1.2	m
18	1.8+2.1=3.9	3.5	1.2	m
19	1.5+2.2=3.7	3.3	1.5	m
20	1.5+2.2=3.7	3.3	1.5	m
21	1.7+2.0=3.7	3.3	1.2	m
22	1.7+2.0=3.7	3.3	1.2	m
23	1.0+2.4=3.4	3.0	2.4	sm
24	1.0+2.4=3.4	3.0	2.4	sm
25	1.2+2.2=3.4	3.0	1.8	sm
26	1.2+2.2=3.4	3.0	1.8	sm
27	1.0+2.1=3.1	2.8	2.1	sm
28	1.0+1.9=2.9	2.6	1.9	sm

Table 5. Measurements of somatic chromosomes of *Alocasia* 'Green Shield' at mitotic metaphase, 2n=28

Chromosome	Length(μ m)	Relative length	Arm ratio	Form
1	2.4+2.7=5.1	4.6	1.1	m
2	2.4+2.7=5.1	4.6	1.1	m
3	2.0+2.7=4.7	4.3	1.4	m
4	2.0+2.7=4.7	4.3	1.4	m
5	1.8+2.7=4.5	4.1	1.5	m
6	1.8+2.7=4.5	4.1	1.5	m
7	2.2+2.3=4.5	4.1	1.0	m
8	2.2+2.3=4.5	4.1	1.0	m
9	2.1+2.2=4.3	3.9	1.0	m
10	2.1+2.2=4.3	3.9	1.0	m
11	1.9+2.3=4.2	3.8	1.2	m
12	1.9+2.3=4.2	3.8	1.2	m
13	1.1+2.9=4.0	3.6	2.6	sm
14	1.1+2.9=4.0	3.6	2.6	sm
15	1.7+2.3=4.0	3.6	1.4	m
16	1.7+2.3=4.0	3.6	1.4	m
17	1.5+2.1=3.6	3.3	1.4	m
18	1.5+2.1=3.6	3.3	1.4	m
19	0.9+2.7=3.6	3.3	3.0	sm
20	0.9+2.7=3.6	3.3	3.0	sm
21	1.3+2.0=3.3	3.0	1.5	m
22	1.3+2.0=3.3	3.0	1.5	m
23	0.7+2.5=3.2	2.9	3.6	st
24	0.7+2.5=3.2	2.9	3.6	st
25	1.0+2.0=3.0	2.7	2.0	sm
26	1.0+2.0=3.0	2.7	2.0	sm
27	1.0+2.0=3.0	2.7	2.0	sm
28	1.0+2.0=3.0	2.7	2.0	sm

Table 6. Measurements of somatic choromosomes of *Alocasia lowii* at mitotic metaphase, 2n=28

Chromosome	Length (μ m)	Relative length	Arm ratio	Form
1	1.9+2.3=4.2	4.5	1.2	m
2	1.9+2.3=4.2	4.5	1.2	m
3	1.9+2.0=3.9	4.2	1.1	m
4	1.9+2.0=3.9	4.2	1.1	m
5	1.7+2.0=3.7	4.0	1.2	m
6	1.7+2.0=3.7	4.0	1.2	m
7	1.7+2.0=3.7	4.0	1.2	m
8	1.7+2.0=3.7	4.0	1.2	m
9	1.6+2.0=3.6	3.8	1.3	m
10	1.6+2.0=3.6	3.8	1.3	m
11	1.3+2.1=3.4	3.6	1.6	m
12	1.3+2.1=3.4	3.6	1.6	m
13	0.8+2.6=3.4	3.6	3.3	st
14	0.8+2.6=3.4	3.6	3.3	st
15	1.5+1.8=3.3	3.5	1.2	m
16	1.5+1.8=3.3	3.5	1.2	m
17	1.4+1.7=3.1	3.3	1.2	m
18	1.4+1.7=3.1	3.3	1.2	m
19	1.1+2.0=3.1	3.3	1.8	sm
20	1.1+2.0=3.1	3.3	1.8	sm
21	0.3+0.7+2.1=3.1*	3.3	2.1	sm
22	1.0+2.1=3.1	3.3	2.1	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	1.0+1.7=2.7	2.9	1.7	m
26	1.0+1.7=2.7	2.9	1.7	m
27	1.0+1.7=2.7	2.9	1.7	m
28	1.0+1.7=2.7	2.9	1.7	m

*Chromosome with secondary constriction

Table 7. Measurements of somatic chromosomes of *Alocasia macrorrhiza* at mitotic metaphase, 2n=28

Chromosome	Length (μ m)	Relative length	Arm ratio	Form
1	2.7+3.3=6.0	4.7	1.2	m
2	2.7+3.3=6.0	4.7	1.2	m
3	2.7+2.9=5.6	4.4	1.1	m
4	2.7+2.9=5.6	4.4	1.1	m
5	2.3+2.8=5.1	4.0	1.2	m
6	2.3+2.8=5.1	4.0	1.2	m
7	2.5+2.6=5.1	4.0	1.0	m
8	2.5+2.6=5.1	4.0	1.0	m
9	2.3+2.6=4.9	3.9	1.1	m
10	2.3+2.6=4.9	3.9	1.1	m
11	2.3+2.4=4.7	3.7	1.0	m
12	2.3+2.4=4.7	3.7	1.0	m
13	1.5+3.0=4.5	3.6	2.0	sm
14	1.5+3.0=4.5	3.6	2.0	sm
15	2.1+2.3=4.4	3.5	1.1	m
16	2.1+2.3=4.4	3.5	1.1	m
17	2.0+2.3=4.3	3.4	1.2	m
18	2.0+2.3=4.3	3.4	1.2	m
19	1.3+2.8=4.1	3.2	2.2	sm
20	1.3+2.8=4.1	3.2	2.2	sm
21	1.8+2.2=4.0	3.2	1.2	m
22	1.8+2.2=4.0	3.2	1.2	m
23	1.0+2.8=3.8	3.0	2.8	sm
24	1.0+2.8=3.8	3.0	2.8	sm
25	1.0+2.5=3.5	2.8	2.5	sm
26	1.0+2.5=3.5	2.8	2.5	sm
27	1.0+2.3=3.3	2.6	2.3	sm
28	1.0+2.3=3.3	2.6	2.3	sm

Table 8. Measurements of somatic chromosomes of *Alocasia micholitziana* at mitotic metaphase, 2n=28

Chromosome	Length (μ m)	Relative length	Arm ratio	Form
1	2.7+3.0=5.7	4.8	1.1	m
2	2.7+3.0=5.7	4.8	1.1	m
3	2.5+2.8=5.3	4.4	1.1	m
4	2.5+2.8=5.3	4.4	1.1	m
5	2.1+2.7=4.8	4.0	1.3	m
6	2.1+2.7=4.8	4.0	1.3	m
7	2.3+2.3=4.6	3.8	1.0	m
8	2.3+2.3=4.6	3.8	1.0	m
9	2.0+2.6=4.6	3.8	1.3	m
10	2.0+2.6=4.6	3.8	1.3	m
11	2.1+2.3=4.4	3.7	1.1	m
12	2.1+2.3=4.4	3.7	1.1	m
13	1.5+2.7=4.2	3.5	1.8	sm
14	1.5+2.7=4.2	3.5	1.8	sm
15	2.0+2.1=4.1	3.4	1.1	m
16	2.0+2.1=4.1	3.4	1.1	m
17	1.5+2.6=4.1	3.4	1.7	m
18	1.5+2.6=4.1	3.4	1.7	m
19	0.6+0.8+2.7=4.1*	3.4	1.9	sm
20	1.2+2.7=3.9	3.3	2.3	sm
21	1.9+2.0=3.9	3.3	1.1	m
22	1.9+2.0=3.9	3.3	1.1	m
23	1.5+2.1=3.6	3.0	1.4	m
24	1.5+2.1=3.6	3.0	1.4	m
25	1.5+2.0=3.5	2.9	1.3	m
26	1.5+2.0=3.5	2.9	1.3	m
27	0.9+2.3=3.2	2.7	2.6	sm
28	0.8+2.3=3.1	2.6	2.9	sm

*Chromosome with secondary constriction

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

Chromosome	Length (μm)	Relative length	Arm ratio	Form
1	2.7+2.9=5.6	4.5	1.1	m
2	2.7+2.9=5.6	4.5	1.1	m
3	2.3+2.8=5.1	4.1	1.2	m
4	2.3+2.8=5.1	4.1	1.2	m
5	2.1+2.8=4.9	3.9	1.3	m
6	2.1+2.8=4.9	3.9	1.3	m
7	2.0+2.7=4.7	3.8	1.4	m
8	2.0+2.7=4.7	3.8	1.4	m
9	1.7+2.9=4.6	3.7	1.7	m
10	1.7+2.9=4.6	3.7	1.7	m
11	2.3+2.3=4.6	3.7	1.0	m
12	2.3+2.3=4.6	3.7	1.0	m
13	1.9+2.7=4.6	3.7	1.4	m
14	1.9+2.7=4.6	3.7	1.4	m
15	2.0+2.4=4.4	3.5	1.2	m
16	2.0+2.4=4.4	3.5	1.2	m
17	1.8+2.6=4.4	3.5	1.4	m
18	1.8+2.6=4.4	3.5	1.4	m
19	2.0+2.3=4.3	3.5	1.2	m
20	2.0+2.3=4.3	3.5	1.2	m
21	1.7+2.3=4.0	3.2	1.4	m
22	1.7+2.3=4.0	3.2	1.4	m
23	1.3+2.7=4.0	3.2	2.1	sm
24	1.3+2.7=4.0	3.2	2.1	sm
25	0.9+2.8=3.7	3.0	3.1	st
26	0.9+2.8=3.7	3.0	3.1	st
27	1.0+2.4=3.4	2.7	2.4	sm
28	1.0+2.4=3.4	2.7	2.4	sm

Table 10. Measurements of somatic chromosomes of *Alocasia plumbea* at mitotic metaphase, 2n=28

Chromosome	Length (μ m)	Relative length	Arm ratio	Form
1	2.3+2.5=4.8	4.1	1.1	m
2	2.3+2.5=4.8	4.1	1.1	m
3	2.3+2.5=4.8	4.1	1.1	m
4	2.3+2.5=4.8	4.1	1.1	m
5	2.2+2.6=4.8	4.1	1.2	m
6	2.2+2.6=4.8	4.1	1.2	m
7	2.3+2.3=4.6	3.9	1.0	m
8	2.3+2.3=4.6	3.9	1.0	m
9	2.0+2.3=4.3	3.7	1.2	m
10	2.0+2.3=4.3	3.7	1.2	m
11	2.1+2.2=4.3	3.7	1.0	m
12	2.1+2.2=4.3	3.7	1.0	m
13	1.4+2.7=4.1	3.5	1.9	sm
14	1.4+2.7=4.1	3.5	1.9	sm
15	1.7+2.2=3.9	3.3	1.3	m
16	1.7+2.2=3.9	3.3	1.3	m
17	1.7+2.2=3.9	3.3	1.3	m
18	1.7+2.2=3.9	3.3	1.3	m
19	1.4+2.5=3.9	3.3	1.8	sm
20	1.4+2.5=3.9	3.3	1.8	sm
21	1.5+2.3=3.8	3.3	1.5	m
22	1.5+2.3=3.8	3.3	1.5	m
23	1.3+2.4=3.7	3.2	1.8	sm
24	1.3+2.4=3.7	3.2	1.8	sm
25	1.0+2.7=3.7	3.2	2.7	sm
26	1.0+2.7=3.7	3.2	2.7	sm
27	1.0+2.7=3.7	3.2	2.7	sm
28	1.0+2.7=3.7	3.2	2.7	sm

Table 11. Measurements of somatic chromosomes of *Alocasia porphyroneura* at mitotic metaphase, 2n=28

Chromosome	Length(μ m)	Relative length	Arm ratio	Form
1	2.3+2.3=4.6	4.5	1.0	m
2	2.3+2.3=4.6	4.5	1.0	m
3	2.0+2.3=4.3	4.2	1.2	m
4	2.0+2.3=4.3	4.2	1.2	m
5	1.7+2.4=4.1	4.0	1.4	m
6	1.7+2.4=4.1	4.0	1.4	m
7	1.7+2.3=4.0	3.9	1.4	m
8	1.7+2.3=4.0	3.9	1.4	m
9	1.7+2.3=4.0	3.9	1.4	m
10	1.7+2.3=4.0	3.9	1.4	m
11	1.7+2.0=3.7	3.6	1.2	m
12	1.7+2.0=3.7	3.6	1.2	m
13	1.0+2.7=3.7	3.6	2.7	sm
14	1.0+2.7=3.7	3.6	2.7	sm
15	1.7+2.0=3.7	3.6	1.2	m
16	1.7+2.0=3.7	3.6	1.2	m
17	1.7+2.0=3.7	3.6	1.2	m
18	1.7+2.0=3.7	3.6	1.2	m
19	1.5+2.0=3.5	3.4	1.3	m
20	1.5+2.0=3.5	3.4	1.3	m
21	1.3+2.0=3.3	3.2	1.5	m
22	1.3+2.0=3.3	3.2	1.5	m
23	0.8+2.2=3.0	2.9	2.8	sm
24	0.8+2.2=3.0	2.9	2.8	sm
25	1.2+1.7=2.9	2.8	1.4	m
26	1.2+1.7=2.9	2.8	1.4	m
27	0.9+1.7=2.6	2.5	1.9	sm
28	0.8+1.7=2.5	2.4	2.1	sm

Table 12. Measurements of somatic chromosomes of *Alocasia portei* at mitotic metaphase, 2n=28

Chromosome	Length (μ m)	Relative length	Arm ratio	Form
1	1.9+2.2=4.1	4.6	1.2	m
2	1.9+2.2=4.1	4.6	1.2	m
3	1.7+2.0=3.7	4.1	1.2	m
4	1.7+2.0=3.7	4.1	1.2	m
5	1.7+2.0=3.7	4.1	1.2	m
6	1.7+2.0=3.7	4.1	1.2	m
7	1.7+1.8=3.5	3.9	1.1	m
8	1.7+1.8=3.5	3.9	1.1	m
9	1.7+1.7=3.4	3.8	1.0	m
10	1.7+1.7=3.4	3.8	1.0	m
11	1.3+2.0=3.3	3.7	1.5	m
12	1.3+2.0=3.3	3.7	1.5	m
13	1.0+2.2=3.2	3.6	2.2	sm
14	1.0+2.2=3.2	3.6	2.2	sm
15	1.5+1.7=3.2	3.6	1.1	m
16	1.5+1.7=3.2	3.6	1.1	m
17	1.2+1.8=3.0	3.4	1.5	m
18	1.2+1.8=3.0	3.4	1.5	m
19	0.9+2.0=2.9	3.2	2.2	sm
20	0.9+2.0=2.9	3.2	2.2	sm
21	1.2+1.7=2.9	3.2	1.4	m
22	1.2+1.7=2.9	3.2	1.4	m
23	0.8+1.9=2.7	3.0	2.4	sm
24	0.8+1.9=2.7	3.0	2.4	sm
25	1.0+1.6=2.6	2.9	1.6	m
26	1.0+1.6=2.6	2.9	1.6	m
27	0.8+1.7=2.5	2.8	2.1	sm
28	0.8+1.7=2.5	2.8	2.1	sm

Table 13. Measurements of somatic chromosomes of *Alocasia sanderana* at mitotic metaphase, 2n=28

Chromosome	Length (μ m)	Relative length	Arm ratio	Form
1	1.7+1.9=3.6	4.4	1.1	m
2	1.7+1.9=3.6	4.4	1.1	m
3	1.5+1.8=3.3	4.0	1.2	m
4	1.5+1.8=3.3	4.0	1.2	m
5	1.5+1.7=3.2	3.9	1.1	m
6	1.5+1.7=3.2	3.9	1.1	m
7	1.5+1.7=3.2	3.9	1.1	m
8	1.5+1.7=3.2	3.9	1.1	m
9	1.3+1.7=3.0	3.7	1.3	m
10	1.3+1.7=3.0	3.7	1.3	m
11	1.3+1.7=3.0	3.7	1.3	m
12	1.3+1.7=3.0	3.7	1.3	m
13	1.3+1.7=3.0	3.7	1.3	m
14	1.3+1.7=3.0	3.7	1.3	m
15	1.4+1.6=3.0	3.7	1.1	m
16	1.4+1.6=3.0	3.7	1.1	m
17	1.3+1.6=2.9	3.5	1.2	m
18	1.3+1.6=2.9	3.5	1.2	m
19	1.0+1.7=2.7	3.3	1.7	m
20	1.0+1.7=2.7	3.3	1.7	m
21	0.3+0.8+1.6=2.7*	3.3	1.5	m
22	1.1+1.6=2.7	3.3	1.5	m
23	1.0+1.5=2.5	3.0	1.5	m
24	1.0+1.5=2.5	3.0	1.5	m
25	1.2+1.3=2.5	3.0	1.1	m
26	1.2+1.3=2.5	3.0	1.1	m
27	1.2+1.3=2.5	3.0	1.1	m
28	1.2+1.3=2.5	3.0	1.1	m

*Chromosome with secondary constriction

Table 14. Measurements of somatic chromosomes of *Alocasia wentii* at mitotic metaphase, 2n=42

Chromosome	Length (μm)	Relative length	Arm ratio	Form
1	2.9+3.3=6.2	3.2	1.1	m
2	2.7+3.3=6.0	3.1	1.2	m
3	2.7+3.3=6.0	3.1	1.2	m
4	2.2+3.7=5.9	3.0	1.7	m
5	2.4+3.3=5.7	2.9	1.4	m
6	2.4+3.3=5.7	2.9	1.4	m
7	2.6+3.1=5.7	2.9	1.2	m
8	2.3+3.2=5.5	2.8	1.4	m
9	2.3+3.2=5.5	2.8	1.4	m
10	2.2+3.2=5.4	2.7	1.5	m
11	2.4+3.0=5.4	2.7	1.3	m
12	2.4+3.0=5.4	2.7	1.3	m
13	2.0+3.3=5.3	2.7	1.7	m
14	2.0+3.3=5.3	2.7	1.7	m
15	1.7+3.3=5.0	2.5	1.9	sm
16	2.5+2.5=5.0	2.5	1.0	m
17	2.5+2.5=5.0	2.5	1.0	m
18	2.4+2.5=4.9	2.5	1.0	m
19	2.3+2.6=4.9	2.5	1.1	m
20	2.3+2.6=4.9	2.5	1.1	m
21	2.1+2.7=4.8	2.4	1.3	m
22	2.0+2.7=4.7	2.4	1.4	m
23	2.2+2.3=4.5	2.3	1.0	m
24	2.2+2.3=4.5	2.3	1.0	m
25	1.7+2.7=4.4	2.2	1.6	m
26	1.4+2.9=4.3	2.2	2.1	sm
27	1.4+2.9=4.3	2.2	2.1	sm
28	0.4+0.6+3.3=4.3*	2.2	3.3	st
29	0.4+0.6+3.3=4.3*	2.2	3.3	st
30	0.4+0.6+3.3=4.3*	2.2	3.3	st
31	1.8+2.2=4.0	2.0	1.2	m
32	1.8+2.2=4.0	2.0	1.2	m
33	2.0+2.0=4.0	2.0	1.0	m
34	1.4+2.3=3.7	1.9	1.6	m
35	1.4+2.3=3.7	1.9	1.6	m
36	1.2+2.5=3.7	1.9	2.1	sm
37	1.5+2.2=3.7	1.9	1.5	m
38	1.5+2.2=3.7	1.9	1.5	m
39	1.5+2.1=3.6	1.8	1.4	m
40	1.5+2.0=3.5	1.8	1.3	m
41	1.5+2.0=3.5	1.8	1.3	m
42	0.8+2.3=3.1	1.6	2.9	sm

*Chromosome with secondary constriction

Table 15. Measurements of somatic chromosomes of *Alocasia zebrina* at mitotic metaphase, 2n=28

Chromosome	Length(μ m)	Relative length	Arm ratio	Form
1	2.0+2.2=4.2	4.4	1.1	m
2	2.0+2.2=4.2	4.4	1.1	m
3	1.7+2.2=3.9	4.1	1.3	m
4	1.7+2.2=3.9	4.1	1.3	m
5	1.7+2.0=3.7	3.9	1.2	m
6	1.7+2.0=3.7	3.9	1.2	m
7	1.7+2.0=3.7	3.9	1.2	m
8	1.7+2.0=3.7	3.9	1.2	m
9	1.7+1.9=3.6	3.8	1.1	m
10	1.7+1.9=3.6	3.8	1.1	m
11	1.5+2.0=3.5	3.7	1.3	m
12	1.5+2.0=3.5	3.7	1.3	m
13	1.4+2.0=3.4	3.6	1.4	m
14	1.4+2.0=3.4	3.6	1.4	m
15	1.6+1.7=3.3	3.5	1.1	m
16	1.6+1.7=3.3	3.5	1.1	m
17	1.3+1.8=3.1	3.3	1.4	m
18	1.3+1.8=3.1	3.3	1.4	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	0.3+0.6+2.2=3.1*	3.3	2.4	sm
22	0.3+0.6+2.2=3.1*	3.3	2.4	sm
23	1.0+2.0=3.0	3.2	2.0	sm
24	1.0+2.0=3.0	3.2	2.0	sm
25	1.0+2.0=3.0	3.2	2.0	sm
26	0.3+0.7+2.0=3.0*	3.2	2.0	sm
27	1.0+2.0=3.0	3.2	2.0	sm
28	1.0+2.0=3.0	3.2	2.0	sm

*Chromosome with secondary constriction

メラスファエルラの生育開花に及ぼす温度と日長の影響*

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Effects of temperature and day-length for growth and flowering on *Melasphaerula ramosa*, Iridaceae.*

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緒　　言

メラスファエルラ（*Melasphaerula ramosa* (L.) N. E.Br.）は南アフリカ原産のアヤメ科の半耐寒性球根植物である。一般に秋に植え付けを行い、霜除けまたは若干の加温を行った温度条件下で栽培し、春に開花させる。複総状花序を形成し（Fig. 1）、横径1 cm程度の黄色い花を群れて咲かせる。その姿は美しく、今後、主に家庭で楽しむ草花としての普及が期待されるが、その生育開花習性はほとんど知られていない。そこで、本研究では、生育開花習性を明らかにしたうえで、本種の生育および開花に及ぼす温度と日長の影響を調査した。

実験1．植え付け後の栽培温度と生育様相

栽培温度が生育に及ぼす影響を調べた。

材料および方法

1993年10月20日に球茎を植え付け、最低15℃、最低10℃、最低3℃、無加温霜除け（最低－3℃）、露地（最低－3℃）でそれぞれ15球ずつ栽培し、開花時および掘り上げ時（地上部褐変後）に調査を行った。

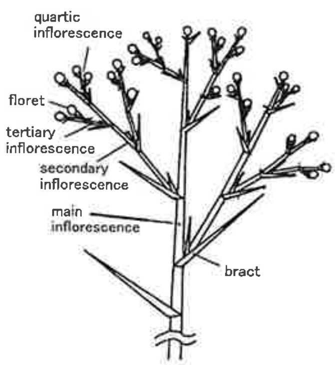

Fig.1 A picture of flower and an illustration of inflorescence of *Melasphaerula ramosa*.

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*　Contribution from The Hiroshima Botanical Garden No.70.
1) The Hiroshima Botanical Garden.
Bulletin of The Hiroshima Botanical Garden, No.20: 35- 43, 2001.

Table 1. Results of examinations cultivated under several temperature conditions

Cultivated condition	Data at blooming*					Weight of new corms at harvesting** (g)
	Date of blooming	Number of leaves	Length of leaf (cm)	Number of branches on the main flower stalk	Length of flower stalk (cm)	
Greenhouse (Min.15℃)	26-Feb.	10.6	50	14.6	107	1.98
Greenhouse (Min.10℃)	9-Feb.	8.6	40	10.5	76	2.01
Greenhouse (Min.3℃)	22-Mar.	7.6	35	10.3	81	2.93
Unheated and frost protected condition (Min.-3℃)	6-Apr.	7.9	16	10.2	50	1.94
Open air (Min.-3℃)	24-Apr.	7.4	9	10.0	38	0.80

All plants bloomed.
15 corms were used for each experience, and they were planted in Oct. 20, 1993.
* Each datum of plant was examined on the blooming day of 1994.
**Each datum of plant was examined in June, 1994.

結　　果

いずれの条件下でも100%開花した（Table 1）。開花は、最低10℃区で最も早く、露地区で最も遅かった。葉数、二次花序数は、最低15℃区が、他区に比べて多くなった。花茎長は最低15℃区で107cmと最も長く、最低10℃区と最低3℃区で76～81cmとやや短く、無加温霜除け区と露地区で38～50cmと劣った。掘り上げ時の新球重は、最低3℃区が最も重かった。

なお、露地区では、葉先に凍害と思われる傷みが観察された。

以上の結果から、開花調節を前提としない普通栽培は最低3℃程度の保温条件下で行われることが適当と考えられた。

実験2．普通栽培の条件下における生育開花習性

本種の一年を通じての生育サイクルを知るための調査を行った。

材料および方法

1995年6月に掘り上げた球茎を、側面を除去したハウス内の日陰部分で乾燥貯蔵した。10月12日に植え付け、最低3℃で栽培した。また、対照として、植え付けずに乾燥貯蔵を続ける区を設けた。

6月18日から翌年5月10日まで、2～3週間毎に、5球ずつサンプリング調査を行った。

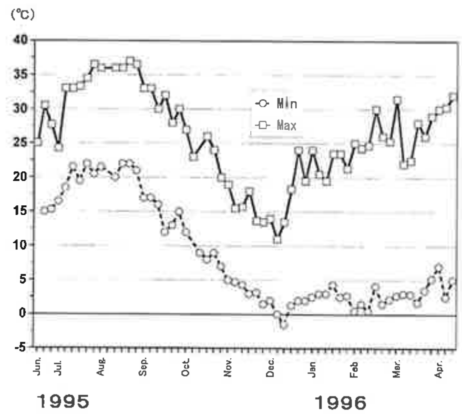

Fig.2. Minimum and maximum temperature of the space for the survey growing and flowering habit (exp. 2).

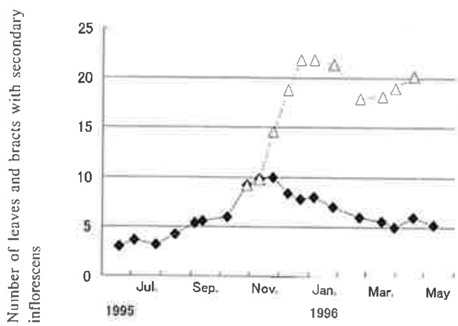

Fig. 3. Processes of increasing number of leaves.
—◆—Number of leaves
…△…Number of leaves and bracts with secondary inflorescence
Corms were stored under dry condition since harvested on early in June, 1995 until planted. They were planted on October 12, 1995, then were cultivated under the condition of described in Fig. 2.

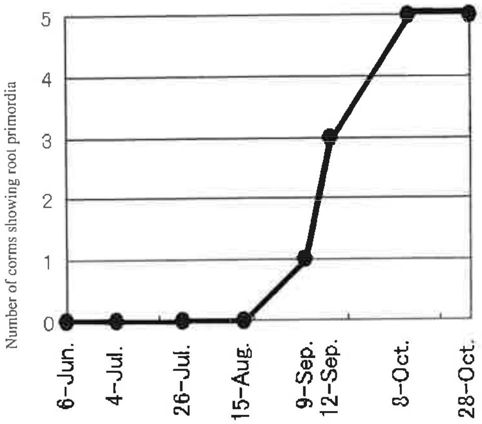

Fig. 4. Number of corms showing root primordia.
Corms were stored under natural temprature and dry condition. 5 corms were checked each day.

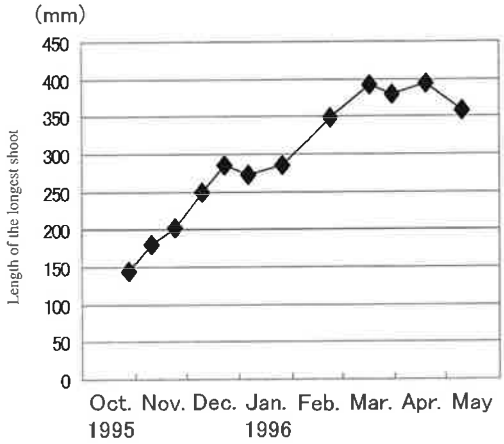

Fig. 5. Length of the longest shoot.
Corms were stored under dry condition since harvested on early in June 1995, until were planted. They were planted on October 12, 1995, they were cultivated under the condition of described in Fig. 2.

結　　果

調査期間中の栽培温度の推移をFig. 2に示した。

球茎最上位節において分化していた葉数は、6月18日の掘り上げ時に3枚であったが、その後徐々に増加し、植え付け直前の10月8日には6枚になった(Fig. 3)。植え付け後も11月上旬まで葉数の増加は続いたが、この頃から花序の形成が始まり、苞葉を含まない葉の枚数は11月下旬にピークに達した。その後、時間の経過とともに花序が発達し、12月下旬まで苞葉の枚数は増加するとともに、それまで花序を形成していなかったより下位の節からも花序が形成しはじめたため、計測結果としては苞葉を含まない葉の枚数は減少した。

9月中旬から、一部の球茎の底盤部で根原基（突起）の発生が肉眼で確認できるようになり、10月8日には調査した5球すべてにおいて根原基が確認できた（Fig. 4）。そこで、10月12日に植え付けたところ、葉は速やかに伸長し、出らいが確認された2月中旬まで伸長を続けた（Fig. 5）。葉の伸長とともに、葉の基部径は大きくなり、翌年の球茎の形作りを開始したが、12月より肥大が顕著になり、3月中旬から葉が褐変し始めたのに伴い、球茎外皮の形成を開始した（Fig. 6）。

花序の分化は11月下旬から始まった（Fig. 7）。

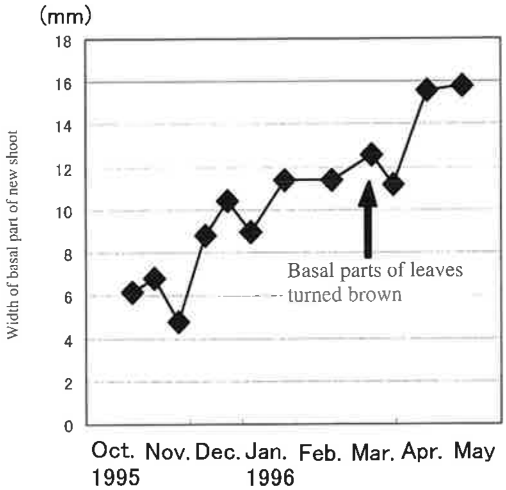

Fig. 6. Width of basal part of new shoot.
Corms were stored under dry condition since harvested on early in June 1995, until were planted. They were planted on October 12, 1995, they were cultivated under the condition of described in Fig. 2.

Number of secondary inflorescence			0.0	4.6	10.4	14.0	13.8	14.4	12.0	12.6	14.0	14.2	-
Length of flower stalk (mm)			-	1.3	3.0	6.4	10.0	83.2	239.4	628	835	994	-
Stage of the development of inflorescences or florets*	Stage of floret	Peel of fruit turned brown											●●●
		Fruit shows enlargement										●●◎	●●●
		Anthers bursted									◎	◎◎	
		Pollens producted								○○○ ○○	◎◎◎ ○		
		Pistil producted							○○○				
		Stamens producted						○○○ ○	○○				
	Stage of inflorescence	Florets or quartic inflorescenses producted						○					
		Tertiary inflorescences producted				○○○	○○○ ○○						
		Secondary inflorescences producted		○	○○○ ○○	○○							
		Main inflorescence producted		○○○ ○									
	Not started differentiation of inflorescence		○○○ ○○										
			10-Nov. 1995	24-Nov.	10-Dec.	23-Dec.	6-Jan. 1996	26-Jan.	23-Feb.	17-Mar.	30-Mar.	19-Apr.	10-May

Fig. 7. Processes of development flowers of *Melasphaerula ramosa*.
*Inflorescence or floret in fastest stage were examined.
'○' shows 'never bloomed', '◎' shows 'blooming', '●' shows 'felt floret'.
Corms were stored under dry condition since harvested on early in June, 1995, until were planted. They were planted on October 12, 1995, then they were cultivated under the condition of described in Fig. 2.

まず新芽先端部の生長点が変化して一次花序の形成が始まり、12月上～中旬に一次花序の各節に、下位節から順に二次花序が形成され、さらに12月下旬から１月上旬に二次花序の各節に三次花序が、１月中～下旬に三次花序の各節に四次花序または小花原基が形成されるという順に発達した。花序は、徐々に伸長しながらステージを進めたが、１月中旬すなわち小花形成が始まった頃より急激に伸長した。その後、小花原基は、６枚の花被片の形成を行い、ほぼ同時か少し遅れて雄ずいを形成し（１月中旬～２月中旬）、２月下旬から３月上旬にかけて雌ずいを形成した。３月中旬までに花粉が完成し、３月下旬までにほとんどの株が開花した。

また､新芽先端部での花序形成開始に少し遅れて､

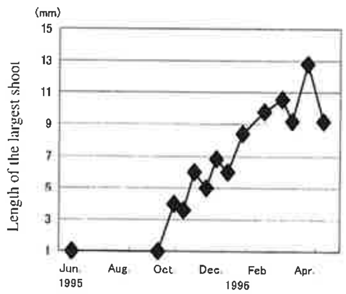

Fig. 8. Length of the largest shoot.
The value measured before October 8, 1995, was shorter than 1mm. Corms were stored under dry condition since harvested on early in June 1995 until the end of this research. They were stored under the temperature condition of described in Fig. 2.

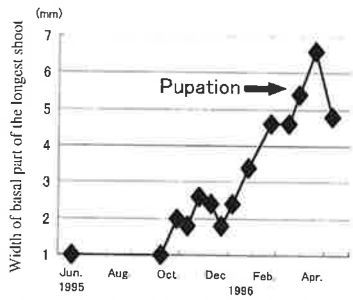

Fig. 9. Width of basal part of the largest shoot.
The value measured before October 8, 1995, was shorter than 1mm. Corms were stored dry condition since harvested on early in June 1995 until the end of this research. They were stored under the temperature condition of described in Fig. 2.

Number of leaves or leaf-primordia (without bracts)		3.0	3.6	3.2	4.2	5.4	5.6	6.0	7.2	6.8	6.4	6.4	7.0	6.8	7.4	7.0	6.6	7.0	6.6	6.6
Number of secondary inflorescence		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6	1.4	4.0	5.0	1.4	5.4	6.0
Stage of the development of inflorescences	Florets or cuatric inflorescences producted																○	○○	○○○	○○
	Tertiary inflorescences producted														○	○○	○○			○
	Secondary inflorescences producted												○	○	○○	○	○	○	○	
	Main inflorescences producted											○								
	Not started differentiation of	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○	○○○○	○○○○	○○	○○	○	○○	○	○○
		18-Jun.	4-Jul.	26-Jul.	15-Aug.	4-Sep.	12-Sep.	8-Oct.	28-Oct.	10-Nov.	24-Nov.	10-Dec.	23-Dec.	6-Jan.	26-Jan.	23-Feb.	17-Mar.	30-Mar.	19-Apr.	10-May.
		1995												1996						

Fig. 10. Processes of development leaves and flowers.

Corms were stored under dry condition since harvested on early in June 1995 until the end of this research.
They were stored under the temperature condition of described in Fig. 2.

より下位の節（それまで「最上葉」として扱われていた葉のついた節）あるいはさらに下の節においても花序の形成が開始された。これら、後から形成が開始された花序は、フリージア等でいうところの２番花、３番花として開花した。

10月12日に植え付けを行わなかった区では、葉（芽）は少しずつ伸長したが展開することはなく、植え付けを行った区と比べて著しく抑制された（Fig. 8）。新芽基部は、10月下旬から徐々に肥大していたが、３月下旬から肥大が顕著になり、葉が伸長せずに基部だけが肥大したため、二階球のような形状になった（Fig. 9）。葉数の増加は約７枚で止まった（Fig.10）。12月下旬から一部の球茎で花序の分化開始が確認され、５月まで発達を続けたが、花序が伸長したり、開花に至ることはなかった。

実験３．植え付け前の貯蔵温度と発芽との関係

球茎の休眠の様相とその打破の条件を調べるため、以下の実験を行った。

材料および方法

1996年６月上旬に掘り上げ後乾燥貯蔵してきた球茎を、６月22日、７月６日、７月20日、８月４日、８月19日に植え付けた。植付けまでの貯蔵温度は、掘り上げ後６月22日までを温度なりゆき、その後植え付けまでを温度なりゆき、５℃一定、30℃（25～33℃）の３通りの条件とした。植え付け後は15～25℃の温度で管理し、発芽日を調査した。調査は各区10球とした。

Table 2. The effects on germinations of corms by storage temperature and term before planting

Storage temperature	Storage term (weeks)	Date of planting	Rate of germinated corms* (%)	Days until germinating since planting** (days ± SD)
Control	0	22-Jun.	30	47± 3
	2	6-Jul.	50	46± 9
	4	20-Jul.	80	42± 8
	6	4-Aug.	100	27± 5
	8	19-Aug.	100	24±11
30℃	2	6-Jul.	50	47±11
	4	20-Jul.	90	41±10
	6	4-Aug.	100	32±11
	8	19-Aug.	100	22± 7
5℃	2	6-Jul.	30	42±10
	4	20-Jul.	10	64
	6	4-Aug.	0	-
	8	19-Aug.	20	62

Corms were stored under dry condition since harvested on early in June, 1996, until the tests were started.
Corms were cultivated under the condition of between 15 and 25℃, after planting.
Each sections were made from ten corms.
* They calculated 65days after planting.
** They calculated within the corms germinated.

Stage of the development of inflorescence	31-Aug.	27-Sep. (4weeks)	14-Oct. (6weeks)	25-Oct. (8weeks)	12-Nov. (10weeks)
Florets or quatric inflorescences producted					◎◎◎
Tertiary inflorescences producted				◎◎◎	◎◎
Secondary inflorescences producted			◎◎	○○ ◎◎	○○○○○
Main inflorescence producted			○	○○ ●	●●●●
Not started differentiation of inflorescence	○○○○○	○○○○○ ◎◎◎◎◎ ●●●●●	○○○○ ◎◎◎ ●●●●●	○ ●●●●	●

Fig. 11. The differences of developments of inflorescences depend on the differences of growing temperature.
Corms were stored under dry condition since harvested on early in June, 1996, until planted on August 31, 1996.
'○' shows 'not regulate temprature (control: in September, between 12 and 33℃; in October, between 7 and 27℃; in November, between 2 and 20℃)', '◎' shows 'keep 10℃', '●' shows 'minimum 15℃'.

結　　果

6月22日の植え付けでは、植え付け後65日以内の発芽率は30%であった（Table 2）。また、温度なりゆき、および30℃貯蔵区では、貯蔵期間が長くなるにつれて発芽率が高くなるとともに、発芽所要日数が短くなった。一方、5℃貯蔵区では、貯蔵期間が長くなっても発芽率は高まらなかった。

実験4．花序の分化に及ぼす温度の影響

材料および方法

1996年6月上旬に掘り上げ後、温度なりゆきの条件下で乾燥貯蔵してきた球茎を、8月31日に植え付け、無加温霜除け、10℃一定、最低15℃の3つの温度条件下で栽培した。植え付け日、9月27日、10月14日、10月25日、11月12日に5球ずつ掘り上げ、サンプリング調査を行った。

結　　果

花序の分化は、10℃一定区で最も早く始まり、11月12日までの段階では発達も速やかであった（Fig.11）。一方、最低15℃区で最も遅れた。

実験5．分化開始後の花序の発達に及ぼす栽培温度の影響

材料および方法

1995年10月中旬に球茎を植え付け、無加温霜除け下で栽培した株を、12月14日に、最低3℃、最低10℃、最低15℃に移し、引き続き栽培し、葉の間からつぼみが見え始める日（出らい日）を調査した。各区20球供試した。

結　　果

出らいは最低10℃区で最も早く、1月下旬であり、最低15℃でやや遅れた（Table 3）。最低3℃区では、両区に比べて2週間以上遅くなった。

Table 3. The effects of growing temperature on the development of inflorecsences already started defferentiation.

Growing temperature	Rate of inflorescenc appearance (%)	Date of inflorescence appearance
Min. 15℃	100	3-Feb. 1996
Min. 10℃	100	28-Jan. 1996
Min. 3℃	100	18-Feb. 1996

Corms were stored under dry condition since harvested on early in June, 1995, until planted on middle in October, 1995. After planting, they were cultivated under the unheated and frost protected condition until December 14, 1995. Then, they were cultivated in three ways of growing temperatures described in this table.

実験6．花序の形成、発達に及ぼす日長の影響

材料および方法

1998年6月に掘り上げ後、温度なりゆきの条件下で乾燥貯蔵してきた球茎を、9月26日に植え付け、最低12℃に設定した温室内において、長日および短日の条件下で栽培した。長日条件は、5時から21時の16時間明期（自然日長＋夜間人工照明）とし、短日条件は9時から17時の8時間明期（箱をかぶせることにより日照時間を調節）とした。両区とも、10月25日、11月7日、12月5日、12月19日に5球ずつ掘り上げ、サンプリング調査を行うとともに、20球ずつ開花の調査を行った。

結　　果

長日、短日ともに、植え付け6～10週後の間（11月頃）に花序の形成が開始され、10週後での発達状況に日長処理の違いによる明確な差が認められなかった（Fig.12）。さらに12週後には、長日条件下で栽培したものに比べ、短日条件下のものは花序の発達程度にばらつきが見られた。

開花日は長日区で2月6日、短日区で3月6日と

Stage of the development of inflorescence	25-Oct (4weeks)	7-Nov. (6weeks)	5-Dec. (10weeks)	12-Dec. (12weeks)
Florets or quatric inflorescences producted				○○ ●●
Tertiary inflorescences producted				○○○ ●
Secondary inflorescences producted			○○○○○ ●●●●●	●
Main inflorescence producted				●
Not started differentiation of inflorescence	○○○○○ ●●●●●	○○○○○ ●●●●●		

Fig. 12. The different of developments of inflorescences depend on the difference of daylength.
Corms were stored under dry condition since harvested in June, 1998, until were planted on September 26, 1998. Corms were cultivated under the conditions of temperature minimum 12℃ and were given long-day condition (light period was between 5:00 and 21:00; natural light and artificial lighting at night) or short-day condition (light period was between 9:00 and 17:00).
'○'shows 'under long-day condition'.
'●'shows 'under short-day condition'.

Table 4. The effects of daylength on blooming.

	Rate of blooming (%)	Date of blooming	Length of flower stalk (cm)	Number of leaves
LD	90	6-Feb. 1999	64.5	11.1
SD	95	6-Mar. 1999	46.6	10.0

Corms were stored under dry condition since harvested in June, 1988, until were planted on September 26, 1998.
Corms were cultivated under the condition of temperature minimum 12℃ and were given long-day condition (LD) or short-day condition (SD).
LD: Light period was between 5:00 and 21:00 ; natural light and artificial lighting at night.
SD: Light period was between 9:00 and 17:00.

なり、長日条件下で栽培することによって短日条件下で栽培した場合に比べ1ヶ月開花が早まった（Table 4）。また、開花時の花茎長は、長日区が64.5cm、短日区が46.6cmであり、長日区のほうが長かった。

考　　察

実験1の結果から、家庭で楽しむことを前提とした場合、本種は霜除けの条件下で十分栽培可能であることがわかった。しかし、最低3℃と無加温霜除けの条件の違いで、花茎長に大きく差が出ていることや、より寒い年の露地栽培では、多くの株が枯死したことから、安全に栽培するためには、寒い日には室内に入れるなど、氷点下に下がらない程度の保温は必要であると考えられる。一方、最低10℃の栽培で最も開花が早まり、最低15℃の栽培で最も花茎が長くなっていることから、営利的に生産する場合にはハウスなどで加温栽培する必要があると考えられる。

球茎の休眠については、以下のように考察された。

実験2において球茎底盤部での根原基の発生が9月中旬まで確認できなかったこと、実験3において6月22日に植え付けた球茎の発芽率が30%と低かったことから、本種の球茎は掘り上げ時の6月頃には休眠状態にあることが明らかとなった。実験3において5℃貯蔵区では貯蔵期間が長くなっても発芽率が高まらなかったのに対し、温度なりゆきおよび30℃貯蔵区で貯蔵期間が長くなるにつれて発芽率が高まり、発芽所要日数が短くなったことから、休眠打破にはある程度の高温（30℃程度）に遭遇することが必要であると考えられる。実験3において温度なりゆき貯蔵区において、8月4日植え付けで発芽率が100%に達し、発芽所要日数が27日と短縮されている（7月20日植え付けでは42日）ことから、自然条件下では7月以後の気温の上昇により、8月中旬には休眠が破られると考えられる。

掘り上げ時に休眠状態にあり、30℃程度の温度に一定期間遭遇することによって休眠打破されるというのは、同じ南アフリカ原産のフリージアと同様である。

花序の形成、発達については、以下のように考察された。

実験2の結果から、自然の温度環境下では11月中～下旬から花序の形成が開始されることが、実験4、5の結果から花序の形成と発達は10℃前後の温度により促されることが明らかとなった。ある程度花序の形成が進んだ株を、以後、最低15℃と最低10℃で栽培した場合には、最低10℃区でその後の花序の発達が促されることもわかった。これは、実験1において、最低10℃区で最も開花が早まったことを裏付けている。また、実験2において、10月以後も乾燥貯蔵を続けた球茎の一部が花序を形成し、多くは花序を形成しなかったが、花序の分化が確認されたものは、そうでないものと比べて芽が伸びている傾向にあり、花序の分化・発達は、芽の伸長とともに進行すると考えらる。

実験6の結果から、小花形成期頃までといった、花序の初期の発達段階においては日長の影響はなく、出らい～開花に至る後期の段階において長日条

件下でより促されることが明らかとなった。長日条件下で開花が早まる例は、春咲きグラジオラスでも報告されている（今西・金子 1977）。一般的な温度での栽培条件下において、花序の初期の発達段階にある時期（11～12月）は日照時間が徐々に短くなっている時期であり、後期の段階にある時期（2～3月）は日照が徐々に長くなっている時期であることから、この結果は、生育サイクルに適合した結果であるといえる。

以上の結果を促成栽培に応用すると、掘り上げ後球茎は温度なりゆきで乾燥貯蔵し、休眠の破れた8月に植え付けた後、10℃で6～8週間栽培し（低温処理）花序の形成を促し、その後最低10℃で栽培した場合には、12月下旬の開花が期待される。また、低温処理後の栽培を長日条件下で行った場合には、さらに開花の早まりが予想される。

摘　　要

メラスファエルラの生育開花に及ぼす温度と日長の影響について調査した。

本種の球茎は、掘り上げ時の6月頃には休眠状態にあり、8月上旬には休眠が破れていた。休眠打破には30℃程度の温度に一定期間遭遇することが必要と考えられた。

花序は、一般的な栽培条件下では11月中～下旬から形成が開始され、その形成と発達は10℃程度の温度により促されること、小花形成後、出らい～開花に至る後期の段階では長日条件により発達が促されることが明らかとなった。

謝　　辞

本報告をまとめるにあたり、大阪府立大学農学部の今西英雄教授には多大なご指導をいただきました。この場をかりて感謝の意を表します。

Summary

It was studied about the effects of temperature and day-length for growth and flowering on *Melasphaerula ramosa,* Iridaceae.

Corms were in dormancy in about June, when they were lifted. And the dormancies were broken on early in August. It was suggested that, for breaking dormancy, it was needed encountering with about 30℃ conditions during fixed period.

Formation of inflorescence started since mid or late November. Formation and development of inflorescence were urged by conditions of about 10℃. After making florets until blooming, development of inflorescence was urged by condition of long-day-length.

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ハナナズナの染色体観察報告*

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Report of chromosomal observation of *Berteroella maximowiczii* (Cruciferae)*

Genjiro Ishida[1)], Naoko Inoue[1)] and Yasukuni Watanabe[2)]

は　じ　め　に

ハナナズナ*Berteroella maximowiczii* (Palibin) O. E. Schulzは、アブラナ科の２年草で、本属ではこの１種のみが知られている。朝鮮半島および中国北部に自生し、日本では広島県、岡山県、長崎県のごく限られた地域で自生が報告されている（大井・北川　1983、広島県監修　1995）。しかし、近年は長崎県の対馬以外での自生が確認されておらず、広島県と岡山県ではハナナズナは絶滅したのではないかと考えられている（広島大学理学部附属宮島自然植物実験所・比婆科学学校振興会編　1997、環境庁自然保護局野生生物課編　2000）。どうしてハナナズナは広島県や岡山県、長崎県に不連続に分布するのか、最近になって絶滅が危惧されるようになったのは何故か、謎が多い植物である。

広島県佐伯郡大野町に在住の岩村　勝氏が1999年に長崎県対馬に自生するハナナズナの種子を入手し、これを渡辺泰邦が育成、開花させた１株を広島市植物公園で預かり（2000年９月）、種子および挿し芽による増殖を試みることとした。

このたび、当該株から得た挿し芽による増殖苗を用い、ハナナズナの染色体の観察を行ったので報告する。

材料および方法

挿し芽から発生した根の先端２、３㎜をとり、18℃の0.002モル８-オキシキノリン液に４時間浸漬したのち、５℃45％酢酸で10分間固定処理し、60℃の１N塩酸と45％酢酸の混液（２：１）で解離処理を行ったのち、２％アセトオルセイン溶液により押しつぶし法でプレパラートを作成した。

体細胞分裂中期染色体の動原体の位置による分類およびその表現は、Levan *et al.*（1964）に従った。

観　察　結　果

静止期核は直径約８μmで、濃染された約20個の染色中央粒が観察された。この静止期核の形態はTanaka（1971）の分類による複雑染色中央粒型に該当した。分裂期前期染色体は早期凝縮部が染色体の動原体基部寄りに観察された。

分裂期中期では２n＝30個の染色体数を算定した。本種の染色体数の報告は今回が始めてである。中期染色体は長さ2.2μmから1.0μmまでの範囲であり、勾配的に変異していた。30個すべての染色体は、腕比が1.2から1.7までの範囲にあり、中部動原体型であった。

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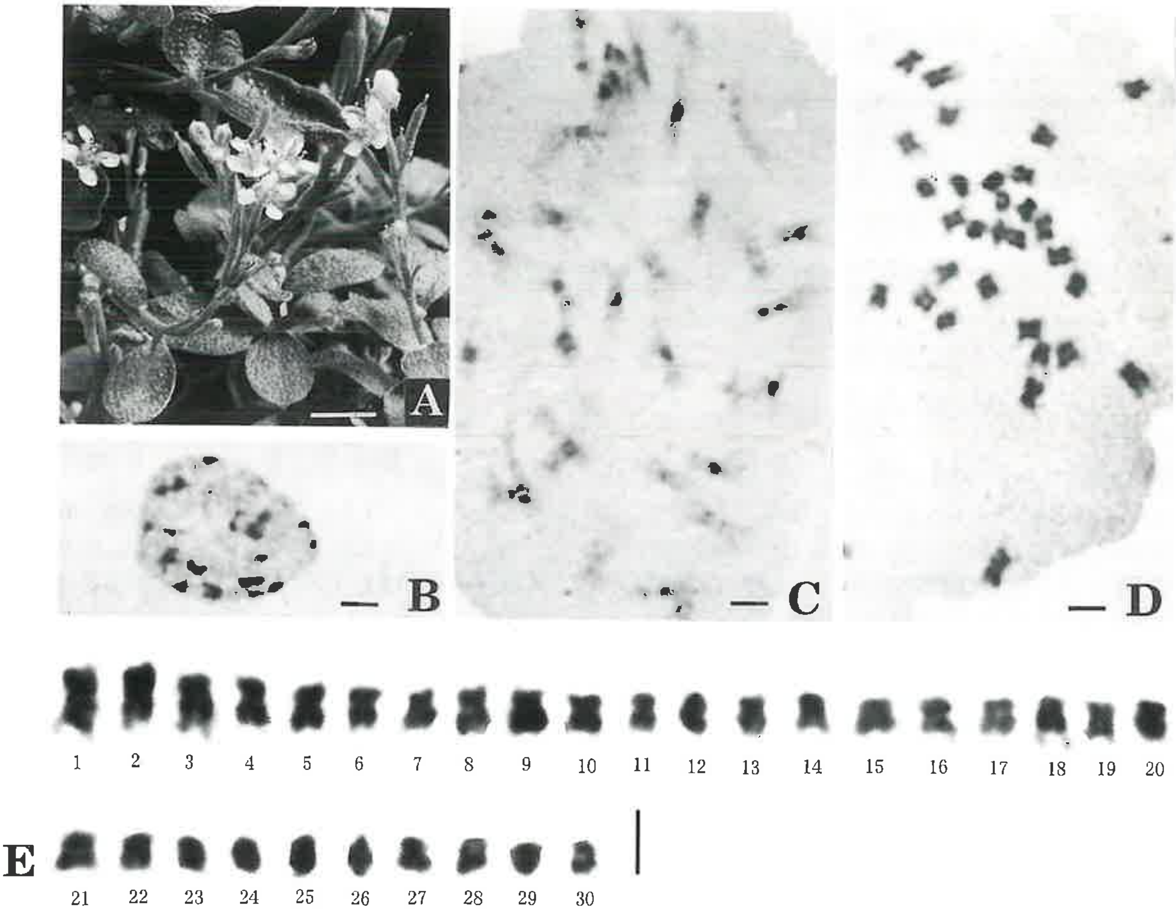

Fig.1 *Berteroella maximowiczii*, 2n=30. A, plant. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bars indicate 1cm in A and 2 μm in B-E.

要　約

ハナナズナの染色体を観察し、体細胞染色体数2n=30を算定した。これは本種の染色体数の初めての報告である。

Summary

Karyomorphological observations were carried out on *Berteroella maximowiczii* (Cruciferae).The chromosome number of *Berteroella maximowiczii* was found to be 2n=30, and was newly reported.

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Table 1. Measurements of somatic chromosomes of *Berteroella maximowiczii* at mitotic metaphase, 2n=30

Chromosome	Length(μ m)	Relative length	Arm ratio	Form
1	1.0+1.2=2.2	5.3	1.2	m
2	1.0+1.2=2.2	5.3	1.2	m
3	0.6+1.0=1.6	3.9	1.7	m
4	0.6+1.0=1.6	3.9	1.7	m
5	0.6+0.9=1.5	3.6	1.5	m
6	0.6+0.9=1.5	3.6	1.5	m
7	0.6+0.8=1.4	3.4	1.3	m
8	0.6+0.8=1.4	3.4	1.3	m
9	0.6+0.8=1.4	3.4	1.3	m
10	0.6+0.8=1.4	3.4	1.3	m
11	0.6+0.8=1.4	3.4	1.3	m
12	0.6+0.8=1.4	3.4	1.3	m
13	0.6+0.8=1.4	3.4	1.3	m
14	0.6+0.8=1.4	3.4	1.3	m
15	0.5+0.8=1.3	3.2	1.6	m
16	0.5+0.8=1.3	3.2	1.6	m
17	0.5+0.8=1.3	3.2	1.6	m
18	0.5+0.8=1.3	3.2	1.6	m
19	0.5+0.8=1.3	3.2	1.6	m
20	0.5+0.8=1.3	3.2	1.6	m
21	0.6+0.7=1.3	3.2	1.2	m
22	0.6+0.7=1.3	3.2	1.2	m
23	0.5+0.7=1.2	2.9	1.4	m
24	0.5+0.7=1.2	2.9	1.4	m
25	0.5+0.7=1.2	2.9	1.4	m
26	0.5+0.7=1.2	2.9	1.4	m
27	0.5+0.6=1.1	2.7	1.2	m
28	0.5+0.6=1.1	2.7	1.2	m
29	0.4+0.6=1.0	2.4	1.5	m
30	0.4+0.6=1.0	2.4	1.5	m

広島県フロラ覚書(1)

ニシキミゾホオズキ（新帰化植物）*

井上尚子[1)]・磯部　実[1)]・関　太郎[2)]

Memoranda for the Flora of Hiroshima Prefecture (1)

A new naturalized record of *Mimulus luteus* L.*

Naoko Inoue[1)], Minoru Isobe[1)] and Tarow Seki[2)]

はじめに

1997年（平成9年）8月22日の中国新聞（夕刊）に「広島県芸北町オオバミゾホオズキ群生　浜田の水元さん西日本で初めて発見」という見出しで次のような記事とともにカラー写真も掲載された。「広島県山県郡芸北町の山中で、本州中部以北にしか分布しないオオバミゾホオズキの群落が見つかった。西日本で発見されたのは初めて。浜田市清水町、調理師水元満夫さん（48）が、趣味の山野草の写真撮影をしていて偶然、見つけた。広島大学総合科学部の中越信和助教授（45）＝群集生態学＝に標本を判定してもらったところ、茎の出方、鋸歯、ガクの形、花の長さはオオバミゾホオズキの特徴を持っていた。しかし、ミゾホオズキの特徴である葉柄があり、葉の形は両者の中間の特徴をしていることが分かった。（以下略）」。

当時、関は『広島県の植物誌』（1997）の編集中であったが、新聞の写真を見て、それは日本産の植物ではなく帰化植物であろうと推察した。しかし生

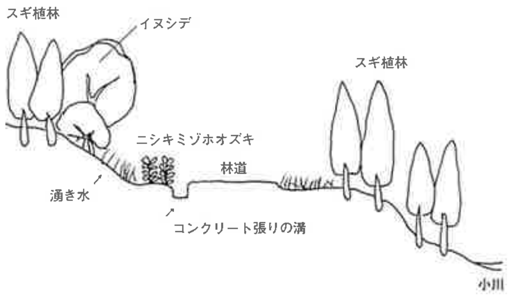

図1　ニシキミゾホウズキ生育地周辺の様子（その1）

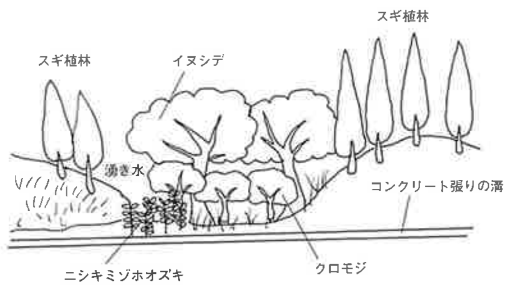

図2　ニシキミゾホウズキ生育地周辺の様子（その2）

*Contribution from The Hiroshima Botanical garden No.72.
1) The Hiroshima Botanical Garden.
2) Professor Emeritus of Hiroshima University.
Bulletin of The Hiroshima Botanical Garden, No.20: 49-52, 2001.

表　広島県山県郡荒神原（A地点）におけるニシキミゾホオズキ生育地の植生

海抜：745m.　斜面方位：S35° E.　調査日：2000年６月19日

調査面積：３×10m. 傾斜：30°.　調査者：井上尚子・磯部実・関太郎

階層	植物高(m)	植被率(%)	胸高直径(m)	優占種	出現種数
Ⅰ. 高木層	～8	20	10	イヌシデ	1
Ⅱ. 亜高木層	～4	40	5	クロモジ	3
Ⅲ. 低木層	～1.5	80	2	コナラ	15
Ⅳ. 草本層	～1	100	—	ハガワリトボシガラ・ススキ	24
Ⅴ. コケ層	～0.01	25	—	ムラサキミズゼニコケ	2

ニシキミゾホオズキの植物高は0.8～１m

Ⅰ. イヌシデ	2.2*	Ⅲ. ミヤマイボタ	+	Ⅳ. ヒカゲノカズラ	+.2
Ⅱ. クロモジ	1.1	(続き)スギ	+	(続き)コアジサイ（芽生え）	+.2
イタヤカエデ	1.1	ヒカサキ	+	シシガシラ	+
エゴノキ	1.1	コマユミ	+	ナガバモミジイチゴ	+
Ⅲ. コナラ	1.2	Ⅳ. ススキ	3.3	サルトリイバラ	+
ミヤマガマズミ	1.2	ハガワリトボシガラ	3.3	ノササゲ	+
コアジサイ	1.2	イヌトクガワザサ	2.3	ヒヨドリバナ	+
フジ	1.2	ニシキミゾホオズキ	2.3	コシアブラ（芽生え）	+
リョウブ	1.2	ワラビ	2.2	スギ（芽生え）	+
オトコヨウゾメ	1.1	ヤマブキショウマ	1.2	ヒノキ	+
アサガラ	1.1	シロヨメナ	1.2	ヤマハギ	+
ヌルデ	1.1	ヨシノアザミ	+.2	タチドコロ	+
クリ	1.1	オオバナニガナ	+.2	Ⅴ. ムラサキミズゼニゴケ	2.2
ヤマウルシ	1.1	ホドイモ	+.2	タニゴケ	+.2

*最初の数字は総合優占度、２番目は群度を示す。

調査区域外にチダケサシ、オトギリソウ、アカバナ、サワオトギリ、ヤマアゼスケ、オカトラノオ、アブラガヤ、ツボスミレ、ヘクソカズラ、フキなどが見られた。

育の現地を確認する機会がなく、『広島県植物誌』には掲載しないままになった。

昨年、中越教授の紹介で水元氏と連絡がつき、現地を案内していただけることになった。2000年６月19日に、水元氏とともに井上、磯部、関が現地を訪れ植生調査を行い、生品をゴマノハグサ科の専門家である山崎敬博士に送付して、同定をお願いした。その結果、これがニシキミゾホオズキ *Mimulus luteus* L.（ゴマノハグサ科）であることが分かったので、報告する。

生育地の状況

ニシキミゾホオズキは、広島県山県郡芸北町荒神原の林道のり面で、東斜面の涌き水が流れている場所に生えていた。うち１ヶ所（A地点とする。図１、２）では、周辺にアカバナやオトギリソウなど在来の湿生植物、道路のり面の緑化に用いられるハガワリトボシガラなどがみられた。他の１ヶ所（B地点）では、道路のり面に吹きつけられたハガワリトボシガラの群生の中、涌き水が出る所にニシキミゾホオズキが割り込むように生えていた。この地域は,広島県内では有数の多雪地帯であり、しばしば１m以上の積雪に覆われる。ニシキミゾホオズキ生育地の植生概況を表に示す。

ニシキミゾホオズキ*Mimulus luteus* L.（ゴマノハグサ科）について

ニシキミゾホオズキは、欧米諸国を中心として近縁の仲間ともども園芸植物として普及し、日本でも，一部で栽培されている（武田・塚本　1994）、チリ原産（Bailey et al. 1976, Phillip and Rix 1991, Huxley et al. 1997）の植物である。記載では花冠の黄色の

地色に赤色の斑点模様が目立つとあるが、芸北町で確認されたものは花冠喉部の小斑点が数ミリの大きさで、目立たないタイプであった。

今回調査した自生状況から判断すると、海外から輸入され林道ののり面の緑化用に使用されたハガワリトボシガラの種子にニシキミゾホオズキの種子が混入していた可能性が高い。おそらく、これが冷たい山水が常時流れている所で発芽し定着したと思われる。

日本では1983年に石川県で帰化が報告されている(小牧　1983)。山崎博士（私信）によれば、その後も1986年に宮城県，1991年に岡山県で野生状態のものが見つかっており、日本への帰化がほぼ定着していると見られるという。水元氏によると，ニシキミゾホオズキが広島県山県郡芸北町ではじめて確認されたのは1990年頃であり、それ以降2000年現在まで毎年開花している。広島県におけるニシキミゾホオズキの帰化は小規模ながらもほぼ定着したと思われる。

謝　　辞

ニシキミゾホオズキの発見者であり貴重な情報をご提供頂いた水元満夫氏、その水元氏を紹介して下さった広島大学総合科学部中越信和教授、同定をして下さった山崎敬博士に厚く御礼申し上げます。

証拠標本：1：50,000図幅「木都賀」。広島県山県郡芸北町荒神原、海抜780m、林道のり面、June 19, 2000, Coll. N. Inoue, M. Isobe & T. Seki. HBG12218, det. Takashi Yamazaki, June, 2000.

摘　　要

1990年に広島県山県郡芸北町において発見された*Mimulus*属の植物が、チリ原産の*Mimulus luteus* L.（ゴマノハグサ科）であることが確認された。広島県では初めての記録となる帰化植物である。

Summary

Mimulus luteus L.(Scrophulariaceae) was newly found as a naturalized plant in Geihoku-cho, Hiroshima Prefecture. Since 1990 this species is growing in a wet slope along the forestry road.

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図版．A：A地点の様子。B：B地点の様子。C：ニシキミゾホウズキ*Mimuls luteus* L.の草姿。D：ニシキミゾホオズキの花序。
A．Bで矢印で示したのが当該植物。

名　　　称	**広島市植物公園紀要第20号**
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