Karyomorphological Studies in *Cymbidium* and its Allied Genera, Orchidaceae

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ラン科シンビジウム属とその近縁属の核形態学的研究*

青 山 幹 男**

Introduction

Cymbidium, the Orchidaceae, which consists of approximately 50 species (Seth and Cribb 1981), is widely distributed in East to Southeast Asia from Japan, Korea, China to the Himalayas and down to Indonesia and Australia.

This genus is important as one of the cultivated orchids: Some terrestrial species naturally occurred in East Asia have been cultivated for many years and have been called "oriental orchids", while some semiepiphytic species in Southeast Asia have been sources of many ornamental orchids. According to Sander's lists of orchid hybrids (1987), a large number of interspecific hybrids within the genus has been produced by artificial hybridization for horticultural purposes. These hybridization results suggest that most of the species of the genus are closely related genetically to each other. However, some species have failed to synthesize any interspecific hybrid. Intergeneric hybrids between *Cymbidium* and its allied genera are extremely rare; only a few intergeneric hybrids have recently been reported (cf. Tanaka *et al.* 1987). Thus, genetical relationships between these species of *Cymbidium* and between *Cymbidium* and its allied genera involved interspecific and intergeneric artificial cross-failure have not yet been clarified.

Chromosome numbers of most of the species of *Cymbidium* have been reported previously (Hoffmann 1929, Mehlquist 1952, Wimber 1957, Tanaka 1965, Vij and Shekhar 1987, etc.). However, morphological study of somatic chromosomes has been poorly made in these reports.

In the present paper 30 species in *Cymbidium* and 28 species and one hybrid in 19 genera allied to *Cymbidium* are karyomorphologically dealt with in order to elucidate interrelationships and speciation.

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Materials and Methods

Thirty species in *Cymbidium* and 28 species and one hybrid in 19 genera allied to *Cymbidium* studied are listed in Table 1. These plant materials were cultivated in the Hiroshima Botanical Garden, Hiroshima City, Japan. Taxonomic treatments of the species of *Cymbidium* followed mostly Seth and Cribb (1981) and partly Maekawa (1971), while those of the allied genera followed mostly Bechtel *et al.* (1980) and some Holttum (1964), Hawkes (1965), Maekawa (1971), Garay and Sweet (1974), Lin (1977), De La Bathie (1981), Stewart *et al.* (1982) and Valmayor (1984). Systematic arrangement of the genus *Cymbidium* followed Seth and Cribb (1981), and that of the allied genera followed Dressler and Dodson (1960).

Somatic chromosomes were observed in meristematic cells of root tips in the taxa studied except for rhizome tips in a saprophytic taxon. Somatic chromosomes were stained and observed by the aceto-orcein squash method of Tanaka (1959) with slight modification: Growing root and rhizome tips were cut into small pieces 1– 2 mm long and immersed in 0.002M 8-hydroxyquinoline for five hours at 18°C. Then, they were fixed in 45% acetic acid for ten minutes at 5°C. The fixed materials were hydrolyzed in 2:1 mixture of 1N hydrochloric acid and 45% acetic acid for a minute at 60°C, and were stained in 1% aceto-orcein by the usual squash method.

Meiotic chromosomes were observed in pollen mother cells. Young anthers were fixed in 3:1 mixture of 99% ethanol and gracial acetic acid for an hour at 5°C. They were then stained in 1% aceto-orcein and squashed.

Chromosomes at resting stage were studied morphologically by their condensed figures. They were classified into the types defined and proposed by Tanaka (1971, 1980). During the course of investigation, the spherical or rod-shaped condensed bodies over 1 μm diameter were counted and expressed as chromocentric bodies. The chromosomes in the overall set at mitotic metaphase in each taxon were arranged in descending order in length and the numbers, 1, 2, 3, etc. represent the chromosomes, graded from longest to shortest. Lengths of the long and short arms of each chromosome were measured. Arm ratio was calculated by long arm length / short arm length, and expressed by the value of arm ratio of 1.0 to 1.7 as median, 1.8 to 3.0 as submedian, 3.1 to 7.0 as subterminal and over 7.1 as terminal according to Levan *et al.* (1964). The karyotype formulas were based on the chromosome lengths and positions of centromeres according to Tanaka (1980).

Table 1. Localities and chromosome numbers of the species of *Cymbidium* and its allied genera investigated

Species	Locality	No. of plant	Chromosome number (2n)
Subtribe Cymbidiinae			
Cymbidium macrorhizon	Japan	2	38
C. lancifolium	Japan, Formosa	9	38, 39
C. javanicum	Japan, Formosa, India, Malaysia	10	38, 43, 57
C. goeringii	Japan, China, Formosa	14	40
C. aliciae	Philippines	2	40
C. ensifolium	Japan, China, Formosa	6	40
C. faberi	Formosa	1	40
C. kanran	Japan, China	8	40, 41
C. sinense	Japan, Formosa	3	40
C. dayanum	Japan, Formosa	2	40
C. aloifolium	Thailand	2	40
C. finlaysonianum	Malaysia	2	40
C. floribundum	Japan, Formosa	3	40
C. canaliculatum	Australia	2	40
C. chloranthum	Indonesia	2	40
C. madidum	Australia	1	40
C. devonianum	India	1	40
C. elegans	India	1	40
C. mastersii	India	1	40
C. whiteae	India	1	40
C. iridioides	India, Nepal	3	40
C. hookerianum	India	1	40
C. insigne	Thailand	2	40
C. longifolium	India	1	40
C. lowianum	China, Thailand	3	40
C. tracyanum	Thailand	2	40
C. eburneum	India	1	40
C. parishii	Burma	1	40
C. erythrostylum	Viet-Num	1	40
C. tigrinum	Burma	3	40
Acriopsis javanica	Malaysia	1	40
Ansellia africana	Africa	2	42
A. gigantea	Africa	1	42
Cymbidiella flabellata	Madagascar	1	52
C. pardalina	Madagascar	1	52
Dipodium paludosum	Malaysia	1	46
Grammangis ellisii	Madagascar	1	54
Grammatophyllum scriptum	Philippines	1	40
G. speciosum	Malaysia	1	40
G. stapeliiflorum	Indonesia	1	40

Table 1. (continued)

Subtribe Cyrtopodiinae			
Cyrtopodium andersonii	Brazil	1	46
C. punctatum	Brazil	2	46
Eulophia guineensis	Africa	1	54
E. paniculata	Madagascar	1	60
E. petersii	Africa	1	48
E. streptopetala	Africa	1	42
Eulophiella Rolfei	Hybrid	2	52
E. roempleriana	Madagascar	1	52
Galeandra baueri	Panama	1	56
G. devoniana	Brazil	1	56
Geodorum densiflorum	Japan	1	54
Graphorkis scripta	Madagascar	1	54
Oecoclades saundersiana	Africa	2	58
Cremastra appendiculata	Japan	1	48
Oreorchis patens	Japan	1	48
Warrea costaricensis	Panama	1	52
Subtribe Collabiinae			
Chrysoglossum ornatum	Formosa	1	36
Subtribe Maxillariinae			
Eriopsis biloba	Peru	1	40
Subtribe Grobynae			
Grobya amherstiae	Brazil	1	54

Observations

Karyomorphological observations were made in chromosomes at resting stage and at mitotic prophase and metaphase stages in all the taxa studied. Meiotic chromosomes at metaphase I were observed in two taxa. The results of the observations in 30 taxa in the genus *Cymbidium* and 29 taxa in its allied 19 genera were described as follows:

I. Genus *Cymbidium*

1. *Cymbidium macrorhizon* Lindl., (Japanese name: Mayaran), 2n=38, Tables 1 and 2, Fig. 1.

Two saprophytic plants were obtained from Tokushima Prefecture, Japan. The leafless stem arisen from the rhizome was about 20 cm long and had 2–5 flowers. Flowers were 3.5 cm wide across. Petals and sepals were white in color with purple veins. Lips were also white in color with few purple spots.

Two plants showed commonly the chromosome number of 2n=38 at mitotic metaphase. Their meiotic chromosomes formed the normal configulations of the bivalents; $2n=19_{\mathrm{II}}$. These results confirmed the previous reports of Mehra and Sehgal (1978) and Vij and Shekhar (1987) for the species, and Aoyama and Tanaka (1988) for a synonym of this species, *Cymbidium nipponicum*.

The chromosomes at resting stage were observed as numerous chromomeric granules, fibrous threads and chromatin blocks scattered throughout the nucleus. The chromatin blocks were round-, rod- and string-shaped with rough surface and varied from 0.5–2.5 μm diameter. Among them average ten chromocentric bodies over 1.0 μm diameter per nucleus were counted. The chromosome features at resting stage were intermediate between those of the simple chromocenter type and the complex chromocenter type according to Tanaka's classification (1971).

The chromosomes at mitotic prophase formed several early condensed segments located in the interstitial regions of both arms. The segregated condensed-segments of each chromosome were later joined to each other following the progress of cell division. Late condensed segments were observed in the proximal and distal regions of the chromosomes.

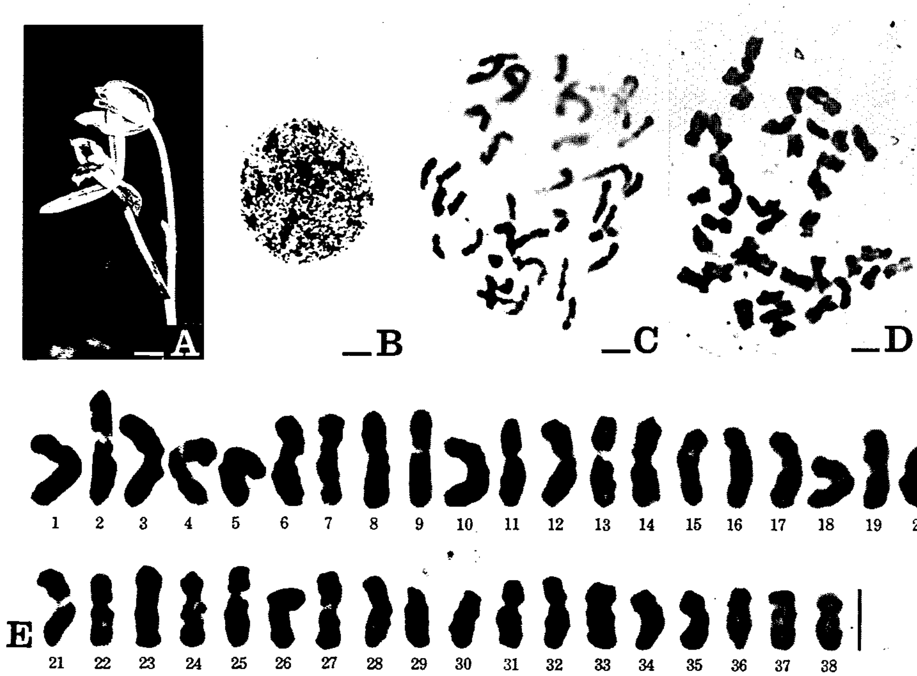

Fig. 1. *Cymbidium macrorhizon*, 2n = 38. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 8 mm in A and 3 μm in B–E.

The chromosomes of 2n = 38 at mitotic metaphase showed a gradual decrease in length from the longest (5.4 μm) to the shortest (2.7 μm) chromosomes. Among the 38 chromosomes in the complement, 28 were median centromeric with arm ratios between 1.0 and 1.7. The other ten chromosomes (Nos. 15–16, 23–24, 29–30, 35–38) were submedian with arm ratios between 1.8 and 3.0. Two chromosomes (Nos. 29–30) had secondary constrictions on the distal regions of their short arms, and formed small satellites.

According to the definition of the karyotype proposed by Tanaka (1980), this species showed a homogeneous and gradual karyotype due to the gradual decrease of the chromosome lengths in the alignment from the longest to the shortest chromosomes and a symmetric karyotype due to the low arm ratios.

2. *Cymbidium lancifolium* Hook., (Japanese name : Nagiran), 2n = 38 and 39, Tables 1 and 3, Fig. 2.

Nine plants were obtained from Japan and Formosa. Pseudobulbs were fusiform and

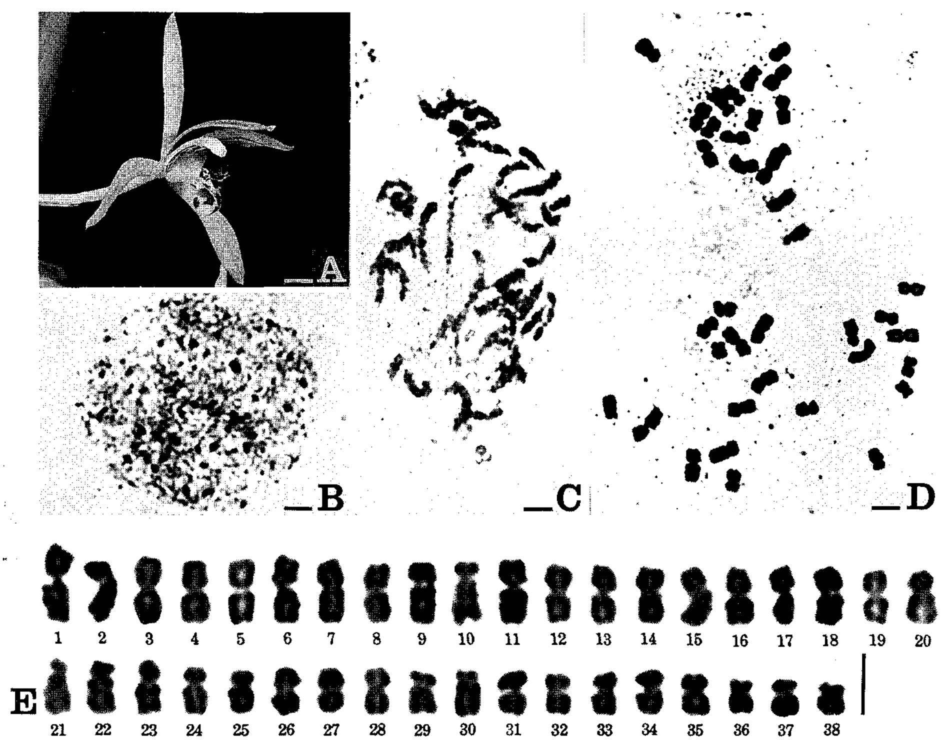

Fig. 2. *Cymbidium lancifolium*, 2n = 38. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 5 mm in A and 3 μm in B–E.

had two or three lanceolate leaves near the apex. Leaf margins were slightly dentate near the pointed end. Flowers were white and 3.5 cm across.

Eight plants showed the chromosome number of 2n=38, while the other plant showed the chromosome number of 2n=39. However, these cytotypes displayed no difference in external morphology. The chromosome number of 2n=38 confirmed Tanaka (1965), Mehra and Sehgal (1978), Aoyama and Tanaka (1988), and that of 2n=39 confirmed Aoyama and Tanaka (1988).

1) Karyotype of the plants with 2n=38 chromosomes

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. However, the chromatin blocks were slightly smaller in size than those of *Cym. macrorhizon*. The chromosome features at resting stage were intermediate between those of the simple chromocenter type and the complex chromocenter type.

The chromosomes at mitotic metaphase exhibited a gradual decrease in length from the longest (3.2 μm) to the shortest (1.3 μm) chromosomes. Among the 38 chromosomes, 31 were median centromeric with arm ratios between 1.0 and 1.7. Another five chromosomes (Nos. 2, 9, 22, 29–30) were submedian with arm ratios between 1.8 and 3.0, and the other two chromosomes (Nos. 10, 20) were subterminal with the arm ratios of 3.3 and 4.7.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

2) Karyotype of the plant with 2n=39 chromosomes

One plant with 2n=39 chromosomes was obtained from Kouzushima Is., Tokyo Prefecture, Japan. Chromosome morphology at resting stage and mitotic prophase were similar to those of the 2n=38 plants. Chromosome morphology at mitotic metaphase was also similar to that of 2n=38 plants. However, aneuploidal extra chromosome was not determined.

3. *Cymbidium javanicum* Blume, (Japanese name: Akizakinagiran), 2n=38, 43 and 57, Tables 1, 4, 5 and 6, Figs. 3, 4 and 5,

Since this species was quite similar to the above species, Seth and Cribb (1981) treated this species into synonym for *Cym. lancifolium,* although Maekawa (1971) separated this species from *Cym. lancifolium* with respect to its smooth leaf margin. Three plants from India and Malaysia set white flowers, while seven plants from Japan and Formosa set pale green flowers.

Eight plants showed the chromosome number of 2n=38, a plant 2n=43 and the other plant 2n=57. A plant with 2n=38 chromosomes displayed normal meiotic chromosome configulation at metaphase I with the complete set of bivalents, $2n=19_{II}$. These results support Aoyama and Tanaka (1988).

1) Karyotype of the plants with 2n=38 chromosomes

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage were intermediate between those of the simple chromocenter type and the complex chromocenter type.

The 2n = 38 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.8 μm) to the shortest (1.6 μm) chromosomes. Among the 38 chromosomes, 31 were median centromeric with arm ratios between 1.0 and 1.7. Another three chromosomes (Nos. 27, 37–38) were submedian with arm ratios between 1.8 and 2.5, and the other four chromosomes (Nos. 21–22, 28–29) were subterminal with arm ratios between 3.2 and 4.5.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

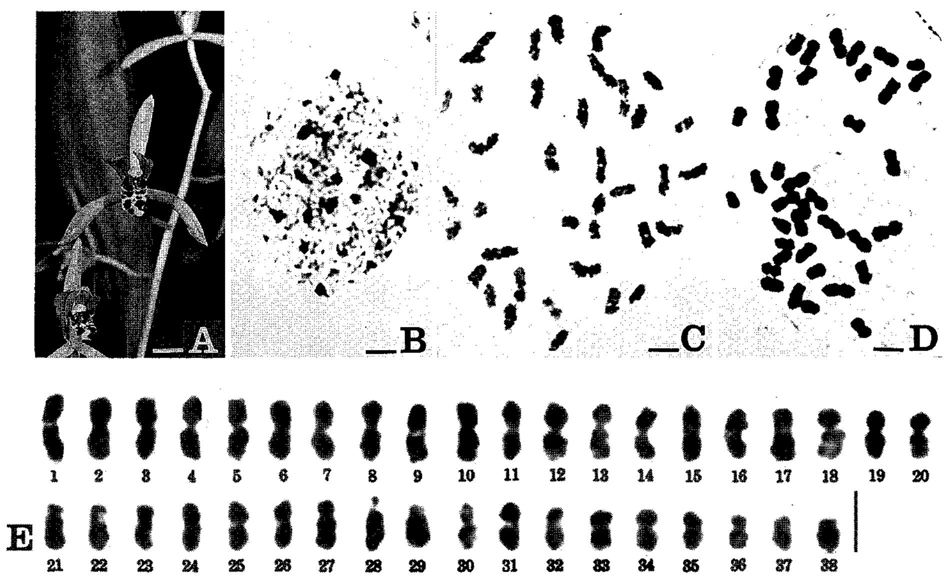

Fig. 3. *Cymbidium javanicum*, 2n=38. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 7 mm in A and 3 μm in B–E.

2) Karyotype of the plant with 2n=43 chromosomes

One plant with 2n=43 chromosomes was obtained from Tsushima Is., Nagasaki Prefecture, Japan.

Among the 2n=43 chromosomes, five small chromosomes formed darkly stained chromocentric bodies at resting stage, and condensed earlier at mitotic prophase than the other chromosomes.

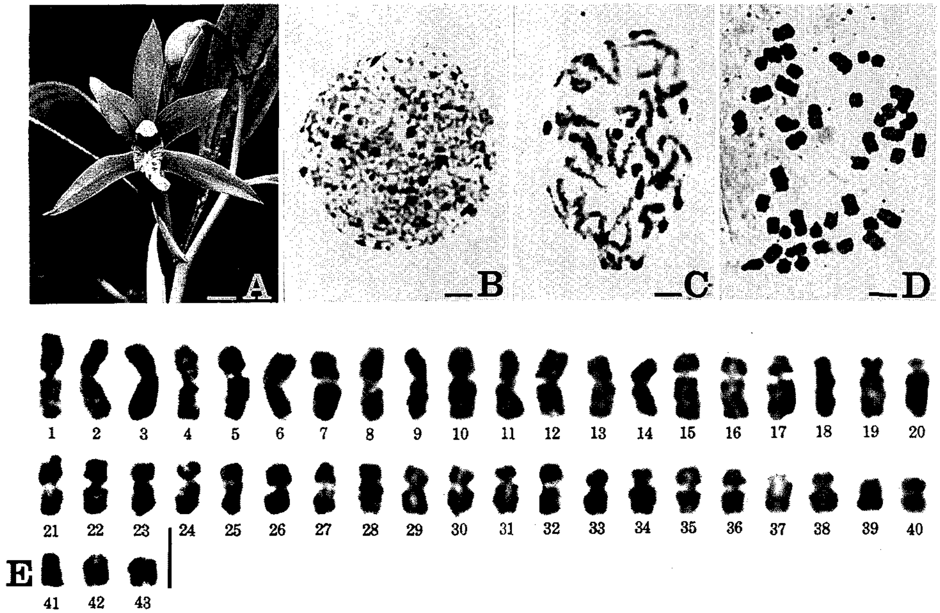

Fig. 4. *Cymbidium javanicum*, 2n=43. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 5 mm in A and 3 μm in B–E.

The 2n = 43 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (4.0 μm) to the shortest (1.4 μm) chromosomes. Among the 43 chromosomes, 30 were median centromeric with arm ratios between 1.0 and 1.7. Another six chromosomes (Nos. 15–17, 32–33, 38) were submedian with arm ratios between 2.1 and 2.8, and the other four chromosomes (Nos. 18–20, 37) were subterminal with arm ratios between 3.3 and 4.2. Three small chromosomes (Nos. 41–43) were one-armed and consisted of only long arms, and thus, were terminal centromeric.

These observations suggested that the five small chromosomes were regarded as B-chromosomes and the chromosome number of this plant could be 2n=43=38+5B.

3) Karyotype of the plant with 2n=57 chromosomes

One plant with 2n=57 chromosomes was obtained from Yakushima Is., Kagoshima Prefecture, Japan.

At resting stage, about 14 chromocentric bodies was counted and were larger than those of 2n=38 plants. Chromosome morphology at mitotic prophase was similar to that of 2n=38 plants.

In the 2n = 57 chromosomes at mitotic metaphase a gradual decrease in length was observed from the longest (6.0 μm) to the shortest (2.4 μm) chromosomes. Among the 57 chromosomes, 41 were median centromeric with arm ratios between 1.0 and 1.7. Another

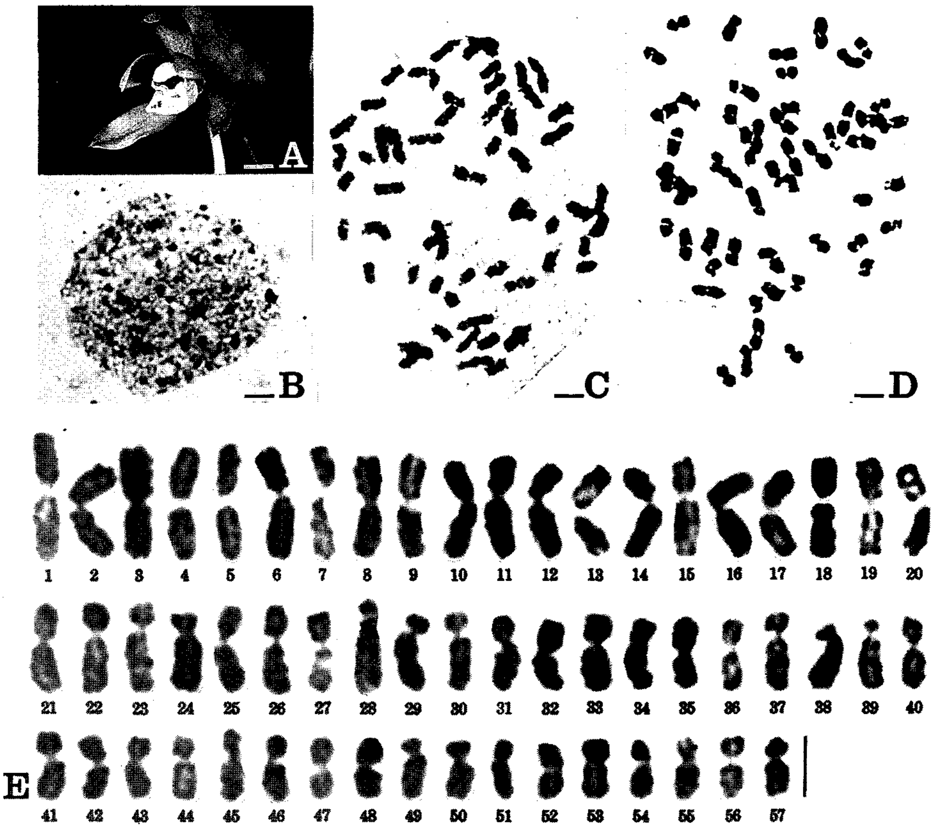

Fig. 5. *Cymbidium javanicum*, 2n=57. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 6 mm in A and 3 μm in B–E.

12 chromosomes (Nos. 22–24, 27, 30, 37, 43–45, 49–51) were submedian with arm ratios between 1.8 and 2.8, and the other four chromosomes (Nos. 28–29, 38–39) were subterminal with arm ratios between 3.6 and 4.3. Three medium- and small-sized chromosomes were somewhat similar to each other with respect to their arm ratios.

Thus, this plant was considered to be triploid with the basic chromosome number of x=19.

4. *Cymbidium goeringii* (Rchb. f.) Rchb. f., (Japanese name: Syunran), 2n =40, Tables 1 and 7, Fig. 6.

Among the 14 plants studied, seven were obtained from Japan, five plants including three cultivated forms from China and two plants from Formosa. The plants from Japan set green flowers and the petal apices were obtuse. The plants from China had green flowers and the petal apices were acute. In contrast, the plants from Formosa had pale brown flowers and the petal apices were acute.

The choromosome number of 14 plants was counted to be 2n=40 at mitotic metaphase and confirmed Tanaka and Kamemoto (1981).

The chromosomes at resting stage were observed as chromomeric granules, fibrous threads and chromatin blocks scattered throughout the nucleus. Chromatin blocks were irregular sizes and forms and varied from 0.5–3.5 μm in diameter. They were larger in size and number than those of *Cym. macrorhizon.* Among them, approximately 30 chromocentric bodies over 1.0 μm diameter were counted every nucleus. The chromosome features at resting stage were of the complex chromocenter type.

Chromosome morphology at mitotic prophase differed from that of *Cym. macrorhizon*, since many early condensed segments were formed in the interstitial regions of both arms of the chromosomes of this species.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (4.9 μm) to the shortest (2.0 μm) chromosomes. Among the 40 chromosomes, 33 were median centromeric with arm ratios between 1.0 and 1.7. Another five chromosomes (Nos. 15–16, 23, 29–30) were submedian with arm ratios between 1.8 and 2.3, and the other two chromosomes (Nos. 25–26) were subterminal with the arm ratio of 3.8.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

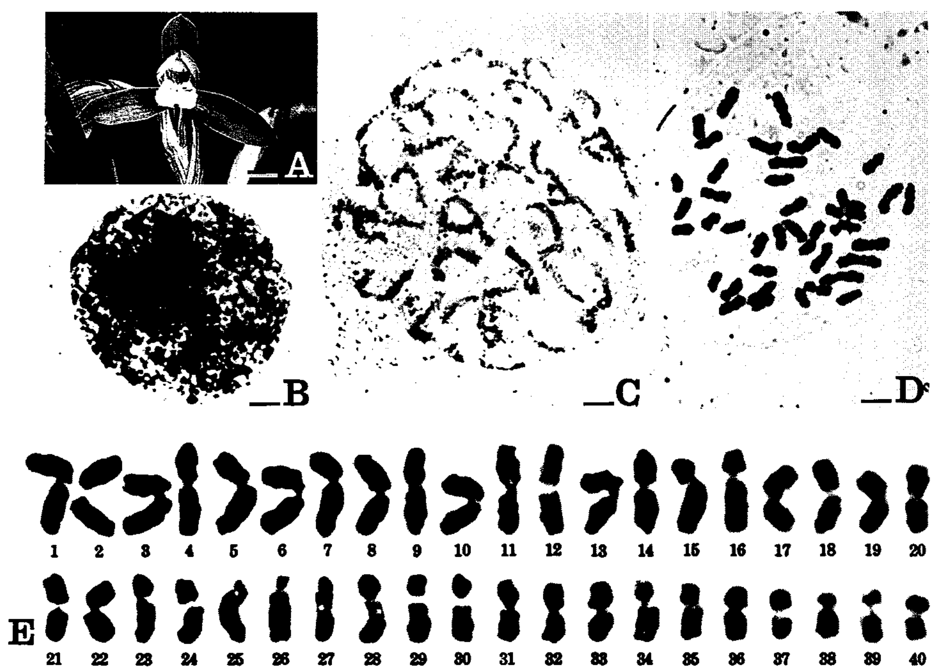

Fig. 6. *Cymbidium goeringii*, 2n=40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 5 mm in A and 3 μm in B–E.

5. *Cymbidium aliciae* Quisumbing, 2n=40, Tables 1 and 8, Fig. 7.

Two plants were obtained from the Philippines. Their leaves were 30 cm long and almost erect. Inflorescences were erect with 5–8 flowers. Flowers were white in color and 4 cm wide across.

The chromosome number of 2n=40 observed in the two plants of *Cym. aliciae* was recorded here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.5 μm) to the shortest (1.2 μm) chromosomes. Among the 40 chromosomes, 26 were median centromeric with arm ratios between 1.0 and 1.7. Another ten chromosomes (Nos. 1–2, 9–10, 31–32, 37–40) were submedian with arm ratios between 1.8 and 2.6, and the other four chromosomes (Nos. 15–16, 21–22) were subterminal with arm ratios between 3.6 and 6.0.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

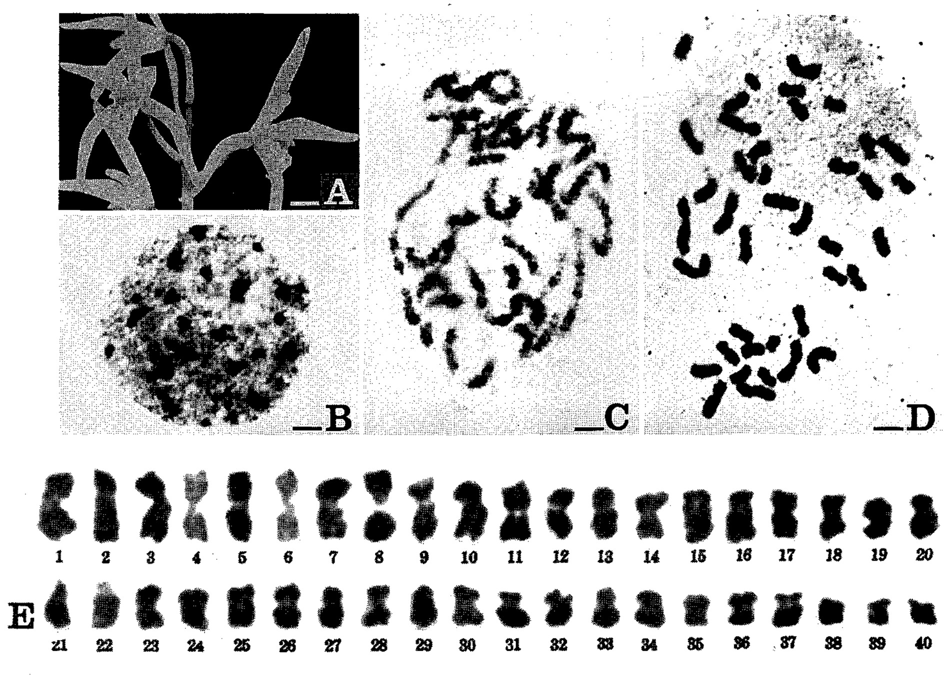

Fig. 7. *Cymbidium aliciae*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 5 mm in A and 3 μm in B–E.

6. *Cymbidium ensifolium* (L.) Sw., (Japanese name: Surugaran), 2n = 40, Tables 1 and 9, Fig. 8.

Six plants including a cultivated form were obtained from Japan, China and Formosa. Leaves were thin and smooth margin. Leaf size was about 50 cm long and 1.0 cm wide. Inflorescences were erect with 3–5 flowers. Flowers varied in color creamy white, yellowish green and pale brown and were 4 cm wide across.

The chromosome number of the six plants was 2n = 40 at mitotic metaphase, and confirmed Tanaka and Kamemoto (1981).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym.goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

In the 2n = 40 chromosomes at mitotic metaphase a gradual decrease in length from the longest (5.1 μm) to the shortest (2.2 μm) chromosomes was observed. Among the 40 chromosomes, 34 were median centromereic with arm ratios between 1.0 and 1.7. The other six chromosomes (Nos. 10, 19–20, 24, 32, 37) were submedian with arm ratios between 1.9 and 2.7.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

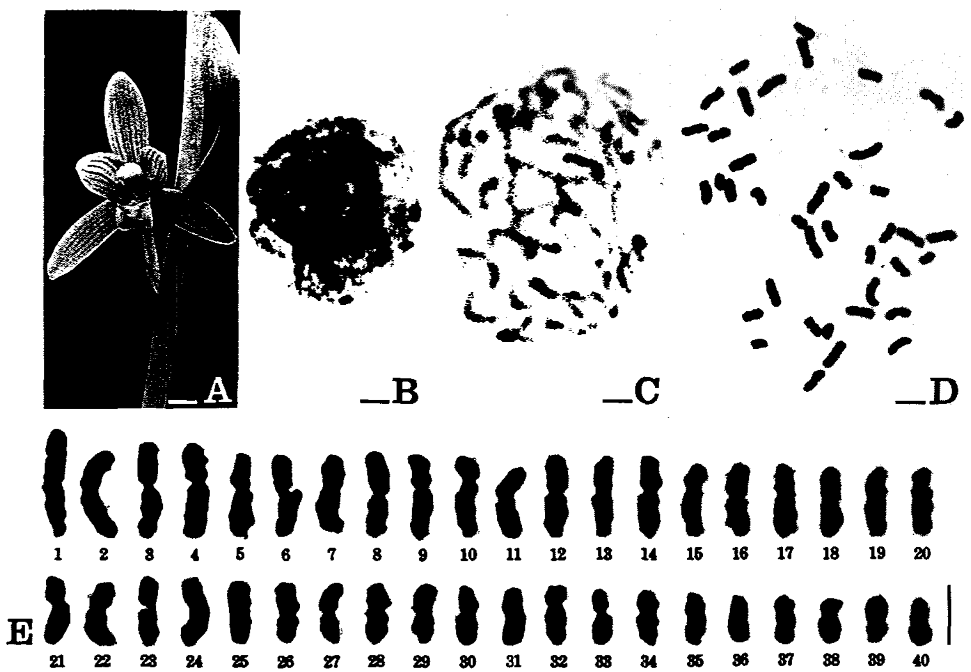

Fig. 8. *Cymbidium ensifolium*, 2n=40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 6 mm in A and 3 μm in B–E.

7. *Cymbidium faberi* Rolfe, (Japanese name: Ikkei-kyuka), 2n=40, Tables 1 and 10, Fig. 9.

A plant was obtained from Formosa. Leaves were thin and slightly serrate near the tips. Leaf sizes were about 50 cm long and 0.8 cm wide. Inflorescences were erect with 5–8 flowers. Flowers were green in color and were 4 cm wide across.

The chromosome number of the plant was counted to be 2n=40 at mitotic metaphase, which confirmed the previous reports by Tanaka (1964) and Löve and Löve (1964).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

A gradual decrease in length was observed from the longest (6.6 μm) to the shortest (2.3 μm) chromosomes in the 2n = 40 chromosomes at mitotic metaphase. Among the 40 chromosomes, 28 were median centromeric with arm ratios between 1.0 and 1.6. Another ten chromosomes (Nos. 13–14, 24, 32–33, 35, 37–40) were submedian with arm ratios between 1.8 and 2.7, while the other two chromosomes (Nos. 28–29) were subterminal with the arm ratios of 4.3 and 3.5.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

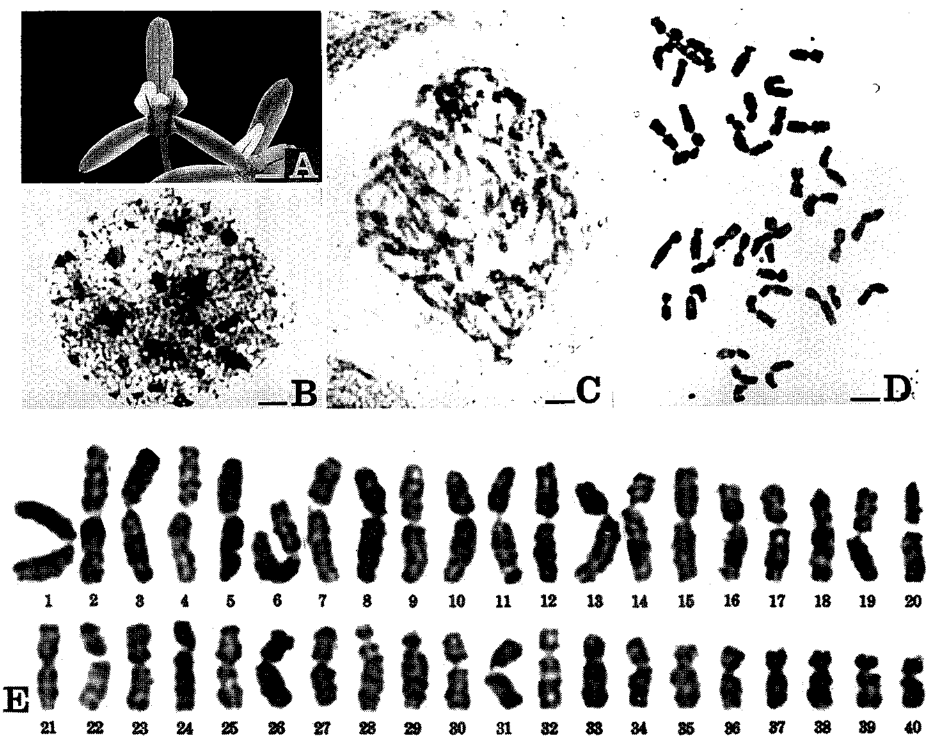

Fig. 9. *Cymbidium faberi*, 2n=40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 5 mm in A and 3 μm in B–E.

8. *Cymbidium kanran* Makino, (Japanese name: Kanran), 2n = 40 and 41, Tables 1, 11 and 12, Figs. 10 and 11.

Eight plants were obtained from Japan, China and Formosa. Leaves were narrow and grassy or sometimes up to 50 cm long and 0.6 cm wide. Inflorescences were erect with 4–7 flowers. Flowers were green, pale brown or reddish brown in color and were 5 cm wide across. Sepals and petals were narrow and acuminate.

The chromosome numbers of the materials were counted as follows; 2n = 40 in seven plants and 2n = 41 in one plant. No difference in external morphology was found between these two cytotypes. The chromosome number of 2n = 40 confirmed Wimber (1957), Tanaka (1965), and so on, while that of 2n = 41 was a first report to this species.

1) Karyotype of the plants with 2n = 40 chromosomes

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (4.9 μm) to the shortest (2.0 μm) chromosomes. Among the 40 chromo-

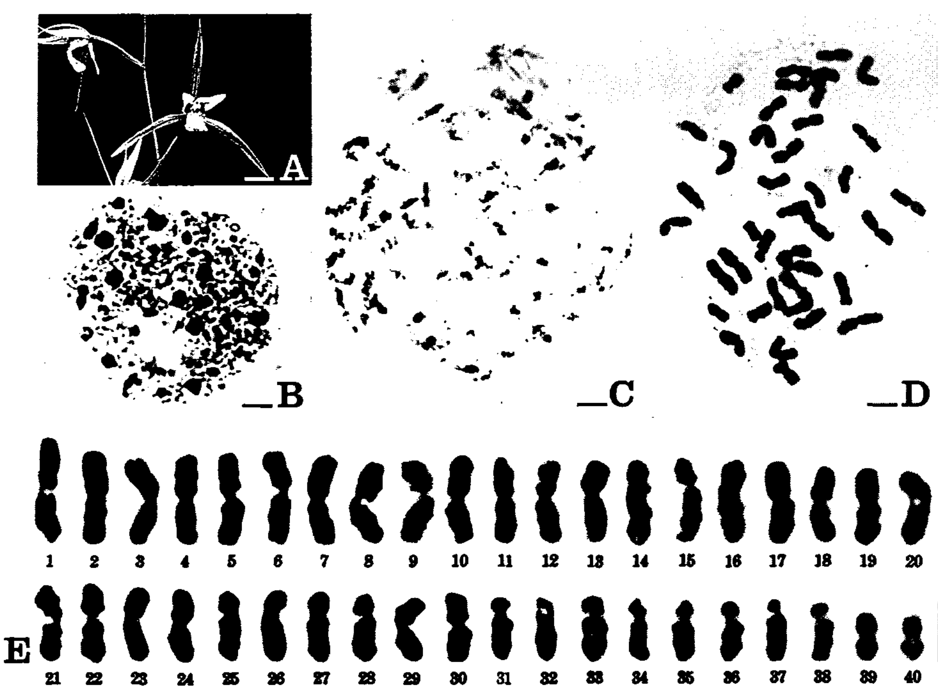

Fig. 10. *Cymbidium kanran*, 2n = 40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 4 mm in A and 3 μm in B–E.

somes, 26 were median centromeric with arm ratios between 1.0 and 1.6. Another 12 chromosomes (Nos. 15–16, 25–28, 31–36) were submedian with arm ratios between 1.9 and 2.8, and the other two chromosomes (Nos. 37–38) were subterminal with the arm ratios of 3.3 and 4.2.

This species showed a homogeneous and gradual karyotype due to relative chromosome length and a symmetric karyotype due to the low arm ratios.

2) Karyotype of the plant with 2n=41 chromosomes

One plant with 2n=41 chromosomes was obtained from Kouchi Prefecture, Japan.

The chromosomes at resting stage were similar in morphology to those of the 2n = 40 plants of this species. The chromosomes of the mitotic prophase complement formed several early- condensed segments located in interstitial regions of both arms except for one chromosome condensed extremely earlier than the others.

In the 2n = 41 chromosomes at mitotic metaphase a gradual decrease in length was observed from the longest (4.7 μm) to the shortest (2.0 μm) chromosomes. This complement consisted of 40 two-armed chromosomes and a one-armed chromosome. Among the

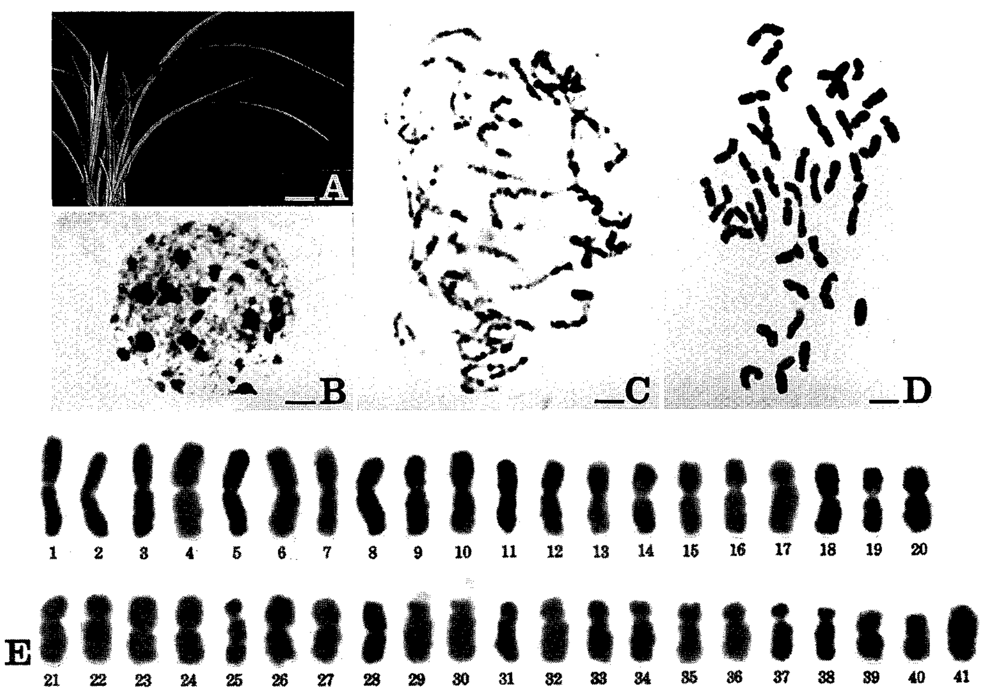

Fig. 11. *Cymbidium kanran*, 2n = 41. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 30 mm in A and 3 μm in B–E.

41 chromosomes, 27 were median centromeric with arm ratios between 1.0 and 1.5. Another 11 chromosomes (Nos. 17, 22, 25, 29–36) were submedian with arm ratios between 1.8 and 2.8, and two chromosomes (Nos. 37–38), which had minute secondary constrictions on the distal regions of their short arms, were subterminal with the arm ratio of 3.8. The last one-armed chromosome (No. 41) was terminal.

These obeservations suggest that the one-armed chromosome could be a supernumerary chromosome and thus, the chromosome number of this plant could be 2n=41=40+1 supernumerary chromosome.

9. ***Cymbidium sinense*** **(Andr.) Willd, (Japanese name: Housairan), 2n=40, Tables 1 and 13, Fig. 12.**

Three plants including a cultivated form were obtained from Japan and Formosa. Leaves were waxy and rather broad with entire margins, about 50 cm long and 1.5 cm wide. Inflorescences were erect with 5–7 flowers. Flowers were 4 cm wide across and were reddish brown in color except for yellowish green in the cultivated form.

The chromosome number of the materials was 2n=40 at mitotic metaphase, which confirmed the previous reports (cf. Tanaka and Kamemoto 1981).

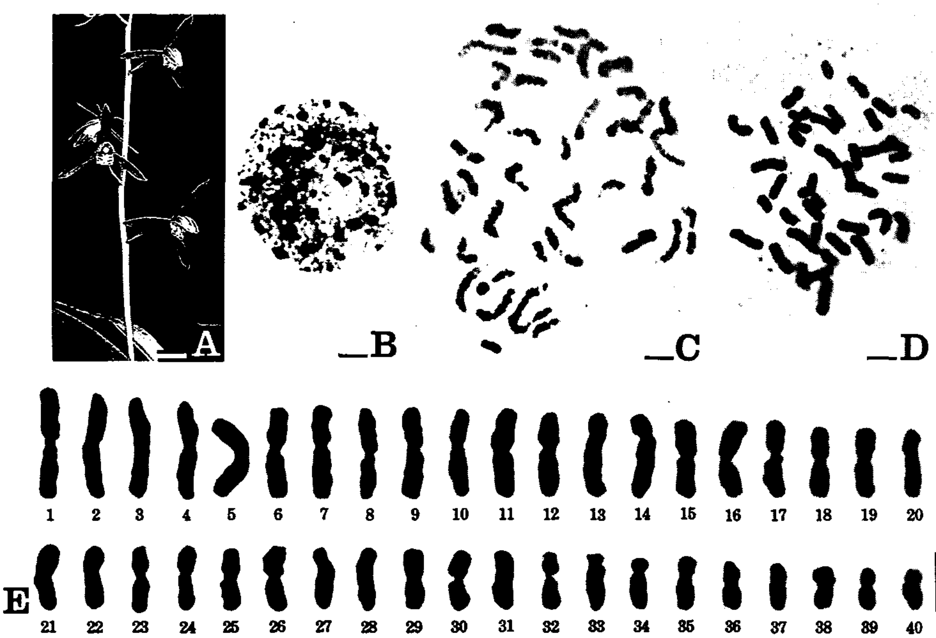

Fig. 12. *Cymbidium sinense*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 14 mm in A and 3 μm in B–E.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (5.3 μm) to the shortest (1.9 μm) chromosomes. Among the 40 chromosomes, 33 were median centromeric with arm ratios between 1.0 and 1.6. Another three chromosomes (Nos. 14, 34, 40) were submedian with arm ratios between 2.1 and 2.7, and the other four chromosomes (Nos. 13, 27–28, 33) were subterminal with arm ratios between 3.1 to 6.5.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

10. *Cymbidium dayanum* Rchb. f., (Japanese name: Hekkaran), 2n = 40, Tables 1 and 14, Fig. 13.

Two plants were obtained from Japan and Formosa. Leaves were linear, coriaceous, about 60 cm long and 1.2 cm wide. Inflorescences were pendulous with approximately ten flowers. Flowers were 4 cm wid across and white colored with deep purple stripes.

The chromosome number of the materials was 2n = 40 at mitotic metaphase, which confirmed Mutsuura and Nakahira (1960) and Tanaka (1965).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

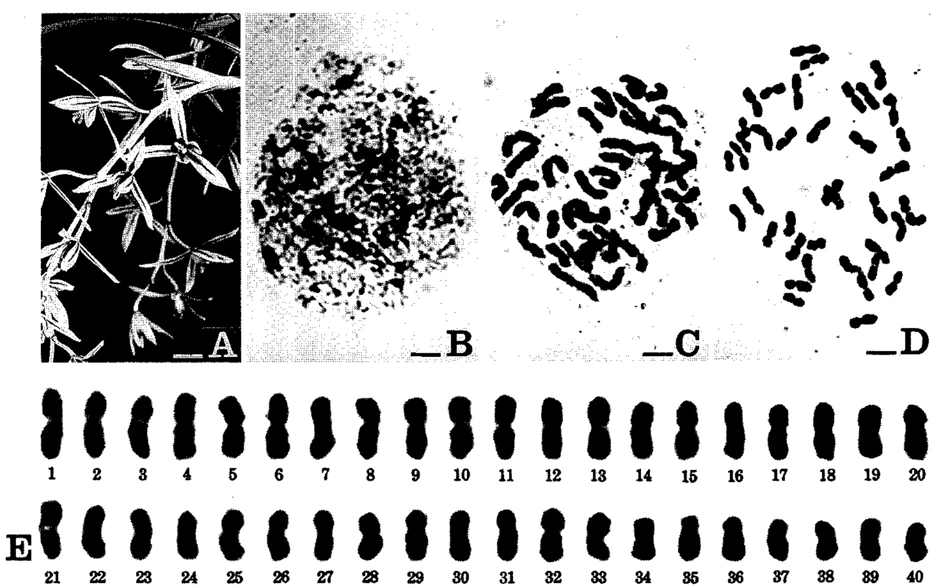

Fig. 13. *Cymbidium dayanum*, 2n = 40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 13 mm in A and 3 μm in B–E.

The 2n = 40 chromosomes at mitotic metaphase displayed a degradation in the chromosome alignment from the longest (3.3 μm) to the shortest (1.6 μm) chromosomes. Among the 40 chromosomes, 38 were median centromeric with arm ratios between 1.0 and 1.7, and the other two chromosomes (Nos. 35–36) were submedian with the arm ratio of 2.3.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

11. *Cymbidium aloifolium* (L.) Sw., 2n=40, Tables 1 and 15, Fig. 14.

Two plants were obtained from Thailand. Leaves were thick, fleshy, about 40 cm long and 2.0 cm wide. Inflorescences were pendulous with many flowers. Flowers were 4 cm wide across and creamy white-colored with purple-colored, broad stripes on their petals and sepals and numerous purple-colored veins on their lips.

The chromosome number of the materials was counted to be 2n = 40 at mitotic metaphase, which confirmed the previous reports of this species and its synonym *Cym. pendulum* (cf. Tanaka and Kamemoto 1981).

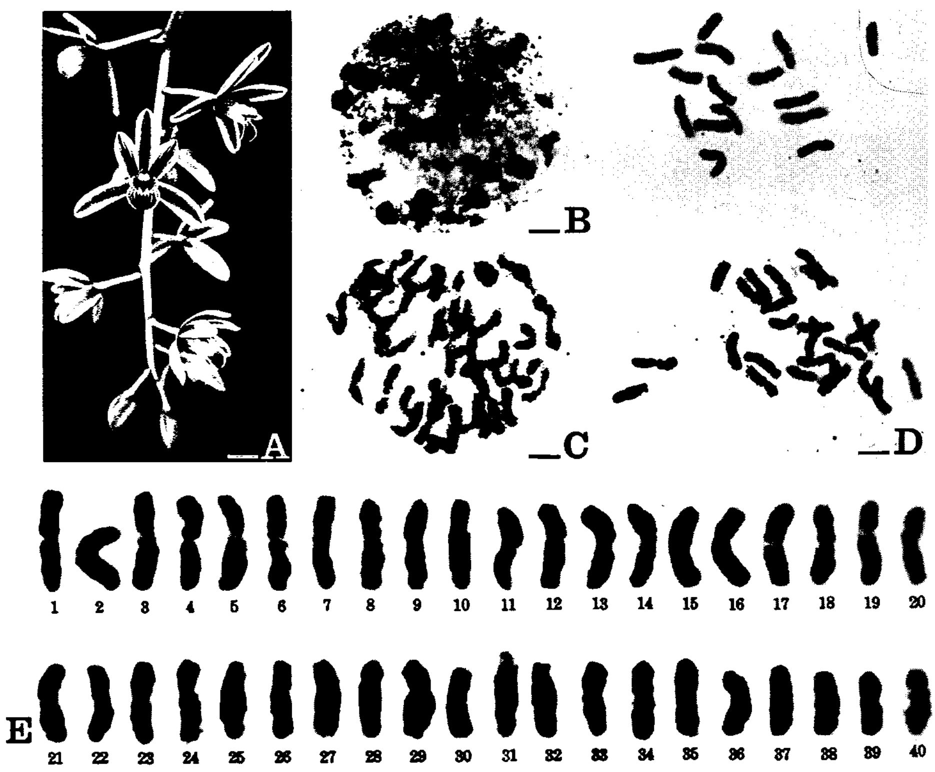

Fig. 14. *Cymbidium aloifolium*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 9 mm in A and 3 μm in B–E.

The chromosomes at resting stage formed larger condensed blocks than those of *Cym. goeringii*. Approximately 35 chromocentric bodies were counted in each nucleus. The chromosomes at mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features were of the complex chromocenter type.

The 2n=40 chromosomes at mitotic metaphase performed an alignment of gradual decrease in length from the longest (4.9 μm) to the shortest (2.9 μm) chromosomes. Among the 40 chromosomes, 32 were median centromeric with arm ratios between 1.0 and 1.7, and six (Nos. 10, 27–28, 36–37, 40) were submedian with arm ratios between 1.9 and 2.3. The other two chromosomes (Nos. 31–32) were subterminal with the arm ratios of 8.5 and 7.7. Two chromosomes (Nos. 31–32) had secondary constrictions on the distal regions of their short arms, and formed small satellites.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

12. *Cymbidium finlaysonianum* Wall., ex Lindl., 2n=40, Tables 1 and 16, Fig. 15.

Two plants were obtained from Malaysia. Leaves were thick, fleshy, about 50 cm long and 3.0 cm wide. Inflorescences were pendulous with well-spaced about ten flowers. Flowers were 4 cm wide across and dull yellow in color. Lip was white with a crescent-shaped purple patch.

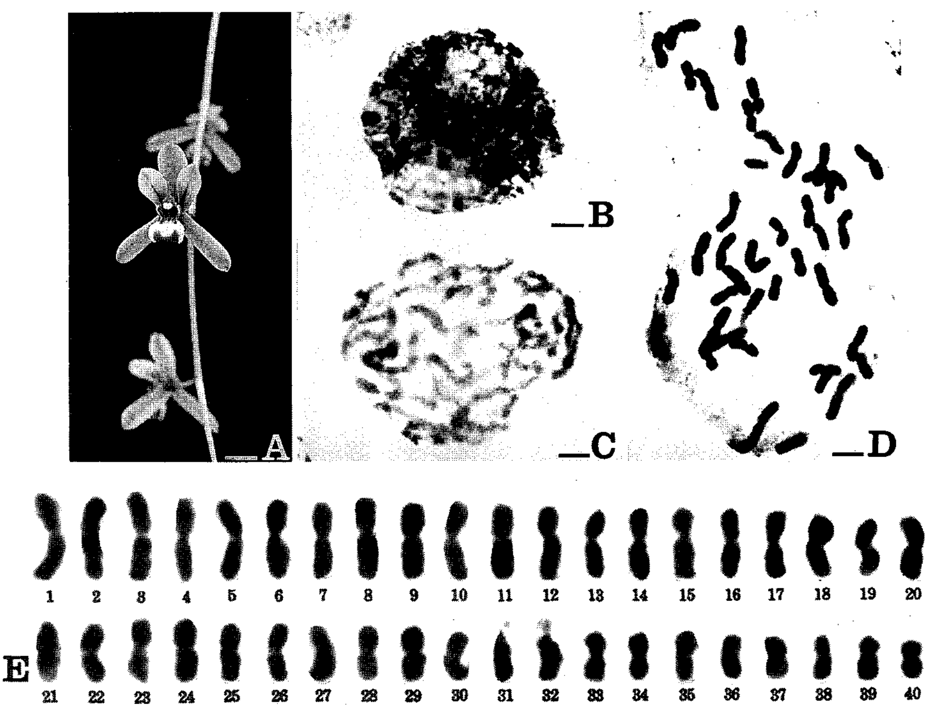

Fig. 15. *Cymbidium finlaysonianum*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 10 mm in A and 3 μm in B–E.

The chromosome number of the materials was 2n=40 at mitotic metaphase, which confirmed Mehlquist (1952), Pancho (1965), and so on.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. aloifolium* described above. The chromosome features at resting stage were of the complex chromocenter type.

A gradual decrease in length from the longest (4.3 μm) to the shortest (1.9 μm) chromosomes was observed in the 2n=40 chromosome complement. Among the 40 chromosomes, 38 were median centromeric with arm ratios between 1.0 and 1.5. The other two chromosomes (Nos. 31–32) were subterminal with the arm ratios of 3.8 and 3.6. These two chromosomes had secondary constrictions on the distal regions of their short arms, and formed small satellites.

Thus, this species showed a homogeneous and gradual karyotype and a symmetric karyotype.

13. *Cymbidium floribundum* Lindl., (Japanese name: Kinryouhen), 2n=40, Tables 1 and 17, Fig. 16.

Three plants including a cultivated form were obtained from Japan and Formosa. Leaves were coriaceous, linear, about 30 cm long and 1.0 cm wide. Inflorescences were sub-

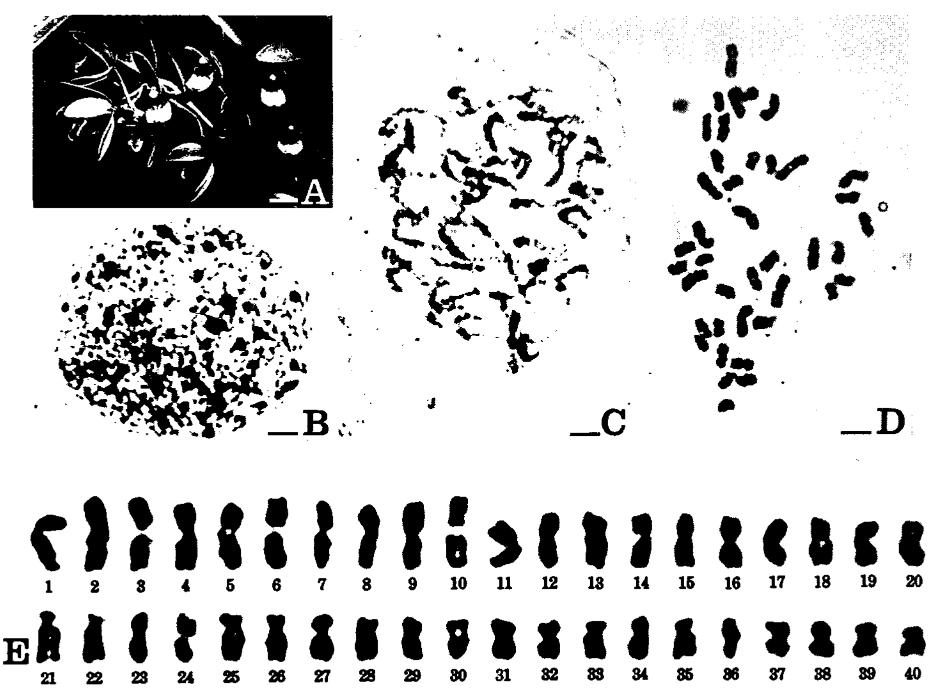

Fig. 16. *Cymbidium floribundum*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 9 mm in A and 3 μm in B–E.

erect with many flowers. Flowers were 2.5 cm wide across and reddish brown or pale yellowish brown in color.

The chromosome number of the materials was 2n=40 at mitotic metaphase, which confirmed the previous report in the species by Aoyama *et al.* (1986) and that in *Cym. pumilum*, a synonim of this species by Tanaka and Kamemoto (1981).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.8 μm) to the shortest (1.4 μm) chromosomes. Among the 40 chromosomes, 31 were median centromeric with arm ratios between 1.0 and 1.6, and six (Nos. 26, 33–36, 40) were submedian with arm ratios between 1.8 and 2.8. The other three chromosomes (Nos. 21–22, 25) were subterminal with arm ratios between 3.6 and 3.8.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

14. *Cymbidium canaliculatum* R. Br., 2n=40, Tables 1 and 18, Fig. 17.

Two plants were obtained from Australia. Leaves were thick, graish green in color, about 20 cm long and 1.5 cm wide. Inflorescences were suberect with many flowers. Flowers

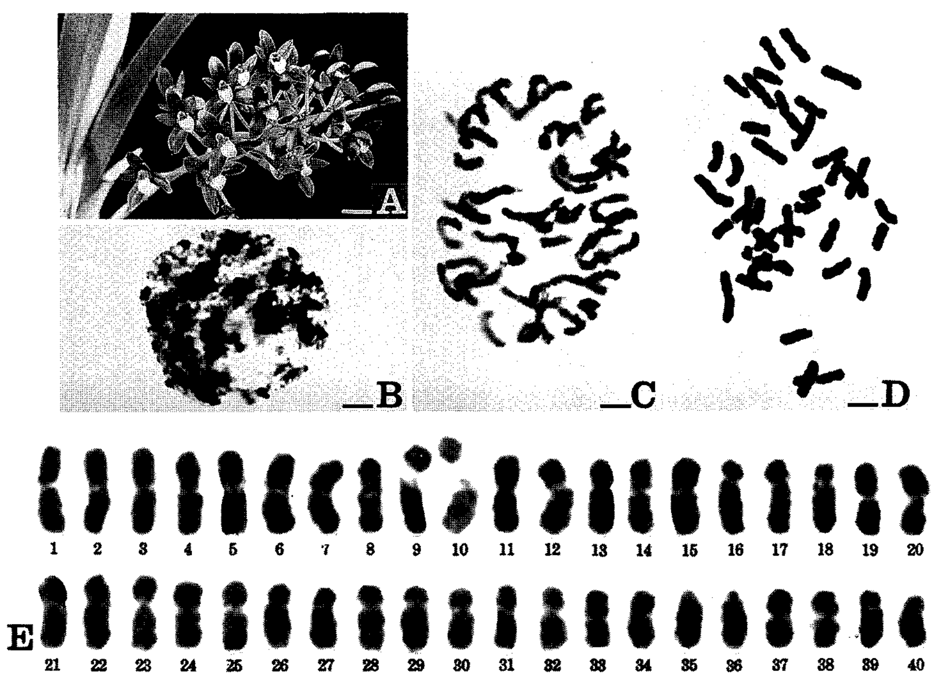

Fig. 17. *Cymbidium canaliculatum*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 11 mm in A and 3 μm in B–E.

were 2.5 cm wide across and dull red in color.

The chromosome number of the two plants of *Cym. canaliculatum* was 2n=40 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (4.1 μm) to the shortest (2.6 μm) chromosomes. Among the 40 chromosomes, 29 were median centromeric with arm ratios between 1.0 and 1.7, and eight (Nos. 17–18, 26–27, 29–30, 39–40) were submedian with arm ratios between 1.8 and 2.5. The other three chromosomes (Nos. 16, 35–36) were subterminal with arm ratios between 3.4 and 6.0. Two medium-sized chromosomes (Nos. 9–10) had secondary constrictions on the proximal regions of their short arms. Their satellites were both 1.0 μm in length.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype. Two satellited chromosomes (Nos. 9–10) characterized the karyotype of *Cym. canaliculatum*.

15. *Cymbidium chloranthum* Lindl., 2n=40, Tables 1 and 19, Fig. 18.

Two plants were obtained from Indonesia. Leaves were erect, about 30 cm long and 2.0 cm wide. Inflorescences were also erect with 15–20 flowers. Flowers were 3 cm wide across

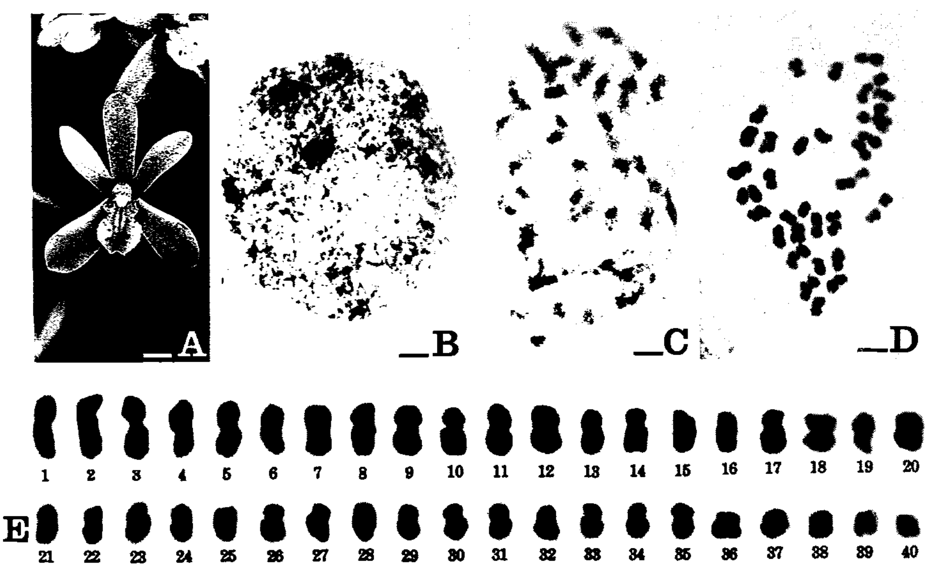

Fig. 18. *Cymbidium chloranthum*, 2n=40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 6 mm in A and 3 μm in B–E.

and yellowish green in color with small purple spots on their lips.

The chromosome number of the two plants of the species was 2n=40 at mitotic metaphase, which was recorded here for the first time.

The chromosomes at resting stage formed many smaller condensed blocks than those of *Cym. goeringii*. Approximately 15 chromocentric bodies over 1.0 μm in diameter were counted in each nucleus. The chromosomes at mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase displayed a gradual decrease in length from the longest (3.0 μm) to the shortest (1.0 μm) chromosomes. Among the 40 chromosomes, 35 were median centromeric with arm raios between 1.0 and 1.7, while the other five chromosomes (Nos. 15–16, 23, 27–28) were submedian with arm ratios between 1.8 and 2.4.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

16. *Cymbidium madidum* Lindl., 2n=40, Tables 1 and 20, Fig. 19.

One plant was obtained from Australia. Pseudobulbs were conical-ovoid and large upto 10 cm long. Leaves were suberect, about 70 cm long 3.0 cm wide. Inflorescences were nutant with 30–50 flowers. Flowers were yellowish brown in color and 2.5 cm wide across.

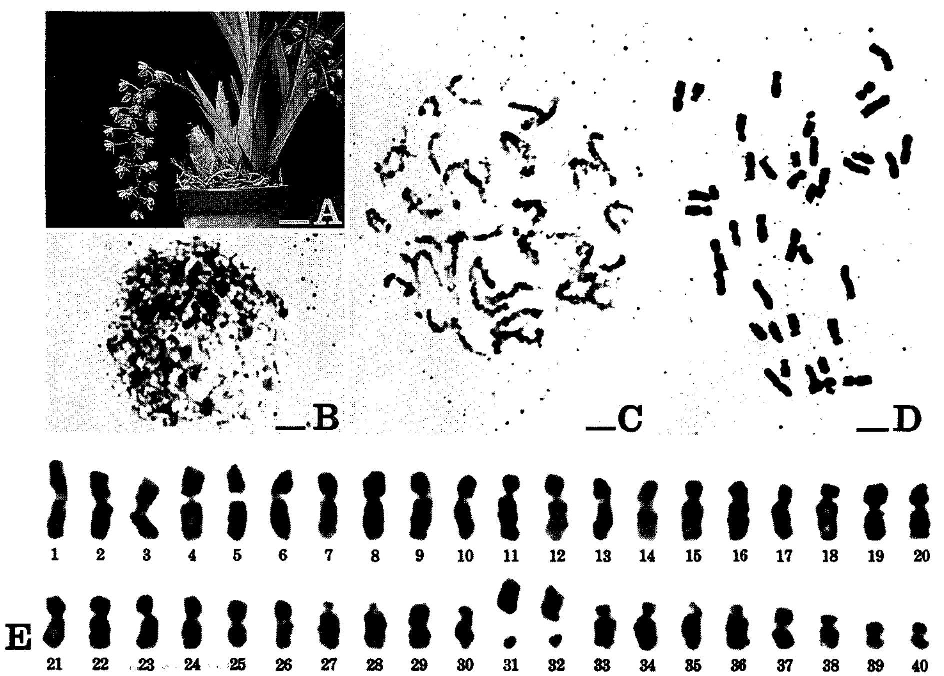

Fig. 19. *Cymbidium madidum*, 2n=40. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 50 mm in A and 3 μm in B–E.

The chromosome number of the plant was 2n=40 at mitotic metaphase, which was reported here for the first time for this species.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

In the 2n = 40 chromosomes at mitotic metaphase a gradual decrease in length was observed from the longest (3.8 μm) to the shortest (1.3 μm) chromosomes. Among the 40 chromosomes, 26 were median centromeric with arm ratios between 1.0 and 1.7, and seven chromosomes (Nos. 9, 11–12, 15–17, 38) were submedian with arm ratios between 1.8 and 2.2. The other seven chromosomes (Nos. 18, 27–28, 33–36) were subterminal with arm ratios between 3.2 and 6.3. Two small-sized chromosomes (Nos. 31–32) had secondary constrictions on the interstitial regions of their long arms. The satellites were both 0.5 μm long.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype. Two satellited chromosomes (Nos. 31–32) characterized the karyotype of this species *Cym. madidum*.

17. *Cymbidium devonianum* Paxt., 2n=40, Tables 1 and 21, Fig. 20.

One plant was obtained from India. Leaves were broadly, coriaceous, upto 30 cm long and 3.0 cm wide. Inflorescences were pendulous with many flowers. Flowers were reddish brown in color and about 3 cm wide across.

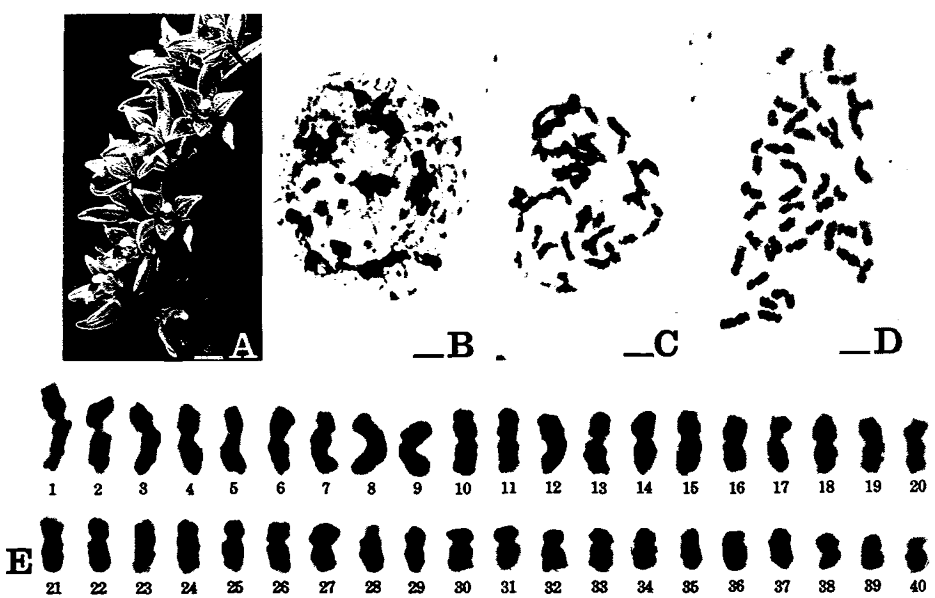

Fig. 20. *Cymbidium devonianum*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 12 mm in A and 3 μm in B–E.

The chromosome number of the plant was counted to be 2n=40 at mitotic metaphase, which confirmed Wimber (1957), Vij *et al.* (1982) and Vij and Shekhar (1987).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (4.2 μm) to the shortest (1.5 μm) chromosomes. Among the 40 chromosomes, 33 were median centromeric with arm ratios between 1.0 and 1.7, and four chromosomes (Nos. 7, 35–36, 40) were submedian with arm ratios between 2.0 and 3.0. The other three chromosomes (Nos. 8, 23–24) were subterminal with arm ratios between 4.0 and 4.3.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

18. *Cymbidium elegans* Lindl., 2n=40, Tables 1 and 22, Fig. 21.

One plant was obtained from India. Pseudobulbs were slender and covered by leaf-bases. Leaves were linear, about 50 cm long and 1.5 cm wide. Fifteen–20 leaves were formed on each pseudobulb. Inflorescences were suberect with several flowers. Flowers were pale yellow in color, and did not fully open.

The chromosome number of the plant was 2n = 40 at mitotic metaphase, which confirmed Vij and Shekhar (1987).

Each resting nucleus contained about 20 chromocentric bodies which were smaller than

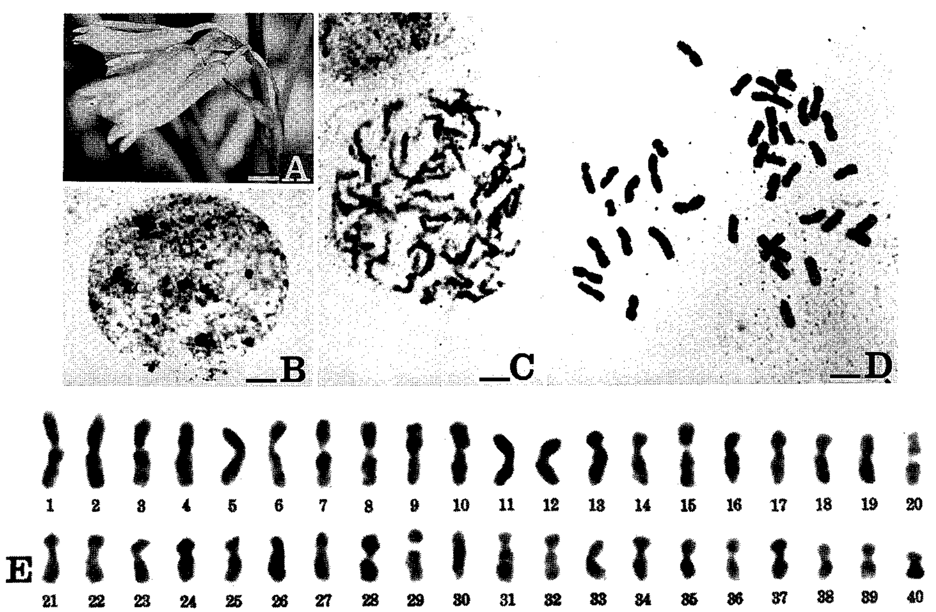

Fig. 21. *Cymbidium elegans*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 8 mm in A and 3 μm in B–E.

those of *Cym. goeringii*. The other morphological characteristics of the chromosomes at resting stage and mitotic prophase were similar to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

In the 2n = 40 chromosomes at mitotic metaphase a gradual decrease in length was observed from the longest (3.6 μm) to the shortest (1.3 μm) chromosomes. Among the 40 chromosomes, 31 were median centromeric with arm ratios between 1.0 and 1.7. Another eight chromosomes (Nos. 13–14, 21–22, 29–30, 32, 34) were submedian with arm ratios between 1.8 and 2.3, and the other one chromosome (No. 31) was subterminal with the arm ratio of 3.2.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

19. *Cymbidium mastersii* Griff., ex Lindl., 2n=40, Tables 1 and 23, Fig. 22.

One plant was obtained from India. Pseudobulbs were slender and covered by leaf-bases. Each pseudobulb had about 25 leaves. Leaves were linear, coriaceous, about 50 cm long and 1.5 cm wide. The plant has not bloomed yet in our Garden.

The chromosome number of the plant was counted to be 2n = 40 at mitotic metaphase and confirmed the previous reports (Wimber 1957, Vij and Shekhar 1987).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromocentric bodies were smaller than those of *Cym. goeringii*. The chromosome features at resting stage were of the complex chro-

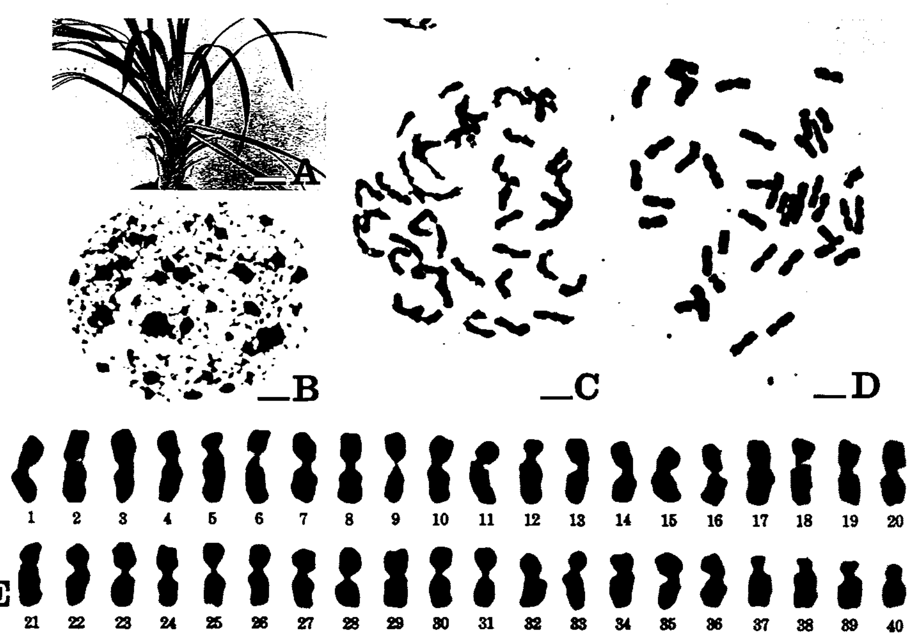

Fig. 22. *Cymbidium mastersii*, 2n = 40. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 40 mm in A and 3 μm in B–E.

mocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.4 μm) to the shortest (2.2 μm) chromosomes. Among the 40 chromosomes, 29 were median centromeric with arm ratios between 1.0 and 1.7, while the other 11 chromosomes (Nos.5–6, 11–12, 17–18, 33–34, 37–39) were submedian with arm ratios between 1.8 and 3.0.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

20. *Cymbidium whiteae* King et Pantling, 2n=40, Tables 1 and 24, Fig. 23.

One plant was obtained from India. Pseudobulbs were slender and had about 25 leaves. Leaves were linear, upto 50 cm long and 1.5 cm wide. Inflorescences were nutant with about ten flowers. Flowers were creamy green in color with numerous small reddish brown spots, and did not fully open.

The chromosome number of the plant was counted to be 2n =40 at mitotic metaphase and confirmed Wimber (1957) and Vij and Shekhar (1987).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.2 μm) to the shortest (1.4 μm) chromosomes. Among the 40 chromosomes, 32 were median centromeric with arm ratios between 1.0 and 1.5. Another six chromosomes (Nos. 9–10, 22–24, 40) were submedian with the arm ratio of 1.8, and the

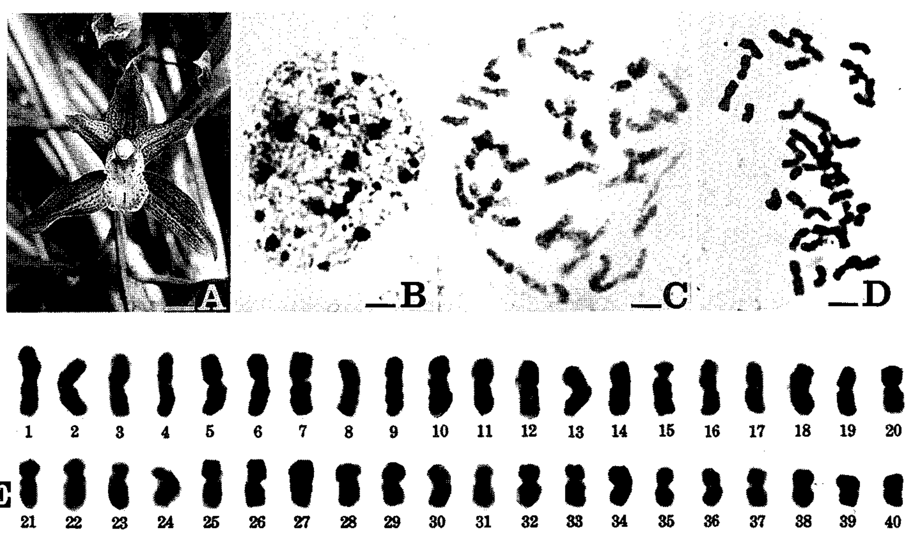

Fig. 23. *Cymbidium whiteae*, 2n=40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 9 mm in A and 3 μm in B–E.

other two chromosomes (Nos. 15–16) were subterminal with the arm ratio of 3.1.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

21. *Cymbidium iridioides* D. Don, 2n=40, Tables 1 and 25, Fig. 24.

Three plants were obtained from India and Nepal. Leaves were linear, coriaceous, upto 50 cm long and 2.5 cm wide. Inflorescences were suberect with about ten flowers. Flowers were 6 cm wide across and yellowish green in color with numerous dull red veins.

The chromosome number of the plants was 2n = 40 at mitotic metaphase, which confirmed the previous reports in a synonym of this species, *Cym. giganteum* (cf. Tanaka and Kamemoto 1981).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase displayed a gradual decrease in length from the longest (4.4 μm) to the shortest (2.5 μm) chromosomes. Among the 40 chromosomes, 29 were median centromeric with arm ratios between 1.0 and 1.7. Another seven chromosomes (Nos. 15–16, 33–36, 39) were submedian with arm ratios between 1.8 and 2.6, and the other four chromosomes (Nos. 9–10, 37–38) were subterminal with arm ratios

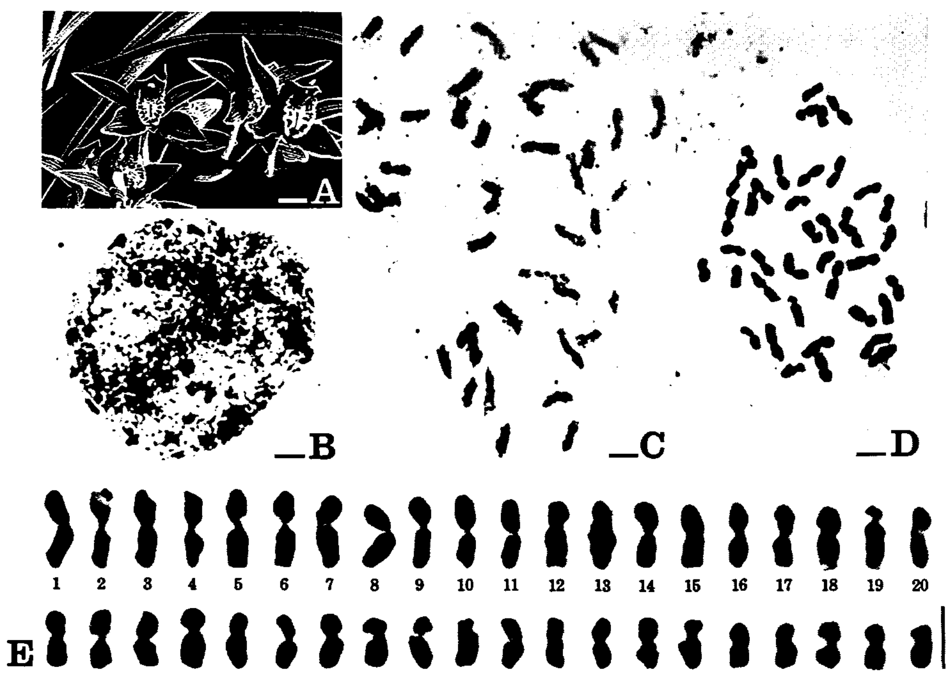

Fig. 24. *Cymbidium iridioides*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 12 mm in A and 3 μm in B–E.

between 3.5 and 6.5.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

22. *Cymbidium hookerianum* Rchb. f., 2n=40, Tables 1 and 26, Fig. 25.

One plant was obtained from India. Pseudobulbs were ovoid and grew upto 6 cm long. Leaves were linear, coriaceous, upto 50 cm long 2.5 cm wide. The plant has not bloomed yet in our Garden.

The chromosome number of the plant was counted to be 2n = 40 at mitotic metaphase and confirmed the previous report in the species (Vij *et al.* 1981) and reports in a synonym of the species *Cym. grandiflorum* (Mehlquist 1952, Wimber 1957).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

In the 2n = 40 chromosomes at mitotic metaphase a gradual decrease in length was observed from the longest (3.7 μm) to the shortest (1.9 μm) chromosomes. Among the 40 chromosomes, 36 were median centromeric with arm ratios between 1.0 and 1.7, and three chromosomes (Nos. 20, 30, 40) were submedian with arm ratios between 1.8 and 3.0. The

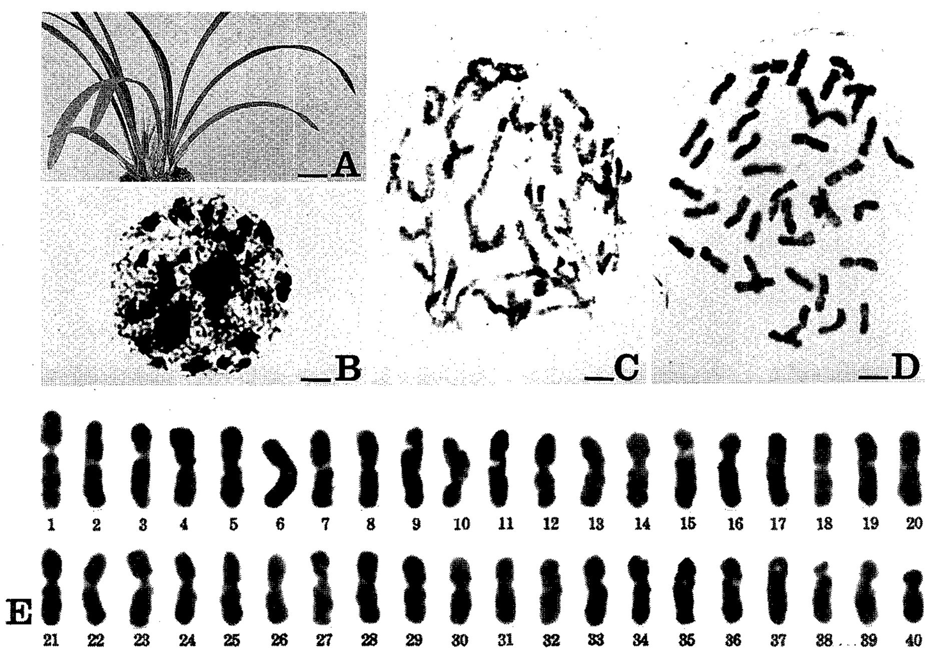

Fig. 25. *Cymbidium hookerianum*, 2n = 40. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar idicates 50 mm in A and 3 μm in B–E.

other chromosome (No. 19) was subterminal with the arm ratio of 4.8.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

23. *Cymbidium insigne* Rolfe, 2n=40, Tables 1 and 27, Fig. 26.

Two plants were obtained from Thailand. Leaves were linear, coriaceous, upto 50 cm long and 2.0 cm wide. Inflorescences were suberect with several flowers. Flowers were 7 cm wide across and pale pink in color with many reddish purple spots on their lips.

The chromosome number of two plants was counted to be 2n=40 at mitotic metaphase and confirmed the previous repots (Mehlquist 1952, Wimber 1957, Larsen 1966).

The chrmosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromocentric bodies were larger than those of *Cym. goeringii*. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (4.8 μm) to the shortest (1.9 μm) chromosomes. Among the 40 chromosomes, 31 were median centromeric and varied in arm ratio from 1.0 to 1.7. Another six chromosomes (Nos. 5–6, 8, 37–38) were submedian and varied in arm ratio from 1.9 to 2.6, and the other three chromosomes (Nos. 20, 31–32) were subterminal and varied in arm ratio from 4.0 to 5.2.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

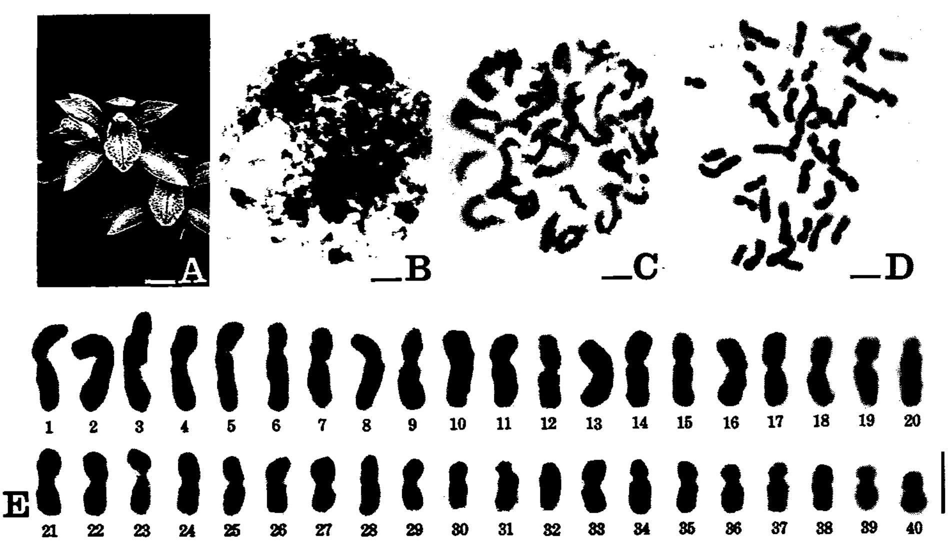

Fig. 26. *Cymbidium insigne*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 17 mm in A and 3 μm in B–E.

24. *Cymbidium longifolium* D. Don, 2n=40, Tables 1 and 28, Fig. 27.

One plant was obtained from India. Leaves were linear, approximately 50 cm long and 1.5 cm wide. Inflorescences were decumbent with several flowers. Flowers were 9 cm wide across. Sepals and petals were linear and yellowish green in color with brown veins. Lips were white in color with few reddish brown spots.

The chromosome number of one plant was counted to be 2n = 40 at mitotic metaphase and confirmed Sharma and Chatterji (1966) Vij and Shekhar (1987).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (5.0 μm) to the shortest (2.1 μm) chromosomes. Among the 40 chromosomes, 37 were median centromeric with arm ratios between 1.0 and 1.7, and two chromosomes (Nos. 23, 38) were submedian with the arm ratios of 1.8 and 2.6. The other chromosome (No. 37) was subterminal with the arm ratio of 3.8. Two chromosomes (Nos. 21, 35) had small constrictions on the interstitial regions of their long arms.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

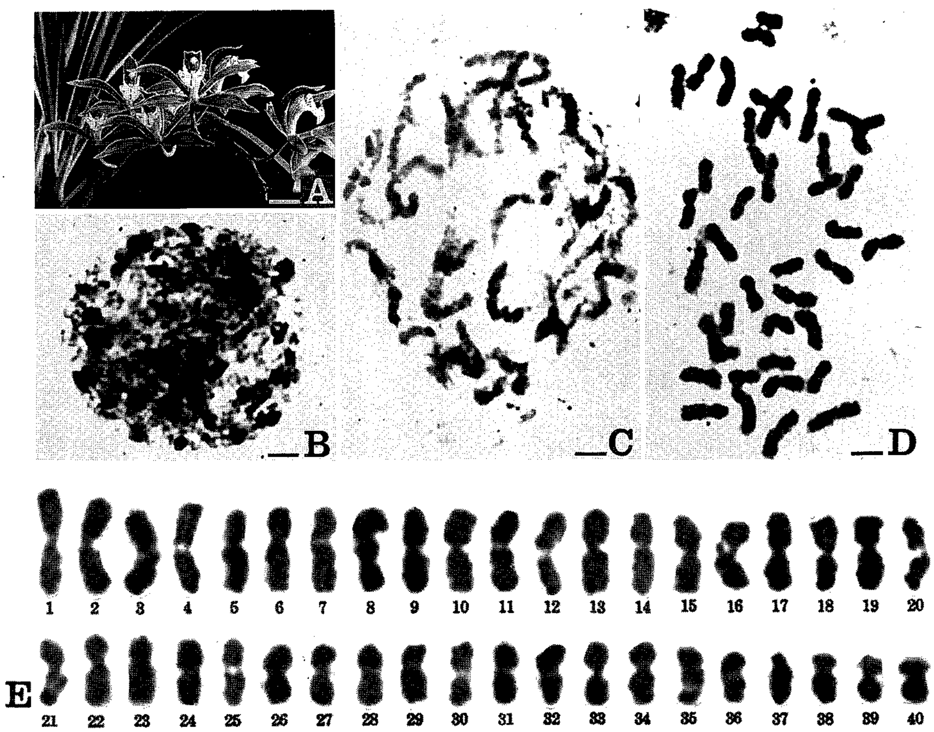

Fig. 27. *Cymbidium longifolium*, 2n = 40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 20 mm in A and 3 μm in B–E.

25. *Cymbidium lowianum* Rchb. f., 2n=40, Tables 1 and 29, Fig. 28.

Three plants were obtained from China and Thailand. Leaves were coriaceous, about 60 cm long and 2.0 cm wide. Inflorescences were nutant with many flowers. Sepals and petals were yellowish green in color (two plants) or creamy yellow (one plant). Lips were nearly white in color with a V-shaped purple spot.

The chromosome number of three plants was 2n = 40 at mitotic metaphase and confirmed Tanaka and Kamemoto (1981).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

A gradual decrease in length was observed from the longest (4.0 μm) to the shortest (2.5 μm) chromosomes in the 2n=40 chromosome alignment at mitotic metaphase. Among the 40 chromosomes, 28 were median centromeric with arm ratios between 1.0 and 1.6, ten chromosomes (Nos. 9–10, 29–32, 35–38) submedian with arm ratios between 1.8 and 3.0, and two chromosomes (Nos. 39–40) subterminal with the arm ratios of 5.7 and 5.2. Two chromosomes (Nos. 39–40) had secondary constrictions on the distal regions of their short arms, and formed small satellites.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

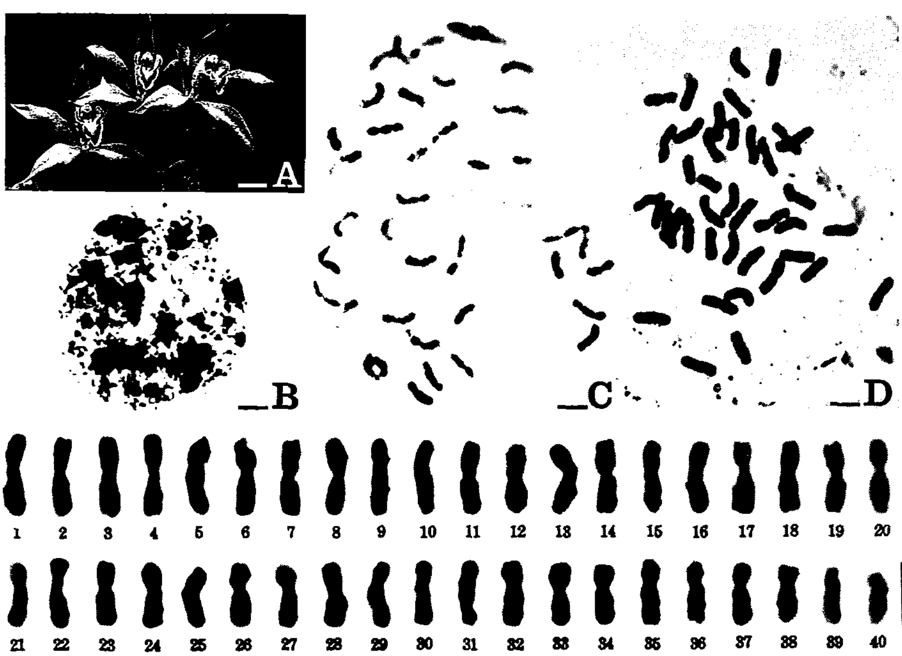

Fig. 28. *Cymbidium lowianum*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 18 mm in A and 3 μm in B–E.

26. *Cymbidium tracyanum* Hort., ex Lindl., 2n=40, Tables 1 and 30, Fig. 29.

Two plants were obtained from Thailand. Leaves were coriaceous, upto 60 cm long and 2.0 cm wide. Inflorescences were nutant with about 15 flowers. Flowers fully opened were about 10 cm wide across. Petals and sepals were linear and yellowish green in color with brown veins. Lips were creamy white in color with numerous reddish brown spots.

The chromosome number of two plants was counted to be 2n=40 at mitotic metaphase and confirmed Tanaka and Kamemoto (1981).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (5.2 μm) to the shortest (2.4 μm) chromosomes. Among the 40 chromosomes, 34 were median centromeric with arm ratios between 1.0 and 1.7. Another four chromosomes (Nos. 17–18, 33–34) were submedian with arm ratios between 1.8 and 2.1, and the other two chromosomes (Nos. 39–40) were subterminal with the arm ratios of 3.8 and 5.0.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

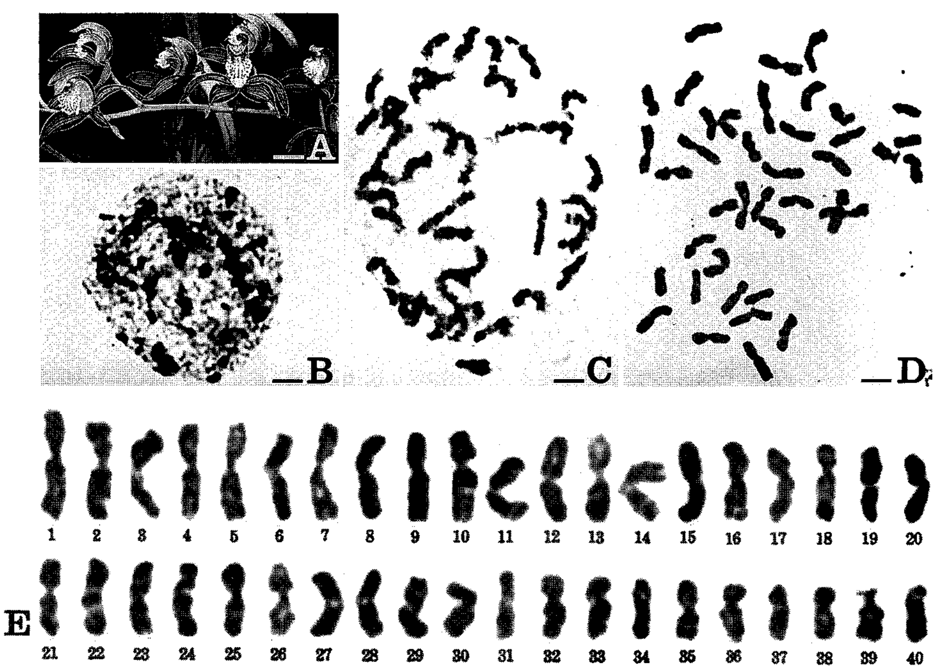

Fig. 29. *Cymbidium tracyanum*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 26 mm in A and 3 μm in B–E.

27. ***Cymbidium eburneum*** **Lindl., 2n=40, Tables 1 and 31, Fig. 30.**

One plant was obtained from India. Leaves were suberect, coriaceous, upto 50 cm long and 1.5 cm wide. Inflorescences were erect with 1–2 flowers. Flowers were 8 cm wide across and white in color with yellow keels on lips.

The chromosome number of the plant was counted to be 2n = 40 at mitotic metaphase and confirmed Tanaka and Kamemoto (1981).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromocentric bodies were smaller than those of *Cym. goeringii*. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase displayed a gradual decrease in length from the longest (3.8 μm) to the shortest (2.1 μm) chromosomes. Among the 40 chromosomes, 37 were median centromeric with arm ratios between 1.0 and 1.7, the other three chromosomes (Nos. 31–32, 38) were submedian with arm ratios between 2.0 and 2.5.

This species showed a homogeneous and gradual karyotype and symmetric karyotype.

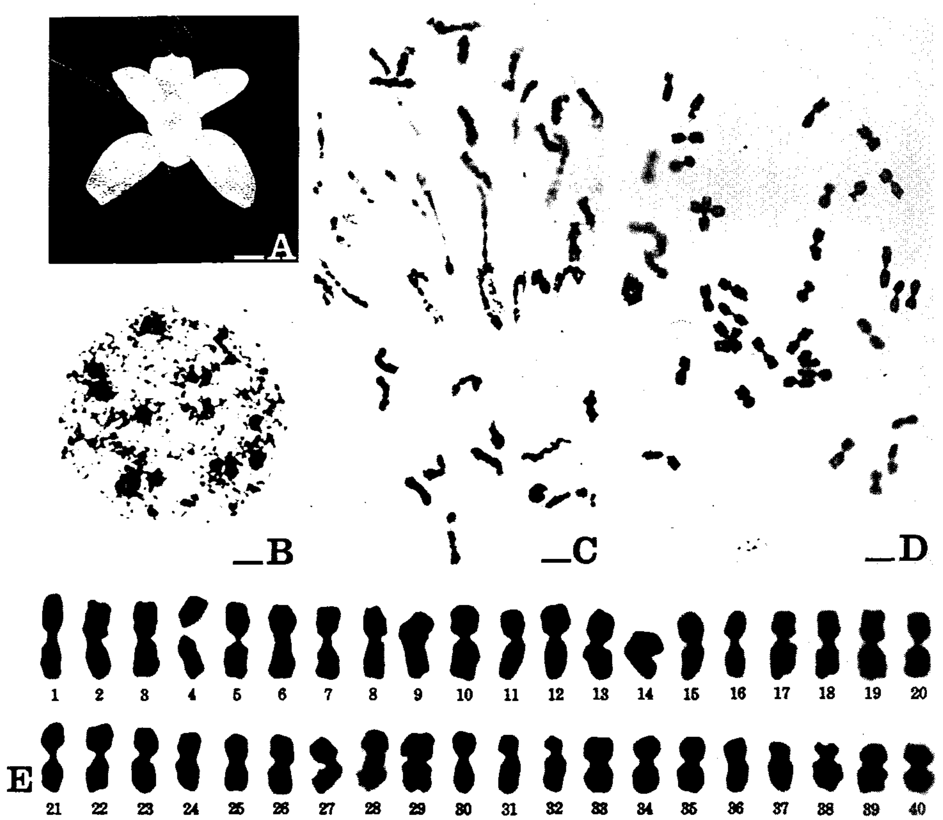

Fig. 30. *Cymbidium eburneum*, 2n = 40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 12 mm in A and 3 μm in B–E.

28. *Cymbidium parishii* Rchb. f., 2n=40, Tables 1 and 32, Fig. 31.

One plant was obtained from Burma. Leaves were linear, coriaceous, about 50 cm long and 2.0 cm wide. Inflorescences were suberect with several flowers. Flowers were 7 cm wide across and white in color with large purple spots on lips.

The chromosome number of the plant was counted to be 2n = 40 at mitotic metaphase and confirmed Mehlquist (1952).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromocentric bodies were smaller than those of *Cym. goeringii*. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (4.3 μm) to the shortest (1.7 μm) chromosomes. Among the 40 chromosomes, 38 were median centromeric with arm ratios between 1.0 and 1 7, while one (No. 6) was submedian with the arm ratio of 1.8, and the other one (No. 18) was subterminal with the arm ratio of 3.2.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype

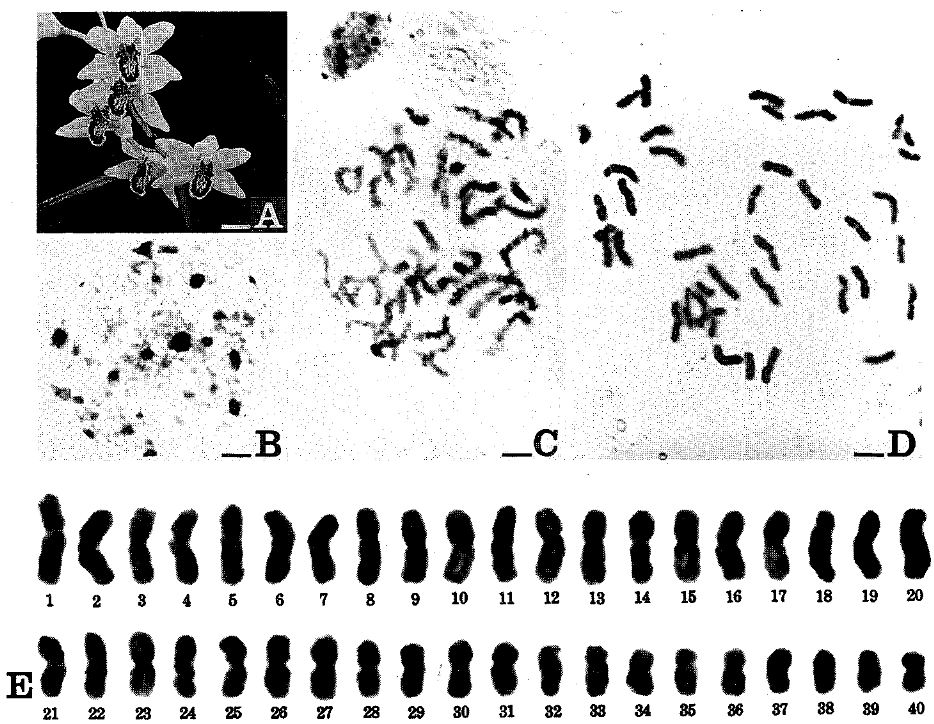

Fig. 31. *Cymbidium parishii*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 20 mm in A and 3 μm in B–E.

29. *Cymbidium erythrostylum* Rolfe, 2n=40, Tables 1 and 33, Fig. 32.

One plant was obtained from Viet-Num. Leaves were linear, coriaceous, about 50 cm long and 1.5 cm wide. Inflorescences were suberect with 6–10 flowers. Flowers were 6 cm wide across and white in color with reddish purple veins on lips. Sepals fully opened and were larger than petals.

The chromosome number of the plant was counted to be 2n=40 at mitotic metaphase and confirmed Mehlquist (1949, 1952) and Wimber (1957).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromocentric bodies were smaller than those of *Cym. goeringii*. The chromosome features at resting stage were of the complex chromocenter type.

In the 2n = 40 chromosomes at mitotic metaphase a gradual decrease in length was observed from the longest (3.9 μm) to the shortest (1.6 μm) chromosomes. Among the 40 chromosomes, 33 were median centromeric with arm ratios between 1.0 and 1.7, and the other seven chromosomes (Nos. 13, 22, 32–36) were submedian with arm ratios between 2.0 and 2.8.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

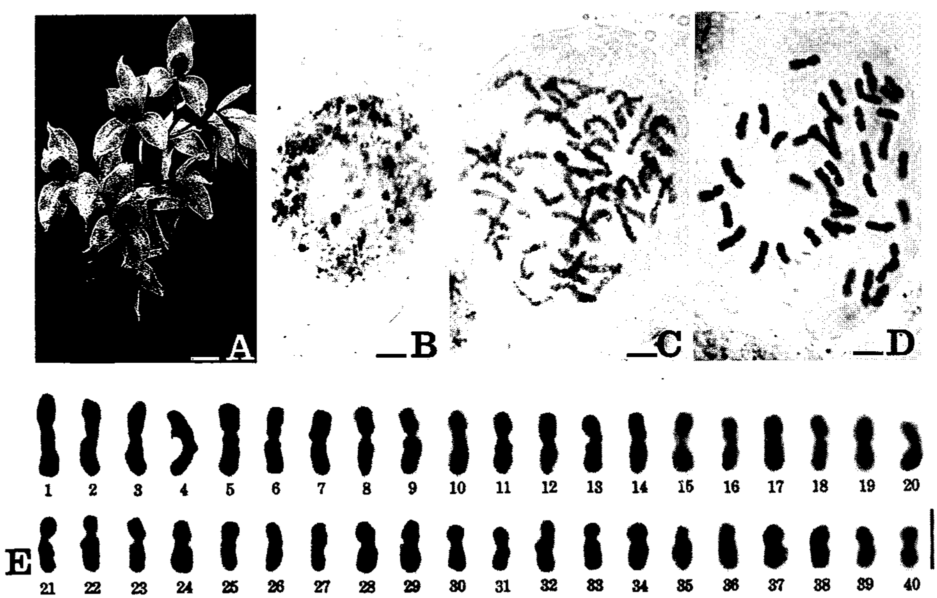

Fig. 32. *Cymbidium erythrostylum*, 2n=40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 24 mm in A and 3 μm in B–E

30. ***Cymbidium tigrinum*** **Par., ex O'Brien, 2n=40, Tables 1 and 34, Fig. 33.**

Three plants were obtained from Burma. Leaves were coriaceous, elliptic lanceolate, about 15 cm long and 3.0 cm wide. Inflorescences were decumbent with few flowers. Flowers were 6 cm wide across and dull yellowish green in color. Lip color was white with many reddish purple spots.

The chromosome number of three plants was 2n = 40 at mitotic metaphase and confirmed Vij *et al.*(1983).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. Average forty chromocentric bodies counted in each nucleus were greater in number than those of *Cym. goeringii*. The chromosome features at resting stage were of the complex chromocenter type.

The 2n=40 chromosome alignment at mitotic metaphase formed a gradual decrease in length from the longest (3.1 μm) to the shortest (1.4 μm) chromosomes. Among the 40 chromosomes, 35 were median centromeric with arm ratios between 1.0 and 1.7, and the other five chromosomes (Nos. 29–31, 35–36) were submedian with arm ratios between 1.8 and 2.8.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

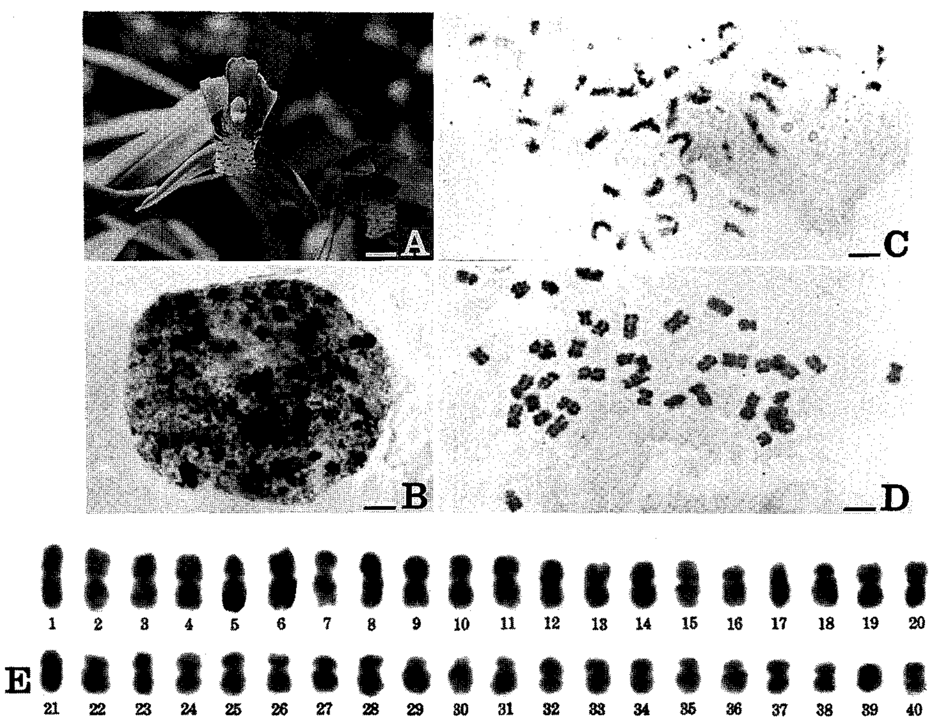

Fig. 33. *Cymbidium tigrinum*, 2n=40. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 9 mm in A and 3 μm in B –E.

II. Allied Genera

1. *Acriopsis javanica* Reinw., 2n=40, Tables 1 and 35, Fig. 34.

One plant was obtained from Malaysia. Pseudobulbs were ovoid and about 2 cm long and had 2–3 linear leaves near the tip. Inflorescences were decumbent and branched with numerous flowers. Flowers were 1.0 cm wide across and white in color with purple stripes. Lateral sepals united to apex.

The chromosome number of the plant was 2n=40 at mitotic metaphase, which was reported here for this species for the first time.

The chromosomes at resting stage formed small chromatin blocks similar to those of *Cym. macrorhizon*. Most of the chromatin blocks were rod or string in shape with rough surface. The chromosomes at mitotic prophase formed several early condensed segments located mostly in the proximal regions of both arms. The chromosome features at resting stage figured intermediate between the simple chromocenter type and the complex chromocenter type.

The set of the 2n=40 chromosomes at mitotic metaphase exhibited a gradual decrease in length from the longest (1.5 μm) to the shortest (0.7 μm) chromosomes. Among the 40 chromosomes, 34 were median centromeric with arm ratios between 1.0 and 1.6. The other six chromosomes (Nos. 3–4, 31–32, 39–40) were submedian with arm ratios between 2.0 and 2.5.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

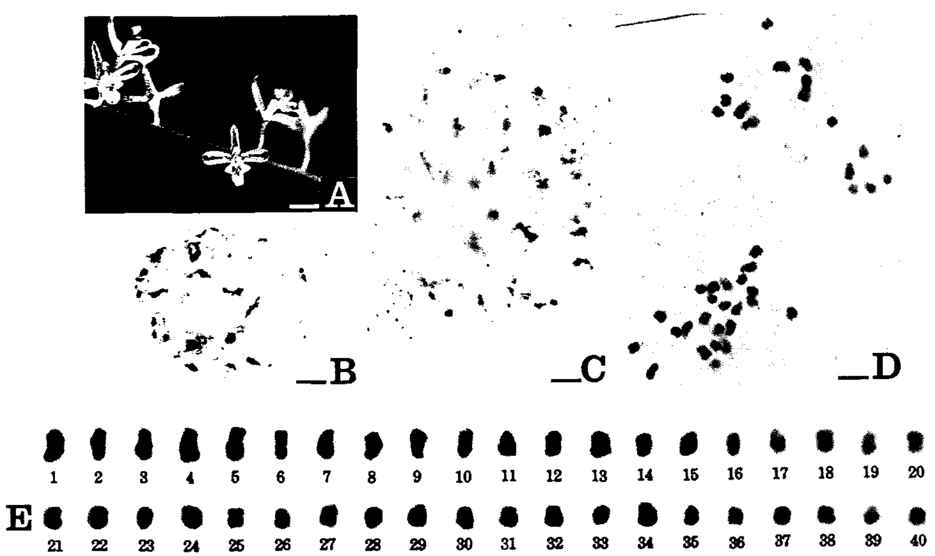

Fig. 34. *Acriopsis javanica*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 5 mm in A and 3 μm in B–E.

2. *Ansellia africana* Lindl., 2n=42, Tables 1 and 36, Fig. 35.

Two plants were obtained from Africa. Pseudobulbs were cylindrical with several nodes. Leaves were coriaceous, about 20 cm long and 2.5 cm wide and gathered at the upper parts of the pseudobulbs. Inflorescences with about ten flowers were produced near the apices of pseudobulbs. Flowers were 4.5 cm wide across and yellow in color with many maroon spots.

The chromosome number of the plants was 2n=42 at mitotic metaphase, which was reported here this species for the first time.

The chromosomes at resting stage were conspicuous. They were observed as lightly-stained chromomeric granules and fibrous threads, or darkly-stained chromatin blocks. Average 22 chromatin blocks counted in each nucleus as chromocentric bodies varied in size and shape. The chromosomes at mitotic prophase formed many early condensed segments located in the proximal and interstitial regions of both arms. Then, late condensed segments were observed in the distal regions of the chromosomes. The chromosome features at resting stage indicated intermediate between the complex chromocenter type and the prochromosome type.

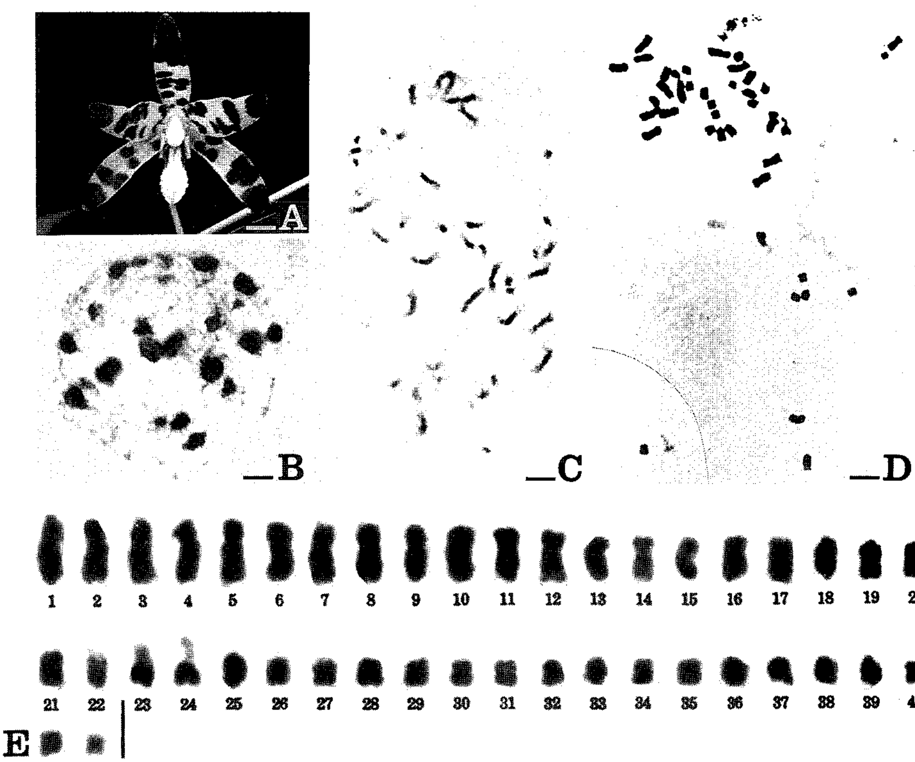

Fig. 35. *Ansellia africana*, 2n=42. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 7 mm in A, 3 μm in B and E, and 4 μm in C and D.

A gradual decrease in length was observed from the longest (3.0 μm) to the shortest (0.9 μm) chromosomes in the mitotic-metaphase chromosome complement of 2n = 42. Among the 42 chromosomes, 29 were median centromeric with arm ratios between 1.0 and 1.7. Another eight (Nos. 1–6, 23, 25) were submedian with arm ratios between 1.8 and 2.7, one (No. 24) was subterminal with the arm ratio of 3.6, and the other four (Nos. 21–22, 37–38) were terminal with arm ratios between 10.0 and 15.0. Two chromosomes (Nos. 23–24) had secondary constrictions on their short arms, and formed small satellites.

This species showed a homogeneous and gradual karyotype and an intermediate karyotype between the symmetric and the asymmetric karyotypes.

3. *Ansellia gigantea* Rchb. f., 2n=42, Tables 1 and 37, Fig. 36.

One plant was obtained from Africa. This species was morphologically quite similar to *A. africana*. However, the plant was relatively large in size, and had a lip with narrow mid-lobe.

The chromosome number of the plant was 2n = 42 at mitotic metaphase, which confirmed the previous report of Tanaka (1964) for a synonym of this species, *A. nilotica* decided by Bechtel *et al.* (1981).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *A. africana* described above. The chromosome features at resting stage were of an

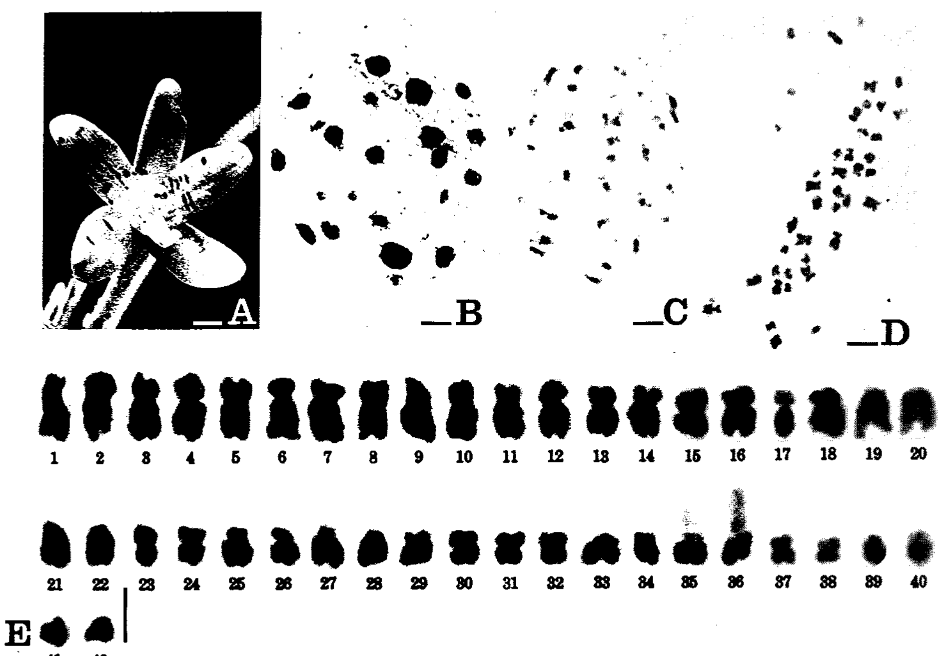

Fig. 36. *Ansellia gigantea*, 2n=42. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 6 mm in A, 3 μm in B and E, and 4 μm in C and D.

intermediate form between the complex chromocenter type and the prochromosome type.

The 2n = 42 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.3 μm) to the shortest (0.9 μm) chromosomes. Among the 42 chromosomes, 19 were median centromeric with arm ratios between 1.2 and 1.7. Another 15 chromosomes (Nos. 2–3, 5–7, 14, 25–26, 29, 33–34, 39–42) were submedian with arm ratios between 1.8 and 2.5, two (Nos. 35–36) were subterminal with the arm ratios of 5.5 and 5.0, and the other six (Nos. 19–22, 27–28) were terminal with arm ratios between 14.0 and 20.0. Two small-sized chromosomes (Nos. 35 –36) had secondary constrictions on their short arms, and formed small satellites.

This species showed a homogeneous and gradual karyotype and an intermediate karyotype between the symmetric and the asymmetric karyotypes.

4. *Cymbidiella flabellata* (Thou.) Rolfe, 2n=52, Tables 1 and 38, Fig. 37.

One plant was obtained from Madagascar. Pseudobulbs were separated at intervals of about 10 cm distance, and were connected by creeping slender rhizomes. Inflorescences were erect with about ten flowers. Flowers were 5 cm wide across. Sepals and petals were yellowish green in color. Lips were spotted and bordered with red.

The chromosome number of the plant was 2n = 52 at mitotic metaphase, which was reported here for this species for the first time.

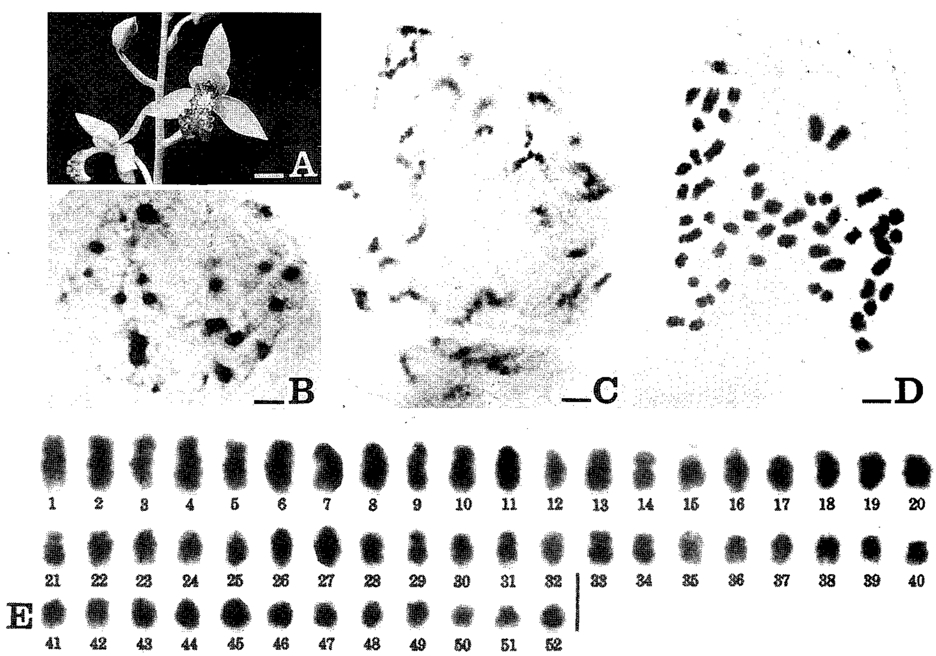

Fig. 37. *Cymbidiella flabellata*, 2n=52. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 12 mm in A and 3 μm in B–E.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Ansellia africana* described above. The chromosome features at resting stage were intermediate between the complex chromocenter type and the prochromosome type.

The $2n=52$ chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (2.7 μm) to the shortest (1.0 μm) chromosomes. Among the 52 chromosomes, ten (Nos. 13–14, 17–19, 29–30, 33–34, 40) were median centromeric with arm ratios between 1.2 and 1.7, 19 (Nos. 1–12, 20–22, 31, 35–36, 47) submedian with arm ratios between 1.8 and 3.0, 12 (Nos. 15–16, 23–25, 32, 37–38, 41–43, 48) subterminal with arm ratios between 3.3 and 6.5, and three (Nos. 26–28) terminal with arm ratios between 7.5 and 8.0. The other eight chromosomes did not show any position of centromere. Two chromosomes (Nos. 15–16) had secondary constrictions on their short arms, and formed small satellites.

This species showed a homogeneous and gradual karyotype and an intermediate karyotype between the symmetric and the asymmetric karyotypes.

5. *Cymbidiella pardalina* (Rchb. f.) Garay, 2n=52, Tables 1 and 39. Fig. 38.

One plant was obtained from Madagascar. *Cymbidiella rhodochila* was formerly used for this specimen (Hawkes 1965). Then, Bechtel *et al.* (1981) determined this specimen into *C. pardalina* and treated the former species name synonym. Leaves were waxy, about 60 cm long and 1.5 cm wide. Inflorescences were erect with several flowers. Flowers were 7 cm wide across. Petals and sepals were yellowish green in color and spotted with black all over the petals. Lips were red with black spots in the basal half.

The chromosome number of the plant at mitotic metaphase was $2n=52$ which was different from the number of $2n=54$ observed in a synonym of the species *C. rhodochila* by Wimber (1957).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Ansellia africana* described above, except for increase of small chromocentric bodies in number. The chromosome features at resting stage were intermediate between the complex chromocenter type and the prochromosome type.

In the $2n=52$ chromosome complement at mitotic metaphase from the longest (3.4 μm) to the shortest (1.1 μm) chromosomes a gradual decrease in length was observed. Among the 52 chromosomes, six (Nos. 27–28, 35–36, 41–42) were median centromeric with arm ratios between 1.3 and 1.6, 16 (Nos. 11–17, 21–22, 29–30, 33–34, 37–39) submedian with arm ratios between 1.8 and 3.0, 22 (Nos. 1–10, 18, 23–26, 31–32, 40, 43–44, 47–48) subterminal with arm ratios between 3.1 and 7.0, and two (Nos. 19–20) terminal with the arm ratio of 8.0. The other chromosomes did not show any position of centromere. Two chromosomes (Nos. 23–24) had secondary constrictions on their short arms, and formed small satellites.

This species showed a homogeneous and gradual karyotype and an intermediate karyotype between the symmetric and the asymmetric karyotypes.

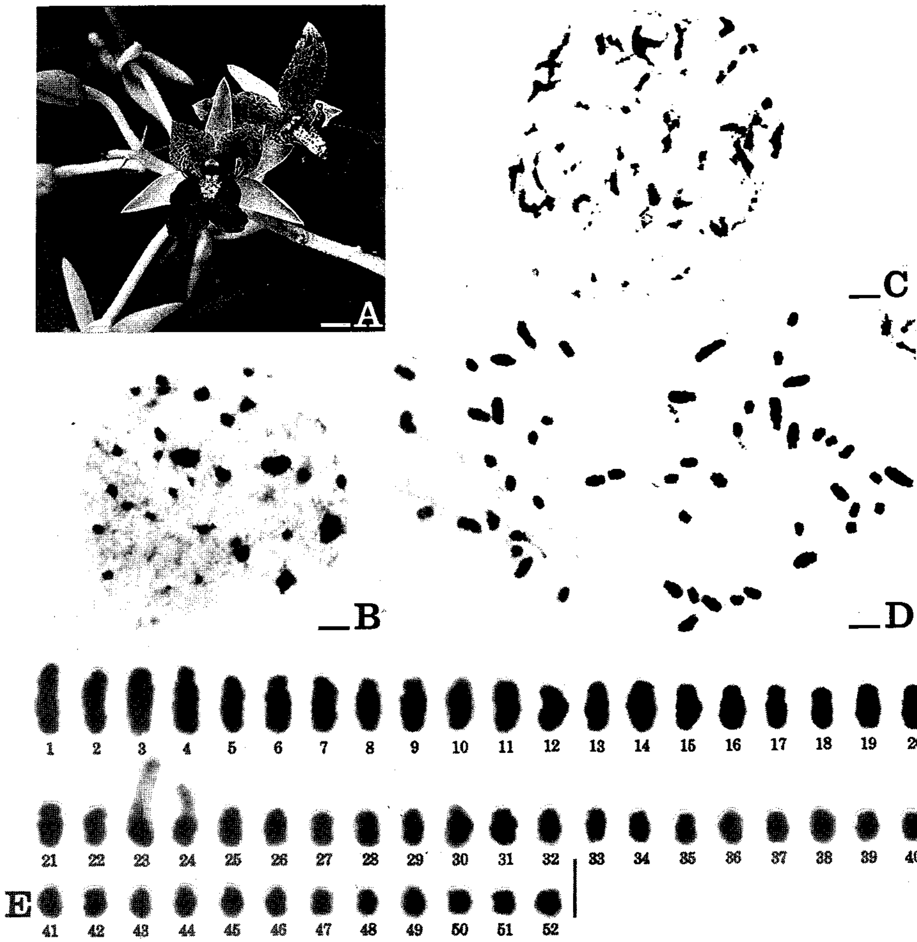

Fig. 38. *Cymbidiella pardalina*, 2n=52. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 10 mm in A and 3 μm in B–E.

6. *Dipodium paludosum* (Griff.) Rchb. f., 2n=46, Tables 1 and 40, Fig. 39.

One plant was obtained from Malaysia. Stems were erect upto 40 cm long and completely covered by leaf bases obvolute. Axillary inflorescences were erect with several flowers. Flowers were 4 cm wide across and white in color and spotted with pale purple.

The chromosome number of this species was 2n=46 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

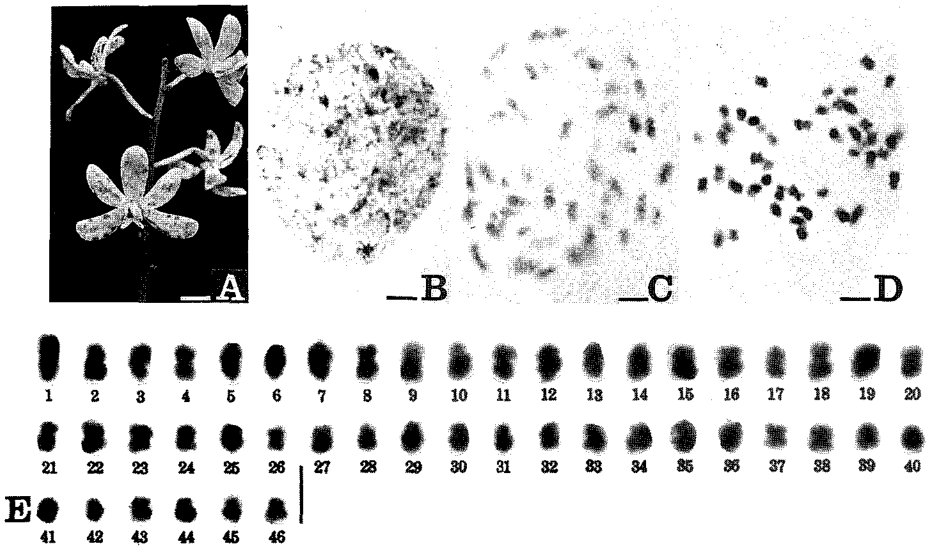

Fig. 39. *Dipodium paludosum*, 2n=46. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 15 mm in A and 3 μm in B–E.

The 2n = 46 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (1.9 μm) to the shortest (0.9 μm) chromosomes. Among the 46 chromosomes, 39 were median centromeric with arm ratios between 1.0 and 1.6, five (Nos. 14–16, 45–46) submedian with arm ratios between 1.8 and 2.0, and two (Nos. 9–10) subterminal with the arm ratios of 4.0 and 3.6.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

7. *Grammangis ellisii* (Lindl.) Rchb. f., 2n=54, Tables 1 and 41, Fig. 40.

One plant was obtained from Madagascar. Pseudobulbs were tetragonal fusiform upto 10 cm high, and had a few leaves near the apex. Inflorescences were suberect with 15–20 flowers. Flowers were waxy, upto 6 cm wide across and brown in color with small yellow spots.

The chromosome number of the plant was 2n = 54 at mitotic metaphase, which confirmed the previous report for this species (Chardard 1963).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Ansellia africana* described above. Chromocentric bodies were slightly larger than those of *A. africana*. The chromosome features at resting stage were intermediate between the complex chromocenter type and the prochromosome type.

In the 2n = 54 chromosome complement at mitotic metaphase a bimodalism in length was displayed; the first group consisted of four large chromosomes showed a degradation from the longest chromosome of 2.9 μm to the chromosome of 2.6 μm, while the other

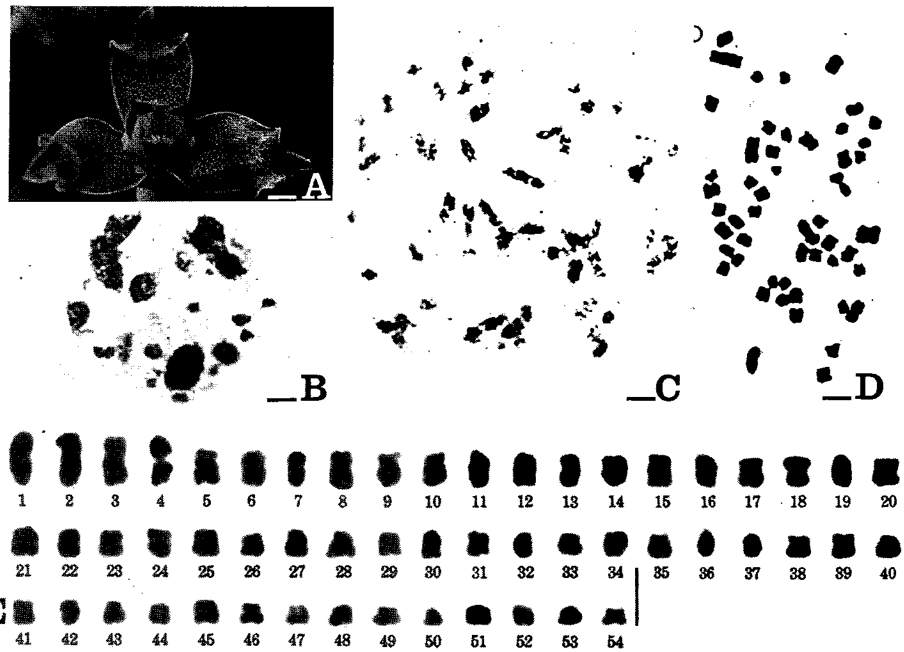

Fig. 40. *Grammangis ellisii*, 2n=54. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 6 mm in A and 3 μm in B–E.

group consisted of 50 short chromosomes showed another degradation from the chromosome of 2.0 μm to the shortest (1.0 μm) chromosome. Among the 54 chromosomes, 39 chromosomes were median centromeric with arm ratios between 1.0 and 1.7, eight (Nos. 2, 11–12, 15–16, 19, 27–28) submedian with arm ratios between 1.8 and 2.8, and two (Nos. 36–37) subterminal with the arm ratio of 3.3. The other chromosomes did not show any position of centromere.

This species showed a heterogeneous and bimodal karyotype and a symmetric karyotype.

8. *Grammatophyllum scriptum* (L.) Blume, 2n=40, Tables 1 and 42, Fig. 41.

One plant was obtained from the Philippines. Pseudobulbs were flattened fusiform, and had a few leaves near the apex. Long inflorescences were suberect and curving with many flowers. Flowers were 3.5 cm wide across and yellowish green in color with numerous brown patchs.

The chromosome number of the plant was counted to be 2n=40 at mitotic metaphase, which confirmed Wimber (1957) and Pancho (1965).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of

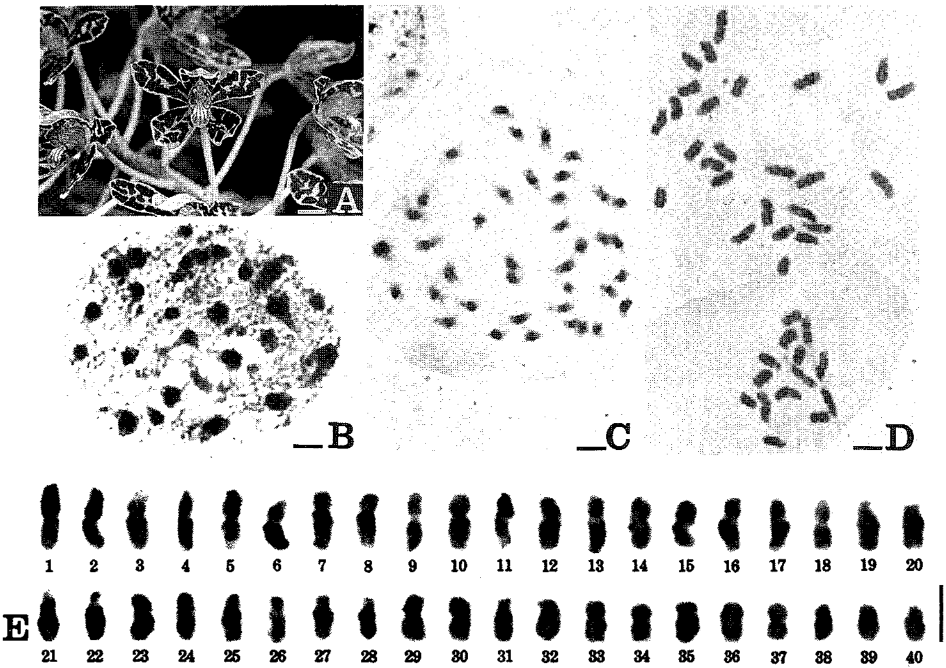

Fig. 41. *Grammatophyllum scriptum*, 2n=40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 8 mm in A and 3 μm in B–E.

the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (3.1 μm) to the shortest (1.5 μm) chromosomes. Among the 40 chromosomes, 24 were median centromeric with arm ratios between 1.0 and 1.7, eight (Nos. 7–8, 27–28, 35–36, 39–40) submedian with arm ratios between 2.0 and 3.0, and eight (Nos. 19–22, 25–26, 31–32) subterminal with arm ratios between 3.2 and 6.3.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

9. *Grammatophyllum speciosum* Blume, 2n=40, Tables 1 and 43, Fig. 42.

One plant was obtained from Malaysia. Stems were cylindrical with many nodes, upto 100 cm long and 5 cm across. Leaves were linear, upto 50 cm long and 3.5 cm wide. The plant has not yet flowered in our Garden.

The chromosome number of the plant was 2n = 40 at mitotic metaphase and confirmed the previous reports (Wimber 1957, Pancho 1965).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. Chromocentric bodies were slightly smaller in size and less in number than those of *Cym. goeringii*. The chromosome features at resting stage were of the complex chromocenter type.

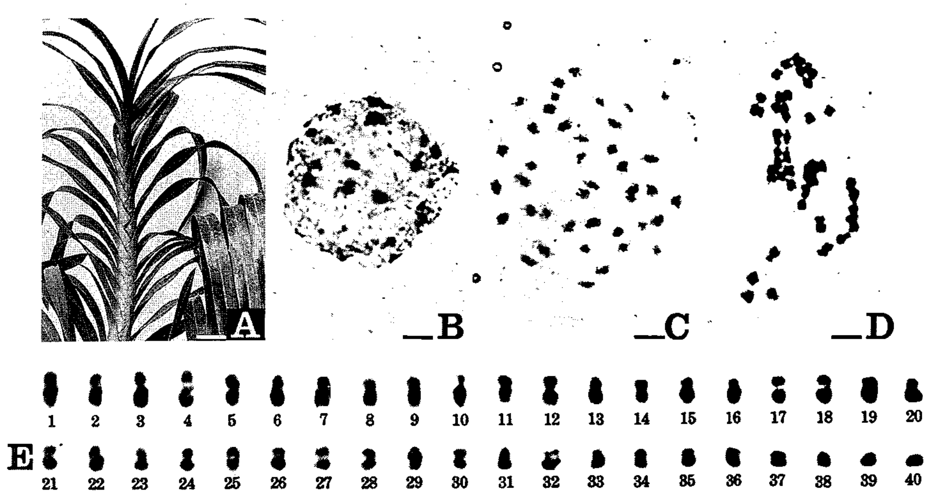

Fig. 42. *Grammatophyllum speciosum*, 2n = 40. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 55 mm in A and 3 μm in B–E.

In the 2n = 40 chromosome alignment at mitotic metaphase from the longest (1.8 μm) to the shortest (0.6 μm) chromosomes a gradual decrease in size was observed. Among the 40 chromosomes, 35 were median centromeric with arm ratios between 1.0 and 1.6, two (Nos. 9–10) were submedian with the arm ratio of 1.8. The other three chromosomes did not show any position of centromere.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

10. *Grammatophyllum stapeliiflorum* (Teijsm. et Binn.) J. J. Sm., 2n = 40, Tables 1 and 44, Fig. 43.

One plant was obtained from Indonesia. Pseudobulbs were slender, fusiform, upto 12 cm long with a few leaves at the top. Leaves were lanceolate to about 25 cm by 6 cm. Inflorescences were pendulous with 6–10 flowers. Flowers were 3.5 cm wide across and pale brown in color with many small reddish brown spots.

The chromosome number of the plant for this species was 2n = 40 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 40 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (1.8 μm) to the shortest (1.1 μm) chromosomes. Among the 40 chromosomes, 35 were median centromeric with arm ratios between 1.0 and 1.6, and the other five (Nos. 13–14, 23, 28–29) submedian with arm ratios between 1.8 and 2.0.

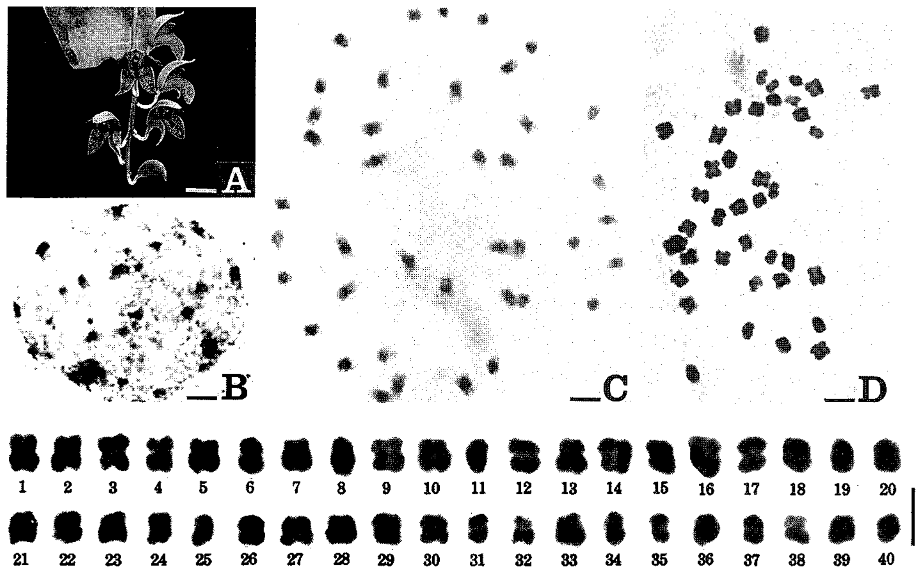

Fig. 43. *Grammatophyllum stapeliiflorum*, 2n = 40. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 24 mm in A and 3 μm in B–E.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

11. *Cyrtopodium andersonii* (Andrews) R. Br., 2n=46, Tables 1 and 45, Fig. 44.

One plant was obtained from Brazil. Pseudobulbs were slender cylindrical upto 60 cm

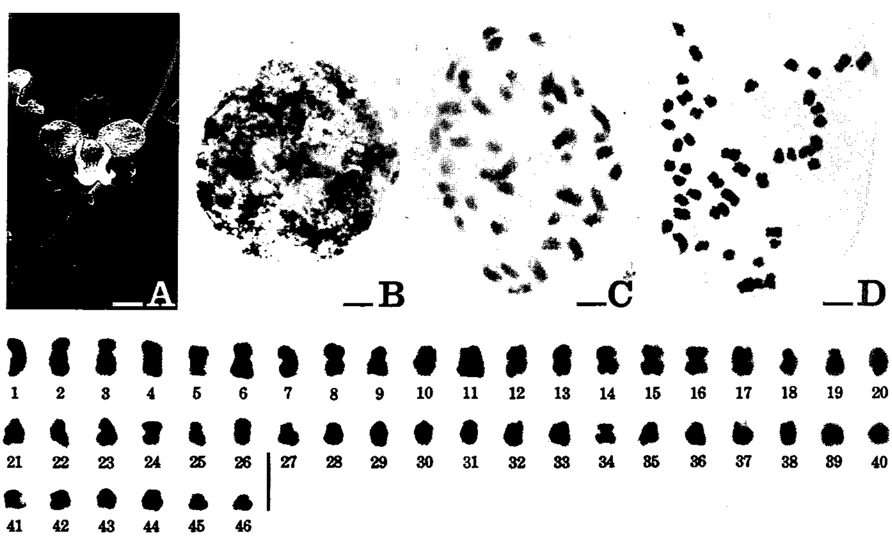

Fig. 44. *Cyrtopodium andersonii*, 2n = 46. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 10 mm in A and 3 μm in B–E.

long. Inflorescences were erect and paniculate with many flowers. Flowers were 3.5 cm wide across. Sepals were yellowish green in color, and petals and lips were yellow in color.

The chromosome number of the plant for this species was 2n=46 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 46 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (1.7 μm) to the shortest (0.8 μm) chromosomes. Among the 46 chromosomes, 23 were median centromeric with arm ratios between 1.0 and 1.7, eight (Nos. 3–4, 11–12, 20–21, 42–43) submedian with arm ratios between 1.8 and 3.0, and two (Nos. 18–19) subterminal with the arm ratio of 3.3.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

12. *Cyrtopodium punctatum* (L.) Lindl., 2n=46, Tables 1 and 46, Fig. 45.

Two plants were obtained from Brazil. Pseudobulbs were also slender cylindrical, upto 40 cm long. Leaves were linear, lanceolate, upto 30 cm long and 3 cm wide. Flowers were 3.5 cm wide across. Sepals and petals were yellowish green in color spotted with reddish brown. Lips were yellow in color with reddish brown margin.

The chromosome number of the two plants of this species was 2n=46 at mitotic metaph-

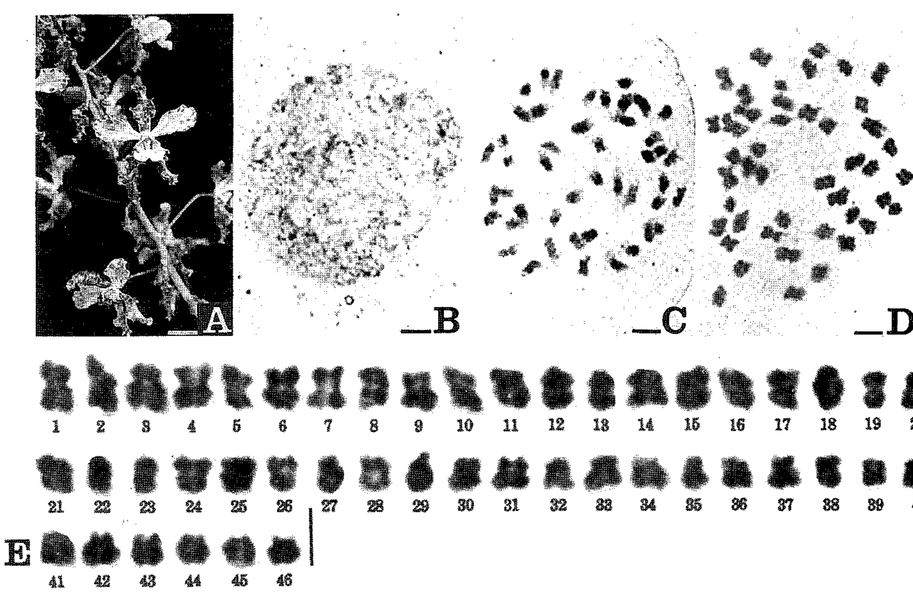

Fig. 45. *Cyrtopodium punctatum*, 2n=46. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 10 mm in A and 3 μm in B–E.

ase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were different in morphology from those of *Cyrto. andersonii* described above, but were similar to those of *Cym. macrorhizon*. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The chromosome complement of the 2n = 46 chromosomes at mitotic metaphase indicated a degaradation in chromosome length from the longest (2.2 μm) to the shortest (1.2 μm) chromosomes. Among the 46 chromosomes, 34 were median centromeric with arm ratios between 1.0 and 1.6, six (Nos. 29–30, 33–34, 37–38) submedian with arm ratios between 1.8 and 2.2 and four (Nos. 41–44) subterminal with the arm ratio of 3.3. The other chromosomes did not show their centromeres.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

13. *Eulophia guineensis* Lindl., 2n=54, Tables 1 and 47, Fig. 46.

One plant was obtained from Africa. Pseudobulbs were ovoid, conical and had a few leaves. Inflorescences were erect with about ten flowers. Flowers were about 5 cm wide across. Sepals and petals were recurved and purplish brown in color. Lips were rose purple colored.

The chromosome number of the plant of this species was 2n = 54 at mitotic metaphase and was here reported for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage

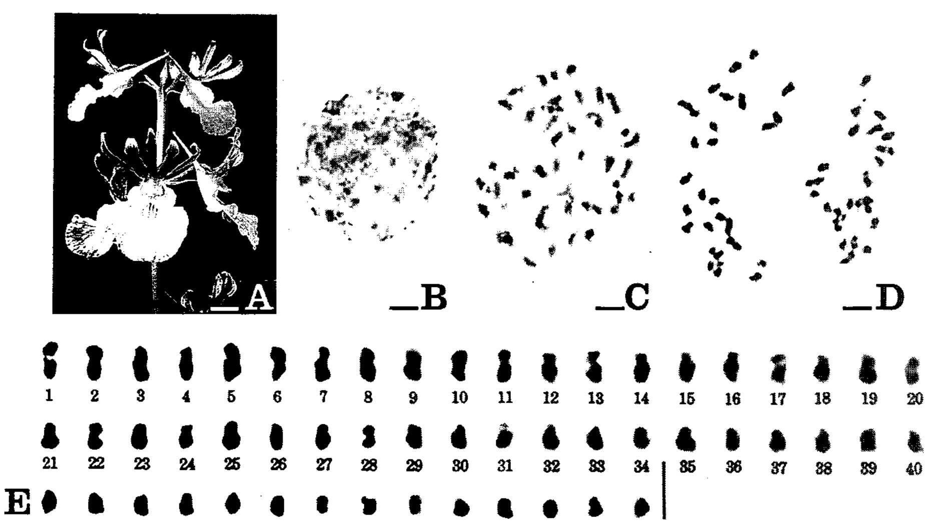

Fig. 46. *Eulophia guineensis*, 2n=54. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 15 mm in A and 3 μm in B–E.

were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n = 54 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (1.7 μm) to the shortest (0.8 μm) chromosomes. Among the 54 chromosomes, 20 were median centromeric with arm ratios between 1.0 and 1.7, and 18 (Nos. 3–4, 7–8, 11–18, 25–26, 31, 38, 47–48) submedian with arm ratios between 1.8 and 3.0.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

14. *Eulophia paniculata* Rolfe, 2n=60, Tables 1 and 48, Fig. 47.

One plant was obtained from Madagascar. Pseudobulbs were ovoid, conical with five angles and had two leaves at the top. Leaves were thick, linear upto 20 cm long and 1.2 cm wide, and had numerous white spots. The plant has not flowered yet in our Garden.

The chromosome number of the plant for this species was counted to be 2n=60 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n = 60 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (1.7 μm) to the shortest (0.7 μm) chromosomes. Among the 60 chromo-

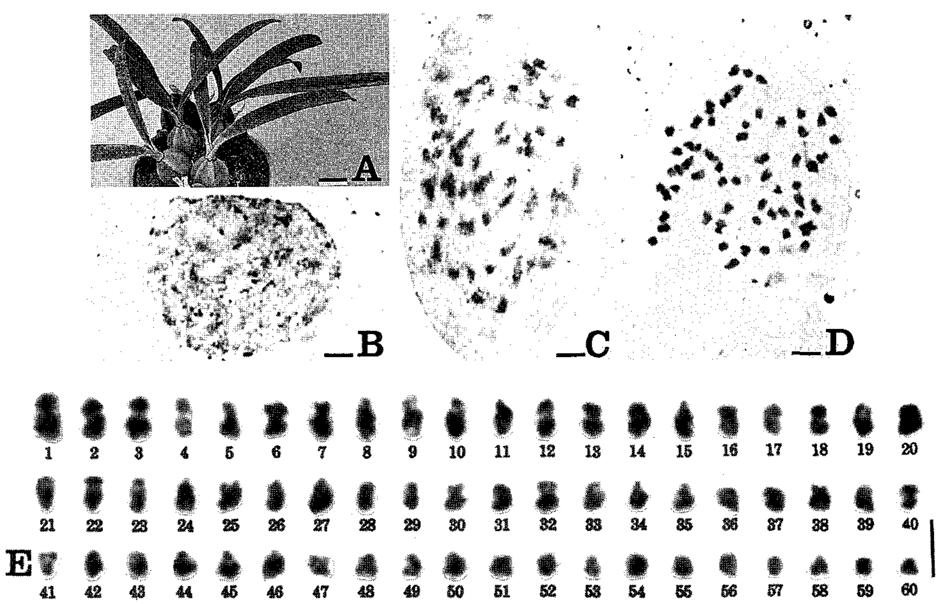

Fig. 47. *Eulophia paniculata*, 2n = 60. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 30 mm in A and 3 μm in B–E.

somes, 38 were median centromeric with arm ratios between 1.0 and 1.7, 17 (Nos. 7, 21–23, 26–27, 32–34, 38–45) submedian with arm ratios between 1.8 and 3.0, and the other five (Nos. 8–11, 46) subterminal with arm ratios between 3.5 and 3.6.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

15. *Eulophia petersii* Rchb. f., 2n=48, Tables 1 and 49, Fig. 48.

One plant was obtained from Africa. Pseudobulbs were fusiform, upto 10 cm long with a few leaves near the top. Leaves were thick and linear upto 30 cm long and 2 cm wide. Inflorescences were erect with many flowers. Flowers were 3 cm wide across. Sepals and petals were recurved and green in color. Lips were white colored with reddish purple veins.

The chromosome number of the plant was 2n = 48 at mitotic metaphase, which confirmed the previous report of the haploid chromosome number of n=24 (Hall 1965).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 48 chromosome complement at mitotic metaphase showed a gradual decrease in length from the longest (5.1 μm) to the shortest (1.2 μm) chromosomes. Among the 48

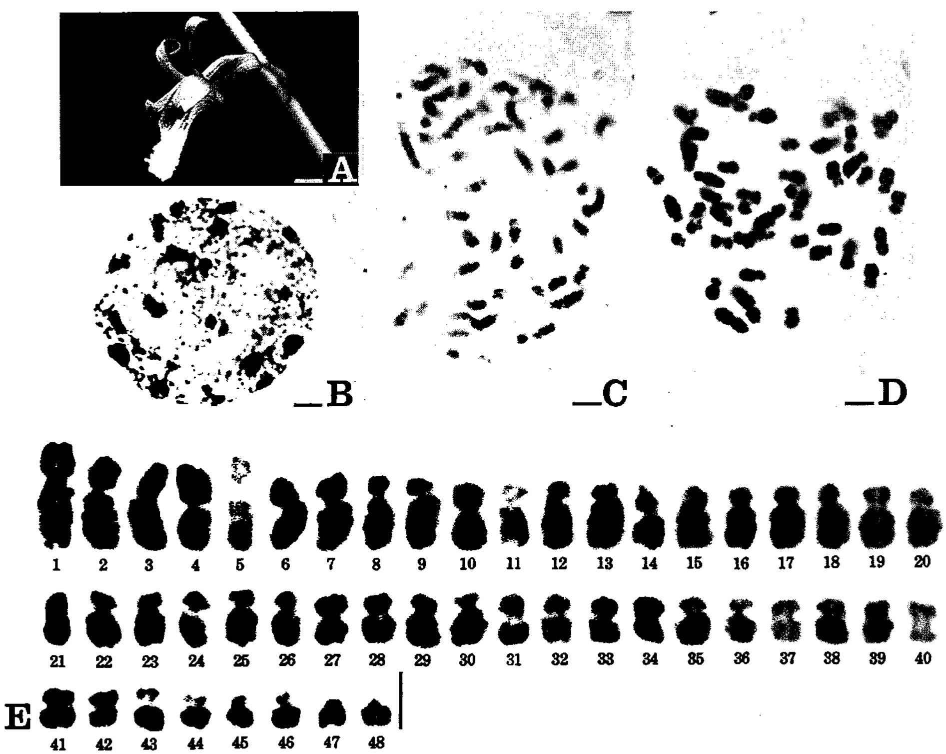

Fig. 48. *Eulophia petersii*, 2n=48. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 7 mm in A and 3 μm in B–E.

chromosomes, 19 were median centromeric with arm ratios between 1.0 and 1.7, 27 (Nos. 1–2, 7–9, 11–12, 15–20, 22–26, 29–30, 35–36, 43–46, 48) submedian with arm ratios between 1.8 and 3.0, and the other two (Nos. 13, 47) subterminal with the arm ratios of 3.2 and 3.3.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

16. *Eulophia streptopetala* Lindl., 2n=42, Tables 1 and 50, Fig. 49.

One plant was obtained from Africa. Pseudobulbs were ovoid with few leaves. Leaves were plicate, upto 30 cm long and 4 cm wide. Inflorescences were erect with about ten flowers. Flowers were 4 cm wide across. Sepals were yellowish green in color with brown spots. Petals were yellow colored and twisted. Lips were yellow colored with reddish brown stripes.

The chromosome number of the plant of this species was 2n = 42 at mitotic metaphase which was different from the previous report of 2n=40 (Hall 1965).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The chromosome complement with 2n=42 at mitotic metaphase displayed a gradual decrease in length from the longest (2.4 μm) to the shortest (1.0 μm) chromosomes. Among the 42 chromosomes, 30 were median centromeric with arm ratios between 1.0 and 1.7, 11

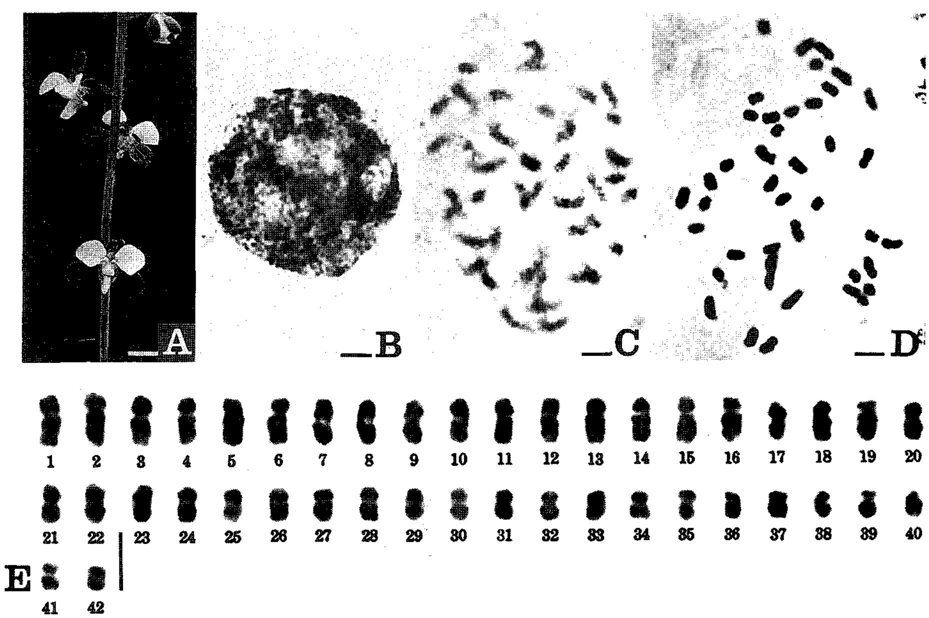

Fig. 49. *Eulophia streptopetala*, 2n=42. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 17 mm in A and 3 μm in B–E.

(Nos. 2, 5–6, 13–16, 20, 27, 39–40) submedian with arm ratios between 1.8 and 3.0, and the other one (No. 19) subterminal with the arm ratio of 3.5.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

17. *Eulophiella* Rolfei, 2n=52, Tables 1 and 51, Fig. 50.

This taxon is a hybrid between *E. roempleriana* and *E. elisabethae*, and has been cultivated widely. Pseudobulbs were connected to each other by creeping rhizomes. Leaves were plicate, upto 80 cm long and 8.5 cm wide. Inflorescences were suberect with large rose purple flowers.

The chromosome number of the two plants was 2n=52 at mitotic metaphase which supported the author's report (Aoyama *et al.* 1986).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Ansellia africana* described above. Chromocentric bodies were slightly smaller than those of *A. africana*. The chromosome features at resting stage were intermediate between the complex chromocenter type and the prochromosome type.

A gradual decrease in length was observed from the longest (2.3 μm) to the shortest (0.8 μm) chromosomes in the 2n=52 chromosome complement at mitotic metaphase. Among the 52 chromosomes, nine chromosomes were median centromeric with arm ratios between

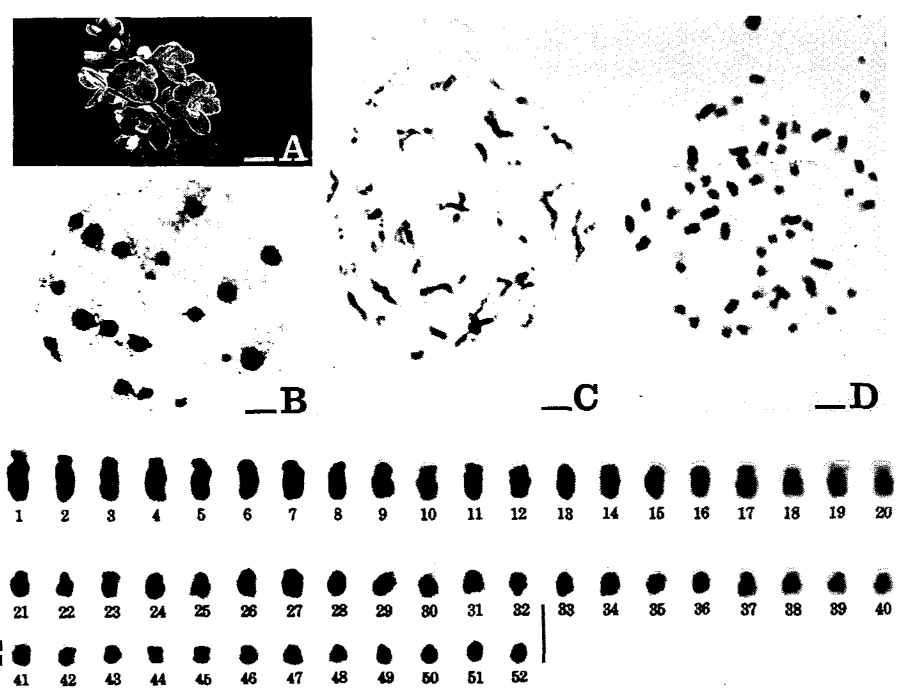

Fig. 50. *Eulophiella* Rolfei, 2n=52. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 40 mm in A and 3 μm in B–E.

1.0 and 1.7, 15 (Nos. 9–18, 21–22, 37–39) submedian with arm ratios between 2.0 to 3.0, ten (Nos. 1–8, 19–20) subterminal with arm ratios between 3.7 and 5.6, and the other two (Nos. 29–30) terminal with the arm ratio of 9.0. The latter two chromosomes had secondary constricitons on the distal regions of short arms, and formed small satellites. The other 16 chromosomes showed no clearly visible position of centromere.

This species showed a homogeneous and gradual karyotype and an intermediate karyotype between the symmetric and the asymmetric karyotypes.

18. *Eulophiella roempleriana* (Rchb. f.) Schltr., 2n=52, Tables 1 and 52, Fig. 51.

One plant was obtained from Madagascar. Pseudobulbs were fusiform, upto 10 cm long and 3 cm diameter and were separated from each others. Leaves were plicate, lanceolate, upto 80 cm long and 8 cm wide. The plant has not flowered yet in our Garden.

The chromosome number of the plant of this species was 2n=52 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *E.* Rolfei described above. The chromosome features at resting stage were intermediate between the complex chromocenter type and the prochromosome type.

The 2n = 52 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (1.6 μm) to the shortest (0.6 μm) chromosomes. Among the 52 chromosomes, 14 were median centromeric with arm ratios between 1.0 and 1.7, 14 (Nos. 1–4, 6–7, 18–19, 29–31, 39, 42–43) submedian with arm ratios between 1.8 and 3.0, 11 (Nos. 8, 11–16, 20–22, 32) subterminal with arm ratios between 3.3 and 5.5, and one (No. 23) ter-

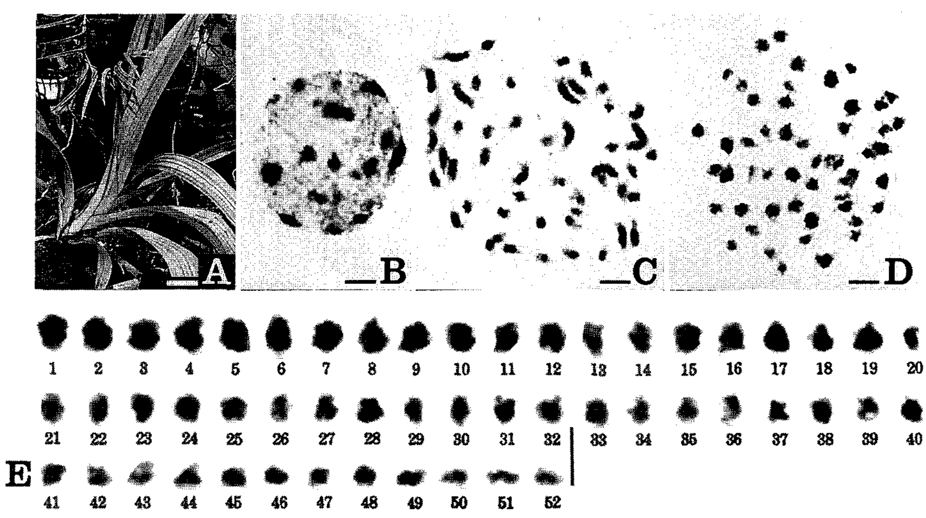

Fig. 51. *Eulophiella roempleriana*, 2n = 52. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 60 mm in A and 3 μm in B–E.

minal with the arm ratio of 11.0. The other 12 chromosomes did not show any clearly visible position of centromere.

This species showed a homogeneous and gradual karyotype and an intermediate karyotype between the symmetric and the asymmetric karyotypes.

19. *Galeandra baueri* Lindl., 2n=56, Tables 1 and 53, Fig. 52.

One plant was obtained from Panama. Pseudobulbs were slender, fusiform with a few linear leaves. Inflorescences were terminal and nutant with few flowers. Flowers were 4 cm wide across. Sepals and petals were yellowish brown in color. Lips were purple colored.

The chromosome number of the plant of this species was 2n=56 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

A gradual decrease in length was observed from the longest (1.8 μm) to the shortest (0.9 μm) chromosomes in the 2n=56 chromosome complement at mitotic metaphase. Among the 56 chromosomes, 49 were median centromeric with arm ratios between 1.0 and 1.7, and

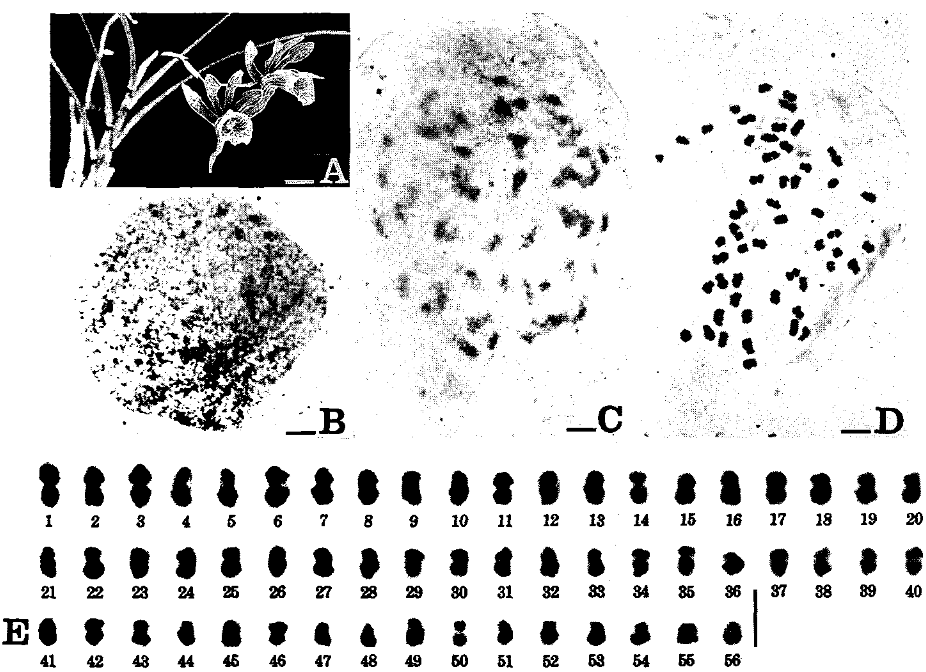

Fig. 52. *Galeandra baueri*, 2n=56. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 14 mm in A and 3 μm in B–E.

the other seven (Nos. 9–10, 14, 21–22, 35–36) submedian with arm ratios between 1.8 and 2.2.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

20. *Galeandra devoniana* Lindl., 2n=56, Tables 1 and 54, Fig. 53.

One plant was obtained from Brazil. Pseudobulbs were slender, fusiform. Leaves were linear and about 15 cm long. Inflorescences were terminal, nutant. Flowers were 6 cm wide across. Sepals and petals were pale brown in color with maroon veins. Lips were white colored with purple veins near the apex.

The chromosome number of the plant of this species was 2n=56 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. Chromocentric bodies were slightly larger than those of *G. baueri*. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n=56 chromosomes at mitotic metaphase exhibited a degradation in length from the longest (1.8 μm) to the shortest (0.8 μm) chromosomes. Among the 56 chromosomes, 19 were median centromeric with arm ratios between 1.0 and 1.5, and three (Nos. 1–2, 5) were submedian with arm ratios between 1.8 and 2.0.

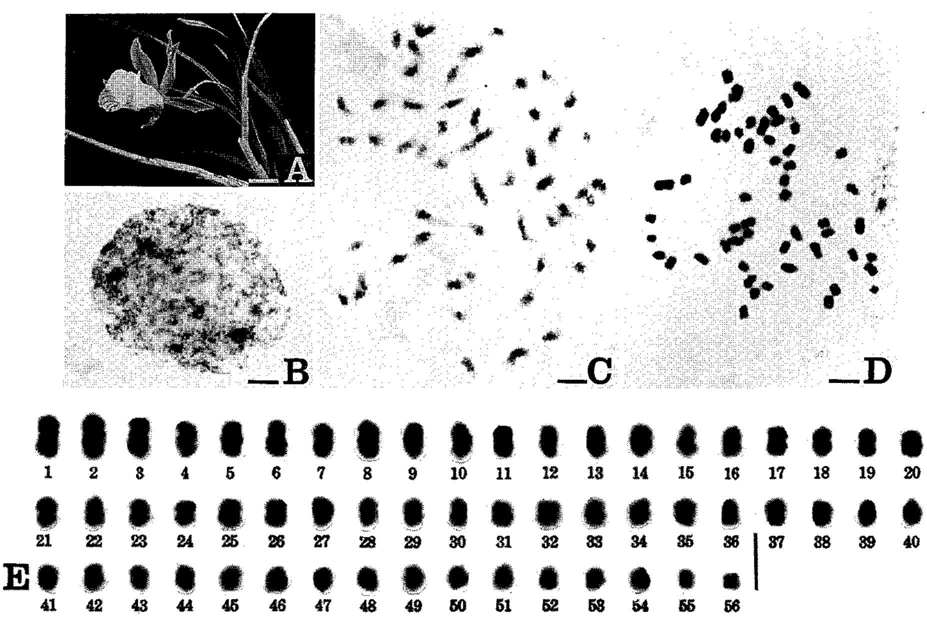

Fig. 53. *Galeandra devoniana*, 2n=56. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 15 mm in A and 3 μm in B–E.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

21. ***Geodorum densiflorum*** **(Lam.) Schltr., (Japanese name: Tosakameotoran), 2n = 54, Tables 1 and 55, Fig. 54.**

One plant was obtained from Okinawa Prefecture, Japan. Pseudobulbs were ovoid with a few leaves at the apex. Leaves were plicate upto 45 cm long and 5 cm wide. Inflorescences were erect and nutant near the top. Flowers were clustered and white colored.

The chromosome number of the plant for the species was 2n = 54 at mitotic metaphase, which confirmed Kulkarni and Jorapur (1979).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n = 54 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (1.3 μm) to the shortest (0.6 μm) chromosomes. Among the 54 chromosomes, 22 were median centromeric with arm ratios between 1.0 and 1.6, three (Nos. 3–4, 18) submedian with the arm ratio of 2.0, and two (Nos. 13–14) subterminal with the arm ratio of 3.5. The other 27 chromosomes showed no clearly visible position of centromere.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

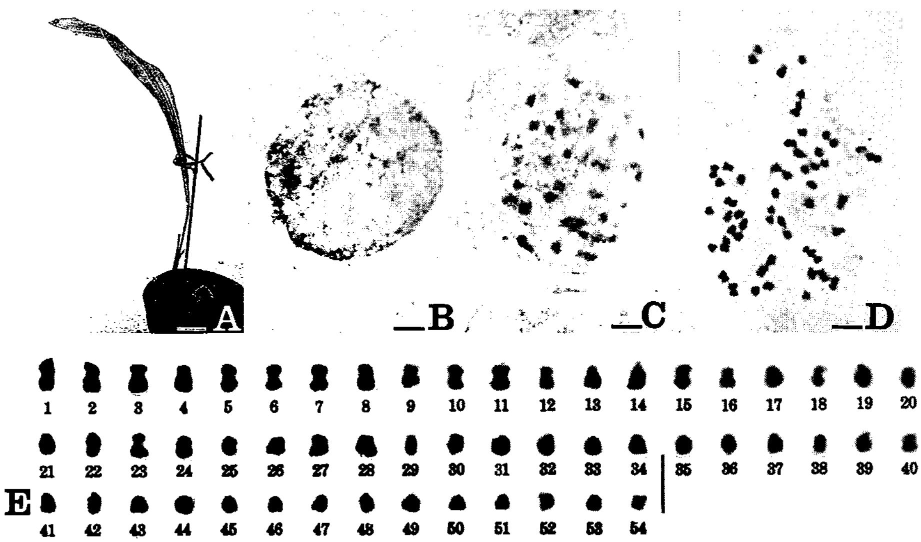

Fig. 54. *Geodorum densiflorum*, 2n = 54. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 28 mm in A and 3 μm in B–E.

22. ***Graphorkis scripta*** **(Thouars) Kuntze, 2n=54, Tables 1 and 56, Fig. 55.**

One plant was obtained from Madagascar. Pseudobulbs were fusiform. Decidious leaves were plicate, lanceolate, upto 25 cm long and 5 cm wide. Inflorescences were erect and paniculate with many flowers. Flowers were 1.5 cm wide across and yellowish green colored with maroon-colored spots.

The chromosome number of the plant of this species was 2n=54 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. Chromocentric bodies were slightly larger than those of *Cym. macrorhizon*. The chromosome features resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n=54 chromosomes at mitotic metaphase showed a degradation in length from the longest(1.6 μm) to the shortest (0.7 μm) chromosomes. Among the 54 chromosomes, 28 were median centromeric with arm ratios between 1.0 and 1.5, six (Nos. 1, 13–14, 34–36) submedian with the arm ratios between 2.0 and 2.6, and two (Nos. 23–24) terminal with arm ratios of 9.0 and 8.0.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

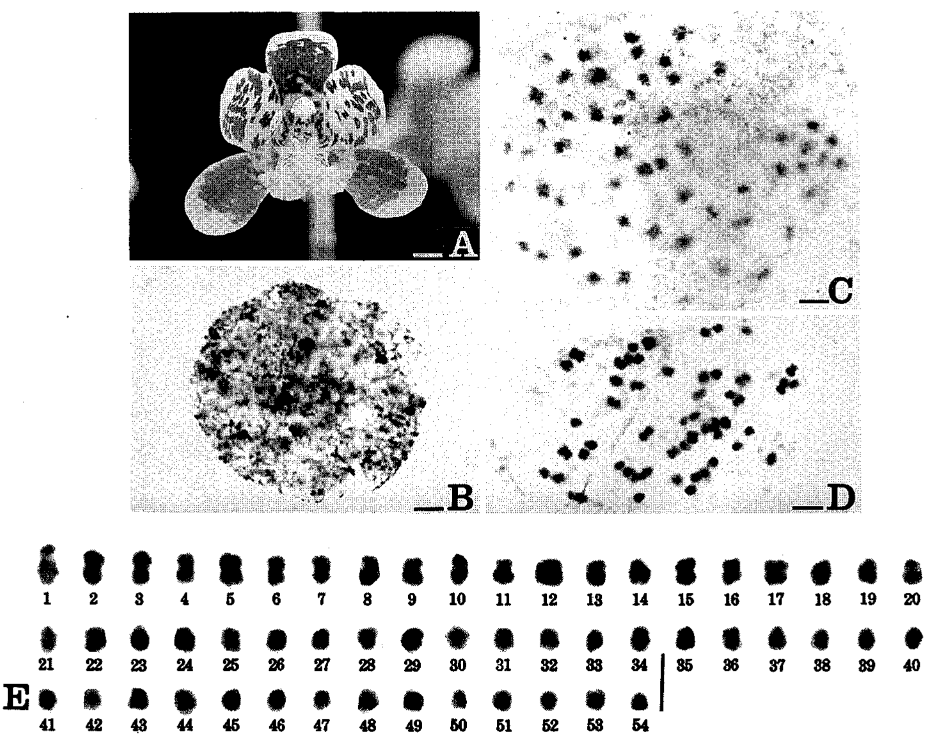

Fig. 55. *Graphorkis scripta*, 2n=54. A, a flower. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 3 mm in A and 3 μm in B–E.

23. *Oecoclades saundersiana* (Rchb. f.) Garay et Tayler, 2n = 58, Tables 1 and 57, Fig. 56.

Two plants were obtained from Africa. Pseudobulbs were slender, fusiform and had two leaves at the apex. Leaves were coriaceous, upto 20 cm long and 4 cm wide. Inflorescences were basal and erect with about 20 flowers. Flowers were 3 cm wide across and pale brown in color with brown veins.

The chromosome number of the two plants was 2n = 58 at mitotic metaphase and confirmed the previous report in a synonym of this species, *Eulophidium saundersianum* by Arrushdi (1971).

The chromocentric bodies at resting stage were slightly smaller than those of *Cym. goeringii*, and the early condensed segments at mitotic prophase were mostly formed in the proximal regions of both chromosome arms. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 58 chromosomes at mitotic metaphase displayed a gradual decrease in length from the longest (1.6 μm) to the shortest (0.9 μm) chromosomes. Among the 58 chromosomes, 54 were median centromeric with arm ratios between 1.0 and 1.6, and the other four (Nos. 3, 37–38, 53) were submedian with arm ratios between 2.0 and 2.6. Two chromosomes (Nos. 37–38) had secondary constrictions on the distal regions of short arms, and formed small satellites.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

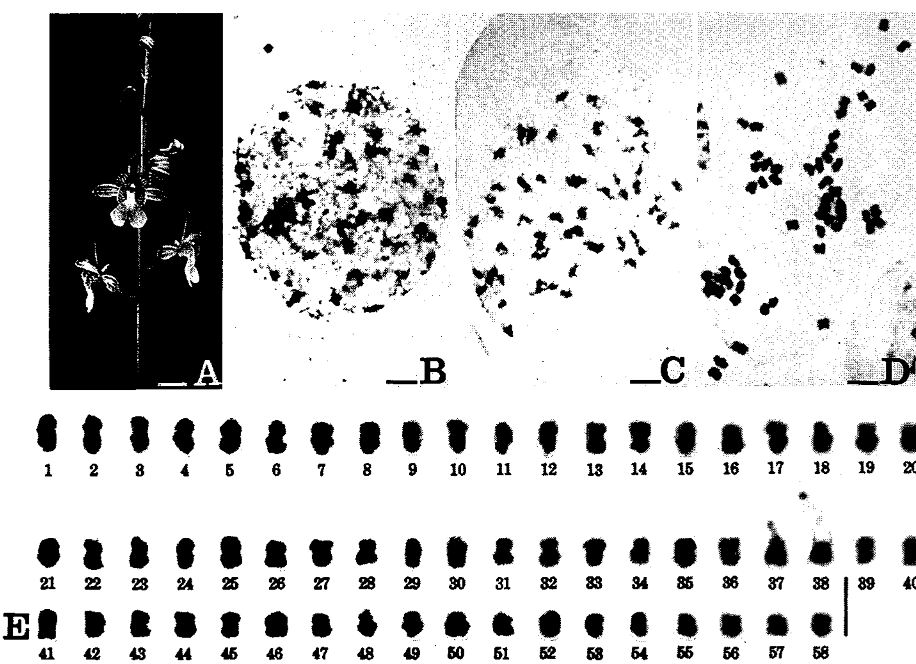

Fig. 56. *Oecoclades saundersiana*, 2n = 58. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 12 mm in A and 3 μm in B–E.

24. ***Cremastra appendiculata*** **(D. Don) Makino, (Japanese name: Saihairan), 2n = 48, Tables 1 and 58, Fig. 57.**

One plant was obtained from Hiroshima Prefecture, Japan. Subterranean pseudobulbs were globose and formed a plicate leaf upto 30 cm long and 6 cm wide. Inflorescences were erect with many flowers. Flowers did not open fully. Sepals and petals were creamy brown in color, and lips were rose purple in color.

The chromosome number of the plant was 2n = 48 at mitotic metaphase, which confirmed Tanaka (1965).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n = 48 chromosomes at mitotic metaphase displayed a gradual decrease in length from the longest (1.7 μm) to the shortest (0.9 μm) chromosomes. All of the 48 chromosomes were median centromeric with arm ratios between 1.0 and 1.4.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

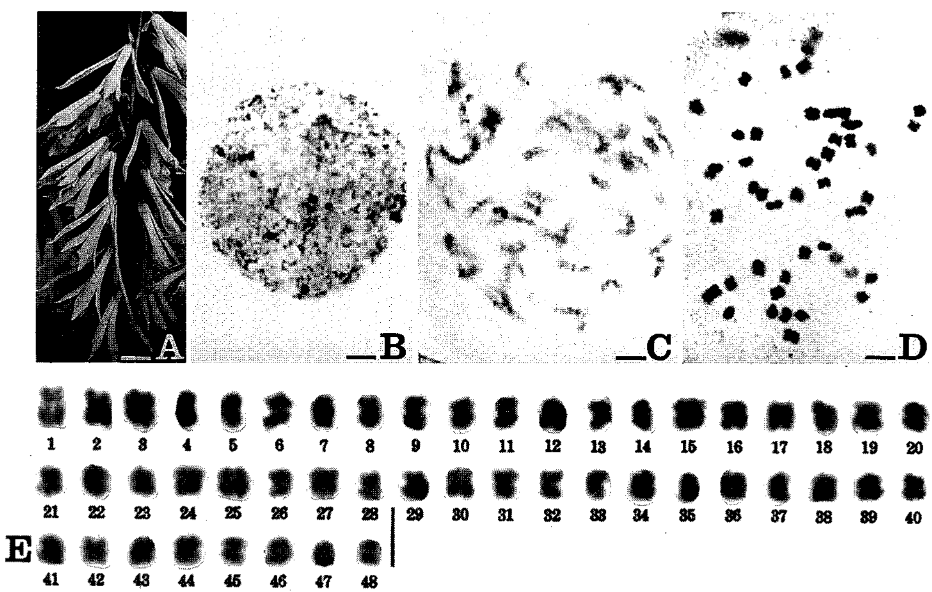

Fig. 57. *Cremastra appendiculata*, 2n = 48. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 12 mm in A and 3 μm in B–E.

25. ***Oreorchis patens*** **(Lindl.) Lindl., (Japanese name: Kokeiran), 2n = 48, Tables 1 and 59, Fig. 58.**

One plant was obtained from Hirosima Prefecture, Japan. Subterranean pseudobulbs were globose and had two linear leaves upto 20 cm long and 2 cm wide. Inflorescences were erect with many flowers. Flowers were 1 cm wide across. Sepals and petals were yellow colored, and lips were creamy white.

The chromosome number of the plant was counted to be 2n = 48 at mitotic metaphase and confirmed the previous reports by Ohno *et al.* (1957) and Mutsuura and Nakahira (1958).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. Two chromocentric bodies at resting stage were about 2 μm diameter, larger than other chromocentric bodies. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n = 48 chromosome complement at mitotic metaphase in this species consisted of two groups of chromosomes; two large chromosomes of 2.4 and 2.2 μm and 46 small chromosomes which showed a gradual decrease in length from 1.9–0.9 μm chromosomes. Among the 48 chromosomes, 41 were median centromeric with arm ratios between 1.0 and 1.7, five (Nos. 8, 16–18, 48) submedian with arm ratios between 1.8 and 3.0, and the other two (Nos. 3–4) subterminal with the arm ratios of 5.3 and 5.0.

This species showed a heterogeneous and bimodal karyotype and a symmetric karyotype.

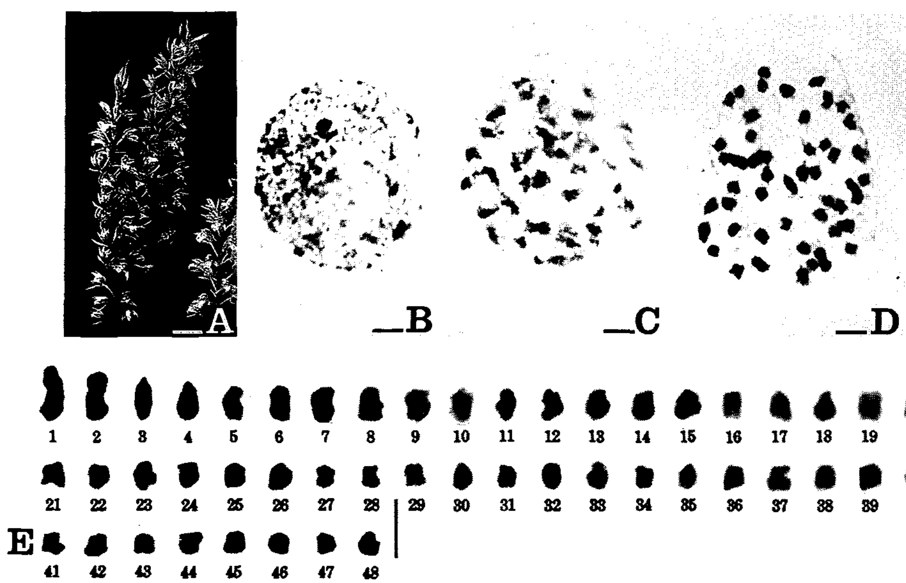

Fig. 58. *Oreorchis patens*, 2n = 48. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 10 mm in A and 3 μm in B–E.

26. ***Warrea costaricensis*** **Schltr., 2n = 52, Tables 1 and 60, Fig. 59.**

One plant was obtained from Panama. Pseudobulbs were small and covered by persistent sheaths. Leaves were plicate, lanceolate upto 40 cm long and 7 cm wide. Inflorescences were erect with a few flowers. Flowers were 6 cm wide across. Sepals and petals were coppery brown in color. Lips were creamy yellow colored in most parts and reddish purple at the base.

The chromosome number of the plant of the species was 2n=52 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromocentric bodies were slightly larger than those of *Cym. macrorhizon*. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

In the chromosome complement of 2n=52 in this species a gradual decrease in length was observed from the longest (2.4 μm) to the shortest (0.9 μm) chromosomes. Among the 52 chromosomes, 32 were median centromeric with arm ratios between 1.0 and 1.6, and the other 20 chromosomes (Nos. 3–4, 7–10, 16–20, 33–38, 49, 51–52) were submedian with arm ratios between 1.8 and 3.0.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

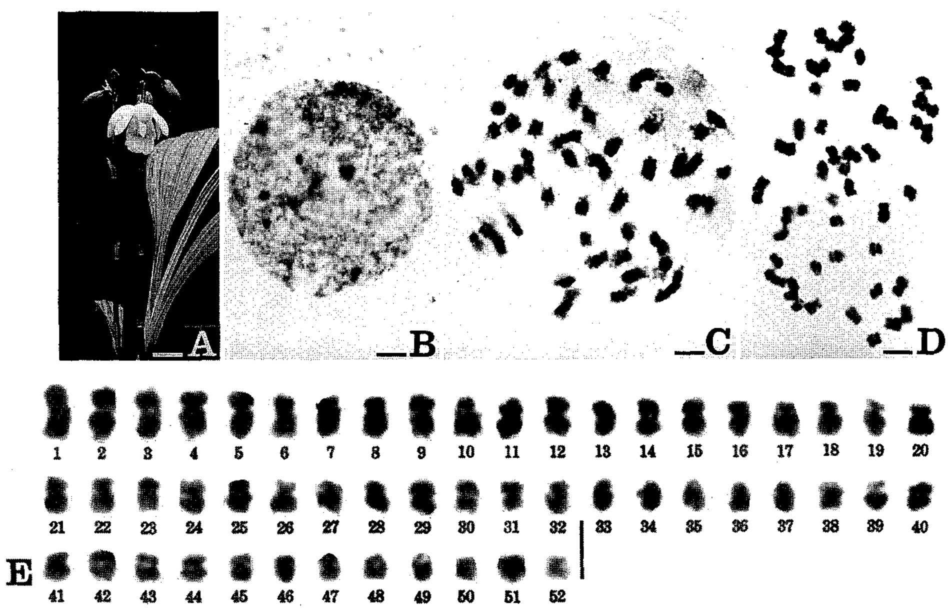

Fig. 59. *Warrea costaricensis*, 2n=52. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 25 mm in A and 3 μm in B–E.

27. *Chrysoglossum ornatum* Blume, 2n=36, Tables 1 and 61, Fig. 60.

One plant was obtained from Formosa. Pseudobulbs were fusiform, were separated from each other, and had a leaf on the apex. Inflorescences were erect with several flowers.

Flowers were 3 cm wide across. Sepals and petals were yellowish green in color with small brown spots. Lips were white colored with purple spots.

The chromosome number of the plant of this species was 2n=36 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. macrorhizon* described above. The chromosome features at resting stage were intermediate between the simple chromocenter type and the complex chromocenter type.

The 2n=36 chromosomes at mitotic metaphase performed a gradual decrease in length from the longest (4.0 μm) to the shortest (1.5 μm) chromosomes. All of the 36 chromosomes were median centromeric with arm ratios between 1.0 and 1.6.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

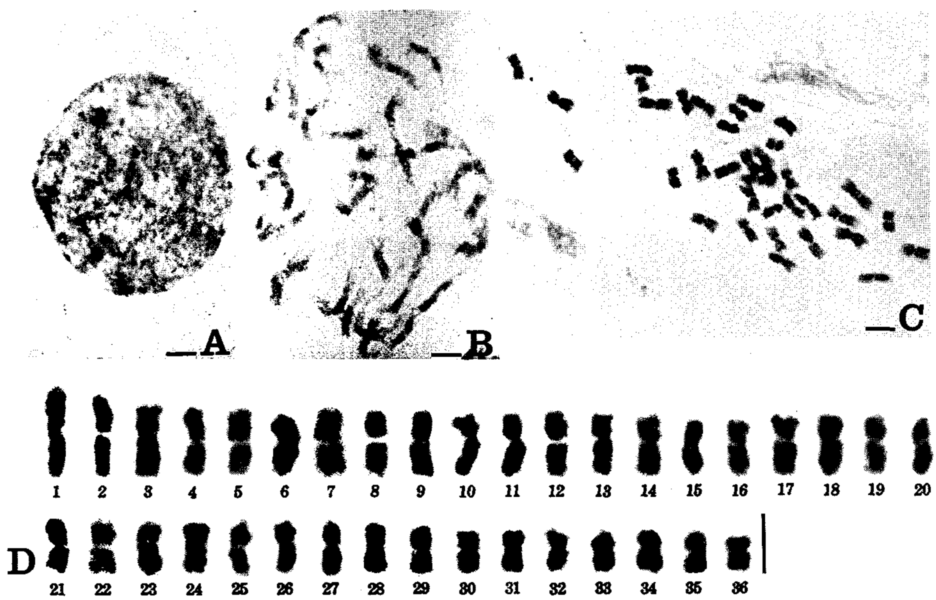

Fig. 60. *Chrysoglossum ornatum*, 2n=36. A, chromosomes at resting stage. B, chromosomes at mitotic prophase. C and D, chromosomes at mitotic metaphase. Bar indicates 3 μm in A–D.

28. *Eriopsis biloba* Lindl., 2n=40, Tables 1 and 62, Fig. 61.

One plant was obtained from Peru. Pseudobulbs were oblong, ovoid, with a few leaves near the apex. Leaves were coriaceous upto 40 cm long and 7 cm wide. Flowers were 3.5 cm wide across and yellowish brown in color bordered with maroon.

The chromosome number of the plant for this species was counted to be 2n=40 at mitotic metaphase and confirmed the previous report by Darker and Jones (1970).

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

A gradual decrease in length was observed from the longest (3.1 μm) to the shortest (1.3 μm) chromosomes in the mitotic-metaphase chromosome complement of 2n = 40. Among the 40 chromosomes, 21 were median centromeric with arm ratios between 1.0 and 1.7, five (Nos. 4, 17, 28–30) submedian with arm ratios between 1.8 and 2.3, and seven (Nos. 19–20, 23–25, 31–32) terminal with arm ratios between 3.5 and 5.0. However, the other seven chromosomes did not show any clearly visible position of centromere.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

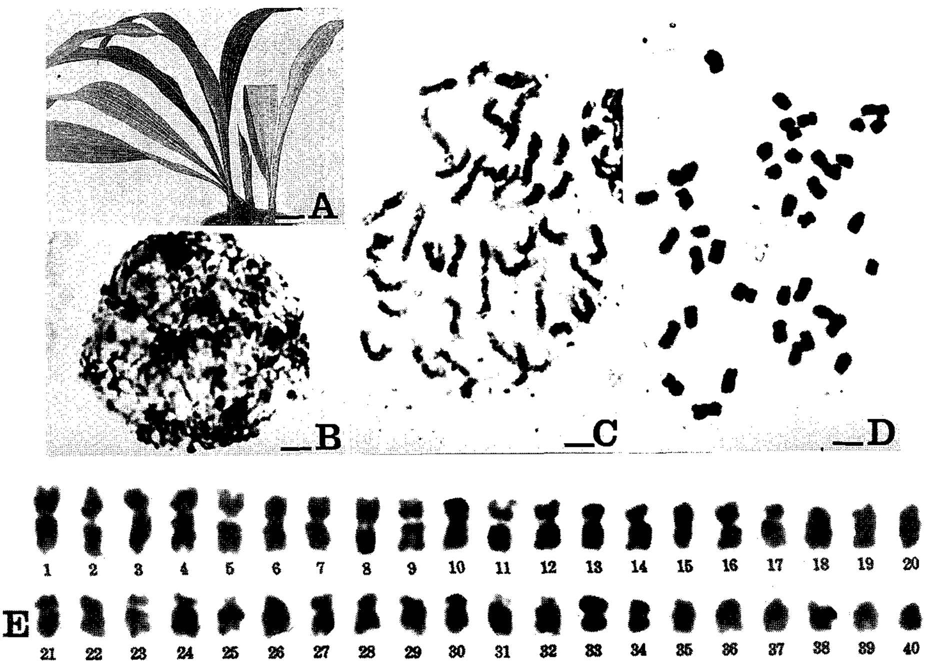

Fig. 61. *Eriopsis biloba*, 2n=40. A, a specimen. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 35 mm in A and 3 μm in B–E.

29. *Grobya amherstiae* Lindl., 2n=54, Tables 1 and 63, Fig. 62.

One plant was obtained from Brazil. Pseudobulbs were globose with a few leaves near the apex. Leaves were linear, lanceolate upto 25 cm long and 1 cm wide. Inflorescences were decumbent with several flowers. Flowers were 3 cm wide across and pale yellow colored. Petals were reticulated with brown netted veins.

The chromosome number of the plant for this species was counted to be 2n=54 at mitotic metaphase, which was reported here for the first time.

The chromosomes at resting stage and mitotic prophase were similar in morphology to those of *Cym. goeringii* described above. The chromosome features at resting stage were of the complex chromocenter type.

The 2n = 54 chromosomes at mitotic metaphase showed a gradual decrease in length from the longest (2.1μm) to the shortest (0.7 μm) chromosomes. Among the 54 chromosomes, 35 were median centromeric with arm ratios between 1.0 and 1.6, 18 (Nos. 2–10, 12–19, 48) submedian with arm ratios between 1.8 and 2.6, and the other one (No. 1) subterminal with the arm ratio of 3.2.

This species showed a homogeneous and gradual karyotype and a symmetric karyotype.

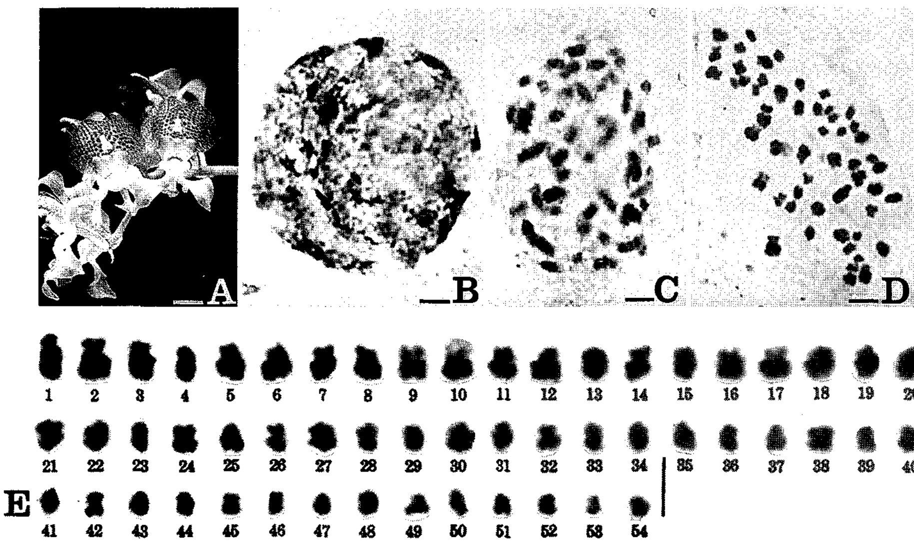

Fig. 62. *Grobya amherstiae*, 2n=54. A, flowers. B, chromosomes at resting stage. C, chromosomes at mitotic prophase. D and E, chromosomes at mitotic metaphase. Bar indicates 12 mm in A and 3 μm in B–E.

Discussion

I. Karyomorphological characteristics

1. Chromosome numbers

Among chromosome numbers of 30 species of *Cymbidium* and 28 species and one hybrid of its 19 allied genera studied (Table 1), those of four species of *Cymbidium* and 16 species of its 13 allied genera were recorded here for the first time; 2n=36 for *Chrysoglossum ornatum*; 2n = 40 for *Acriopsis javanica*, *Cym. aliciae*, *Cym. canaliculatum*, *Cym. chloranthum*, *Cym. madidum* and *Grammatophyllum stapeliiflorum*; 2n = 42 for *Ansellia africana*; 2n = 46 for *Cyrtopodium andersonii*, *Cyrto. punctatum* and *Dipodium paludosum*; 2n = 52 for *Cymbidiella flabellata*, *Eulophiella roempleriana* and *Warrea constaricensis*; 2n = 54 for

Eulophia guineensis, *Graphorkis scripta* and *Grobya amherstiae*; 2n = 56 for *Galeandra baueri* and *Gal. devoniana*; 2n = 60 for *Eulophia paniculata*. The present chromosome counts of 2n=38, 43 and 57 in *Cym. javanicum* reaffirmed the previous report by Aoyama and Tanaka (1988), and those of 2n=52 in *Cymbidiella pardalina* and 2n=42 in *Eulophia streptopetala* corrected the previous reports by Wimber (1957) and Hall (1965).

Thus, the chromosome numbers of *Cymbidium* indicated an aneuploid series with 2n= 38, 39, 40, 41, 43 and 57. The majority of the species of *Cymbidium* studied had 2n=40 chromosomes excepting three species with the 2n=38 chromosomes have been found. The chromosome numbers of 2n = 39 and 43 seemed to contain one and five supernumerary chromosomes; 2n = 38 + 1 supernumerary chromosome and 2n = 38 + 5 supernumerary chromosomes. Similarly, the chromosome number of 2n = 41 means 2n = 40 + 1 supernumerary chromosome. The 2n=57 seemed to be triploid with the basic chromosome number of x=19. Thus, two groups with respect to the different chromosome numbers of 2n= 38 and 40 could be seen in *Cymbidium*.

The chromosome numbers of ten species in six genera belonged to subtribe Cymbidiinae except for *Cymbidium* were varied with 2n=40, 42, 46 and 54, although same chromosome number was seen in the species of each genus studied. In contrast, the chromosome numbers of 15 species and one hybrid in ten genera belonged to subtribe Cyrtopodiinae varied with 2n=42, 46, 48, 52, 54, 56, 58 and 60. The same chromosome numbers were counted in the species in three genera, while the different chromosome numbers of 2n=42, 48, 54 and 60 were counted in the four species of *Eulophia*. The chromosome number of one species belonged to subtribe Collabiinae was the lowest number of 2n=36 among the chromosome numbers given during the course of investigation. The chromosome number of one species belonged to subtribe Maxillariinae was 2n=40, while that of one species belonged to subtribe Grobynae was 2n=54.

2. Morphology of the chromosomes at resting stage

The chromosomes at resting stage throughout the taxa studied were observed as chromomeric granules, fibrous threads and chromatin blocks. The chromatin blocks were highly variable in number, size and shape.

Three different karyotypes were recognized following Tanaka (1971): The intermediate type between the simple chromocenter type and the complex chromocenter type, which was characterized by their smaller and fewer chromocentric bodies, was observed in 16 taxa in 12 genera. The complex chromocenter type characterized by their many larger chromocentric bodies was observed in 36 taxa in seven genera. The intermediate type between the complex chromocenter type and the prochromosome type characterized by large and darkly stained chromocentric bodies, and lightly stained chromomeric granules and fibrous threads was observed in seven taxa in four genera.

3. Morphology of the chromosomes at mitotic prophase

The chromosomes at mitotic prophase of *Cymbidium* formed many early condensed segments at the interstitial regions of both chromosome arms. They got joined with each other during to the progress of cell division. The distal regions of the chromosomes showed mostly delayed condensations.

Morphological characteristics of the chromosomes at mitotic prophase in the genera allied to *Cymbidium* were similar to those of *Cymbidium*. However, the short arms of subtelocentric and telocentric chromosomes were usually condensed later than the long arms. In the species carrying small chromosomes such as *Acriopsis javanica* and *Dipodium paludosum* the early condensed segments were located in the proximal and interstitial regions of their chromosomes.

4. Morphology of the chromosomes at mitotic metaphase

Among the 59 taxa in the 20 genera studied, only *Grammangis ellisii* which had four distinguishably large chromosomes and *Oreorchis patens* which two distinguishably large chromosomes exhibited heterogeneous and bimodal karyotypes. The other 57 taxa showed homogeneous and gradual karyotypes.

The average chromosome length in the chromosome complements at mitotic metaphase in *Cymbidium* was as 3.0 μm. The extremes of the chromosome lengths were the longest chromosome of 4.5 μm in *Cym. faberi* and the shortest chromosome of 1.9 μm in *Cym. chloranthum*. In contrast, the average chromosome length in the chromosome complemants at mitotic metaphase in ten taxa in six genera belonged to subtribe Cymbidiinae except for *Cymbidium* was 1.6 μm. The extremes of the chromosome length were the longest chromosome of 2.2 μm in *Grammatophyllum scriptum* and the shortest chromosome of 1.0 μm in *Acriopsis javanica*. The average chromosome lengths in the chromosome complements at mitotic metaphase in 16 taxa in ten genera belonged to subtribe Cyrtopodiinae was 1.3 μm. The extremes of the chromosome lengths were the longest chromosome of 2.5 μm in *Eulophia petersii* and the shortest chromosome of 0.8 μm in *Geodorum densiflorum*. In the other three taxa of *Chrysoglossum ornatum* (subtribe Collabiinae), *Eriopsis biloba* (subtribe Maxillariinae) and *Grobya amherstiae* (subtribe Grobynae), the average chromosome lengths were 2.5, 2.0 and 1.2 μm, respectively.

The average arm ratio in the chromosome complements at mitotic metaphase in *Cymbidium* was 1.5. The arm ratios ranged from 2.1 in *Cym. madidum* to 1.2 *in Cym. dayanum, Cym. finlaysonianum, Cym. eburneum* and *Cym. parishii*. The average arm ratio in the species studied in subtribe Cymbidiinae except for *Cymbidium* was 2.2. The arm ratios ranged from 4.1 in *Cymbidiella flabellata* to 1.2 in *Acriopsis javanica*. The average arm ratio in the chromosome complements at mitotic metaphase in the species studied in subtribe Cyrtopodiinae was 1.7. The arm ratios ranged from 3.1 in *Eulophiella* Rolfei to 1.1 in *Cremastra appendiculata*. In the other three taxa of *Chrysoglossum ornatum, Eriopsis biloba* and *Grobya amherstiae*, the average arm ratios were 1.2, 1.9 and 1.5, respectively.

Among the 59 taxa studied, 53 taxa showed symmetric karyotypes and the other six taxa (two taxa of *Ansellia*, two taxa of *Cymbidiella* and two taxa of *Eulophiella*) showed intermediate karyotype between the symmetric and the asymmetric karyotypes.

Secondary constrictions mostly located near the distal regions of short arms were observed in 15 taxa in five genera. Their satellites were small in size. The secondary constrictions of *Cym. canaliculatum* were located at the proximal regions of the short arms of certain chromosomes at mitotic metaphase, and those of *Cym. madidum* were located at the interstitial regions of the long arms. Thus, these two taxa were quite different in position of secondary constriction from the other taxa studied. Their satellites were large.

5. Karyomorphological types

With respect to chromosome morphology at resting stage and chromosome length and arm ratio at mitotic metaphase, the karyotypes observed in the 59 taxa were grouped into seven types described as follows:

Type A. Intermediate type between the simple and complex chromocenter types at resting stage; homogeneous, gradual and symmetric karyotype at mitotic metaphase; average chromosome length of over 2.0 μm; 2n=36 and 38. This type was observed in four taxa in two genera; *Cym. macrorhizon, Cym. javanicum, Cym. lancifolium* and *Chrysoglossum ornatum*.

Type B. Intermediate type between the simple and complex chromocenter types; homogeneous, gradual and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=40, 46, 48, 52, 54, 56 and 60. This type was observed in 11 taxa in nine genera; *Acriopsis javanica, Cyrtopodium punctatum, Dipodium paludosum, Eulophia guineensis, E. paniculata, Galeandra baueri, G. devoniana, Geodorum densiflorum, Graphorkis scripta, Cremastra appendiculata* and *Warrea costaricensis*.

Type C. Intermediate type between the simple and complex chromocenter types; heterogeneous, bimodal and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=48. This type was observed only in *Oreorchis patens*..

Type D. The complex chromocenter type; homogeneous, gradual and symmetric karyotype; average chromosome length of over 2.0 μm; 2n = 40 and 48. This type was observed in 29 taxa in four genera; *Cymbidium goeringii, Cym, aliciae, Cym. ensifolium, Cym. faberi, Cym. kanran, Cym. sinense, Cym. dayanum, Cym. aloifolium, Cym. finlaysonianum, Cym. floribundum, Cym. canaliculatum, Cym. madidum, Cym. devonianum, Cym. elegans, Cym. mastersii, Cym. whiteae, Cym. iridioides, Cym. hookerianum, Cym. insigne, Cym. longifolium, Cym. lowianum, Cym. tracyanum, Cym. eburneum, Cym. parishii, Cym. erythrostylum, Cym. tigrinum, Grammatophyllum scriptum, Eulophia petersii* and *Eriopsis biloba*.

Type E. The complex chromocenter type; homogeneous, gradual and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=40, 42, 46, 54 and 58. This type was observed in seven taxa in six genera; *Cymbidium chloranthum, Grammatophyllum speciosum, G. stapeliiflorum, Cyrtopodium andersonii, Eulophia streptopetala, Oecoclades* *saundersiana* and *Grobya amherstiae*.

Type F. Intermediate type between the complex chromocenter type and the prochromosome type; heterogeneous, bimodal and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=54. This type was observed only in *Grammangis ellisii*.

Type G. Intermediate type between the complex chromocenter type and the prochromosome type; homogeneous, gradual and intermediate karyotype between the symmetric and the asymmetric karyotypes; average chromosome length of less than 2.0 μm; 2n=42 and 52. This type was observed in six taxa in three genera; *Ansellia africana, A. gigantea, Cymbidiella flabellata, C. pardalina, Eulophiella* Rolfei and *E. roempleriana*.

II. Cytotaxonomical investigations in *Cymbidium* and its allied genera

1. Genus *Cymbidium*

Schlechter (1924) first studied the systematic classification of *Cymbidium*. He described *Cyperorchis* separated from *Cymbidium* by the distinct characters of slender column and lip united at its base to the sides of the column. Then, he divided *Cymbidium* into eight sections and *Cyperorchis* into four sections. Hunt (1970) treated *Cyperorchis* into a subgenus rank of *Cymbidium*, equal rank to the Schlechter's sections. In contrast, Seth and Cribb (1981) reviewed and classified three subgenera and the previous nine sections and additional three sections in *Cymbidium* by the distinct characters such as number of pollinia, lip unity and so on.

As compared with Seth and Cribb's system (1981), karyomorphological relationships on 30 taxa of *Cymbidium* were studied and discussed as follows:

1) Subgenus Jensoa

Among nine taxa studied in this subgenus, *Cym. macrorhizon* in section Pachirizanthe and *Cym. lancifolium* and *Cym. javanicum* in section Geocymbidium had the 2n = 38 chromosome number and the intermediate karyotype between the simple and complex chromocenter types at resting stage, and were classified into type A. The other six taxa in section Maxillarianthe and section Jensoa had the 2n = 40 chromosome number and the complex chromocenter type at resting stage, and were classified into type D. *Cymbidium aliciae* belonged to section Jensoa was chracterized by lower average chromosome length and higher average arm ratio than the other taxa. Supernumerary chromosomes were observed in three taxa in this subgenus. The triploid chromosome number was counted in a plant of *Cym. javanicum*.

Thus, the species studied in this subgenus could be divided karyomorphologically into two different groups. Those two groups were quite different in chromosome number and karyotype at resting stage from each other.

2) Subgenus Cymbidium

Among six sections of this subgenus of Seth and Cribb's system (1981), five were investigated using their eight taxa. All of the taxa had the 2n = 40 chromosome number and showed the complex chromocenter type at resting stage. *Cymbidium chloranthum* had the average chromosome length of 1.9 μm. It was classified karyomorphologically into type E, while the other seven taxa were classified into type D.

Cymbidium canaliculatum and *Cym. madidum* in section Austrocymbidium had secondary constrictions on the proximal regions of the short arms of certain two chromosomes and the interstitial regions of the long arms of certain two chromosomes, respectively. These satellited chromosomes in the two taxa were very conspicuous, since the secondary constrictions of the other taxa were located near the distal regions of the short arms of certain chromosomes. *Cymbidium chloranthum* in this section showed the shortest average chromosome length among the members of *Cymbidium* studied.

Thus, this subgenus included the taxa with karyomorphological uniformity except for one taxon, although section Austrocymbidium of this subgenus had taxa varied in position of secondary constriction and chromosome length.

3) Subgenus Cyperorchis

The eight taxa investigated in five sections had the 2n = 40 chromosome number and showed the complex chromocenter type at resting stage. Two taxa in section Eburnea showed commonly the average arm ratio of 1.2, which was lower in value than the other taxa in the other sections.

Thus, this subgenus included the taxa with quite high karyomorphological uniformity.

2. Allied genera

Various phylogenetic arrangements on *Cymbidium* and its allied genera have been proposed by some workers: Schlechter (1926) treated that *Cymbidium* was placed in subtribe Cymbidiinae and was related to *Ansellia, Dipodium, Grammatophyllum* and so on. Dressler and Dodson (1960) and Dressler (1974) supported besically Schlechter's system (1926), but changed rankings of some genera between subtribe Cymbidiinae and other subtribes. In contrast, Dressler (1981) treated that *Cymbidium* placed in subtribe Cymbidiinae was combined together with some other genera in the subtribe into subtribe Cyrtopodiinae. Thus, they were considered to be closely related to *Cyrtopodium, Eulophia, Galeandra* and so on.

As compared with Dressler and Dodson's system (1960), karyomorphological relationships on 29 taxa in 19 genera allied to *Cymbidium* were studied and discussed as follows:

1) Subtribe Cymbidiinae

Among the ten taxa in six genera in this subtribe, four taxa in two genera had the chromosome number of 2n=40, two taxa in a genus 2n=42, a taxon in a genus 2n=46, two taxa in a genus 2n=52 and a taxon in a genus 2n=54. Their chromosome morphologies at resting stage and mitotic metaphase were different from each other in this subtribe.

The karyotype of *Grammatophyllum scriptum* was classified into type D which was commonly observed in most of the taxa of *Cymbidium*, while that of *Grammatophyllum speciosum* and *G. stapeliiflorum* was classified into type E which was observed in *Cym. chloranthum*. However, the other genera showed different karyotypes from *Cymbidium* were listed as follows; *Acriopsis javanica* and *Dipodium paludosum* for type B, *Grammangis ellisii* for type F. Two taxa of *Ansellia* and two taxa of *Cymbidiella* were placed in type G.

Thus, this subtribe included complex genera varying karyomorphologically. *Grammatophyllum* seemed the most close relative of *Cymbidium* according to the similarity of karyotypes.

2) Subtribe Cyrtopodiinae

Among the 16 taxa in ten genera in this subtribe, a taxon in a genus had the chromosome number of 2n=42, two taxa in a genus 2n=46, three taxa in three genera 2n=48, three taxa in two genera 2n=52, two taxa in a genus 2n=56, one taxon in a genus 2n=58 and one taxon in a genus 2n=60. Their chromosome morphologies at resting stage and mitotic metaphase were different from each other in this subtribe. This subtribe showed relatively higher chromosome numbers but smaller arm ratios than those of subtribe Cymbidiinae.

The karyotype of *Eulophia petersii* was classified into type D which was commonly observed in most of the taxa of *Cymbidium*, while that of *Eulophia streptopetala* and *Cyrtopodium andersonii* was classified into type E which was observed in *Cym. chloranthum*. However, the other taxa showed different karyotypes from *Cymbidium* were listed as follows; *Cyrtopodium punctatum, Dipodium paludosum, Eulophia guineensis, E. paniculata, Galeandra baueri, G. devoniana, Geodorum densiflorum, Graphorkis scripta, Cremastra appendiculata* and *Warrea costaricensis* for type B, *Oreorchis patens* for type C and *Eulophiella* Rolfei and *E. roempleriana* for type G.

Thus, this subtribe included complex genera varying karyomorphologically. Four taxa in *Eulophia* were different in chromosome number and karyotype from each other, and this genus was karyomorphologically heterogeneous.

3) Subtribe Collabiinae

According to Dressler's system (1974, 1981), *Chrysoglossum* in this subtribe was transferred into subtribe Cyrtopodiinae which included *Cymbidium*. The chromosome number of *Chrysoglossum ornatum* was 2n=36, the lowest among the chromosome numbers in the taxa investigated. The karyotype of this taxon was classified into type A which was observed in *Cym. macrorhizon.*

4) Subtribe Maxillariinae

According to Dressler's system (1974, 1981), *Eriopsis* in this subtribe was transferred into subtribe Cyrtopodiinae. The chromosome number of *Eriopsis biloba* was 2n=40, and the karyotype was classified into type D which was observed in most of the taxa of *Cymbidium* studied.

5) Subtribe Grobynae

Dressler (1974, 1981) transferred *Grobya* from this subtribe into subtribe Cyrtopodiinae. The chromosome number of *Grobya amherstiae* was 2n=54, and the karyotype was classified into type E which was observed in *Cym. chloranthum.*

As a conclusion of the karyomorphological studeis on 59 taxa of *Cymbidium* and its allied genera, the taxa were different from in chromosome number and karyotype each other. The chromosomes at resting stage in all of the taxa showed karyomorphologically the complex chromocenter type and its variations on the basis of the features of chromocentric bodies. Thus, the karyomorphological comparisons of the resting nuclei and the prophase and metaphase chromosomes are necessary to justify phylogenetic relationships among the species of *Cymbidium* and its allied genera.

Summary

1. Karyomorphological observations were made in 30 taxa in *Cymbidium* and 29 taxa in its allied 19 genera (Table 1).
2. The chromosome numbers of four taxa in *Cymbidium* and 16 taxa in its allied 13 genera were reported here for the first time. The chromosome numbers of *Cymbidiella pardalina* (2n=52) and *Eulophia streptopetala* (2n=42) counted here were different from the previous reports, while those of the other 26 taxa of *Cymbidium* and 11 taxa of ten genera verified the previous reports.
3. The chromosomes at resting stage classified into the chromocenter type were found in all of the 30 taxa in *Cymbidium* and 29 taxa in the allied genera investigated. The chromocenter type was divided into three subdivisions by difference in chromocentric bodies; (1) intermediate type between the simple chromocenter type and the complex chromocenter type found in 16 taxa in 12 genera, (2) complex chromocenter type found in 36 taxa in seven genera and (3) intermediate type between the complex chromocenter type and the prochromosome type found in seven taxa in four genera.
4. Most of the taxa showed homogeneous and gradual karyotypes. *Grammangis ellisii* and *Oreorchis patens* had two and four extremely large chromosomes, respectively, and thus showed heterogeneous and bimodal karyotypes.

5. The highest average chromosome length in the taxa of *Cymbidium* studied at mitotic metaphase was 4.5 μm found in *Cym. faberi* while the lowest was 1.9 μm in *Cym. chloranthum*. Most of the 30 taxa of *Cymbidium* studied had the average chromosome length of 3.0 μm at mitotic metaphase. The highest average chromosome length at mitotic metaphase in the 29 taxa in the 19 allied genera studied was 2.5 μm found in *Eulophia petersii* and *Chrysoglossum ornatum*, while the lowest was 0.8 μm in *Geodorum densiflorum*.
6. The highest average arm ratio at mitotic metaphase calculated was 2.1 found in *Cym. madidum* and the lowest was 1.2 in four taxa of *Cymbidium*. Most of the 30 taxa of *Cymbidium* studied had the average arm ratio of 1.5 calculated at mitotic metaphase. The highest average arm ratio calculated at mitotic metaphase in the 29 taxa in the 19 allied genera was 4.1 found in *Cymbidiella flabellata*, while the lowest was 1.1 in *Cremastra appendiculata*.
7. Secondary constrictions were observed near the distal regions of the short arms of certain chromosomes in 15 taxa in five genera, while the secondary constriction in *Cym. canaliculatum* was located at the proximal region of the short arm and that in *Cym. madidum* in the interstitial region of the long arm.
8. With respect to karyomorphological features the 59 taxa studied here could be grouped into seven types as follows:

   Type A. Intermediate type between the simple and complex chromocenter types; homogeneous, gradual and symmetric karyotype; average chromosome length of over 2.0 μm; 2n = 36 and 38; and represented by *Cym. macrorhizon, Cym. lancifolium, Cym. javanicum* and *Chrysoglossum ornatum*.

   Type B. Intermediate type between the simple and complex chromocenter types; homogeneous, gradual and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=40, 46, 48, 52, 54, 56 and 60; and represented by *Acriopsis javanica, Cyrtopodium punctatum, Dipodium paludosum, Eulophia guineensis, E. paniculata, Galeandra baueri, G. devoniana, Geodorum densiflorum, Graphorkis scripta, Cremastra appendiculata* and *Warrea costaricensis*.

   Type C. Intermediate type between the simple and complex chromocenter types; heterogeneous, bimodal and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=48; and represented by *Oreorchis patens*.

   Type D. The complex chromocenter type; homogeneous, gradual and symmetric karyotype; average chromosome length of over 2.0 μm; 2n = 40 and 48; and represented by *Cymbidium* 26 spp., *Grammatophyllum scriptum, Eulophia petersii* and *Eriopsis biloba*.

   Type E. The complex chromocenter type; homogeneous, gradual and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=40, 42, 46, 54 and 58; and represented by *Cym. chloranthum, Grammatophyllum speciosum, G. stapeliiflorum, Cyrtopodium andersonii, Eulophia streptopetala, Oecoclades saundersiana* and *Grobya amherstiae*.

   Type F. Intermediate type between the complex chromocenter type and the prochromosome type; heterogeneous, bimodal and symmetric karyotype; average chromosome length of less than 2.0 μm; 2n=54; and represented by *Grammangis ellisii*.

Type G. Intermediate type between the complex chromocenter type and the prochromosome type; homogeneous, gradual and intermediate between the symmetric and the asymmetric karyotype; average chromosome length of less than 2.0 μm; 2n=42 and 52; and represented by *Ansellia africana, A. gigantea, Cymbidiella flabellata, C. pardalina, Eulophiella* Rolfei and *E. roempleriana*.

9. The karyomorphological types described above were compared with the taxonomical treatments of *Cymbidium* by Seth and Cribb (1981) and its allied genera by Dressler and Dodson (1960).

1) Genus *Cymbidium*

Among nine taxa in subgenus Jensoa, three taxa placed in two section Pachirizanthe and Geocymbidium showed the karyomorphological type A and the other six taxa placed in two sections Maxillarianthe and Jensoa showed the karyomorphological type D. Seven taxa in subgenus Cymbidium except for *Cym. chloranthum* and 13 taxa in subgenus Cyperorchis showed the karyomorphological type D, but, *Cym. chloranthum* showed the karyomorphological type E.

2) Allied 19 genera

Five karyomorphological types, B, D, E, F and G were found in the ten taxa placed in subtribe Cymbidiinae. The type B was found in two taxa placed in two different genera, the type D in one taxon the type E in two taxa within a genus, the type F in one taxon, and the type G in two taxa placed in two different genera. Five karyomorphological types, B, C, D, E and G were found in the 16 taxa placed in subtribe Cyrtopodiinae. The type B was found in 11 taxa in eight genera, the type C in one taxon, the type D in one taxon, the type E in one taxon and the type G in two taxa within a genus. *Chrysoglossum ornatum* placed in subtribe Collabiinae, *Eriopsis biloba* placed in subtribe Maxillariinae and *Grobya amherstiae* placed in subtribe Grobynae showed the type A, the type D and the type E, respectively.

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Table 2. Measurements of somatic chromosomes of *Cymbidium macrorhizon* at mitotic metaphase, 2n=38

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.6+2.8=5.4	3.6	1.0	m
2	2.1+3.3=5.4	3.6	1.5	m
3	2.6+2.6=5.2	3.5	1.0	m
4	2.1+3.0=5.1	3.4	1.4	m
5	2.3+2.4=4.7	3.1	1.0	m
6	1.9+2.8=4.7	3.1	1.4	m
7	1.8+2.9=4.7	3.1	1.6	m
8	1.8+2.8=4.6	3.1	1.5	m
9	1.9+2.6=4.5	3.0	1.3	m
10	2.0+2.4=4.4	2.9	1.2	m
11	1.9+2.5=4.4	2.9	1.3	m
12	1.9+2.4=4.3	2.9	1.2	m
13	1.8+2.5=4.3	2.9	1.3	m
14	2.1+2.1=4.2	2.8	1.0	m
15	1.1+2.9=4.0	2.7	2.6	sm
16	1.0+3.0=4.0	2.7	3.0	sm
17	2.0+2.1=4.1	2.7	1.0	m
18	1.8+2.1=3.9	2.6	1.1	m
19	1.9+1.9=3.8	2.5	1.0	m
20	1.8+2.0=3.8	2.5	1.1	m
21	1.8+2.0=3.8	2.5	1.1	m
22	1.8+2.0=3.8	2.5	1.1	m
23	1.3+2.4=3.7	2.5	1.8	sm
24	1.3+2.4=3.7	2.5	1.8	sm
25	1.4+2.4=3.8	2.5	1.7	m
26	1.8+1.8=3.6	2.4	1.0	m
27	1.6+2.0=3.6	2.4	1.2	m
28	1.5+2.0=3.5	2.3	1.3	m
29	0.6+1.5+2.4=3.5*	2.3	2.1	sm
30	0.5+1.4+2.3=3.2*	2.1	2.5	sm
31	1.3+2.0=3.3	2.2	1.5	m
32	1.3+2.0=3.3	2.2	1.5	m
33	1.2+2.0=3.2	2.1	1.6	m
34	1.1+1.9=3.0	2.0	1.7	m
35	1.0+2.0=3.0	2.0	2.0	sm
36	1.0+2.0=3.0	2.0	2.0	sm
37	1.8+2.0=2.8	1.9	2.5	sm
38	1.9+1.8=2.7	1.8	2.0	sm

* : Chromosome with secondary constriction

Table 3. Measurements of somatic chromosomes of *Cymbidium lancifolium* at mitotic metaphase, 2n=38

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.3+1.9=3.2	3.7	1.4	m
2	1.1+2.0=3.1	3.6	1.8	sm
3	1.4+1.5=2.9	3.3	1.0	m
4	1.4+1.4=2.8	3.2	1.0	m
5	1.3+1.5=2.8	3.2	1.1	m
6	1.3+1.5=2.8	3.2	1.1	m
7	1.1+1.6=2.7	3.1	1.4	m
8	1.3+1.4=2.7	3.1	1.0	m
9	0.9+1.8=2.7	3.1	2.0	sm
10	0.6+2.0=2.6	3.0	3.3	st
11	1.1+1.5=2.6	3.0	1.3	m
12	1.3+1.3=2.6	3.0	1.0	m
13	1.3+1.3=2.6	3.0	1.0	m
14	1.1+1.4=2.5	2.9	1.2	m
15	1.0+1.5=2.5	2.9	1.5	m
16	1.1+1.3=2.4	2.7	1.1	m
17	1.1+1.3=2.4	2.7	1.1	m
18	1.1+1.3=2.4	2.7	1.1	m
19	1.1+1.3=2.4	2.7	1.1	m
20	1.0+1.4=2.4	2.7	1.4	m
21	0.4+1.9=2.3	2.6	4.7	st
22	0.6+1.6=2.2	2.5	2.6	sm
23	0.8+1.4=2.2	2.5	1.7	m
24	0.8+1.3=2.1	2.4	1.6	m
25	0.8+1.3=2.1	2.4	1.6	m
26	1.0+1.0=2.0	2.3	1.0	m
27	1.0+1.0=2.0	2.3	1.0	m
28	0.9+1.1=2.0	2.3	1.2	m
29	0.5+1.5=2.0	2.3	3.0	sm
30	0.5+1.4=1.9	2.2	2.8	sm
31	0.9+1.0=1.9	2.2	1.1	m
32	0.8+1.0=1.8	2.1	1.2	m
33	0.8+1.0=1.8	2.1	1.2	m
34	0.8+1.0=1.8	2.1	1.2	m
35	0.8+1.0=1.8	2.1	1.2	m
36	0.6+0.9=1.5	1.7	1.5	m
37	0.6+0.9=1.5	1.7	1.5	m
38	0.5+0.8=1.3	1.5	1.6	m

Table 4. Measurements of somatic chromosomes of *Cymbidium javanicum* at mitotic metaphase, 2n=38

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.4+1.9=3.3	3.8	1.3	m
2	1.4+1.8=3.2	3.7	1.2	m
3	1.4+1.5=2.9	3.3	1.0	m
4	1.4+1.5=2.9	3.3	1.0	m
5	1.3+1.5=2.8	3.2	1.1	m
6	1.4+1.4=2.8	3.2	1.0	m
7	1.3+1.5=2.8	3.2	1.1	m
8	1.1+1.6=2.7	3.1	1.4	m
9	1.3+1.3=2.6	3.0	1.0	m
10	1.1+1.5=2.6	3.0	1.3	m
11	1.0+1.6=2.6	3.0	1.6	m
12	1.1+1.4=2.5	2.9	1.2	m
13	1.0+1.5=2.5	2.9	1.5	m
14	1.1+1.3=2.4	2.7	1.1	m
15	1.0+1.4=2.4	2.7	1.4	m
16	1.1+1.3=2.4	2.7	1.1	m
17	1.0+1.4=2.4	2.7	1.4	m
18	1.0+1.4=2.4	2.7	1.4	m
19	1.0+1.3=2.3	2.6	1.3	m
20	0.9+1.3=2.2	2.5	1.4	m
21	0.4+1.8=2.2	2.5	4.5	st
22	0.4+1.8=2.2	2.5	4.5	st
23	0.8+1.4=2.2	2.5	1.7	m
24	1.0+1.1=2.1	2.4	1.1	m
25	1.0+1.1=2.1	2.4	1.1	m
26	1.0+1.1=2.1	2.4	1.1	m
27	0.6+1.5=2.1	2.4	2.5	sm
28	0.5+1.6=2.1	2.4	3.2	st
29	0.4+1.6=2.0	2.3	4.0	st
30	0.9+1.1=2.0	2.3	1.2	m
31	0.9+1.1=2.0	2.3	1.2	m
32	0.9+1.1=2.0	2.3	1.2	m
33	0.8+1.1=1.9	2.2	1.3	m
34	0.8+1.0=1.8	2.1	1.2	m
35	0.6+0.9=1.5	1.7	1.5	m
36	0.6+0.9=1.5	1.7	1.5	m
37	0.5+0.9=1.4	1.6	1.8	sm
38	0.5+0.9=1.4	1.6	1.8	sm

Table 5. Measurements of somatic chromosomes of *Cymbidium javanicum* at mitotic metaphase, 2n=43

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.9+2.1=4.0	3.7	1.1	m
2	1.8+2.1=3.9	3.6	1.1	m
3	1.6+2.1=3.7	3.4	1.3	m
4	1.6+1.8=3.4	3.1	1.1	m
5	1.5+1.9=3.4	3.1	1.2	m
6	1.3+2.1=3.4	3.1	1.6	m
7	1.5+1.8=3.3	3.0	1.2	m
8	1.3+2.0=3.3	3.0	1.5	m
9	1.3+2.0=3.3	3.0	1.5	m
10	1.3+2.0=3.3	3.0	1.5	m
11	1.4+1.8=3.2	2.9	1.2	m
12	1.5+1.6=3.1	2.8	1.0	m
13	1.3+1.8=3.1	2.8	1.3	m
14	1.3+1.8=3.1	2.8	1.3	m
15	0.9+2.0=2.9	2.7	2.2	sm
16	0.9+1.9=2.8	2.6	2.1	sm
17	0.9+1.9=2.8	2.6	2.1	sm
18	0.6+2.0=2.6	2.4	3.3	st
19	0.5+2.1=2.6	2.4	4.2	st
20	0.5+2.1=2.6	2.4	4.2	st
21	1.3+1.4=2.7	2.5	1.0	m
22	1.1+1.4=2.5	2.3	1.2	m
23	0.9+1.4=2.3	2.1	1.5	m
24	0.9+1.4=2.3	2.1	1.5	m
25	0.9+1.4=2.3	2.1	1.5	m
26	0.9+1.3=2.2	2.0	1.4	m
27	0.8+1.4=2.2	2.0	1.7	m
28	1.0+1.1=2.1	1.9	1.1	m
29	1.0+1.1=2.1	1.9	1.1	m
30	0.8+1.3=2.1	1.9	1.6	m
31	0.8+1.3=2.1	1.9	1.6	m
32	0.6+1.4=2.0	1.8	2.3	sm
33	0.5+1.4=1.9	1.7	2.8	sm
34	0.8+1 1=1.9	1.7	1.3	m
35	0.8+1.1=1.9	1.7	1.3	m
36	0.8+1.0=1.8	1.7	1.2	m
37	0.4+1.4=1.8	1.7	3.5	st
38	0.5+1.1=1.6	1.5	2.2	sm
39	0.8+0.8=1.6	1.5	1.0	m
40	0.6+0.8=1.4	1.3	1.3	m
41	—+1.5=1.5	1.4	—	—
42	—+1.5=1.5	1.4	—	—
43	—+1.4=1.4	1.3	—	—

Table 6. Measurements of somatic chromosomes of *Cymbidium javanicum* at mitotic metaphase, 2n=57

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.6+3.4=6.0	2.7	1.3	m
2	2.6+2.8=5.4	2.5	1.0	m
3	2.6+2.8=5.4	2.5	1.0	m
4	2.6+2.6=5.2	2.4	1.0	m
5	2.6+2.6=5.2	2.4	1.0	m
6	2.1+3.0=5.1	2.3	1.4	m
7	2.0+3.1=5.1	2.3	1.5	m
8	2.4+2.6=5.0	2.3	1.0	m
9	2.3+2.6=4.9	2.2	1.1	m
10	2.0+2.9=4.9	2.2	1.4	m
11	1.9+3.0=4.9	2.2	1.5	m
12	2.0+2.8=4.8	2.2	1.4	m
13	2.3+2.4=4.7	2.2	1.0	m
14	1.9+2.8=4.7	2.2	1.4	m
15	1.8+2.8=4.6	2.1	1.5	m
16	2.1+2.4=4.5	2.1	1.1	m
17	2.1+2.4=4.5	2.1	1.1	m
18	1.9+2.6=4.5	2.1	1.3	m
19	2.0+2.4=4.4	2.0	1.2	m
20	1.8+2.6=4.4	2.0	1.4	m
21	1.8+2.5=4.3	2.0	1.3	m
22	1.4+2.8=4.2	1.9	2.0	sm
23	1.1+3.0=4.1	1.9	2.7	sm
24	1.0+2.8=3.8	1.7	2.8	sm
25	1.6+2.4=4.0	1.8	1.5	m
26	1.5+2.5=4.0	1.8	1.6	m
27	1.5+2.2=3.7	1.7	1.4	m
28	0.8+3.0=3.8	1.7	3.7	st
29	0.8+2.9=3.7	1.7	3.6	st
30	1.0+2.6=3.6	1.6	2.6	sm
31	1.2+2.4=3.6	1.6	2.0	sm
32	1.5+2.0=3.5	1.6	1.3	m
33	1.4+2.1=3.5	1.6	1.5	m
34	1.3+2.1=3.4	1.6	1.6	m
35	1.5+1.8=3.3	1.5	1.2	m
36	1.3+1.9=3.2	1.5	1.4	m
37	1.0+2.6=3.6	1.6	2.6	sm
38	0.1+0.5+2.6=3.2*	1.5	4.3	st
39	0.6+2.6=3.2	1.5	4.3	st
40	1.3+2.0=3.3	1.5	1.5	m

Table 6. continued

41	1.4+1.6=3.0	1.4	1.1	m
42	1.1+1.8=2.9	1.3	1.6	m
43	1.0+1.9=2.9	1.3	1.9	sm
44	1.0+1.9=2.9	1.3	1.9	sm
45	1.0+1.9=2.9	1.3	1.9	sm
46	1.1+1.8=2.9	1.3	1.6	m
47	1.4+1.4=2.8	1.3	1.0	m
48	1.3+1.5=2.8	1.3	1.1	m
49	0.8+2.1=2.9	1.3	2.6	sm
50	1.0+1.8=2.8	1.3	1.8	sm
51	0.9+1.9=2.8	1.3	2.1	sm
52	1.3+1.4=2.7	1.2	1.0	m
53	1.1+1.6=2.7	1.2	1.4	m
54	1.0+1.6=2.6	1.2	1.6	m
55	1.0+1.6=2.6	1.2	1.6	m
56	1.0+1.5=2.5	1.1	1.5	m
57	0.9+1.5=2.4	1.1	1.6	m

* : Chromosome with secondary constriction

Table 7. Measurements of somatic chromosomes of *Cymbidium goeringii* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.4+2.5=4.9	3.6	1.0	m
2	2.4+2.4=4.8	3.6	1.0	m
3	2.1+2.6=4.7	3.5	1.2	m
4	2.1+2.4=4.5	3.3	1.1	m
5	2.0+2.5=4.5	3.3	1.2	m
6	2.1+2.3=4.4	3.3	1.0	m
7	1.8+2.6=4.4	3.3	1.4	m
8	2.1+2.1=4.2	3.1	1.0	m
9	1.8+2.4=4.2	3.1	1.3	m
10	2.0+2.1=4.1	3.0	1.0	m
11	2.0+2.0=4.0	3.0	1.0	m
12	2.0+2.0=4.0	3.0	1.0	m
13	1.9+2.0=3.9	2.9	1.0	m
14	1.8+2.1=3.9	2.9	1.1	m
15	1.1+2.6=3.7	2.7	2.3	sm
16	1.1+2.6=3.7	2.7	2.3	sm
17	1.8+1.8=3.6	2.7	1.0	m
18	1.5+2.0=3.5	2.6	1.3	m
19	1.5+1.6=3.1	2.3	1.0	m
20	1.5+1.6=3.1	2.3	1.0	m
21	1.5+1.6=3.1	2.3	1.0	m
22	1.5+1.6=3.1	2.3	1.0	m
23	1.1+2.0=3.1	2.3	1.8	sm
24	1.1+1.9=3.0	2.2	1.7	m
25	0.6+2.3=2.9	2.1	3.8	st
26	0.6+2.3=2.9	2.1	3.8	st
27	1.4+1.5=2.9	2.1	1.0	m
28	1.3+1.5=2.8	2.1	1.1	m
29	1.0+1.9=2.9	2.1	1.9	sm
30	1.0+1.8=2.8	2.1	1.8	sm
31	1.3+1.5=2.8	2.1	1.1	m
32	1.3+1.5=2.8	2.1	1.1	m
33	1.3+1.4=2.7	2.0	1.0	m
34	1.1+1.6=2.7	2.0	1.4	m
35	1.0+1.5=2.5	1.9	1.5	m
36	1.0+1.4=2.4	1.8	1.4	m
37	1.0+1.1=2.1	1.6	1.1	m
38	0.8+1.3=2.1	1.6	1.6	m
39	0.8+1.3=2.1	1.6	1.6	m
40	0.9+1.1=2.0	1.5	1.2	m

Table 8. Measurements of somatic chromosomes of *Cymbidium aliciae* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.1+2.4=3.5	3.9	2.1	sm
2	1.1+2.3=3.4	3.8	2.0	sm
3	1.3+2.1=3.4	3.8	1.6	m
4	1.4+1.8=3.2	3.5	1.2	m
5	1.4+1.8=3.2	3.5	1.2	m
6	1.3+1.9=3.2	3.5	1.4	m
7	1.5+1.6=3.1	3.4	1.0	m
8	1.5+1.5=3.0	3.3	1.0	m
9	1.0+1.8=2.8	3.1	1.8	sm
10	1.0+1.8=2.8	3.1	1.8	sm
11	1.3+1.4=2.7	3.0	1.0	m
12	1.0+1.5=2.5	2.8	1.5	m
13	1.0+1.4=2.4	2.6	1.4	m
14	1.0+1.3=2.3	2.5	1.3	m
15	0.5+1.9=2.4	2.6	3.8	st
16	0.5+1.8=2.3	2.5	3.6	st
17	0.9+1.4=2.3	2.5	1.5	m
18	1.1+1.1=2.2	2.4	1.0	m
19	0.9+1.3=2.2	2.4	1.4	m
20	0.8+1.4=2.2	2.4	1.7	m
21	0.4+1.8=2.2	2.4	4.5	st
22	0.3+1.8=2.1	2.3	6.0	st
23	1.0+1.1=2.1	2.3	1.1	m
24	0.8+1.3=2.1	2.3	1.6	m
25	0.9+1.1=2.0	2.2	1.2	m
26	0.9+1.1=2.0	2.2	1.2	m
27	0.8+1.1=1.9	2.1	1.3	m
28	0.8+1.1=1.9	2.1	1.3	m
29	0.8+1.1=1.9	2.1	1.3	m
30	0.8+1.0=1.8	2.0	1.2	m
31	0.5+1.3=1.8	2.0	2.6	sm
32	0.5+1.3=1.8	2.0	2.6	sm
33	0.8+1.0=1.8	2.0	1.2	m
34	0.6+1.0=1.6	1.8	1.6	m
35	0.8+0.8=1.6	1.8	1.0	m
36	0.8+0.8=1.6	1.8	1.0	m
37	0.5+1.0=1.5	1.7	2.0	sm
38	0.5+0.9=1.4	1.5	1.8	sm
39	0.4+0.8=1.2	1.3	2.0	sm
40	0.4+0.8=1.2	1.3	2.0	sm

Table 9. Measurements of somatic chromosomes of *Cymbidium ensifolium* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.3+2.8=5.1	3.8	1.2	m
2	2.1+2.6=4.7	3.5	1.2	m
3	2.1+2.5=4.6	3.4	1.1	m
4	2.0+2.6=4.6	3.4	1.3	m
5	1.8+2.4=4.2	3.1	1.3	m
6	1.8+2.3=4.1	3.0	1.2	m
7	1.8+2.3=4.1	3.0	1.2	m
8	2.0+2.0=4.0	3.0	1.0	m
9	1.6+2.4=4.0	3.0	1.5	m
10	1.1+2.9=4.0	3.0	2.6	sm
11	1.9+2.0=3.9	2.9	1.0	m
12	1.8+2.1=3.9	2.9	1.1	m
13	1.6+2.3=3.9	2.9	1.4	m
14	1.6+2.3=3.9	2.9	1.4	m
15	1.3+2.3=3.6	2.7	1.7	m
16	1.5+2.0=3.5	2.6	1.3	m
17	1.5+2.0=3.5	2.6	1.3	m
18	1.6+1.8=3.4	2.5	1.1	m
19	0.9+2.5=3.4	2.5	2.7	sm
20	0.9+2.4=3.3	2.4	2.6	sm
21	1.3+2.0=3.3	2.4	1.5	m
22	1.3+2.0=3.3	2.4	1.5	m
23	1.4+1.8=3.2	2.4	1.2	m
24	1.1+2.1=3.2	2.4	1.9	sm
25	1.5+1.6=3.1	2.3	1.0	m
26	1.5+1.5=3.0	2.2	1.0	m
27	1.5+1.5=3.0	2.2	1.0	m
28	1.3+1.6=2.9	2.2	1.2	m
29	1.4+1.4=2.8	2.1	1.0	m
30	1.3+1.5=2.8	2.1	1.1	m
31	1.3+1.5=2.8	2.1	1.1	m
32	0.9+1.9=2.8	2.1	2.1	sm
33	1.1+1.5=2.6	1.9	1.3	m
34	1.0+1.6=2.6	1.9	1.6	m
35	1.1+1.4=2.5	1.9	1.2	m
36	1.1+1.1=2.2	1.6	1.0	m
37	0.8+1.6=2.4	1.8	2.0	sm
38	0.8+1.4=2.2	1.6	1.7	m
39	1.1+1.1=2.2	1.6	1.0	m
40	1.1+1.1=2.2	1.6	1.0	m

Table 10. Measurements of somatic chromosomes of *Cymbidium fabei* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	3.3+3.3=6.6	3.7	1.0	m
2	3.1+3.3=6.4	3.6	1.0	m
3	2.9+3.5=6.4	3.6	1.2	m
4	2.9+3.4=6.3	3.5	1.1	m
5	2.8+3.3=6.1	3.4	1.1	m
6	2.5+3.3=5.8	3.2	1.3	m
7	2.3+3.5=5.8	3.2	1.5	m
8	2.5+3.3=5.8	3.2	1.3	m
9	2.8+2.9=5.7	3.2	1.0	m
10	2.3+3.3=5.6	3.1	1.4	m
11	2.3+3.3=5.6	3.1	1.4	m
12	2.6+2.9=5.5	3.1	1.1	m
13	1.8+3.5=5.3	2.9	1.9	sm
14	1.5+3.6=5.1	2.8	2.4	sm
15	2.5+2.8=5.3	2.9	1.1	m
16	2.0+2.8=4.8	2.7	1.4	m
17	2.0+2.6=4.6	2.6	1.3	m
18	1.9+2.6=4.5	2.5	1.3	m
19	2.1+2.3=4.4	2.4	1.0	m
20	2.0+2.4=4.4	2.4	1.2	m
21	2.0+2.3=4.3	2.4	1.1	m
22	1.8+2.4=4.2	2.3	1.3	m
23	2.0+2.1=4.1	2.3	1.0	m
24	1.1+3.0=4.1	2.3	2.7	sm
25	1.9+2.1=4.0	2.2	1.1	m
26	1.6+2.4=4.0	2.2	1.5	m
27	1.8+2.0=3.8	2.1	1.1	m
28	0.7+3.0=3.7	2.1	4.3	st
29	0.8+2.9=3.7	2.1	3.6	st
30	1.5+2.0=3.5	1.9	1.3	m
31	1.5+2.0=3.5	1.9	1.3	m
32	1.1+2.4=3.5	1.9	2.1	sm
33	1.1+2.3=3.4	1.9	2.0	sm
34	1.3+2.0=3.3	1.8	1.5	m
35	1.0+2.1=3.1	1.7	2.1	sm
36	1.1+1.8=2.9	1.6	1.6	m
37	1.0+1.9=2.9	1.6	1.9	sm
38	1.0+1.9=2.9	1.6	1.9	sm
39	0.8+1.8=2.6	1.4	2.2	sm
40	0.8+1.5=2.3	1.3	1.8	sm

Table 11. Measurements of somatic chromosomes of *Cymbidium kanran* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.4+2.5=4.9	3.5	1.0	m
2	2.3+2.4=4.7	3.3	1.0	m
3	2.1+2.3=4.4	3.1	1.0	m
4	2.1+2.3=4.4	3.1	1.0	m
5	2.0+2.4=4.4	3.1	1.2	m
6	1.9+2.4=4.3	3.0	1.2	m
7	2.1+2.1=4.2	3.0	1.0	m
8	1.9+2.3=4.2	3.0	1.2	m
9	1.8+2.3=4.1	2.9	1.2	m
10	2.0+2.0=4.0	2.8	1.0	m
11	2.0+2.0=4.0	2.8	1.0	m
12	1.8+2.1=3.9	2.8	1.1	m
13	1.6+2.3=3.9	2.8	1.4	m
14	1.5+2.4=3.9	2.8	1.6	m
15	1.3+2.6=3.9	2.8	2.0	sm
16	1.3+2.6=3.9	2.8	2.0	sm
17	1.8+2.0=3.8	2.7	1.1	m
18	1.6+1.9=3.5	2.5	1.1	m
19	1.6+1.9=3.5	2.5	1.1	m
20	1.6+1.9=3.5	2.5	1.1	m
21	1.6+1.9=3.5	2.5	1.1	m
22	1.5+2.0=3.5	2.5	1.3	m
23	1.5+2.0=3.5	2.5	1.3	m
24	1.5+1.9=3.4	2.4	1.2	m
25	1.0+2.3=3.3	2.3	2.3	sm
26	1.1+2.1=3.2	2.3	1.9	sm
27	1.1+2.1=3.2	2.3	1.9	sm
28	0.9+2.3=3.2	2.3	2.5	sm
29	1.5+1.6=3.1	2.2	1.0	m
30	1.5+1.6=3.1	2.2	1.0	m
31	1.0+2.1=3.1	2.2	2.1	sm
32	0.8+2.3=3.1	2.2	2.8	sm
33	0.9+2.1=3.0	2.1	2.3	sm
34	0.9+2.0=2.9	2.1	2.2	sm
35	0.9+1.9=2.8	2.0	2.1	sm
36	0.8+1.8=2.6	1.8	2.2	sm
37	0.6+2.0=2.6	1.8	3.3	st
38	0.5+2.1=2.6	1.8	4.2	st
39	1.0+1.3=2.3	1.6	1.3	m
40	1.0+1.0=2.0	1.4	1.0	m

Table 12. Measurements of somatic chromosomes of *Cymbidium kanran* at mitotic metaphase, 2n=41

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.3+2.4=4.7	3.5	1.0	m
2	2.1+2.4=4.5	3.4	1.1	m
3	2.1+2.4=4.5	3.4	1.1	m
4	2.1+2.3=4.4	3.3	1.0	m
5	2.0+2.1=4.1	3.1	1.0	m
6	2.0+2.1=4.1	3.1	1.0	m
7	1.6+2.3=3.9	2.9	1.4	m
8	1.6+2.3=3.9	2.9	1.4	m
9	1.5+2.3=3.8	2.8	1.5	m
10	1.6+2.1=3.7	2.8	1.3	m
11	1.6+1.8=3.4	2.5	1.1	m
12	1.4+2.0=3.4	2.5	1.4	m
13	1.5+1.8=3.3	2.5	1.2	m
14	1.5+1.8=3.3	2.5	1.2	m
15	1.4+1.9=3.3	2.5	1.3	m
16	1.3+2.0=3.3	2.5	1.5	m
17	1.0+2.3=3.3	2.5	2.3	sm
18	1.6+1.6=3.2	2.4	1.0	m
19	1.4+1.8=3.2	2.4	1.2	m
20	1.4+1.8=3.2	2.4	1.2	m
21	1.3+1.9=3.2	2.4	1.4	m
22	1.1+2.0=3.1	2.3	1.8	sm
23	1.5+1.6=3.1	2.3	1.0	m
24	1.5+1.6=3.1	2.3	1.0	m
25	0.8+2.3=3.1	2.3	2.8	sm
26	1.4+1.6=3.0	2.2	1.1	m
27	1.4+1.6=3.0	2.2	1.1	m
28	1.5+1.5=3.0	2.2	1.0	m
29	0.2+0.7+2.1=3.0*	2.2	2.3	sm
30	0.2+0.7+2.1=3.0*	2.2	2.3	sm
31	0.9+2.0=2.9	2.2	2.2	sm
32	0.9+2.0=2.9	2.2	2.2	sm
33	0.9+2.0=2.9	2.2	2.2	sm
34	0.8+2.0=2.8	2.1	2.5	sm
35	0.8+1.8=2.6	1.9	2.2	sm
36	0.8+1.8=2.6	1.9	2.2	sm
37	0.5+1.9=2.4	1.8	3.8	st
38	0.5+1.9=2.4	1.8	3.8	st
39	1.0+1.1=2.1	1.6	1.1	m
40	0.9+1.1=2.0	1.5	1.2	m
41	d+2.6=2.6	1.9	∞	t

d : dot, * : chromosome with secondary constriction

Table 13. Measurements of somatic chromosomes of *Cymbidium sinense* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.4+2.9=5.3	3.8	1.2	m
2	2.4+2.8=5.2	3.7	1.1	m
3	2.4+2.4=4.8	3.5	1.0	m
4	2.3+2.4=4.7	3.4	1.0	m
5	2.3+2.3=4.6	3.3	1.0	m
6	2.1+2.4=4.5	3.2	1.1	m
7	2.0+2.5=4.5	3.2	1.2	m
8	2.1+2.3=4.4	3.2	1.0	m
9	2.1+2.3=4.4	3.2	1.0	m
10	1.9+2.5=4.4	3.2	1.3	m
11	2.1+2.1=4.2	3.0	1.0	m
12	2.0+2.1=4.1	3.0	1.0	m
13	1.0+3.1=4.1	3.0	3.1	st
14	1.0+3.0=4.1	3.0	2.7	sm
15	1.9+2.0=3.9	2.8	1.0	m
16	1.9+1.9=3.8	2.7	1.0	m
17	1.6+2.1=3.7	2.7	1.3	m
18	1.6+1.9=3.5	2.5	1.1	m
19	1.6+1.9=3.5	2.5	1.1	m
20	1.3+2.1=3.4	2.4	1.6	m
21	1.6+1.6=3.2	2.3	1.0	m
22	1.5+1.6=3.1	2.2	1.0	m
23	1.4+1.7=3.1	2.2	1.2	m
24	1.3+1.8=3.1	2.2	1.3	m
25	1.5+1.5=3.0	2.2	1.0	m
26	1.4+1.6=3.0	2.2	1.1	m
27	0.6+2.4=3.0	2.2	4.0	st
28	0.4+2.6=3.0	2.2	6.5	st
29	1.4+1.5=2.9	2.1	1.0	m
30	1.4+1.5=2.9	2.1	1.0	m
31	1.1+1.8=2.9	2.1	1.6	m
32	1.1+1.5=2.6	1.9	1.3	m
33	0.5+2.2=2.7	1.9	4.4	st
34	0.7+1.8=2.5	1.8	2.5	sm
35	1.0+1.5=2.5	1.8	1.5	m
36	1.1+1.1=2.2	1.6	1.0	m
37	1.0+1.2=2.2	1.6	1.2	m
38	1.0+1.0=2.0	1.4	1.0	m
39	0.9+1.1=2.0	1.4	1.2	m
40	0.6+1.3=1.9	1.4	2.1	sm

Table 14. Measurements of somatic chromosomes of *Cymbidium dayanum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.5+1.8=3.3	3.3	1.2	m
2	1.3+1.8=3.1	3.1	1.3	m
3	1.3+1.8=3.1	3.1	1.3	m
4	1.4+1.6=3.0	3.0	1.1	m
5	1.5+1.5=3.0	3.0	1.0	m
6	1.4+1.5=2.9	2.9	1.0	m
7	1.4+1.5=2.9	2.9	1.0	m
8	1.3+1.6=2.9	2.9	1.2	m
9	1.3+1.6=2.9	2.9	1.2	m
10	1.3+1.6=2.9	2.9	1.2	m
11	1.4+1.5=2.9	2.9	1.0	m
12	1.4+1.5=2.9	2.9	1.0	m
13	1.3+1.5=2.8	2.8	1.1	m
14	1.3+1.4=2.7	2.7	1.0	m
15	1.3+1.4=2.7	2.7	1.0	m
16	1.1+1.5=2.6	2.6	1.3	m
17	1.1+1.5=2.6	2.6	1.3	m
18	1.3+1.3=2.6	2.6	1.0	m
19	1.3+1.3=2.6	2.6	1.0	m
20	1.1+1.5=2.6	2.6	1.3	m
21	1.1+1.4=2.5	2.5	1.2	m
22	1.1+1.4=2.5	2.5	1.2	m
23	1.1+1.3=2.4	2.4	1.1	m
24	1.1+1.3=2.4	2.4	1.1	m
25	1.0+1.4=2.4	2.4	1.4	m
26	1.0+1.3=2.3	2.3	1.3	m
27	1.0+1.3=2.3	2.3	1.3	m
28	1.0+1.3=2.3	2.3	1.3	m
29	0.9+1.4=2.3	2.3	1.5	m
30	1.1+1.1=2.2	2.2	1.0	m
31	0.8+1.4=2.2	2.2	1.7	m
32	0.8+1.4=2.2	2.2	1.7	m
33	1.1+1.1=2.2	2.2	1.0	m
34	1.0+1.0=2.0	2.0	1.0	m
35	0.6+1.4=2.0	2.0	2.3	sm
36	0.6+1.4=2.0	2.0	2.3	sm
37	0.9+1.0=1.9	1.9	1.1	m
38	0.9+0.9=1.8	1.8	1.0	m
39	0.9+0.9=1.8	1.8	1.0	m
40	0.8+0.8=1.6	1.6	1.0	m

Table 15. Measurements of somatic chromosomes of *Cymbidium aloifolium* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.3+2.6=4.9	3.1	1.1	m
2	2.3+2.4=4.7	3.0	1.0	m
3	2.1+2.6=4.7	3.0	1.2	m
4	2.3+2.4=4.7	3.0	1.0	m
5	2.1+2.6=4.7	3.0	1.2	m
6	2.1+2.5=4.6	2.9	1.1	m
7	2.0+2.6=4.6	2.9	1.3	m
8	2.0+2.4=4.4	2.8	1.2	m
9	2.0+2.3=4.3	2.7	1.1	m
10	1.4+2.9=4.3	2.7	2.0	sm
11	2.1+2.1=4.2	2.7	1.0	m
12	1.8+2.4=4.2	2.7	1.3	m
13	2.0+2.1=4.1	2.6	1.0	m
14	2.0+2.1=4.1	2.6	1.0	m
15	2.0+2.1=4.1	2.6	1.0	m
16	1.6+2.5=4.1	2.6	1.5	m
17	2.0+2.0=4.0	2.5	1.0	m
18	2.0+2.0=4.0	2.5	1.0	m
19	1.5+2.5=4.0	2.5	1.6	m
20	1.4+2.5=3.9	2.5	1.7	m
21	1.9+2.0=3.9	2.5	1.0	m
22	1.8+2.0=3.8	2.4	1.1	m
23	1.8+2.0=3.8	2.4	1.1	m
24	1.5+2.3=3.8	2.4	1.5	m
25	1.5+2.3=3.8	2.4	1.5	m
26	1.4+2.4=3.8	2.4	1.7	m
27	1.3+2.5=3.8	2.4	1.9	sm
28	1.1+2.6=3.7	2.4	2.3	sm
29	1.4+2.3=3.7	2.4	1.6	m
30	1.8+1.8=3.6	2.3	1.0	m
31	0.1+0.3+3.4=3.8*	2.4	8.5	t
32	0.1+0.3+3.1=3.5*	2.2	7.7	t
33	1.6+1.9=3.5	2.2	1.1	m
34	1.5+2.0=3.5	2.2	1.3	m
35	1.5+2.0=3.5	2.2	1.3	m
36	1.1+2.1=3.2	2.0	1.9	sm
37	1.1+2.1=3.2	2.0	1.9	sm
38	1.1+1.9=3.0	1.9	1.7	m
39	1.3+1.6=2.9	1.8	1.2	m
40	0.9+2.0=2.9	1.8	2.2	sm

* : Chromosome with secondary constriction

Table 16. Measurements of somatic chromosomes of *Cymbidium finlaysonianum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.0+2.3=4.3	3.6	1.1	m
2	1.9+2.3=4.2	3.5	1.2	m
3	1.9+2.1=4.0	3.3	1.1	m
4	1.9+2.0=3.9	3.3	1.0	m
5	1.8+2.0=3.8	3.2	1.1	m
6	1.8+2.0=3.8	3.2	1.1	m
7	1.8+2.0=3.8	3.2	1.1	m
8	1.6+2.1=3.7	3.1	1.3	m
9	1.6+2.0=3.6	3.0	1.2	m
10	1.6+2.0=3.6	3.0	1.2	m
11	1.6+2.0=3.6	3.0	1.2	m
12	1.4+2.1=3.5	2.9	1.5	m
13	1.4+1.9=3.3	2.8	1.3	m
14	1.4+1.9=3.3	2.8	1.3	m
15	1.3+2.0=3.3	2.8	1.5	m
16	1.4+1.8=3.2	2.7	1.2	m
17	1.5+1.6=3.1	2.6	1.0	m
18	1.3+1.8=3.1	2.6	1.3	m
19	1.5+1.5=3.0	2.5	1.0	m
20	1.4+1.6=3.0	2.5	1.1	m
21	1.4+1.4=2.8	2.3	1.0	m
22	1.4+1.4=2.8	2.3	1.0	m
23	1.3+1.5=2.8	2.3	1.1	m
24	1.3+1.5=2.8	2.3	1.1	m
25	1.3+1.5=2.8	2.3	1.1	m
26	1.3+1.4=2.7	2.3	1.0	m
27	1.3+1.4=2.7	2.3	1.0	m
28	1.3+1.3=2.6	2.2	1.0	m
29	1.1+1.4=2.5	2.1	1.2	m
30	1.1+1.3=2.4	2.0	1.1	m
31	0.1+0.4+1.9=2.4*	2.0	3.8	st
32	0.1+0.4+1.8=2.3*	1.9	3.6	st
33	1.1+1.3=2.4	2.0	1.1	m
34	1.1+1.1=2.2	1.8	1.0	m
35	1.1+1.1=2.2	1.8	1.0	m
36	1.0+1.1=2.1	1.8	1.1	m
37	1.0+1.0=2.0	1.7	1.0	m
38	0.9+1.1=2.0	1.7	1.2	m
39	0.9+1.1=2.0	1.7	1.2	m
40	0.9+1.0=1.9	1.6	1.1	m

* : Chromosome with secondary constriction

Table 17. Measurements of somatic chromosomes of *Cymbidium floribundum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.5+2.3=3.8	3.9	1.5	m
2	1.5+2.1=3.6	3.6	1.4	m
3	1.5+1.8=3.3	3.3	1.2	m
4	1.4+1.8=3.2	3.2	1.2	m
5	1.4+1.8=3.2	3.2	1.2	m
6	1.4+1.8=3.2	3.2	1.2	m
7	1.3+1.9=3.2	3.2	1.4	m
8	1.5+1.6=3.1	3.1	1.0	m
9	1.5+1.6=3.1	3.1	1.0	m
10	1.3+1.8=3.1	3.1	1.3	m
11	1.4+1.6=3.0	3.0	1.1	m
12	1.3+1.5=2.8	2.8	1.1	m
13	1.0+1.6=2.6	2.6	1.6	m
14	1.1+1.4=2.5	2.5	1.2	m
15	1.1+1.4=2.5	2.5	1.2	m
16	1.1+1.3=2.4	2.4	1.1	m
17	1.0+1.4=2.4	2.4	1.4	m
18	1.0+1.4=2.4	2.4	1.4	m
19	0.9+1.5=2.4	2.4	1.6	m
20	0.9+1.5=2.4	2.4	1.6	m
21	0.5+1.9=2.4	2.4	3.8	st
22	0.5+1.9=2.4	2.4	3.8	st
23	1.0+1.3=2.3	2.3	1.3	m
24	1.0+1.3=2.3	2.3	1.3	m
25	0.5+1.8=2.3	2.3	3.6	st
26	0.6+1.6=2.2	2.2	2.6	sm
27	0.8+1.3=2.1	2.1	1.6	m
28	0.8+1.3=2.1	2.1	1.6	m
29	0.8+1.3=2.1	2.1	1.6	m
30	0.8+1.3=2.1	2.1	1.6	m
31	0.9+1.1=2.0	2.0	1.2	m
32	0.9+1.0=1.9	1.9	1.1	m
33	0.6+1.4=2.0	2.0	2.3	sm
34	0.6+1.3=1.9	1.9	2.1	sm
35	0.6+1.3=1.9	1.9	2.1	sm
36	0.5+1.4=1.9	1.9	2.8	sm
37	0.8+1.0=1.8	1.8	1.2	m
38	0.8+0.9=1.7	1.7	1.1	m
39	0.8+0.9=1.7	1.7	1.1	m
40	0.5+0.9=1.4	1.4	1.8	sm

Table 18. Measurements of somatic chromosomes of *Cymbidium canaliculatum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.8+2.3=4.1	3.1	1.2	m
2	1.8+2.1=3.9	2.9	1.1	m
3	1.9+2.0=3.9	2.9	1.0	m
4	1.9+2.0=3.9	2.9	1.0	m
5	1.8+2.0=3.8	2.9	1.1	m
6	1.8+2.0=3.8	2.9	1.1	m
7	1.8+2.0=3.8	2.9	1.1	m
8	1.8+1.9=3.7	2.8	1.0	m
9	1.0+0.4+2.3=3.7*	2.8	1.6	m
10	1.0+0.3+2.3=3.6*	2.7	1.7	m
11	1.6+2.0=3.6	2.7	1.2	m
12	1.3+2.3=3.6	2.7	1.7	m
13	1.3+2.3=3.6	2.7	1.7	m
14	1.5+2.0=3.5	2.6	1.3	m
15	1.5+2.0=3.5	2.6	1.3	m
16	0.8+2.7=3.5	2.6	3.4	st
17	1.0+2.5=3.5	2.6	2.5	sm
18	1.0+2.4=3.4	2.6	2.4	sm
19	1.6+1.8=3.4	2.6	1.1	m
20	1.6+1.8=3.4	2.6	1.1	m
21	1.3+2.1=3.4	2.6	1.6	m
22	1.3+2.1=3.4	2.6	1.6	m
23	1.3+2.1=3.4	2.6	1.6	m
24	1.4+1.8=3.2	2.4	1.2	m
25	1.3+1.9=3.2	2.4	1.4	m
26	1.1+2.0=3.1	2.3	1.8	sm
27	1.0+2.0=3.0	2.3	2.0	sm
28	1.1+1.9=3.0	2.3	1.7	m
29	0.9+2.1=3.0	2.3	2.3	sm
30	1.0+1.9=2.9	2.2	1.9	sm
31	1.1+1.8=2.9	2.2	1.6	m
32	1.1+1.8=2.9	2.2	1.6	m
33	1.3+1.6=2.9	2.2	1.2	m
34	1.3+1.5=2.8	2.1	1.1	m
35	0.4+2.4=2.8	2.1	6.0	st
36	0.4+2.4=2.8	2.1	6.0	st
37	1.3+1.5=2.8	2.1	1.1	m
38	1.3+1.4=2.7	2.0	1.0	m
39	0.8+1.8=2.6	2.0	2.2	sm
40	0.8+1.8=2.6	2.0	2.2	sm

* : Chromosome with secondary constriction

Table 19. Measurements of somatic chromosomes of *Cymbidium chloranthum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.3+1.7=3.0	3.9	1.3	m
2	1.1+1.9=3.0	3.9	1.7	m
3	1.3+1.5=2.8	3.7	1.1	m
4	1.3+1.4=2.7	3.5	1.0	m
5	1.3+1.4=2.7	3.5	1.0	m
6	1.1+1.3=2.4	3.1	1.1	m
7	1.1+1.3=2.4	3.1	1.1	m
8	0.9+1.5=2.4	3.1	1.6	m
9	1.1+1.2=2.3	3.0	1.0	m
10	1.0+1.3=2.3	3.0	1.3	m
11	1.1+1.1=2.2	2.9	1.0	m
12	1.0+1.1=2.1	2.8	1.1	m
13	1.0+1.1=2.1	2.8	1.1	m
14	0.9+1.2=2.1	2.8	1.3	m
15	0.7+1.3=2.0	2.6	1.8	sm
16	0.6+1.3=1.9	2.5	2.1	sm
17	0.8+1.2=2.0	2.6	1.5	m
18	0.9+0.9=1.8	2.4	1.0	m
19	0.9+0.9=1.8	2.4	1.0	m
20	0.9+0.9=1.8	2.4	1.0	m
21	0.8+1.0=1.8	2.4	1.2	m
22	0.8+1.0=1.8	2.4	1.2	m
23	0.6+1.1=1.7	2.2	1.8	sm
24	0.8+0.9=1.7	2.2	1.1	m
25	0.8+0.9=1.7	2.2	1.1	m
26	0.7+1.0=1.7	2.2	1.4	m
27	0.5+1.2=1.7	2.2	2.4	sm
28	0.5+1.2=1.7	2.2	2.4	sm
29	0.7+0.9=1.6	2.1	1.2	m
30	0.6+1.0=1.6	2.1	1.6	m
31	0.7+0.8=1.5	2.0	1.1	m
32	0.7+0.8=1.5	2.0	1.1	m
33	0.6+0.9=1.5	2.0	1.5	m
34	0.6+0.9=1.5	2.0	1.5	m
35	0.6+0.9=1.5	2.0	1.5	m
36	0.5+0.8=1.3	1.7	1.6	m
37	0.5+0.8=1.3	1.7	1.6	m
38	0.6+0.6=1.2	1.6	1.0	m
39	0.5+0.6=1.1	1.4	1.2	m
40	0.5+0.5=1.0	1.3	1.0	m

Table 20. Measurements of somatic chromosomes of *Cymbidium madidum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.8+2.0=3.8	3.7	1.1	m
2	1.5+1.9=3.4	3.3	1.2	m
3	1.5+1.8=3.3	3.2	1.2	m
4	1.4+1.9=3.3	3.2	1.3	m
5	1.3+2.0=3.3	3.2	1.5	m
6	1.3+2.0=3.3	3.2	1.5	m
7	1.3+2.0=3.3	3.2	1.5	m
8	1.3+1.9=3.2	3.1	1.4	m
9	1.1+2.0=3.1	3.0	1.8	sm
10	1.1+1.9=3.0	2.9	1.7	m
11	1.0+2.1=3.1	3.0	2.1	sm
12	1.0+2.0=3.0	2.9	2.0	sm
13	1.1+1.9=3.0	2.9	1.7	m
14	1.3+1.6=2.9	2.8	1.2	m
15	0.9+2.0=2.9	2.8	2.2	sm
16	0.9+2.0=2.9	2.8	2.2	sm
17	0.9+1.9=2.8	2.7	2.1	sm
18	0.6+2.0=2.6	2.5	3.3	st
19	1.1+1.5=2.6	2.5	1.3	m
20	1.1+1.5=2.6	2.5	1.3	m
21	1.0+1.5=2.5	2.4	1.5	m
22	0.9+1.6=2.5	2.4	1.7	m
23	0.9+1.6=2.5	2.4	1.7	m
24	1.0+1.4=2.4	2.3	1.4	m
25	1.1+1.3=2.4	2.3	1.1	m
26	1.0+1.3=2.3	2.2	1.3	m
27	1.3+1.9=2.2	2.1	6.3	st
28	1.3+1.9=2.2	2.1	6.3	st
29	1.1+1.1=2.2	2.1	1.0	m
30	0.8+1.3=2.1	2.0	1.6	m
31	0.8+0.8+0.5=2.1*	2.0	1.6	m
32	0.8+0.8+0.5=2.1*	2.0	1.6	m
33	0.5+1.6=2.1	2.0	3.2	st
34	0.5+1.6=2.1	2.0	3.2	st
35	0.3+1.8=2.1	2.0	6.0	st
36	0.3+1.8=2.1	2.0	6.0	st
37	0.9+1.1=2.0	1.9	1.2	m
38	0.5+1.0=1.5	1.5	2.0	sm
39	0.5+0.8=1.3	1.3	1.6	m
40	0.5+0.8=1.3	1.3	1.6	m

* : Chromosome with secondary constriction

Table 21. Measurements of somatic chromosomes of *Cymbidium devonianum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.8+2.4=4.2	4.0	1.3	m
2	1.8+2.0=3.8	3.6	1.1	m
3	1.4+2.3=3.7	3.5	1.6	m
4	1.5+1.9=3.4	3.2	1.2	m
5	1.4+2.0=3.4	3.2	1.4	m
6	1.6+1.6=3.2	3.0	1.0	m
7	0.8+2.4=3.2	3.0	3.0	sm
8	0.6+2.6=3.2	3.0	4.3	st
9	1.4+1.8=3.2	3.0	1.2	m
10	1.5+1.6=3.1	2.9	1.0	m
11	1.4+1.6=3.0	2.8	1.1	m
12	1.4+1.6=3.0	2.8	1.1	m
13	1.3+1.6=2.9	2.7	1.2	m
14	1.3+1.6=2.9	2.7	1.2	m
15	1.1+1.8=2.9	2.7	1.6	m
16	1.4+1.4=2.8	2.6	1.0	m
17	1.3+1.5=2.8	2.6	1.1	m
18	1.3+1.4=2.7	2.6	1.0	m
19	1.3+1.4=2.7	2.6	1.0	m
20	1.1+1.5=2.6	2.5	1.3	m
21	1.0+1.6=2.6	2.5	1.6	m
22	1.0+1.6=2.6	2.5	1.6	m
23	0.5+2.0=2.5	2.4	4.0	st
24	0.5+2.0=2.5	2.4	4.0	st
25	0.9+1.5=2.4	2.3	1.6	m
26	0.9+1.5=2.4	2.3	1.6	m
27	1.0+1.3=2.3	2.2	1.3	m
28	1.0+1.3=2.3	2.2	1.3	m
29	0.9+1.3=2.2	2.1	1.4	m
30	0.8+1.4=2.2	2.1	1.7	m
31	0.8+1.3=2.1	2.0	1.6	m
32	0.8+1.3=2.1	2.0	1.6	m
33	0.8+1.3=2.1	2.0	1.6	m
34	0.9+1.1=2.0	1.9	1.2	m
35	0.5+1.4=1.9	1.8	2.8	sm
36	0.5+1.4=1.9	1.8	2.8	sm
37	0.9+1.0=1.9	1.8	1.1	m
38	0.9+1.0=1.9	1.8	1.1	m
39	0.8+0.9=1.7	1.6	1.1	m
40	0.5+1.0=1.5	1.4	2.0	sm

Table 22. Measurements of somatic chromosomes of *Cymbidium elegans* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.6+2.0=3.6	3.7	1.2	m
2	1.6+1.9=3.5	3.6	1.1	m
3	1.4+1.8=3.2	3.3	1.2	m
4	1.4+1.8=3.2	3.3	1.2	m
5	1.4+1.8=3.2	3.3	1.2	m
6	1.3+1.9=3.2	3.3	1.4	m
7	1.3+1.8=3.1	3.2	1.3	m
8	1.3+1.6=2.9	3.0	1.2	m
9	1.3+1.6=2.9	3.0	1.2	m
10	1.3+1.6=2.9	3.0	1.2	m
11	1.4+1.4=2.8	2.9	1.0	m
12	1.3+1.5=2.8	2.9	1.1	m
13	0.9+1.9=2.8	2.9	2.1	sm
14	0.9+1.8=2.7	2.8	2.0	sm
15	1.1+1.6=2.7	2.8	1.4	m
16	1.1+1.5=2.6	2.7	1.3	m
17	0.9+1.6=2.5	2.6	1.7	m
18	0.9+1.5=2.4	2.4	1.6	m
19	1.1+1.3=2.4	2.4	1.1	m
20	1.1+1.3=2.4	2.4	1.1	m
21	0.8+1.6=2.4	2.4	2.0	sm
22	0.8+1.5=2.3	2.3	1.8	sm
23	1.0+1.3=2.3	2.3	1.3	m
24	0.8+1.4=2.2	2.2	1.7	m
25	0.8+1.4=2.2	2.2	1.7	m
26	0.8+1.4=2.2	2.2	1.7	m
27	0.8+1.4=2.2	2.2	1.7	m
28	1.0+1.1=2.1	2.1	1.1	m
29	0.6+1.5=2.1	2.1	2.5	sm
30	0.6+1.5=2.1	2.1	2.5	sm
31	0.5+1.6=2.1	2.1	3.2	st
32	0.6+1.4=2.0	2.0	2.3	sm
33	0.9+1.1=2.0	2.0	1.2	m
34	0.6+1.4=2.0	2.0	2.3	sm
35	0.9+1.0=1.9	1.9	1.1	m
36	0.8+1.1=1.9	1.9	1.3	m
37	0.8+1.1=1.9	1.9	1.3	m
38	0.6+0.9=1.5	1.5	1.5	m
39	0.6+0.9=1.5	1.5	1.5	m
40	0.5+0.8=1.3	1.3	1.6	m

Table 23. Measurements of somatic chromosomes of *Cymbidium mastersii* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.6+1.8=3.4	2.8	1.1	m
2	1.5+1.9=3.4	2.8	1.2	m
3	1.5+1.9=3.4	2.8	1.2	m
4	1.4+2.0=3.4	2.8	1.4	m
5	0.9+2.5=3.4	2.8	2.7	sm
6	1.0+2.3=3.3	2.8	2.3	sm
7	1.5+1.9=3.4	2.8	1.2	m
8	1.5+1.8=3.3	2.8	1.2	m
9	1.4+1.9=3.3	2.8	1.3	m
10	1.4+1.8=3.2	2.7	1.2	m
11	1.0+2.3=3.3	2.8	2.3	sm
12	0.9+2.3=3.2	2.7	2.5	sm
13	1.3+1.9=3.2	2.7	1.4	m
14	1.3+1.8=3.1	2.6	1.3	m
15	1.3+1.8=3.1	2.6	1.3	m
16	1.5+1.5=3.0	2.5	1.0	m
17	1.1+2.0=3.1	2.6	1.8	sm
18	1.0+1.9=2.9	2.4	1.9	sm
19	1.4+1.6=3.0	2.5	1.1	m
20	1.4+1.6=3.0	2.5	1.1	m
21	1.1+1.9=3.0	2.5	1.7	m
22	1.1+1.9=3.0	2.5	1.7	m
23	1.4+1.6=3.0	2.5	1.1	m
24	1.4+1.5=2.9	2.4	1.0	m
25	1.3+1.6=2.9	2.4	1.2	m
26	1.3+1.6=2.9	2.4	1.2	m
27	1.3+1.6=2.9	2.4	1.2	m
28	1.4+1.4=2.8	2.3	1.0	m
29	1.3+1.5=2.8	2.3	1.1	m
30	1.3+1.5=2.8	2.3	1.1	m
31	1.3+1.5=2.8	2.3	1.1	m
32	1.3+1.5=2.8	2.3	1.1	m
33	1.0+1.8=2.8	2.3	1.8	sm
34	1.0+1.8=2.8	2.3	1.8	sm
35	1.3+1.5=2.8	2.3	1.1	m
36	1.3+1.4=2.7	2.3	1.0	m
37	0.7+1.8=2.5	2.1	2.5	sm
38	0.6+1.8=2.4	2.0	3.0	sm
39	0.8+1.5=2.3	1.9	1.8	sm
40	0.8+1.4=2.2	1.8	1.7	m

Table 24. Measurements of somatic chromosomes of *Cymbidium whiteae* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.5+1.7=3.2	3.4	1.1	m
2	1.6+1.6=3.2	3.4	1.0	m
3	1.5+1.5=3.0	3.2	1.0	m
4	1.4+1.6=3.0	3.2	1.1	m
5	1.4+1.6=3.0	3.2	1.1	m
6	1.3+1.6=2.9	3.1	1.2	m
7	1.3+1.6=2.9	3.1	1.2	m
8	1.4+1.4=2.8	3.0	1.0	m
9	1.0+1.8=2.8	3.0	1.8	sm
10	1.0+1.8=2.8	3.0	1.8	sm
11	1.3+1.4=2.7	2.9	1.0	m
12	1.3+1.4=2.7	2.9	1.0	m
13	1.1+1.5=2.6	2.7	1.3	m
14	1.1+1.4=2.5	2.6	1.2	m
15	0.6+1.9=2.5	2.6	3.1	st
16	0.6+1.9=2.5	2.6	3.1	st
17	1.1+1.3=2.4	2.5	1.1	m
18	1.1+1.3=2.4	2.5	1.1	m
19	1.1+1.3=2.4	2.5	1.1	m
20	1.0+1.3=2.3	2.4	1.3	m
21	0.9+1.4=2.3	2.4	1.5	m
22	0.8+1.5=2.3	2.4	1.8	sm
23	0.8+1.5=2.3	2.4	1.8	sm
24	0.8+1.5=2.3	2.4	1.8	sm
25	1.0+1.3=2.3	2.4	1.3	m
26	1.1+1.1=2.2	2.3	1.0	m
27	1.0+1.1=2.1	2.2	1.1	m
28	0.9+1.2=2.1	2.2	1.3	m
29	1.0+1.1=2.1	2.2	1.1	m
30	1.0+1.1=2.1	2.2	1.1	m
31	0.9+1.1=2.0	2.1	1.2	m
32	0.9+1.1=2.0	2.1	1.2	m
33	0.8+1.2=2.0	2.1	1.5	m
34	0.9+1.0=1.9	2.0	1.1	m
35	0.9+1.0=1.9	2.0	1.1	m
36	0.9+0.9=1.8	1.9	1.0	m
37	0.8+0.9=1.7	1.8	1.1	m
38	0.8+0.9=1.7	1.8	1.1	m
39	0.6+0.8=1.4	1.5	1.3	m
40	0.5+0.9=1.4	1.5	1.8	sm

Table 25. Measurements of somatic chromosomes of *Cymbidium iridioides* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.6+2.1=3.7	3.3	1.3	m
2	1.8+1.9=3.7	3.3	1.0	m
3	1.6+2.0=3.6	3.2	1.2	m
4	1.8+1.8=3.6	3.2	1.0	m
5	1.6+1.9=3.5	3.1	1.1	m
6	1.5+2.0=3.5	3.1	1.3	m
7	1.5+2.0=3.5	3.1	1.3	m
8	1.5+2.0=3.5	3.1	1.3	m
9	1.5+1.9=3.4	3.0	1.2	m
10	1.6+1.6=3.2	2.8	1.0	m
11	1.6+1.6=3.2	2.8	1.0	m
12	1.2+2.0=3.2	2.8	1.6	m
13	1.2+2.0=3.2	2.8	1.6	m
14	1.5+1.6=3.1	2.7	1.0	m
15	1.5+1.5=3.0	2.6	1.0	m
16	1.4+1.6=3.0	2.6	1.1	m
17	1.4+1.5=2.9	2.6	1.0	m
18	1.3+1.6=2.9	2.6	1.2	m
19	0.5+2.4=2.9	2.6	4.8	st
20	1.0+1.8=2.8	2.5	1.8	sm
21	1.3+1.5=2.8	2.5	1.1	m
22	1.3+1.4=2.7	2.4	1.0	m
23	1.3+1.4=2.7	2.4	1.0	m
24	1.0+1.6=2.6	2.3	1.6	m
25	1.0+1.6=2.6	2.3	1.6	m
26	1.1+1.4=2.5	2.2	1.2	m
27	1.0+1.5=2.5	2.2	1.5	m
28	1.0+1.5=2.5	2.2	1.5	m
29	0.9+1.6=2.5	2.2	1.7	m
30	0.6+1.8=2.4	2.1	3.0	sm
31	1.1+1.3=2.4	2.1	1.1	m
32	1.1+1.3=2.4	2.1	1.1	m
33	1.1+1.3=2.4	2.1	1.1	m
34	1.0+1.3=2.3	2.0	1.3	m
35	0.9+1.4=2.3	2.0	1.5	m
36	1.0+1.1=2.1	1.8	1.1	m
37	1.0+1.1=2.1	1.8	1.1	m
38	1.0+1.1=2.1	1.8	1.1	m
39	1.0+1.1=2.1	1.8	1.1	m
40	0.6+1.3=1.9	1.7	2.1	sm

Table 26. Measurements of somatic chromosomes of *Cymbidium hookerianum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.8+2.6=4.4	3.2	1.4	m
2	1.9+2.1=4.0	2.9	1.1	m
3	1.5+2.4=3.9	2.9	1.6	m
4	1.9+1.9=3.8	2.8	1.0	m
5	1.8+2.0=3.8	2.8	1.1	m
6	1.8+1.9=3.7	2.7	1.0	m
7	1.8+1.9=3.7	2.7	1.0	m
8	1.8+1.9=3.7	2.7	1.0	m
9	0.8+2.9=3.7	2.7	3.6	st
10	0.8+2.8=3.6	2.6	3.5	st
11	1.6+2.0=3.6	2.6	1.2	m
12	1.6+1.9=3.5	2.6	1.1	m
13	1.6+1.9=3.5	2.6	1.1	m
14	1.5+2.0=3.5	2.6	1.3	m
15	1.0+2.6=3.6	2.6	2.6	sm
16	1.0+2.4=3.4	2.5	2.4	sm
17	1.4+2.1=3.5	2.6	1.5	m
18	1.5+1.9=3.4	2.5	1.2	m
19	1.5+1.9=3.4	2.5	1.2	m
20	1.5+1.9=3.4	2.5	1.2	m
21	1.5+1.9=3.4	2.5	1.2	m
22	1.5+1.9=3.4	2.5	1.2	m
23	1.4+2.0=3.4	2.5	1.4	m
24	1.4+2.0=3.4	2.5	1.4	m
25	1.5+1.9=3.4	2.5	1.2	m
26	1.5+1.9=3.4	2.5	1.2	m
27	1.3+2.1=3.4	2.5	1.6	m
28	1.4+1.9=3.3	2.4	1.3	m
29	1.5+1.8=3.3	2.4	1.2	m
30	1.5+1.8=3.3	2.4	1.2	m
31	1.3+1.9=3.2	2.3	1.4	m
32	1.3+1.8=3.1	2.3	1.3	m
33	1.1+2.1=3.2	2.3	1.9	sm
34	1.1+2.0=3.1	2.3	1.8	sm
35	1.1+2.0=3.1	2.3	1.8	sm
36	1.0+2.0=3.0	2.2	2.0	sm
37	0.4+2.6=3.0	2.2	6.5	st
38	0.4+2.4=2.8	2.0	6.0	st
39	1.0+1.9=2.9	2.1	1.9	sm
40	0.9+1.6=2.5	1.8	1.7	m

Table 27. Measurements of somatic chromosomes of *Cymbidium insigne* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.3+2.5=4.8	3.8	1.0	m
2	1.9+2.8=4.7	3.8	1.4	m
3	1.6+2.8=4.4	3.5	1.7	m
4	1.8+2.3=4.1	3.3	1.2	m
5	1.3+2.8=4.1	3.3	2.1	sm
6	1.3+2.8=4.1	3.3	2.1	sm
7	1.5+2.3=3.8	3.0	1.5	m
8	1.3+2.5=3.8	3.0	1.9	sm
9	1.5+2.1=3.6	2.9	1.4	m
10	1.5+2.1=3.6	2.9	1.4	m
11	1.5+2.1=3.6	2.9	1.4	m
12	1.8+1.8=3.6	2.9	1.0	m
13	1.6+1.9=3.5	2.8	1.1	m
14	1.5+2.0=3.5	2.8	1.3	m
15	1.4+2.1=3.5	2.8	1.5	m
16	1.6+1.8=3.4	2.7	1.1	m
17	1.6+1.8=3.4	2.7	1.1	m
18	1.6+1.8=3.4	2.7	1.1	m
19	1.0+2.1=3.1	2.5	2.1	sm
20	0.5+2.6=3.1	2.5	5.2	st
21	1.4+1.6=3.0	2.4	1.1	m
22	1.5+1.5=3.0	2.4	1.0	m
23	1.1+1.9=3.0	2.4	1.7	m
24	1.4+1.5=2.9	2.3	1.0	m
25	1.3+1.4=2.7	2.2	1.0	m
26	1.3+1.4=2.7	2.2	1.0	m
27	1.3+1.3=2.6	2.1	1.0	m
28	1.1+1.5=2.6	2.1	1.3	m
29	1.1+1.4=2.5	2.0	1.2	m
30	1.0+1.5=2.5	2.0	1.5	m
31	0.5+2.0=2.5	2.0	4.0	st
32	0.4+1.9=2.3	1.8	4.7	st
33	1.1+1.3=2.4	1.9	1.1	m
34	0.9+1.5=2.4	1.9	1.6	m
35	0.9+1.5=2.4	1.9	1.6	m
36	0.8+1.4=2.2	1.8	1.7	m
37	0.6+1.6=2.2	1.8	2.6	sm
38	0.6+1.5=2.1	1.7	2.5	sm
39	0.8+1.4=2.2	1.8	1.7	m
40	0.8+1.1=1.9	1.5	1.3	m

Table 28. Measurements of somatic chromosomes of *Cymbidium longifolium* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.4+2.6=5.0	3.8	1.0	m
2	2.3+2.4=4.7	3.5	1.0	m
3	2.0+2.3=4.3	3.2	1.1	m
4	2.0+2.1=4.1	3.1	1.0	m
5	1.6+2.4=4.0	3.0	1.5	m
6	1.6+2.4=4.0	3.0	1.5	m
7	1.5+2.4=3.9	2.9	1.6	m
8	1.4+2.5=3.9	2.9	1.7	m
9	1.9+2.0=3.9	2.9	1.0	m
10	1.8+2.1=3.9	2.9	1.1	m
11	1.8+2.1=3.9	2.9	1.1	m
12	1.9+1.9=3.8	2.9	1.0	m
13	1.8+2.0=3.8	2.9	1.1	m
14	1.5+2.3=3.8	2.9	1.5	m
15	1.8+1.9=3.7	2.8	1.0	m
16	1.4+2.3=3.7	2.8	1.6	m
17	1.8+1.8=3.6	2.7	1.0	m
18	1.6+1.8=3.4	2.6	1.1	m
19	1.4+2.0=3.4	2.6	1.4	m
20	1.5+1.8=3.3	2.5	1.2	m
21	1.5+1.8=3.3	2.5	1.2	m
22	1.3+2.0=3.3	2.5	1.5	m
23	1.1+2.0=3.1	2.3	1.8	sm
24	1.5+1.5=3.0	2.3	1.0	m
25	1.4+1.6=3.0	2.3	1.1	m
26	1.4+1.5=2.9	2.2	1.0	m
27	1.3+1.6=2.9	2.2	1.2	m
28	1.3+1.6=2.9	2.2	1.2	m
29	1.1+1.8=2.9	2.2	1.6	m
30	1.4+1.4=2.8	2.1	1.0	m
31	1.3+1.5=2.8	2.1	1.1	m
32	1.3+1.5=2.8	2.1	1.1	m
33	1.3+1.4=2.7	2.0	1.0	m
34	1.1+1.5=2.6	2.0	1.3	m
35	1.0+1.5=2.5	1.9	1.5	m
36	1.0+1.3=2.3	1.7	1.3	m
37	0.5+1.9=2.4	1.8	3.8	st
38	0.6+1.6=2.2	1.7	2.6	sm
39	0.9+1.3=2.2	1.7	1.4	m
40	0.8+1.3=2.1	1.6	1.6	m

Table 29. Measurements of somatic chromosomes of *Cymbidium lowianum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.6+2.4=4.0	3.0	1.5	m
2	1.8+2.1=3.9	2.9	1.1	m
3	1.8+2.1=3.9	2.9	1.1	m
4	1.6+2.3=3.9	2.9	1.4	m
5	1.5+2.4=3.9	2.9	1.6	m
6	1.6+2.1=3.7	2.7	1.3	m
7	1.8+1.9=3.7	2.7	1.0	m
8	1.8+1.9=3.7	2.7	1.0	m
9	1.1+2.6=3.7	2.7	2.3	sm
10	1.1+2.6=3.7	2.7	2.3	sm
11	1.8+1.9=3.7	2.7	1.0	m
12	1.8+1.8=3.6	2.7	1.0	m
13	1.5+2.1=3.6	2.7	1.4	m
14	1.6+1.9=3.5	2.6	1.1	m
15	1.5+2.0=3.5	2.6	1.3	m
16	1.5+2.0=3.5	2.6	1.3	m
17	1.4+2.1=3.5	2.6	1.5	m
18	1.5+1.9=3.4	2.5	1.2	m
19	1.5+1.9=3.4	2.5	1.2	m
20	1.4+2.0=3.4	2.5	1.4	m
21	1.3+2.0=3.3	2.4	1.5	m
22	1.4+1.9=3.3	2.4	1.3	m
23	1.3+2.0=3.3	2.4	1.5	m
24	1.3+1.9=3.2	2.4	1.4	m
25	1.3+1.9=3.2	2.4	1.4	m
26	1.3+1.9=3.2	2.4	1.4	m
27	1.3+1.9=3.2	2.4	1.4	m
28	1.5+1.6=3.1	2.3	1.0	m
29	1.1+2.1=3.2	2.4	1.9	sm
30	0.8+2.4=3.2	2.4	3.0	sm
31	0.8+2.4=3.2	2.4	3.0	sm
32	1.1+2.0=3.1	2.3	1.8	sm
33	1.3+1.8=3.1	2.3	1.3	m
34	1.1+1.8=2.9	2.2	1.6	m
35	1.1+2.0=3.1	2.3	1.8	sm
36	1.0+1.9=2.9	2.2	1.9	sm
37	1.0+1.9=2.9	2.2	1.9	sm
38	1.0+1.9=2.9	2.2	1.9	sm
39	0.4+2.3=2.7*	2.0	5.7	st
40	0.4+2.1=2.5*	1.9	5.2	st

* : Chromosome with secondary constriction

Table 30. Measurements of somatic chromosomes of *Cymbidium tracyanum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.3+2.9=5.2	3.6	1.2	m
2	2.0+2.6=4.6	3.2	1.3	m
3	1.8+2.8=4.6	3.2	1.5	m
4	2.0+2.6=4.6	3.2	1.3	m
5	2.0+2.5=4.5	3.2	1.2	m
6	2.0+2.5=4.5	3.2	1.2	m
7	1.9+2.6=4.5	3.2	1.3	m
8	2.0+2.4=4.4	3.1	1.2	m
9	1.6+2.6=4.2	2.9	1.6	m
10	1.5+2.6=4.1	2.9	1.7	m
11	2.0+2.1=4.1	2.9	1.0	m
12	2.0+2.1=4.1	2.9	1.0	m
13	1.9+2.0=3.9	2.7	1.0	m
14	1.8+2.1=3.9	2.7	1.1	m
15	1.8+2.0=3.8	2.7	1.1	m
16	1.8+2.0=3.8	2.7	1.1	m
17	1.3+2.4=3.7	2.6	1.8	sm
18	1.1+2.4=3.5	2.5	2.1	sm
19	1.8+1.8=3.6	2.5	1.0	m
20	1.5+2.0=3.5	2.5	1.3	m
21	1.4+2.1=3.5	2.5	1.5	m
22	1.4+2.1=3.5	2.5	1.5	m
23	1.6+1.8=3.4	2.4	1.1	m
24	1.3+2.1=3.4	2.4	1.6	m
25	1.4+1.9=3.3	2.3	1.3	m
26	1.4+1.9=3.3	2.3	1.3	m
27	1.5+1.6=3.1	2.2	1.0	m
28	1.5+1.6=3.1	2.2	1.0	m
29	1.5+1.6=3.1	2.2	1.0	m
30	1.5+1.6=3.1	2.2	1.0	m
31	1.3+1.8=3.1	2.2	1.3	m
32	1.1+1.9=3.0	2.1	1.7	m
33	1.0+1.9=2.9	2.0	1.9	sm
34	0.9+1.9=2.8	2.0	2.1	sm
35	1.3+1.4=2.7	1.9	1.0	m
36	0.9+1.6=2.5	1.8	1.7	m
37	0.9+1.5=2.4	1.7	1.6	m
38	0.9+1.5=2.4	1.7	1.6	m
39	0.5+1.9=2.4	1.7	3.8	st
40	0.4+2.0=2.4	1.7	5.0	st

Table 31. Measurements of somatic chromosomes of *Cymbidium eburneum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.8+2.0=3.8	3.1	1.1	m
2	1.8+2.0=3.8	3.1	1.1	m
3	1.8+1.9=3.7	3.1	1.0	m
4	1.6+2.1=3.7	3.1	1.3	m
5	1.7+1.8=3.5	2.9	1.0	m
6	1.5+2.0=3.5	2.9	1.3	m
7	1.5+1.9=3.4	2.8	1.2	m
8	1.6+1.8=3.4	2.8	1.1	m
9	1.6+1.8=3.4	2.8	1.1	m
10	1.5+1.9=3.4	2.8	1.2	m
11	1.4+2.0=3.4	2.8	1.4	m
12	1.4+2.0=3.4	2.8	1.4	m
13	1.5+1.8=3.3	2.7	1.2	m
14	1.5+1.8=3.3	2.7	1.2	m
15	1.5+1.7=3.2	2.7	1.1	m
16	1.5+1.7=3.2	2.7	1.1	m
17	1.3+1.9=3.2	2.7	1.4	m
18	1.5+1.6=3.1	2.6	1.0	m
19	1.5+1.6=3.1	2.6	1.0	m
20	1.5+1.6=3.1	2.6	1.0	m
21	1.5+1.6=3.1	2.6	1.0	m
22	1.3+1.8=3.1	2.6	1.3	m
23	1.3+1.8=3.1	2.6	1.3	m
24	1.3+1.6=2.9	2.4	1.2	m
25	1.4+1.4=2.8	2.3	1.0	m
26	1.3+1.5=2.8	2.3	1.1	m
27	1.2+1.6=2.8	2.3	1.3	m
28	1.2+1.5=2.7	2.2	1.2	m
29	1.2+1.5=2.7	2.2	1.2	m
30	1.1+1.6=2.7	2.2	1.4	m
31	0.9+1.8=2.7	2.2	2.0	sm
32	0.7+1.8=2.5	2.1	2.5	sm
33	1.2+1.4=2.6	2.2	1.1	m
34	1.1+1.4=2.5	2.1	1.2	m
35	1.1+1.4=2.5	2.1	1.2	m
36	1.1+1.4=2.5	2.1	1.2	m
37	0.8+1.4=2.2	1.8	1.7	m
38	0.7+1.5=2.2	1.8	2.1	sm
39	1.0+1.3=2.3	1.9	1.3	m
40	1.0+1.1=2.1	1.7	1.1	m

Table 32. Measurements of somatic chromosomes of *Cymbidium parishii* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.8+2.5=4.3	3.5	1.3	m
2	1.9+2.3=4.2	3.4	1.2	m
3	1.8+1.9=3.7	3.0	1.0	m
4	1.6+2.1=3.7	3.0	1.3	m
5	1.6+2.1=3.7	3.0	1.3	m
6	1.3+2.4=3.7	3.0	1.8	sm
7	1.8+1.8=3.6	2.9	1.0	m
8	1.5+2.1=3.6	2.9	1.4	m
9	1.8+1.8=3.6	2.9	1.0	m
10	1.8+1.8=3.6	2.9	1.0	m
11	1.6+1.9=3.5	2.9	1.1	m
12	1.4+2.1=3.5	2.9	1.5	m
13	1.4+2.0=3.4	2.8	1.4	m
14	1.5+1.9=3.4	2.8	1.2	m
15	1.6+1.8=3.4	2.8	1.1	m
16	1.6+1.8=3.4	2.8	1.1	m
17	1.6+1.8=3.4	2.8	1.1	m
18	0.8+2.6=3.4	2.8	3.2	st
19	1.6+1.7=3.3	2.7	1.0	m
20	1.3+2.0=3.3	2.7	1.5	m
21	1.5+1.6=3.1	2.5	1.0	m
22	1.4+1.7=3.1	2.5	1.2	m
23	1.5+1.5=3.0	2.5	1.0	m
24	1.4+1.6=3.0	2.5	1.1	m
25	1.4+1.6=3.0	2.5	1.1	m
26	1.4+1.5=2.9	2.4	1.0	m
27	1.3+1.5=2.8	2.3	1.1	m
28	1.4+1.4=2.8	2.3	1.0	m
29	1.3+1.4=2.7	2.2	1.0	m
30	1.1+1.5=2.6	2.1	1.3	m
31	1.1+1.5=2.6	2.1	1.3	m
32	1.0+1.4=2.4	2.0	1.4	m
33	0.9+1.5=2.4	2.0	1.6	m
34	1.1+1.1=2.2	1.8	1.0	m
35	0.8+1.4=2.2	1.8	1.7	m
36	1.0+1.1=2.1	1.7	1.1	m
37	1.0+1.1=2.1	1.7	1.1	m
38	1.0+1.1=2.1	1.7	1.1	m
39	0.8+1.0=1.8	1.5	1.2	m
40	0.7+1.0=1.7	1.4	1.4	m

Table 33. Measurements of somatic chromosomes of *Cymbidium erythrostylum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.9+2.0=3.9	4.0	1.0	m
2	1.6+1.8=3.4	3.5	1.1	m
3	1.6+1.8=3.4	3.5	1.1	m
4	1.6+1.8=3.4	3.5	1.1	m
5	1.3+2.0=3.3	3.4	1.5	m
6	1.4+1.6=3.0	3.1	1.1	m
7	1.4+1.5=2.9	3.0	1.0	m
8	1.3+1.6=2.9	3.0	1.2	m
9	1.1+1.8=2.9	3.0	1.6	m
10	1.1+1.6=2.7	2.8	1.4	m
11	1.1+1.6=2.7	2.8	1.4	m
12	1.3+1.4=2.7	2.8	1.0	m
13	0.9+1.8=2.7	2.8	2.0	sm
14	1.1+1.4=2.5	2.5	1.2	m
15	1.1+1.4=2.5	2.5	1.2	m
16	1.1+1.3=2.4	2.4	1.1	m
17	1.0+1.4=2.4	2.4	1.4	m
18	1.0+1.4=2.4	2.4	1.4	m
19	1.1+1.3=2.4	2.4	1.1	m
20	1.0+1.4=2.4	2.4	1.4	m
21	0.9+1.5=2.4	2.4	1.6	m
22	0.8+1.6=2.4	2.4	2.0	sm
23	1.0+1.3=2.3	2.3	1.3	m
24	0.9+1.4=2.3	2.3	1.5	m
25	0.8+1.4=2.2	2.2	1.7	m
26	0.8+1.4=2.2	2.2	1.7	m
27	1.1+1.1=2.2	2.2	1.0	m
28	1.0+1.1=2.1	2.1	1.1	m
29	1.0+1.1=2.1	2.1	1.1	m
30	0.8+1.3=2.1	2.1	1.6	m
31	0.9+1.1=2.0	2.0	1.2	m
32	0.6+1.5=2.1	2.1	2.5	sm
33	0.6+1.4=2.0	2.0	2.3	sm
34	0.6+1.3=1.9	1.9	2.1	sm
35	0.5+1.4=1.9	1.9	2.8	sm
36	0.5+1.4=1.9	1.9	2.8	sm
37	0.9+1.0=1.9	1.9	1.1	m
38	0.9+0.9=1.8	1.8	1.0	m
39	0.8+1.0=1.8	1.8	1.2	m
40	0.6+1.0=1.6	1.6	1.6	m

Table 34. Measurements of somatic chromosomes of *Cymbidium tigrinum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.5+1.6=3.1	3.6	1.0	m
2	1.4+1.5=2.9	3.4	1.0	m
3	1.3+1.4=2.7	3.2	1.0	m
4	1.3+1.4=2.7	3.2	1.0	m
5	1.1+1.6=2.7	3.2	1.4	m
6	1.1+1.5=2.6	3.0	1.3	m
7	1.1+1.5=2.6	3.0	1.3	m
8	1.1+1.5=2.6	3.0	1.3	m
9	1.3+1.3=2.6	3.0	1.0	m
10	1.3+1.3=2.6	3.0	1.0	m
11	1.1+1.4=2.5	2.9	1.2	m
12	1.1+1.3=2.4	2.8	1.1	m
13	1.1+1.3=2.4	2.8	1.1	m
14	1.1+1.1=2.2	2.6	1.0	m
15	1.1+1.1=2.2	2.6	1.0	m
16	0.9+1.3=2.2	2.6	1.4	m
17	0.8+1.4=2.2	2.6	1.7	m
18	0.8+1.4=2.2	2.6	1.7	m
19	1.0+1.1=2.1	2.5	1.1	m
20	1.0+1.1=2.1	2.5	1.1	m
21	1.0+1.1=2.1	2.5	1.1	m
22	0.8+1.3=2.1	2.5	1.6	m
23	0.9+1.1=2.0	2.3	1.2	m
24	1.0+1.0=2.0	2.3	1.0	m
25	0.9+1.0=1.9	2.2	1.1	m
26	0.8+1.1=1.9	2.2	1.3	m
27	0.8+1.1=1.9	2.2	1.3	m
28	0.8+1.1=1.9	2.2	1.3	m
29	0.5+1.4=1.9	2.2	2.8	sm
30	0.5+1.4=1.9	2.2	2.8	sm
31	0.6+1.3=1.9	2.2	2.1	sm
32	0.9+0.9=1.8	2.1	1.0	m
33	0.8+1.0=1.8	2.1	1.2	m
34	0.8+1.0=1.8	2.1	1.2	m
35	0.6+1.1=1.7	2.0	1.8	sm
36	0.5+1.0=1.5	1.8	2.0	sm
37	0.8+0.9=1.7	2.0	1.1	m
38	0.6+0.8=1.4	1.6	1.3	m
39	0.6+0.8=1.4	1.6	1.3	m
40	0.6+0.8=1.4	1.6	1.3	m

Table 35. Measurements of somatic chromosomes of *Acriopsis javanica* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.7+0.8=1.5	3.6	1.1	m
2	0.7+0.8=1.5	3.6	1.1	m
3	0.5+1.0=1.5	3.6	2.0	sm
4	0.5+1.0=1.5	3.6	2.0	sm
5	0.6+0.9=1.5	3.6	1.5	m
6	0.7+0.7=1.4	3.3	1.0	m
7	0.6+0.7=1.3	3.1	1.1	m
8	0.5+0.8=1.3	3.1	1.6	m
9	0.5+0.8=1.3	3.1	1.6	m
10	0.6+0.6=1.2	2.9	1.0	m
11	0.6+0.6=1.2	2.9	1.0	m
12	0.6+0.6=1.2	2.9	1.0	m
13	0.6+0.6=1.2	2.9	1.0	m
14	0.5+0.6=1.1	2.6	1.2	m
15	0.5+0.6=1.1	2.6	1.2	m
16	0.5+0.6=1.1	2.6	1.2	m
17	0.4+0.6=1.0	2.4	1.5	m
18	0.4+0.6=1.0	2.4	1.5	m
19	0.4+0.6=1.0	2.4	1.5	m
20	0.5+0.5=1.0	2.4	1.0	m
21	0.5+0.5=1.0	2.4	1.0	m
22	0.5+0.5=1.0	2.4	1.0	m
23	0.5+0.5=1.0	2.4	1.0	m
24	0.4+0.5=0.9	2.1	1.2	m
25	0.4+0.5=0.9	2.1	1.2	m
26	0.4+0.5=0.9	2.1	1.2	m
27	0.4+0.5=0.9	2.1	1.2	m
28	0.4+0.5=0.9	2.1	1.2	m
29	0.4+0.5=0.9	2.1	1.2	m
30	0.4+0.5=0.9	2.1	1.2	m
31	0.3+0.6=0.9	2.1	2.0	sm
32	0.3+0.6=0.9	2.1	2.0	sm
33	0.4+0.4=0.8	1.9	1.0	m
34	0.3+0.5=0.8	1.9	1.6	m
35	0.3+0.5=0.8	1.9	1.6	m
36	0.3+0.4=0.7	1.7	1.3	m
37	0.3+0.4=0.7	1.7	1.3	m
38	0.3+0.4=0.7	1.7	1.3	m
39	0.2+0.5=0.7	1.7	2.5	sm
40	0.2+0.5=0.7	1.7	2.5	sm

Table 36. Measurements of somatic chromosomes of *Ansellia africana* at mitotic metaphase, 2n=42

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.0+2.0=3.0	4.1	2.0	sm
2	1.0+1.9=2.9	3.9	1.9	sm
3	1.0+1.8=2.8	3.8	1.8	sm
4	0.9+1.9=2.8	3.8	2.1	sm
5	0.9+1.9=2.8	3.8	2.1	sm
6	0.9+1.7=2.6	3.5	1.8	sm
7	1.0+1.6=2.6	3.5	1.6	m
8	1.0+1.6=2.6	3.5	1.6	m
9	0.9+1.6=2.5	3.4	1.7	m
10	0.9+1.6=2.5	3.4	1.7	m
11	0.9+1.5=2.4	3.3	1.6	m
12	0.9+1.5=2.4	3.3	1.6	m
13	0.8+1.4=2.2	3.0	1.7	m
14	0.8+1.3=2.1	2.9	1.6	m
15	0.8+1.3=2.1	2.9	1.6	m
16	0.8+1.2=2.0	2.7	1.5	m
17	0.8+1.2=2.0	2.7	1.5	m
18	0.9+1.0=1.9	2.6	1.1	m
19	0.9+0.9=1.8	2.4	1.0	m
20	0.8+0.9=1.7	2.3	1.1	m
21	0.1+1.5=1.6	2.2	15.0	t
22	0.1+1.4=1.5	2.0	14.0	t
23	0.1+0.3+1.1=1.5*	2.0	2.7	sm
24	0.2+0.1+1.1=1.4*	1.9	3.6	st
25	0.5+0.9=1.4	1.9	1.8	sm
26	0.5+0.8=1.3	1.8	1.6	m
27	0.5+0.6=1.1	1.5	1.2	m
28	0.5+0.6=1.1	1.5	1.2	m
29	0.5+0.6=1.1	1.5	1.2	m
30	0.5+0.6=1.1	1.5	1.2	m
31	0.5+0.6=1.1	1.5	1.2	m
32	0.5+0.6=1.1	1.5	1.2	m
33	0.5+0.6=1.1	1.5	1.2	m
34	0.5+0.6=1.1	1.5	1.2	m
35	0.5+0.6=1.1	1.5	1.2	m
36	0.5+0.6=1.1	1.5	1.2	m
37	0.1+1.0=1.1	1.5	10.0	t
38	0.1+1.0=1.1	1.5	10.0	t
39	0.5+0.6=1.1	1.5	1.2	m
40	0.4+0.6=1.0	1.4	1.5	m
41	0.4+0.6=1.0	1.4	1.5	m
42	0.4+0.5=0.9	1.2	1.2	m

* : Chromosome with secondary constriction

Table 37. Measurements of somatic chromosomes of *Ansellia gigantea* at mitotic metaphase, 2n=42

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.4+1.9=3.3	4.0	1.3	m
2	1.1+2.1=3.2	3.9	1.9	sm
3	1.0+2.0=3.0	3.7	2.0	sm
4	1.1+1.8=2.9	3.5	1.6	m
5	0.9+1.9=2.8	3.4	2.1	sm
6	0.8+2.0=2.8	3.4	2.5	sm
7	0.8+2.0=2.8	3.4	2.5	sm
8	1.1+1.6=2.7	3.3	1.4	m
9	1.1+1.6=2.7	3.3	1.4	m
10	1.0+1.6=2.6	3.2	1.6	m
11	1.0+1.6=2.6	3.2	1.6	m
12	1.0+1.6=2.6	3.2	1.6	m
13	0.9+1.4=2.3	2.8	1.5	m
14	0.8+1.5=2.3	2.8	1.8	sm
15	0.9+1.3=2.2	2.7	1.4	m
16	0.8+1.4=2.2	2.7	1.7	m
17	0.8+1.4=2.2	2.7	1.7	m
18	0.8+1.3=2.1	2.6	1.6	m
19	0.1+2.0=2.1	2.6	20.0	t
20	0.1+1.9=2.0	2.4	19.0	t
21	0.1+1.8=1.9	2.3	18.0	t
22	0.1+1.8=1.9	2.3	18.0	t
23	0.8+1.0=1.8	2.2	1.2	m
24	0.6+1.0=1.6	2.0	1.6	m
25	0.6+1.1=1.7	2.1	1.8	sm
26	0.5+1.0=1.5	1.8	2.0	sm
27	0.1+1.4=1.5	1.8	14.0	t
28	0.1+1.4=1.5	1.8	14.0	t
29	0.5+1.0=1.5	1.8	2.0	sm
30	0.6+0.8=1.4	1.7	1.3	m
31	0.6+0.8=1.4	1.7	1.3	m
32	0.6+0.8=1.4	1.7	1.3	m
33	0.5+0.9=1.4	1.7	1.8	sm
34	0.5+0.9=1.4	1.7	1.8	sm
35	0.1+0.1+1.1=1.3*	1.6	5.5	st
36	0.1+0.1+1.0=1.2*	1.5	5.0	st
37	0.5+0.6=1.1	1.3	1.2	m
38	0.4+0.6=1.0	1.2	1.5	m
39	0.3+0.7=1.0	1.2	2.3	sm
40	0.3+0.7=1.0	1.2	2.3	sm
41	0.3+0.7=1.0	1.2	2.3	sm
42	0.3+0.6=0.9	1.1	2.0	sm

* : Chromosome with secondary constriction

Table 38. Measurements of somatic chromosomes of *Cymbidiella flabellata* at mitotic metaphase, 2n=52

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.9+1.8=2.7	3.0	2.0	sm
2	0.9+1.7=2.6	2.8	1.8	sm
3	0.8+1.8=2.6	2.8	2.2	sm
4	0.8+1.8=2.6	2.8	2.2	sm
5	0.8+1.7=2.5	2.7	2.1	sm
6	0.8+1.7=2.5	2.7	2.1	sm
7	0.8+1.7=2.5	2.7	2.1	sm
8	0.8+1.7=2.5	2.7	2.1	sm
9	0.6+1.8=2.4	2.6	3.0	sm
10	0.7+1.6=2.3	2.5	2.2	sm
11	0.6+1.5=2.1	2.3	2.5	sm
12	0.5+1.5=2.0	2.2	3.0	sm
13	0.8+1.2=2.0	2.2	1.5	m
14	0.8+1.1=1.9	2.1	1.3	m
15	0.4+1.6=2.0*	2.2	4.0	st
16	0.4+1.5=1.9*	2.1	3.7	st
17	0.7+1.2=1.9	2.1	1.7	m
18	0.7+1.2=1.9	2.1	1.7	m
19	0.8+1.0=1.8	2.0	1.2	m
20	0.6+1.2=1.8	2.0	2.0	sm
21	0.6+1.2=1.8	2.0	2.0	sm
22	0.5+1.3=1.8	2.0	2.6	sm
23	0.4+1.4=1.8	2.0	3.5	st
24	0.4+1.4=1.8	2.0	3.5	st
25	0.3+1.5=1.8	2.0	5.0	st
26	0.2+1.6=1.8	2.0	8.0	t
27	0.2+1.6=1.8	2.0	8.0	t
28	0.2+1.5=1.7	1.9	7.5	t
29	0.6+1.0=1.6	1.8	1.6	m
30	0.6+1.0=1.6	1.8	1.6	m
31	0.4+1.2=1.6	1.8	3.0	sm
32	0.3+1.3=1.6	1.8	4.3	st
33	0.6+0.9=1.5	1.6	1.5	m
34	0.6+0.9=1.5	1.6	1.5	m
35	0.5+1.0=1.5	1.6	2.0	sm
36	0.4+1.1=1.5	1.6	2.7	sm
37	0.3+1.2=1.5	1.6	4.0	st
38	0.2+1.3=1.5	1.6	6.5	st
39	—+1.4=1.4	1.5	—	—
40	0.5+0.8=1.3	1.4	1.6	m

Table 38. continued

41	0.3+1.0=1.3	1.4	3.3	st
42	0.3+1.0=1.3	1.4	3.3	st
43	0.2+1.1=1.3	1.4	5.5	st
44	—+1.3=1.3	1.4	—	—
45	—+1.3=1.3	1.4	—	—
46	—+1.3=1.3	1.4	—	—
47	0.4+0.8=1.2	1.3	2.0	sm
48	0.2+0.9=1.1	1.2	4.5	st
49	—+1.1=1.1	1.2	—	—
50	—+1.1≐1.1	1.2	—	—
51	—+1.1=1.1	1.2	—	—
52	—+1.0=1.0	1.1	—	—

* : Chromosome with secondary constriction

Table 39. Measurements of somatic chromosomes of *Cymbidiella pardalina* at mitotic metaphase, 2n=52

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.6+2.8=3.4	3.4	4.6	st
2	0.7+2.5=3.2	3.2	3.5	st
3	0.6+2.6=3.2	3.2	4.3	st
4	0.6+2.5=3.1	3.1	4.1	st
5	0.7+2.2=2.9	2.9	3.1	st
6	0.6+2.3=2.9	2.9	3.8	st
7	0.5+2.2=2.7	2.7	4.4	st
8	0.5+2.1=2.6	2.6	4.2	st
9	0.4+2.1=2.5	2.5	5.2	st
10	0.4+2.0=2.4	2.4	5.0	st
11	0.7+1.7=2.4	2.4	2.4	sm
12	0.7+1.7=2.4	2.4	2.4	sm
13	0.7+1.6=2.3	2.3	2.2	sm
14	0.7+1.6=2.3	2.3	2.2	sm
15	0.6+1.7=2.3	2.3	2.8	sm
16	0.6+1.6=2.2	2.2	2.6	sm
17	0.6+1.5=2.1	2.1	2.5	sm
18	0.4+1.7=2.1	2.1	4.2	st
19	0.2+1.8=2.0	2.0	9.0	t
20	0.2+1.8=2.0	2.0	9.0	t
21	0.7+1.3=2.0	2.0	1.8	sm
22	0.5+1.5=2.0	2.0	3.0	sm
23	0.3+1.6=1.9*	1.9	5.3	st
24	0.3+1.6=1.9*	1.9	5.3	st
25	0.4+1.3=1.7	1.7	3.2	st
26	0.3+1.4=1.7	1.7	4.6	st
27	0.7+1.0=1.7	1.7	1.4	m
28	0.6+1.0=1.6	1.6	1.6	m
29	0.4+1.2=1.6	1.6	3.0	sm
30	0.4+1.2=1.6	1.6	3.0	sm
31	0.3+1.3=1.6	1.6	4.3	st
32	0.2+1.4=1.6	1.6	7.0	st
33	0.5+1.1=1.6	1.6	2.2	sm
34	0.5+1.0=1.5	1.5	2.0	sm
35	0.6+0.9=1.5	1.5	1.5	m
36	0.6+0.9=1.5	1.5	1.5	m
37	0.5+1.0=1.5	1.5	2.0	sm
38	0.4+1.0=1.4	1.4	2.5	sm
39	0.4+1.0=1.4	1.4	2.5	sm
40	0.3+1.1=1.4	1.4	3.6	st

Table 39. continued

41	0.6+0.8=1.4	1.4	1.3	m
42	0.6+0.8=1.4	1.4	1.3	m
43	0.3+1.1=1.4	1.4	3.6	st
44	0.3+1.1=1.4	1.4	3.6	st
45	—+1.3=1.3	1.3	—	—
46	—+1.3=1.3	1.3	—	—
47	0.2+1.0=1.2	1.2	5.0	st
48	0.2+1.0=1.2	1.2	5.0	st
49	—+1.2=1.2	1.2	—	—
50	—+1.2=1.2	1.2	—	—
51	—+1.2=1.2	1.2	—	—
52	—+1.1=1.1	1.1	—	—

* : Chromosome with secondary constriction

Table 40. Measurements of somatic chromosomes of *Dipodium paludosum* at mitotic metaphase, 2n=46

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.9+1.0=1.9	3.3	1.1	m
2	0.7+0.9=1.6	2.8	1.2	m
3	0.7+0.9=1.6	2.8	1.2	m
4	0.7+0.8=1.5	2.6	1.1	m
5	0.7+0.8=1.5	2.6	1.1	m
6	0.7+0.8=1.5	2.6	1.1	m
7	0.6+0.9=1.5	2.6	1.5	m
8	0.6+0.8=1.4	2.4	1.3	m
9	0.3+1.2=1.5	2.6	4.0	st
10	0.3+1.1=1.4	2.4	3.6	st
11	0.6+0.8=1.4	2.4	1.3	m
12	0.6+0.8=1.4	2.4	1.3	m
13	0.6+0.8=1.4	2.4	1.3	m
14	0.5+0.9=1.4	2.4	1.8	sm
15	0.5+0.9=1.4	2.4	1.8	sm
16	0.5+0.9=1.4	2.4	1.8	sm
17	0.5+0.8=1.3	2.2	1.6	m
18	0.6+0.7=1.3	2.2	1.1	m
19	0.6+0.7=1.3	2.2	1.1	m
20	0.6+0.7=1.3	2.2	1.1	m
21	0.6+0.7=1.3	2.2	1.1	m
22	0.6+0.7=1.3	2.2	1.1	m
23	0.6+0.6=1.2	2.1	1.0	m
24	0.6+0.6=1.2	2.1	1.0	m
25	0.6+0.6=1.2	2.1	1.0	m
26	0.6+0.6=1.2	2.1	1.0	m
27	0.5+0.7=1.2	2.1	1.4	m
28	0.5+0.7=1.2	2.1	1.4	m
29	0.5+0.7=1.2	2.1	1.4	m
30	0.5+0.7=1.2	2.1	1.4	m
31	0.5+0.6=1.1	1.9	1.2	m
32	0.5+0.6=1.1	1.9	1.2	m
33	0.5+0.6=1.1	1.9	1.2	m
34	0.5+0.6=1.1	1.9	1.2	m
35	0.5+0.6=1.1	1.9	1.2	m
36	0.5+0.6=1.1	1.9	1.2	m
37	0.5+0.6=1.1	1.9	1.2	m
38	0.5+0.6=1.1	1.9	1.2	m
39	0.5+0.5=1.0	1.7	1.0	m
40	0.5+0.5=1.0	1.7	1.0	m

Table 40. continued

41	0.5+0.5=1.0	1.7	1.0	m
42	0.5+0.5=1.0	1.7	1.0	m
43	0.4+0.6=1.0	1.7	1.5	m
44	0.4+0.6=1.0	1.7	1.5	m
45	0.3+0.6=0.9	1.6	2.0	sm
46	0.3+0.6=0.9	1.6	2.0	sm

Table 41. Measurements of somatic chromosomes of *Grammangis ellisii* at mitotic metaphase, 2n=54

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.4+1.5=2.9	3.4	1.0	m
2	1.0+1.9=2.9	3.4	1.9	sm
3	1.2+1.5=2.7	3.2	1.2	m
4	1.2+1.4=2.6	3.1	1.1	m
5	1.0+1.0=2.0	2.4	1.0	m
6	0.9+1.1=2.0	2.4	1.2	m
7	0.8+1.2=2.0	2.4	1.5	m
8	0.8+1.1=1.9	2.2	1.3	m
9	0.7+1.2=1.9	2.2	1.7	m
10	0.7+1.2=1.9	2.2	1.7	m
11	0.6+1.3=1.9	2.2	2.1	sm
12	0.5+1.4=1.9	2.2	2.8	sm
13	0.7+1.1=1.8	2.1	1.5	m
14	0.7+1.1=1.8	2.1	1.5	m
15	0.6+1.2=1.8	2.1	2.0	sm
16	0.6+1.2=1.8	2.1	2.0	sm
17	0.7+1.0=1.7	2.0	1.4	m
18	0.7+1.0=1.7	2.0	1.4	m
19	0.6+1.1=1.7	2.0	1.8	sm
20	0.7+0.9=1.6	1.9	1.2	m
21	0.7+0.8=1.5	1.8	1.1	m
22	0.7+0.8=1.5	1.8	1.1	m
23	0.7+0.8=1.5	1.8	1.1	m
24	0.6+0.9=1.5	1.8	1.5	m
25	0.6+0.9=1.5	1.8	1.5	m
26	0.6+0.9=1.5	1.8	1.5	m
27	0.5+1.0=1.5	1.8	2.0	sm
28	0.4+1.1=1.5	1.8	2.7	sm
29	0.7+0.7=1.4	1.6	1.0	m
30	0.7+0.7=1.4	1.6	1.0	m
31	0.6+0.8=1.4	1.6	1.3	m
32	0.6+0.8=1.4	1.6	1.3	m
33	0.6+0.8=1.4	1.6	1.3	m
34	0.6+0.8=1.4	1.6	1.3	m
35	0.6+0.8=1.4	1.6	1.3	m
36	0.3+1.0=1.3	1.5	3.3	st
37	0.3+1.0=1.3	1.5	3.3	st
38	0.6+0.7=1.3	1.5	1.1	m
39	0.5+0.8=1.3	1.5	1.6	m
40	0.5+0.8=1.3	1.5	1.6	m

Table 41. continued

41	0.5+0.8=1.3	1.5	1.6	m
42	0.5+0.8=1.3	1.5	1.6	m
43	—+1.3=1.3	1.5	—	—
44	—+1.3=1.3	1.5	—	—
45	0.5+0.7=1.2	1.4	1.4	m
46	0.5+0.7=1.2	1.4	1.4	m
47	0.4+0.7=1.1	1.3	1.7	m
48	0.4+0.7=1.1	1.3	1.7	m
49	0.4+0.7=1.1	1.3	1.7	m
50	0.4+0.7=1.1	1.3	1.7	m
51	—+1.1=1.1	1.3	—	—
52	—+1.0=1.0	1.2	—	—
53	—+1.0=1.0	1.2	—	—
54	0.4+0.6=1.0	1.2	1.5	m

Table 42. Measurements of somatic chromosomes of *Grammatophyllum scriptum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.5+1.6=3.1	3.4	1.0	m
2	1.5+1.6=3.1	3.4	1.0	m
3	1.3+1.6=2.9	3.2	1.2	m
4	1.3+1.5=2.8	3.1	1.1	m
5	1.3+1.5=2.8	3.1	1.1	m
6	1.1+1.5=2.6	2.9	1.3	m
7	0.9+1.8=2.7	3.0	2.0	sm
8	0.9+1.8=2.7	3.0	2.0	sm
9	1.1+1.5=2.6	2.9	1.3	m
10	1.0+1.6=2.6	2.9	1.6	m
11	1.1+1.4=2.5	2.8	1.2	m
12	1.0+1.5=2.5	2.8	1.5	m
13	0.9+1.6=2.5	2.8	1.7	m
14	1.0+1.4=2.4	2.7	1.4	m
15	1.0+1.4=2.4	2.7	1.4	m
16	0.9+1.5=2.4	2.7	1.6	m
17	1.0+1.3=2.3	2.6	1.3	m
18	1.1+1.1=2.2	2.4	1.0	m
19	0.4+1.9=2.3	2.6	4.7	st
20	0.4+1.8=2.2	2.4	4.5	st
21	0.4+1.8=2.2	2.4	4.5	st
22	0.3+1.9=2.2	2.4	6.3	st
23	0.9+1.3=2.2	2.4	1.4	m
24	1.0+1.1=2.1	2.3	1.1	m
25	0.5+1.6=2.1	2.3	3.2	st
26	0.5+1.6=2.1	2.3	3.2	st
27	0.5+1.5=2.0	2.2	3.0	sm
28	0.5+1.5=2.0	2.2	3.0	sm
29	1.0+1.1=2.1	2.3	1.1	m
30	0.9+1.0=1.9	2.1	1.1	m
31	0.3+1.6=1.9	2.1	5.3	st
32	0.3+1.6=1.9	2.1	5.3	st
33	0.8+1.1=1.9	2.1	1.3	m
34	0.8+1.0=1.8	2.0	1.2	m
35	0.5+1.3=1.8	2.0	2.6	sm
36	0.5+1.3=1.8	2.0	2.6	sm
37	0.8+0.9=1.7	1.9	1.1	m
38	0.6+1.0=1.6	1.8	1.6	m
39	0.5+1.0=1.5	1.7	2.0	sm
40	0.5+1.0=1.5	1.7	2.0	sm

Table 43. Measurements of somatic chromosomes of *Grammatophyllum speciosum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.8+1.0=1.8	3.8	1.2	m
2	0.8+0.9=1.7	3.5	1.1	m
3	0.7+1.0=1.7	3.5	1.4	m
4	0.6+1.0=1.6	3.3	1.6	m
5	0.7+0.8=1.5	3.1	1.1	m
6	0.7+0.8=1.5	3.1	1.1	m
7	0.6+0.8=1.4	2.9	1.3	m
8	0.6+0.8=1.4	2.9	1.3	m
9	0.5+0.9=1.4	2.9	1.8	sm
10	0.5+0.9=1.4	2.9	1.8	sm
11	0.6+0.8=1.4	2.9	1.3	m
12	0.6+0.7=1.3	2.7	1.1	m
13	0.6+0.7=1.3	2.7	1.1	m
14	0.6+0.7=1.3	2.7	1.1	m
15	0.5+0.8=1.3	2.7	1.6	m
16	0.5+0.8=1.3	2.7	1.6	m
17	0.5+0.7=1.2	2.5	1.4	m
18	0.5+0.7=1.2	2.5	1.4	m
19	0.5+0.7=1.2	2.5	1.4	m
20	0.5+0.7=1.2	2.5	1.4	m
21	0.5+0.7=1.2	2.5	1.4	m
22	0.5+0.7=1.2	2.5	1.4	m
23	0.6+0.6=1.2	2.5	1.0	m
24	0.6+0.6=1.2	2.5	1.0	m
25	0.5+0.6=1.1	2.3	1.2	m
26	0.5+0.6=1.1	2.3	1.2	m
27	0.5+0.6=1.1	2.3	1.2	m
28	0.5+0.6=1.1	2.3	1.2	m
29	0.5+0.6=1.1	2.3	1.2	m
30	0.5+0.6=1.1	2.3	1.2	m
31	0.5+0.5=1.0	2.1	1.0	m
32	0.4+0.6=1.0	2.1	1.5	m
33	0.4+0.6=1.0	2.1	1.5	m
34	0.4+0.5=0.9	1.9	1.2	m
35	0.4+0.5=0.9	1.9	1.2	m
36	0.4+0.4=0.8	1.7	1.0	m
37	0.4+0.4=0.8	1.7	1.0	m
38	—+0.8=0.8	1.7	—	—
39	—+0.7=0.7	1.5	—	—
40	—+0.6=0.6	1.3	—	—

Table 44. Measurements of somatic chromosomes of *Grammatophyllum stapeliiflorum* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.8+1.0=1.8	3.1	1.2	m
2	0.8+1.0=1.8	3.1	1.2	m
3	0.8+0.9=1.7	2.9	1.1	m
4	0.7+1.0=1.7	2.9	1.4	m
5	0.7+1.0=1.7	2.9	1.4	m
6	0.8+0.8=1.6	2.7	1.0	m
7	0.6+1.0=1.6	2.7	1.6	m
8	0.6+1.0=1.6	2.7	1.6	m
9	0.6+1.0=1.6	2.7	1.6	m
10	0.6+1.0=1.6	2.7	1.6	m
11	0.6+1.0=1.6	2.7	1.6	m
12	0.7+0.8=1.5	2.6	1.1	m
13	0.5+1.0=1.5	2.6	2.0	sm
14	0.5+1.0=1.5	2.6	2.0	sm
15	0.7+0.8=1.5	2.6	1.1	m
16	0.7+0.8=1.5	2.6	1.1	m
17	0.7+0.8=1.5	2.6	1.1	m
18	0.7+0.8=1.5	2.6	1.1	m
19	0.7+0.8=1.5	2.6	1.1	m
20	0.7+0.8=1.5	2.6	1.1	m
21	0.6+0.9=1.5	2.6	1.5	m
22	0.6+0.9=1.5	2.6	1.5	m
23	0.5+0.9=1.4	2.4	1.8	sm
24	0.7+0.7=1.4	2.4	1.0	m
25	0.6+0.8=1.4	2.4	1.3	m
26	0.6+0.8=1.4	2.4	1.3	m
27	0.6+0.8=1.4	2.4	1.3	m
28	0.5+0.9=1.4	2.4	1.8	sm
29	0.5+0.9=1.4	2.4	1.8	sm
30	0.6+0.7=1.3	2.2	1.1	m
31	0.6+0.7=1.3	2.2	1.1	m
32	0.6+0.7=1.3	2.2	1.1	m
33	0.5+0.8=1.3	2.2	1.6	m
34	0.5+0.8=1.3	2.2	1.6	m
35	0.5+0.8=1.3	2.2	1.6	m
36	0.5+0.8=1.3	2.2	1.6	m
37	0.6+0.6=1.2	2.1	1.0	m
38	0.5+0.7=1.2	2.1	1.4	m
39	0.5+0.7=1.2	2.1	1.4	m
40	0.5+0.6=1.1	1.9	1.2	m

Table 45. Measurements of somatic chromosomes of *Cyrtopodium andersonii* at mitotic metaphase, 2n=46

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.6+1.2=1.8	3.2	2.0	sm
2	0.6+1.2=1.8	3.2	2.0	sm
3	0.6+1.1=1.7	3.0	1.8	sm
4	0.8+0.9=1.7	3.0	1.1	m
5	0.7+0.9=1.6	2.9	1.2	m
6	0.6+1.0=1.6	2.9	1.6	m
7	0.7+0.9=1.6	2.9	1.2	m
8	0.7+0.8=1.5	2.7	1.1	m
9	0.6+0.8=1.4	2.5	1.3	m
10	0.5+0.9=1.4	2.5	1.8	sm
11	0.5+0.8=1.3	2.3	1.6	m
12	0.6+0.7=1.3	2.3	1.1	m
13	0.6+0.7=1.3	2.3	1.1	m
14	0.6+0.7=1.3	2.3	1.1	m
15	0.6+0.7=1.3	2.3	1.1	m
16	0.6+0.7=1.3	2.3	1.1	m
17	0.6+0.7=1.3	2.3	1.1	m
18	0.6+0.7=1.3	2.3	1.1	m
19	0.4+0.9=1.3	2.3	2.2	sm
20	0.4+0.9=1.3	2.3	2.2	sm
21	0.4+0.8=1.2	2.1	2.0	sm
22	0.4+0.8=1.2	2.1	2.0	sm
23	0.6+0.6=1.2	2.1	1.0	m
24	0.5+0.6=1.1	2.0	1.2	m
25	0.5+0.6=1.1	2.0	1.2	m
26	0.4+0.7=1.1	2.0	1.7	m
27	0.4+0.7=1.1	2.0	1.7	m
28	0.4+0.7=1.1	2.0	1.7	m
29	—+1.1=1.1	2.0	—	—
30	—+1.1=1.1	2.0	—	—
31	—+1.1=1.1	2.0	—	—
32	—+1.1=1.1	2.0	—	—
33	—+1.1=1.1	2.0	—	—
34	0.5+0.5=1.0	1.8	1.0	m
35	0.4+0.6=1.0	1.8	1.5	m
36	0.3+0.7=1.0	1.8	2.3	sm
37	0.2+0.8=1.0	1.8	4.0	st
38	—+1.0=1.0	1.8	—	—
39	—+1.0=1.0	1.8	—	—
40	—+1.0=1.0	1.8	—	—
41	0.4+0.5=0.9	1.6	1.2	m
42	0.4+0.5=0.9	1.6	1.2	m
43	0.3+0.6=0.9	1.6	2.0	sm
44	0.3+0.6=0.9	1.6	2.0	sm
45	0.3+0.5=0.8	1.4	1.6	m
46	0.3+0.5=0.8	1.4	1.6	m

Table 46. Measurements of somatic chromosomes of *Cyrtopodium punctatum* at mitotic metaphase, 2n=46

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.0+1.2=2.2	2.9	1.2	m
2	0.9+1.2=2.1	2.8	1.3	m
3	0.8+1.3=2.1	2.8	1.6	m
4	0.9+1.1=2.0	2.7	1.2	m
5	0.9+1.1=2.0	2.7	1.2	m
6	0.9+1.0=1.9	2.5	1.1	m
7	0.8+1.1=1.9	2.5	1.3	m
8	0.8+1.1=1.9	2.5	1.3	m
9	0.9+1.0=1.9	2.5	1.1	m
10	0.7+1.1=1.8	2.4	1.5	m
11	0.7+1.1=1.8	2.4	1.5	m
12	0.9+0.9=1.8	2.4	1.0	m
13	0.9+0.9=1.8	2.4	1.0	m
14	0.9+0.9=1.8	2.4	1.0	m
15	0.8+1.0=1.8	2.4	1.2	m
16	0.8+1.0=1.8	2.4	1.2	m
17	0.8+1.0=1.8	2.4	1.2	m
18	0.8+1.0=1.8	2.4	1.2	m
19	0.8+1.0=1.8	2.4	1.2	m
20	0.8+1.0=1.8	2.4	1.2	m
21	0.8+1.0=1.8	2.4	1.2	m
22	0.8+0.9=1.7	2.3	1.1	m
23	0.8+0.9=1.7	2.3	1.1	m
24	0.8+0.9=1.7	2.3	1.1	m
25	0.7+1.0=1.7	2.3	1.4	m
26	0.7+0.9=1.6	2.1	1.2	m
27	0.6+1.0=1.6	2.1	1.6	m
28	0.6+0.9=1.5	2.0	1.5	m
29	0.5+1.0=1.5	2.0	2.0	sm
30	0.5+1.0=1.5	2.0	2.0	sm
31	0.6+0.8=1.4	1.9	1.3	m
32	0.6+0.8=1.4	1.9	1.3	m
33	0.5+0.9=1.4	1.9	1.8	sm
34	0.5+0.9=1.4	1.9	1.8	sm
35	0.6+0.8=1.4	1.9	1.3	m
36	0.5+0.8=1.3	1.7	1.6	m
37	0.5+0.9=1.4	1.9	1.8	sm
38	0.4+0.9=1.3	1.7	2.2	sm
39	0.5+0.8=1.3	1.7	1.6	m
40	0.5+0.8=1.3	1.7	1.6	m
41	0.3+1.0=1.3	1.7	3.3	st
42	0.3+1.0=1.3	1.7	3.3	st
43	0.3+1.0=1.3	1.7	3.3	st
44	0.3+1.0=1.3	1.7	3.3	st
45	—+1.3=1.3	1.7	—	—
46	—+1.2=1.2	1.6	—	—

Table 46. continued

Table 47. Measurements of somatic chromosomes of *Eulophia guineensis* at mitotic metaphase, 2n=54

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.7+1.0=1.7	2.7	1.4	m
2	0.8+0.9=1.7	2.7	1.1	m
3	0.6+1.1=1.7	2.7	1.8	sm
4	0.5+1.1=1.6	2.5	2.2	sm
5	0.6+1.0=1.6	2.5	1.6	m
6	0.6+0.9=1.5	2.3	1.5	m
7	0.5+1.0=1.5	2.3	2.0	sm
8	0.5+1.0=1.5	2.3	2.0	sm
9	0.7+0.8=1.5	2.3	1.1	m
10	0.6+0.8=1.4	2.2	1.3	m
11	0.5+0.9=1.4	2.2	1.8	sm
12	0.5+0.9=1.4	2.2	1.8	sm
13	0.5+0.9=1.4	2.2	1.8	sm
14	0.4+1.0=1.4	2.2	2.5	sm
15	0.4+1.0=1.4	2.2	2.5	sm
16	0.4+1.0=1.4	2.2	2.5	sm
17	0.4+0.9=1.3	2.0	2.2	sm
18	0.4+0.9=1.3	2.0	2.2	sm
19	0.5+0.8=1.3	2.0	1.6	m
20	0.6+0.6=1.2	1.9	1.0	m
21	0.6+0.6=1.2	1.9	1.0	m
22	0.5+0.7=1.2	1.9	1.4	m
23	0.5+0.7=1.2	1.9	1.4	m
24	0.5+0.7=1.2	1.9	1.4	m
25	0.4+0.8=1.2	1.9	2.0	sm
26	0.3+0.9=1.2	1.9	3.0	sm
27	0.5+0.7=1.2	1.9	1.4	m
28	0.5+0.6=1.1	1.7	1.2	m
29	0.5+0.6=1.1	1.7	1.2	m
30	0.4+0.7=1.1	1.7	1.7	m
31	0.3+0.8=1.1	1.7	2.6	sm
32	—+1.1=1.1	1.7	—	—
33	—+1.1=1.1	1.7	—	—
34	0.5+0.5=1.0	1.6	1.0	m
35	0.4+0.6=1.0	1.6	1.5	m
36	0.4+0.6=1.0	1.6	1.5	m
37	0.4+0.6=1.0	1.6	1.5	m
38	0.3+0.7=1.0	1.6	2.3	sm
39	—+1.0=1.0	1.6	—	—
40	—+1.0=1.0	1.6	—	—

Table 47. continued

Chromosome	Length(μm)	Relative length	Arm ratio	Form
41	—+1.0=1.0	1.6	—	—
42	—+1.0=1.0	1.6	—	—
43	—+1.0=1.0	1.6	—	—
44	—+1.0=1.0	1.6	—	—
45	—+1.0=1.0	1.6	—	—
46	—+1.0=1.0	1.6	—	—
47	0.3+0.6=0.9	1.4	2.0	sm
48	0.3+0.6=0.9	1.4	2.0	sm
49	—+0.9=0.9	1.4	—	—
50	—+0.9=0.9	1.4	—	—
51	—+0.9=0.9	1.4	—	—
52	—+0.9=0.9	1.4	—	—
53	—+0.8=0.8	1.2	—	—
54	—+0.8=0.8	1.2	—	—

Table 48. Measurements of somatic chromosomes of *Eulophia paniculata* at mitotic metaphase, 2n=60

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.7+1.0=1.7	2.7	1.4	m
2	0.6+1.0=1.6	2.5	1.6	m
3	0.6+0.9=1.5	2.3	1.5	m
4	0.6+0.9=1.5	2.3	1.5	m
5	0.6+0.8=1.4	2.2	1.3	m
6	0.6+0.8=1.4	2.2	1.3	m
7	0.5+0.9=1.4	2.2	1.8	sm
8	0.3+1.1=1.4	2.2	3.6	st
9	0.3+1.1=1.4	2.2	3.6	st
10	0.3+1.1=1.4	2.2	3.6	st
11	0.3+1.1=1.4	2.2	3.6	st
12	0.5+0.8=1.3	2.0	1.6	m
13	0.6+0.7=1.3	2.0	1.1	m
14	0.5+0.8=1.3	2.0	1.6	m
15	0.5+0.8=1.3	2.0	1.6	m
16	0.5+0.8=1.3	2.0	1.6	m
17	0.5+0.8=1.3	2.0	1.6	m
18	0.5+0.8=1.3	2.0	1.6	m
19	0.5+0.7=1.2	1.9	1.4	m
20	0.5+0.7=1.2	1.9	1.4	m
21	0.4+0.8=1.2	1.9	2.0	sm
22	0.3+0.9=1.2	1.9	3.0	sm
23	0.3+0.9=1.2	1.9	3.0	sm
24	0.5+0.6=1.1	1.7	1.2	m
25	0.4+0.7=1.1	1.7	1.7	m
26	0.3+0.8=1.1	1.7	2.6	sm
27	0.3+0.8=1.1	1.7	2.6	sm
28	0.4+0.6=1.0	1.6	1.5	m
29	0.4+0.6=1.0	1.6	1.5	m
30	0.4+0.6=1.0	1.6	1.5	m
31	0.4+0.6=1.0	1.6	1.5	m
32	0.3+0.7=1.0	1.6	2.3	sm
33	0.3+0.7=1.0	1.6	2.3	sm
34	0.3+0.7=1.0	1.6	2.3	sm
35	0.4+0.5=0.9	1.4	1.2	m
36	0.4+0.5=0.9	1.4	1.2	m
37	0.4+0.5=0.9	1.4	1.2	m
38	0.3+0.6=0.9	1.4	2.0	sm
39	0.3+0.6=0.9	1.4	2.0	sm
40	0.3+0.6=0.9	1.4	2.0	sm

Table 48. continued

41	0.3+0.6=0.9	1.4	2.0	sm
42	0.3+0.6=0.9	1.4	2.0	sm
43	0.3+0.6=0.9	1.4	2.0	sm
44	0.3+0.6=0.9	1.4	2.0	sm
45	0.3+0.6=0.9	1.4	2.0	sm
46	0.2+0.7=0.9	1.4	3.5	st
47	0.4+0.4=0.8	1.3	1.0	m
48	0.3+0.5=0.8	1.3	1.6	m
49	0.3+0.5=0.8	1.3	1.6	m
50	0.3+0.5=0.8	1.3	1.6	m
51	0.3+0.5=0.8	1.3	1.6	m
52	0.3+0.5=0.8	1.3	1.6	m
53	0.3+0.4=0.7	1.1	1.3	m
54	0.3+0.4=0.7	1.1	1.3	m
55	0.3+0.4=0.7	1.1	1.3	m
56	0.3+0.4=0.7	1.1	1.3	m
57	0.3+0.4=0.7	1.1	1.3	m
58	0.3+0.4=0.7	1.1	1.3	m
59	0.3+0.4=0.7	1.1	1.3	m
60	0.3+0.4=0.7	1.1	1.3	m

Table 49. Measurements of somatic chromosomes of *Eulophia petersii* at mitotic metaphase, 2n=48

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.8+3.3=5.1	4.2	1.8	sm
2	1.5+2.8=4.3	3.5	1.8	sm
3	1.8+2.6=4.4	3.6	1.4	m
4	2.0+2.1=4.1	3.4	1.0	m
5	1.5+2.5=4.0	3.3	1.6	m
6	1.3+2.3=3.6	3.0	1.7	m
7	1.1+2.3=3.4	2.8	2.0	sm
8	0.9+2.4=3.3	2.7	2.6	sm
9	0.8+2.4=3.2	2.6	3.0	sm
10	1.3+1.8=3.1	2.5	1.3	m
11	1.0+2.0=3.0	2.5	2.0	sm
12	0.6+2.1=3.0	2.5	2.3	sm
13	0.7+2.3=3.0	2.5	3.2	st
14	1.3+1.5=2.8	2.3	1.1	m
15	0.9+1.9=2.8	2.3	2.1	sm
16	0.8+2.0=2.8	2.3	2.5	sm
17	0.8+2.0=2.8	2.3	2.5	sm
18	0.7+2.1=2.8	2.3	3.0	sm
19	0.8+1.9=2.7	2.2	2.3	sm
20	0.8+1.9=2.7	2.2	2.3	sm
21	1.0+1.4=2.4	2.0	1.4	m
22	0.8+1.6=2.4	2.0	2.0	sm
23	0.8+1.6=2.4	2.0	2.0	sm
24	0.8+1.6=2.4	2.0	2.0	sm
25	0.8+1.6=2.4	2.0	2.0	sm
26	0.8+1.6=2.4	2.0	2.0	sm
27	1.0+1.3=2.3	1.9	1.3	m
28	0.9+1.4=2.3	1.9	1.5	m
29	0.7+1.6=2.3	1.9	2.2	sm
30	0.6+1.6=2.2	1.8	2.6	sm
31	1.1+1.1=2.2	1.8	1.0	m
32	0.9+1.3=2.2	1.8	1.4	m
33	1.0+1.1=2.1	1.7	1.1	m
34	0.9+1.1=2.0	1.6	1.2	m
35	0.7+1.4=2.1	1.7	2.0	sm
36	0.6+1.3=1.9	1.6	2.1	sm
37	0.8+1.1=1.9	1.6	1.3	m
38	0.7+1.2=1.9	1.6	1.7	m
39	0.8+1.0=1.8	1.5	1.2	m
40	0.8+1.0=1.8	1.5	1.2	m
41	0.8+1.0=1.8	1.5	1.2	m
42	0.6+0.9=1.5	1.2	1.5	m
43	0.5+1.1=1.6	1.3	2.2	sm
44	0.5+1.0=1.5	1.2	2.0	sm
45	0.5+0.9=1.4	1.1	1.8	sm
46	0.4+1.0=1.4	1.1	2.5	sm
47	0.3+1.0=1.3	1.1	3.3	st
48	0.3+0.9=1.2	1.0	3.0	sm

Table 49. continued

Table 50. Measurements of somatic chromosomes of *Eulophia streptopetala* at mitotic metaphase, 2n=42

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.9+1.5=2.4	3.4	1.6	m
2	0.6+1.8=2.4	3.4	3.0	sm
3	0.9+1.4=2.3	3.2	1.5	m
4	0.8+1.4=2.2	3.1	1.7	m
5	0.6+1.5=2.1	2.9	2.5	sm
6	0.7+1.4=2.1	2.9	2.0	sm
7	1.0+1.1=2.1	2.9	1.1	m
8	1.0+1.1=2.1	2.9	1.1	m
9	1.0+1.1=2.1	2.9	1.1	m
10	1.0+1.1=2.1	2.9	1.1	m
11	0.8+1.3=2.1	2.9	1.6	m
12	0.8+1.3=2.1	2.9	1.6	m
13	0.7+1.4=2.1	2.9	2.0	sm
14	0.7+1.3=2.0	2.8	1.8	sm
15	0.6+1.4=2.0	2.8	2.3	sm
16	0.6+1.4=2.0	2.8	2.3	sm
17	0.8+1.0=1.8	2.5	1.2	m
18	0.7+1.1=1.8	2.5	1.5	m
19	0.4+1.4=1.8	2.5	3.5	st
20	0.6+1.1=1.7	2.4	1.8	sm
21	0.8+0.9=1.7	2.4	1.1	m
22	0.8+0.9=1.7	2.4	1.1	m
23	0.8+0.9=1.7	2.4	1.1	m
24	0.8+0.9=1.7	2.4	1.1	m
25	0.8+0.8=1.6	2.2	1.0	m
26	0.6+0.9=1.5	2.1	1.5	m
27	0.5+1.0=1.5	2.1	2.0	sm
28	0.6+0.8=1.4	2.0	1.3	m
29	0.6+0.8=1.4	2.0	1.3	m
30	0.6+0.8=1.4	2.0	1.3	m
31	0.6+0.8=1.4	2.0	1.3	m
32	0.6+0.8=1.4	2.0	1.3	m
33	0.6+0.7=1.3	1.8	1.1	m
34	0.6+0.7=1.3	1.8	1.1	m
35	0.5+0.8=1.3	1.8	1.6	m
36	0.5+0.7=1.2	1.7	1.4	m
37	0.5+0.7=1.2	1.7	1.4	m
38	0.5+0.7=1.2	1.7	1.4	m
39	0.3+0.8=1.1	1.5	2.6	sm
40	0.3+0.8=1.1	1.5	2.6	sm
41	0.4+0.6=1.0	1.4	1.5	m
42	0.4+0.6=1.0	1.4	1.5	m

Table 51. Measurements of somatic chromosomes of *Eulophiella* Rolfei at mitotic metaphase, 2n=52

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.4+1.9=2.3	3.6	4.7	st
2	0.4+1.8=2.2	3.4	4.5	st
3	0.4+1.6=2.0	3.1	4.0	st
4	0.4+1.6=2.0	3.1	4.0	st
5	0.3+1.7=2.0	3.1	5.6	st
6	0.3+1.7=2.0	3.1	5.6	st
7	0.4+1.5=1.9	3.0	3.7	st
8	0.4+1.5=1.9	3.0	3.7	st
9	0.5+1.1=1.6	2.5	2.2	sm
10	0.5+1.1=1.6	2.5	2.2	sm
11	0.4+1.2=1.6	2.5	3.0	sm
12	0.5+1.1=1.6	2.5	2.2	sm
13	0.4+1.2=1.6	2.5	3.0	sm
14	0.4+1.1=1.5	2.3	2.7	sm
15	0.4+1.1=1.5	2.3	2.7	sm
16	0.4+1.0=1.4	2.2	2.5	sm
17	0.4+1.0=1.4	2.2	2.5	sm
18	0.4+1.0=1.4	2.2	2.5	sm
19	0.2+1.1=1.3	2.0	5.5	st
20	0.2+1.1=1.3	2.0	5.5	st
21	0.4+0.8=1.2	1.9	2.0	sm
22	0.3+0.8=1.1	1.7	2.6	sm
23	0.5+0.6=1.1	1.7	1.2	m
24	0.5+0.6=1.1	1.7	1.2	m
25	0.4+0.7=1.1	1.7	1.7	m
26	—+1.1=1.1	1.7	—	—
27	—+1.1=1.1	1.7	—	—
28	—+1.0=1.0	1.6	—	—
29	0.1+0.9=1.0*	1.6	9.0	t
30	0.1+0.9=1.0*	1.6	9.0	t
31	—+1.0=1.0	1.6	—	—
32	—+1.0=1.0	1.6	—	—
33	—+1.0=1.0	1.6	—	—
34	—+0.9=0.9	1.4	—	—
35	0.4+0.5=0.9	1.4	1.2	m
36	0.4+0.5=0.9	1.4	1.2	m
37	0.3+0.6=0.9	1.4	2.0	sm
38	0.3+0.6=0.9	1.4	2.0	sm
39	0.3+0.6=0.9	1.4	2.0	sm
40	—+0.9=0.9	1.4	—	—

Table 51. continued

41	—+0.9=0.9	1.4	—	—
42	—+0.9=0.9	1.4	—	—
43	0.4+0.4=0.8	1.3	1.0	m
44	0.4+0.4=0.8	1.3	1.0	m
45	0.4+0.4=0.8	1.3	1.0	m
46	0.4+0.4=0.8	1.3	1.0	m
47	—+0.8=0.8	1.3	—	—
48	—+0.8=0.8	1.3	—	—
49	—+0.8=0.8	1.3	—	—
50	—+0.8=0.8	1.3	—	—
51	—+0.8=0.8	1.3	—	—
52	—+0.8=0.8	1.3	—	—

* : Chromosome with secondary constriction

Table 52. Measurements of somatic chromosomes of *Eulophiella roempleriana* at mitotic metaphase, 2n=52

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.4+1.2=1.6	2.8	3.0	sm
2	0.4+1.2=1.6	2.8	3.0	sm
3	0.4+1.1=1.5	2.6	2.7	sm
4	0.4+1.1=1.5	2.6	2.7	sm
5	0.6+0.8=1.4	2.4	1.3	m
6	0.5+0.9=1.5	2.4	1.8	sm
7	0.4+1.0=1.4	2.4	2.5	sm
8	0.3+1.1=1.4	2.4	3.6	st
9	0.6+0.7=1.3	2.2	1.1	m
10	0.6+0.7=1.3	2.2	1.1	m
11	0.3+1.0=1.3	2.2	3.3	st
12	0.3+1.0=1.3	2.2	3.3	st
13	0.3+1.0=1.3	2.2	3.3	st
14	0.3+1.0=1.3	2.2	3.3	st
15	0.2+1.1=1.3	2.2	5.5	st
16	0.2+1.1=1.3	2.2	5.5	st
17	—+1.3=1.3	2.2	—	—
18	0.4+0.8=1.2	2.1	2.0	sm
19	0.3+0.9=1.2	2.1	3.0	sm
20	0.2+1.0=1.2	2.1	5.0	st
21	0.2+1.0=1.2	2.1	5.0	st
22	0.2+1.0=1.2	2.1	5.0	st
23	0.1+1.1=1.2	2.1	11.0	t
24	—+1.2=1.2	2.1	—	—
25	0.5+0.6=1.1	1.9	1.2	m
26	0.5+0.6=1.1	1.9	1.2	m
27	0.5+0.6=1.1	1.9	1.2	m
28	0.4+0.7=1.1	1.9	1.7	m
29	0.3+0.8=1.1	1.9	2.6	sm
30	0.3+0.8=1.1	1.9	2.6	sm
31	0.3+0.8=1.1	1.9	2.6	sm
32	0.2+0.9=1.1	1.9	4.5	st
33	—+1.1=1.1	1.9	—	—
34	0.5+0.5=1.0	1.7	1.0	m
35	0.4+0.6=1.0	1.7	1.5	m
36	0.4+0.6=1.0	1.7	1.5	m
37	0.4+0.6=1.0	1.7	1.5	m
38	0.4+0.6=1.0	1.7	1.5	m
39	0.3+0.7=1.0	1.7	2.3	sm
40	—+1.0=1.0	1.7	—	—

Table 52. continued

41	0.4+0.5=0.9	1.6	1.2	m
42	0.3+0.6=0.9	1.6	2.0	sm
43	0.3+0.6=0.9	1.6	2.0	sm
44	—+0.9=0.9	1.6	—	—
45	0.3+0.5=0.8	1.4	1.6	m
46	—+0.8=0.8	1.4	—	—
47	—+0.8=0.8	1.4	—	—
48	—+0.7=0.7	1.2	—	—
49	—+0.6=0.6	1.0	—	—
50	—+0.6=0.6	1.0	—	—
51	—+0.6=0.6	1.0	—	—
52	—+0.6=0.6	1.0	—	—

Table 53. Measurements of somatic chromosomes of *Galeandra baueri* at mitotic metaphase, 2n=56

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.9+0.9=1.8	2.5	1.0	m
2	0.8+0.9=1.7	2.4	1.1	m
3	0.8+0.9=1.7	2.4	1.1	m
4	0.8+0.9=1.7	2.4	1.1	m
5	0.8+0.9=1.7	2.4	1.1	m
6	0.8+0.9=1.7	2.4	1.1	m
7	0.8+0.9=1.7	2.4	1.1	m
8	0.8+0.8=1.6	2.2	1.0	m
9	0.5+1.1=1.6	2.2	2.2	sm
10	0.5+1.1=1.6	2.2	2.2	sm
11	0.7+0.8=1.5	2.1	1.1	m
12	0.6+0.9=1.5	2.1	1.5	m
13	0.6+0.9=1.5	2.1	1.5	m
14	0.5+0.9=1.4	1.9	1.8	sm
15	0.7+0.7=1.4	1.9	1.0	m
16	0.6+0.8=1.4	1.9	1.3	m
17	0.6+0.8=1.4	1.9	1.3	m
18	0.6+0.8=1.4	1.9	1.3	m
19	0.6+0.8=1.4	1.9	1.3	m
20	0.6+0.8=1.4	1.9	1.3	m
21	0.5+0.9=1.4	1.9	1.8	sm
22	0.5+0.9=1.4	1.9	1.8	sm
23	0.6+0.7=1.3	1.8	1.1	m
24	0.6+0.7=1.3	1.8	1.1	m
25	0.6+0.7=1.3	1.8	1.1	m
26	0.5+0.8=1.3	1.8	1.6	m
27	0.6+0.6=1.2	1.7	1.0	m
28	0.6+0.6=1.2	1.7	1.0	m
29	0.6+0.6=1.2	1.7	1.0	m
30	0.6+0.6=1.2	1.7	1.0	m
31	0.5+0.7=1.2	1.7	1.4	m
32	0.5+0.7=1.2	1.7	1.4	m
33	0.5+0.7=1.2	1.7	1.4	m
34	0.5+0.7=1.2	1.7	1.4	m
35	0.4+0.8=1.2	1.7	2.0	sm
36	0.4+0.8=1.2	1.7	2.0	sm
37	0.6+0.6=1.2	1.7	1.0	m
38	0.5+0.6=1.1	1.5	1.2	m
39	0.5+0.6=1.1	1.5	1.2	m
40	0.5+0.6=1.1	1.5	1.2	m

Table 53. continued

41	0.5+0.6=1.1	1.5	1.2	m
42	0.5+0.6=1.1	1.5	1.2	m
43	0.5+0.6=1.1	1.5	1.2	m
44	0.5+0.6=1.1	1.5	1.2	m
45	0.5+0.6=1.1	1.5	1.2	m
46	0.5+0.6=1.1	1.5	1.2	m
47	0.5+0.6=1.1	1.5	1.2	m
48	0.5+0.6=1.1	1.5	1.2	m
49	0.4+0.7=1.1	1.5	1.7	m
50	0.5+0.5=1.0	1.4	1.0	m
51	0.4+0.6=1.0	1.4	1.5	m
52	0.4+0.6=1.0	1.4	1.5	m
53	0.4+0.6=1.0	1.4	1.5	m
54	0.4+0.5=0.9	1.2	1.2	m
55	0.4+0.5=0.9	1.2	1.2	m
56	0.4+0.5=0.9	1.2	1.2	m

Table 54. Measurements of somatic chromosomes of *Galeandra devoniana* at mitotic metaphase, 2n=56

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.6+1.2=1.8	2.7	2.0	sm
2	0.6+1.2=1.8	2.7	2.0	sm
3	0.7+1.1=1.8	2.7	1.5	m
4	0.7+1.0=1.7	2.5	1.4	m
5	0.6+1.1=1.7	2.5	1.8	sm
6	0.7+0.9=1.6	2.4	1.2	m
7	0.7+0.8=1.5	2.2	1.1	m
8	0.6+0.9=1.5	2.2	1.5	m
9	—+1.6=1.6	2.4	—	—
10	—+1.6=1.6	2.4	—	—
11	0.6+0.8=1.4	2.1	1.3	m
12	—+1.4=1.4	2.1	—	—
13	—+1.4=1.4	2.1	—	—
14	—+1.3=1.3	1.9	—	—
15	0.6+0.7=1.3	1.9	1.1	m
16	0.6+0.6=1.2	1.8	1.0	m
17	0.6+0.6=1.2	1.8	1.0	m
18	0.6+0.6=1.2	1.8	1.0	m
19	0.6+0.6=1.2	1.8	1.0	m
20	0.6+0.6=1.2	1.8	1.0	m
21	0.6+0.6=1.2	1.8	1.0	m
22	0.6+0.6=1.2	1.8	1.0	m
23	0.5+0.7=1.2	1.8	1.4	m
24	—+1.2=1.2	1.8	—	—
25	—+1.2=1.2	1.8	—	—
26	—+1.2=1.2	1.8	—	—
27	—+1.2=1.2	1.8	—	—
28	—+1.2=1.2	1.8	—	—
29	—+1.2=1.2	1.8	—	—
30	0.5+0.6=1.1	1.6	1.2	m
31	0.5+0.6=1.1	1.6	1.2	m
32	0.5+0.6=1.1	1.6	1.2	m
33	0.5+0.6=1.1	1.6	1.2	m
34	—+1.1=1.1	1.6	—	—
35	—+1.1=1.1	1.6	—	—
36	—+1.1=1.1	1.6	—	—
37	—+1.1=1.1	1.6	—	—
38	—+1.1=1.1	1.6	—	—
39	—+1.1=1.1	1.6	—	—
40	—+1.1=1.1	1.6	—	—

Table 54. continued

41	—+1.1=1.1	1.6	—	—
42	—+1.0=1.0	1.5	—	—
43	—+1.0=1.0	1.5	—	—
44	—+1.0=1.0	1.5	—	—
45	—+1.0=1.0	1.5	—	—
46	—+1.0=1.0	1.5	—	—
47	—+1.0=1.0	1.5	—	—
48	—+1.0=1.0	1.5	—	—
49	—+1.0=1.0	1.5	—	—
50	—+1.0=1.0	1.5	—	—
51	—+0.9=0.9	1.3	—	—
52	—+0.9=0.9	1.3	—	—
53	—+0.9=0.9	1.3	—	—
54	—+0.9=0.9	1.3	—	—
55	—+0.8=0.8	1.2	—	—
56	—+0.8=0.8	1.2	—	—

Table 55. Measurements of somatic chromosomes of *Geodorum densiflorum* at mitotic metaphase, 2n=54

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.6+0.7=1.3	2.8	1.1	m
2	0.5+0.7=1.2	2.6	1.4	m
3	0.4+0.8=1.2	2.6	2.0	sm
4	0.4+0.8=1.2	2.6	2.0	sm
5	0.5+0.6=1.1	2.4	1.2	m
6	0.5+0.6=1.1	2.4	1.2	m
7	0.5+0.6=1.1	2.4	1.2	m
8	0.5+0.6=1.1	2.4	1.2	m
9	0.5+0.5=1.0	2.2	1.0	m
10	0.4+0.6=1.0	2.2	1.5	m
11	0.4+0.6=1.0	2.2	1.5	m
12	0.4+0.6=1.0	2.2	1.5	m
13	0.2+0.7=0.9	2.0	3.5	st
14	0.2+0.7=0.9	2.0	3.5	st
15	0.4+0.5=0.9	2.0	1.2	m
16	0.4+0.5=0.9	2.0	1.2	m
17	0.4+0.5=0.9	2.0	1.2	m
18	0.3+0.6=0.9	2.0	2.0	sm
19	—+0.9=0.9	2.0	—	—
20	—+0.9=0.9	2.0	—	—
21	—+0.9=0.9	2.0	—	—
22	0.3+0.5=0.8	1.8	1.6	m
23	0.3+0.5=0.8	1.8	1.6	m
24	0.4+0.4=0.8	1.8	1.0	m
25	0.4+0.4=0.8	1.8	1.0	m
26	0.4+0.4=0.8	1.8	1.0	m
27	0.3+0.5=0.8	1.8	1.6	m
28	0.3+0.5=0.8	1.8	1.6	m
29	—+0.8=0.8	1.8	—	—
30	—+0.8=0.8	1.8	—	—
31	—+0.8=0.8	1.8	—	—
32	—+0.8=0.8	1.8	—	—
33	—+0.8=0.8	1.8	—	—
34	—+0.8=0.8	1.8	—	—
35	—+0.8=0.8	1.8	—	—
36	—+0.8=0.8	1.8	—	—
37	—+0.8=0.8	1.8	—	—
38	—+0.8=0.8	1.8	—	—
39	—+0.8=0.8	1.8	—	—
40	0.3+0.4=0.7	1.5	1.3	m

Table 55. continued

41	0.3+0.4=0.7	1.5	1.3	m
42	—+0.7=0.7	1.5	—	—
43	—+0.7=0.7	1.5	—	—
44	—+0.7=0.7	1.5	—	—
45	—+0.7=0.7	1.5	—	—
46	—+0.7=0.7	1.5	—	—
47	—+0.7=0.7	1.5	—	—
48	—+0.7=0.7	1.5	—	—
49	—+0.6=0.6	1.3	—	—
50	—+0.6=0.6	1.3	—	—
51	—+0.6=0.6	1.3	—	—
52	—+0.6=0.6	1.3	—	—
53	—+0.6=0.6	1.3	—	—
54	—+0.6=0.6	1.3	—	—

Table 56. Measurements of somatic chromosomes of *Graphorkis scripta* at mitotic metaphase, 2n=54

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.5+1.1=1.6	3.0	2.2	sm
2	0.6+0.9=1.5	2.8	1.5	m
3	0.6+0.8=1.4	2.6	1.3	m
4	0.6+0.7=1.3	2.4	1.1	m
5	0.6+0.7=1.3	2.4	1.1	m
6	0.6+0.6=1.2	2.2	1.0	m
7	0.6+0.6=1.2	2.2	1.0	m
8	0.6+0.6=1.2	2.2	1.0	m
9	0.5+0.7=1.2	2.2	1.4	m
10	0.5+0.7=1.2	2.2	1.4	m
11	0.5+0.7=1.2	2.2	1.4	m
12	0.5+0.7=1.2	2.2	1.4	m
13	0.4+0.8=1.2	2.2	2.0	sm
14	0.3+0.8=1.1	2.1	2.6	sm
15	0.5+0.6=1.1	2.1	1.2	m
16	0.5+0.6=1.1	2.1	1.2	m
17	0.5+0.6=1.1	2.1	1.2	m
18	0.5+0.6=1.1	2.1	1.2	m
19	0.5+0.5=1.0	1.9	1.0	m
20	0.4+0.6=1.0	1.9	1.5	m
21	0.4+0.6=1.0	1.9	1.5	m
22	0.4+0.6=1.0	1.9	1.5	m
23	0.1+0.9=1.0	1.9	9.0	t
24	0.1+0.8=0.9	1.7	8.0	t
25	0.4+0.5=0.9	1.7	1.2	m
26	0.4+0.5=0.9	1.7	1.2	m
27	0.4+0.5=0.9	1.7	1.2	m
28	0.4+0.5=0.9	1.7	1.2	m
29	0.4+0.5=0.9	1.7	1.2	m
30	0.4+0.5=0.9	1.7	1.2	m
31	0.4+0.5=0.9	1.7	1.2	m
32	0.4+0.5=0.9	1.7	1.2	m
33	0.4+0.5=0.9	1.7	1.2	m
34	0.3+0.6=0.9	1.7	2.0	sm
35	0.3+0.6=0.9	1.7	2.0	sm
36	0.3+0.6=0.9	1.7	2.0	sm
37	—+0.9=0.9	1.7	—	—
38	—+0.9=0.9	1.7	—	—
39	—+0.9=0.9	1.7	—	—
40	—+0.9=0.9	1.7	—	—

Table 56. continued

41	—+0.9=0.9	1.7	—	—
42	—+0.8=0.8	1.5	—	—
43	—+0.8=0.8	1.5	—	—
44	—+0.8=0.8	1.5	—	—
45	—+0.8=0.8	1.5	—	—
46	—+0.8=0.8	1.5	—	—
47	—+0.8=0.8	1.5	—	—
48	—+0.8=0.8	1.5	—	—
49	—+0.8=0.8	1.5	—	—
50	—+0.8=0.8	1.5	—	—
51	—+0.8=0.8	1.5	—	—
52	—+0.8=0.8	1.5	—	—
53	—+0.7=0.7	1.3	—	—
54	—+0.7=0.7	1.3	—	—

Table 57. Measurements of somatic chromosomes of *Oecoclades saundersiana* at mitotic metaphase, 2n=58

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.8+0.8=1.6	2.3	1.0	m
2	0.6+1.0=1.6	2.3	1.6	m
3	0.5+1.0=1.5	2.1	2.0	sm
4	0.7+0.8=1.5	2.1	1.1	m
5	0.7+0.8=1.5	2.1	1.1	m
6	0.7+0.7=1.4	2.0	1.0	m
7	0.6+0.8=1.4	2.0	1.3	m
8	0.6+0.8=1.4	2.0	1.3	m
9	0.6+0.8=1.4	2.0	1.3	m
10	0.5+0.8=1.3	1.9	1.6	m
11	0.6+0.7=1.3	1.9	1.1	m
12	0.6+0.7=1.3	1.9	1.1	m
13	0.6+0.7=1.3	1.9	1.1	m
14	0.6+0.7=1.3	1.9	1.1	m
15	0.6+0.7=1.3	1.9	1.1	m
16	0.6+0.7=1.3	1.9	1.1	m
17	0.5+0.8=1.3	1.9	1.6	m
18	0.5+0.8=1.3	1.9	1.6	m
19	0.5+0.8=1.3	1.9	1.6	m
20	0.5+0.8=1.3	1.9	1.6	m
21	0.5+0.8=1.3	1.9	1.6	m
22	0.6+0.6=1.2	1.7	1.0	m
23	0.6+0.6=1.2	1.7	1.0	m
24	0.6+0.6=1.2	1.7	1.0	m
25	0.6+0.6=1.2	1.7	1.0	m
26	0.6+0.6=1.2	1.7	1.0	m
27	0.6+0.6=1.2	1.7	1.0	m
28	0.6+0.6=1.2	1.7	1.0	m
29	0.5+0.7=1.2	1.7	1.4	m
30	0.5+0.7=1.2	1.7	1.4	m
31	0.5+0.7=1.2	1.7	1.4	m
32	0.5+0.7=1.2	1.7	1.4	m
33	0.5+0.7=1.2	1.7	1.4	m
34	0.5+0.7=1.2	1.7	1.4	m
35	0.5+0.7=1.2	1.7	1.4	m
36	0.5+0.6=1.1	1.6	1.2	m
37	0.1+0.2+0.8=1.1*	1.6	2.6	sm
38	0.1+0.2+0.8=1.1*	1.6	2.6	sm
39	0.5+0.6=1.1	1.6	1.2	m
40	0.5+0.6=1.1	1.6	1.2	m

Table 57. continued

41	0.5+0.6=1.1	1.6	1.2	m
42	0.5+0.6=1.1	1.6	1.2	m
43	0.5+0.6=1.1	1.6	1.2	m
44	0.5+0.6=1.1	1.6	1.2	m
45	0.5+0.6=1.1	1.6	1.2	m
46	0.5+0.6=1.1	1.6	1.2	m
47	0.5+0.6=1.1	1.6	1.2	m
48	0.5+0.6=1.1	1.6	1.2	m
49	0.5+0.6=1.1	1.6	1.2	m
50	0.5+0.6=1.1	1.6	1.2	m
51	0.5+0.6=1.1	1.6	1.2	m
52	0.5+0.6=1.1	1.6	1.2	m
53	0.3+0.7=1.0	1.4	2.3	sm
54	0.4+0.6=1.0	1.4	1.5	m
55	0.4+0.5=0.9	1.3	1.2	m
56	0.4+0.5=0.9	1.3	1.2	m
57	0.4+0.5=0.9	1.3	1.2	m
58	0.4+0.5=0.9	1.3	1.2	m

* : Chromosome with secondary constriction

Table 58. Measurements of somatic chromosomes of *Cremastra appendiculata* at mitotic metaphase, 2n=48

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.7+1.0=1.7	3.0	1.4	m
2	0.7+1.0=1.7	3.0	1.4	m
3	0.7+0.9=1.6	2.8	1.2	m
4	0.7+0.8=1.5	2.6	1.1	m
5	0.7+0.8=1.5	2.6	1.1	m
6	0.7+0.8=1.5	2.6	1.1	m
7	0.6+0.7=1.3	2.3	1.1	m
8	0.6+0.7=1.3	2.3	1.1	m
9	0.6+0.7=1.3	2.3	1.1	m
10	0.6+0.7=1.3	2.3	1.1	m
11	0.6+0.6=1.2	2.1	1.0	m
12	0.6+0.6=1.2	2.1	1.0	m
13	0.6+0.6=1.2	2.1	1.0	m
14	0.6+0.6=1.2	2.1	1.0	m
15	0.6+0.6=1.2	2.1	1.0	m
16	0.6+0.6=1.2	2.1	1.0	m
17	0.6+0.6=1.2	2.1	1.0	m
18	0.6+0.6=1.2	2.1	1.0	m
19	0.6+0.6=1.2	2.1	1.0	m
20	0.6+0.6=1.2	2.1	1.0	m
21	0.6+0.6=1.2	2.1	1.0	m
22	0.6+0.6=1.2	2.1	1.0	m
23	0.6+0.6=1.2	2.1	1.0	m
24	0.6+0.6=1.2	2.1	1.0	m
25	0.5+0.6=1.1	1.9	1.2	m
26	0.5+0.6=1.1	1.9	1.2	m
27	0.5+0.6=1.1	1.9	1.2	m
28	0.5+0.6=1.1	1.9	1.2	m
29	0.5+0.6=1.1	1.9	1.2	m
30	0.5+0.6=1.1	1.9	1.2	m
31	0.5+0.6=1.1	1.9	1.2	m
32	0.5+0.6=1.1	1.9	1.2	m
33	0.5+0.6=1.1	1.9	1.2	m
34	0.5+0.6=1.1	1.9	1.2	m
35	0.5+0.6=1.1	1.9	1.2	m
36	0.5+0.6=1.1	1.9	1.2	m
37	0.5+0.6=1.1	1.9	1.2	m
38	0.5+0.6=1.1	1.9	1.2	m
39	0.5+0.6=1.1	1.9	1.2	m
40	0.5+0.6=1.1	1.9	1.2	m

Table 58. continued

41	0.5+0.6=1.1	1.9	1.2	m
42	0.5+0.6=1.1	1.9	1.2	m
43	0.5+0.6=1.1	1.9	1.2	m
44	0.5+0.6=1.1	1.9	1.2	m
45	0.5+0.5=1.0	1.7	1.0	m
46	0.5+0.5=1.0	1.7	1.0	m
47	0.5+0.5=1.0	1.7	1.0	m
48	0.4+0.5=0.9	1:6	1.2	m

Table 59. Measurements of somatic chromosomes of *Oreorchis patens* at mitotic metaphase, 2n=48

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.0+1.4=2.4	4.2	1.4	m
2	1.0+1.2=2.2	3.8	1.2	m
3	0.3+1.6=1.9	3.3	5.3	st
4	0.3+1.5=1.8	3.1	5.0	st
5	0.6+0.9=1.5	2.6	1.5	m
6	0.6+0.9=1.5	2.6	1.5	m
7	0.6+0.8=1.4	2.4	1.3	m
8	0.5+0.9=1.4	2.4	1.8	sm
9	0.6+0.8=1.4	2.4	1.3	m
10	0.5+0.8=1.3	2.3	1.6	m
11	0.5+0.8=1.3	2.3	1.6	m
12	0.5+0.8=1.3	2.3	1.6	m
13	0.5+0.8=1.3	2.3	1.6	m
14	0.6+0.6=1.2	2.1	1.0	m
15	0.6+0.6=1.2	2.1	1.0	m
16	0.3+0.9=1.2	2.1	3.0	sm
17	0.3+0.9=1.2	2.1	3.0	sm
18	0.4+0.8=1.2	2.1	2.0	sm
19	0.5+0.6=1.1	1.9	1.2	m
20	0.5+0.6=1.1	1.9	1.2	m
21	0.5+0.6=1.1	1.9	1.2	m
22	0.5+0.6=1.1	1.9	1.2	m
23	0.5+0.6=1.1	1.9	1.2	m
24	0.5+0.6=1.1	1.9	1.2	m
25	0.5+0.6=1.1	1.9	1.2	m
26	0.5+0.6=1.1	1.9	1.2	m
27	0.5+0.6=1.1	1.9	1.2	m
28	0.5+0.6=1.1	1.9	1.2	m
29	0.5+0.6=1.1	1.9	1.2	m
30	0.5+0.6=1.1	1.9	1.2	m
31	0.4+0.7=1.1	1.9	1.7	m
32	0.4+0.7=1.1	1.9	1.7	m
33	0.4+0.7=1.1	1.9	1.7	m
34	0.5+0.5=1.0	1.7	1.0	m
35	0.5+0.5=1.0	1.7	1.0	m
36	0.5+0.5=1.0	1.7	1.0	m
37	0.4+0.6=1.0	1.7	1.5	m
38	0.4+0.6=1.0	1.7	1.5	m
39	0.4+0.6=1.0	1.7	1.5	m
40	0.4+0.6=1.0	1.7	1.5	m

Table 59. continued

41	0.4+0.6=1.0	1.7	1.5	m
42	0.4+0.5=0.9	1.6	1.2	m
43	0.4+0.5=0.9	1.6	1.2	m
44	0.4+0.5=0.9	1.6	1.2	m
45	0.4+0.5=0.9	1.6	1.2	m
46	0.4+0.5=0.9	1.6	1.2	m
47	0.4+0.5=0.9	1.6	1.2	m
48	0.3+0.6=0.9	1.6	2.0	sm

Table 60. Measurements of somatic chromosomes of *Warrea costaricensis* at mitotic metaphase, 2n=52

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.0+1.4=2.4	3.3	1.4	m
2	0.9+1.4=2.3	3.2	1.5	m
3	0.7+1.3=2.0	2.8	1.8	sm
4	0.6+1.3=1.9	2.6	2.1	sm
5	0.8+1.1=1.9	2.6	1.4	m
6	0.8+1.0=1.8	2.5	1.2	m
7	0.6+1.3=1.9	2.6	2.1	sm
8	0.5+1.3=1.8	2.5	2.6	sm
9	0.6+1.1=1.7	2.4	1.8	sm
10	0.6+1.1=1.7	2.4	1.8	sm
11	0.7+1.0=1.7	2.4	1.4	m
12	0.7+1.0=1.7	2.4	1.4	m
13	0.6+1.0=1.6	2.2	1.6	m
14	0.6+0.9=1.5	2.1	1.5	m
15	0.6+0.9=1.5	2.1	1.5	m
16	0.5+1.0=1.5	2.1	2.0	sm
17	0.5+1.0=1.5	2.1	2.0	sm
18	0.5+1.0=1.5	2.1	2.0	sm
19	0.4+1.1=1.5	2.1	2.7	sm
20	0.5+0.9=1.4	1.9	1.8	sm
21	0.6+0.8=1.4	1.9	1.3	m
22	0.6+0.8=1.4	1.9	1.3	m
23	0.6+0.8=1.4	1.9	1.3	m
24	0.6+0.8=1.4	1.9	1.3	m
25	0.6+0.8=1.4	1.9	1.3	m
26	0.6+0.8=1.4	1.9	1.3	m
27	0.6+0.8=1.4	1.9	1.3	m
28	0.6+0.7=1.3	1.8	1.1	m
29	0.6+0.6=1.2	1.7	1.0	m
30	0.6+0.6=1.2	1.7	1.0	m
31	0.6+0.6=1.2	1.7	1.0	m
32	0.5+0.7=1.2	1.7	1.4	m
33	0.4+0.8=1.2	1.7	2.0	sm
34	0.4+0.8=1.2	1.7	2.0	sm
35	0.3+0.9=1.2	1.7	3.0	sm
36	0.3+0.9=1.2	1.7	3.0	sm
37	0.3+0.9=1.2	1.7	3.0	sm
38	0.3+0.9=1.2	1.7	3.0	sm
39	0.5+0.7=1.2	1.7	1.4	m
40	0.5+0.6=1.1	1.5	1.2	m

Table 60. continued

41	0.5+0.6=1.1	1.5	1.2	m
42	0.5+0.6=1.1	1.5	1.2	m
43	0.4+0.6=1.0	1.4	1.5	m
44	0.4+0.6=1.0	1.4	1.5	m
45	0.4+0.6=1.0	1.4	1.5	m
46	0.4+0.6=1.0	1.4	1.5	m
47	0.4+0.6=1.0	1.4	1.5	m
48	0.4+0.6=1.0	1.4	1.5	m
49	0.3+0.7=1.0	1.4	2.3	sm
50	0.4+0.5=0.9	1.2	1.2	m
51	0.3+0.6=0.9	1.2	2.0	sm
52	0.3+0.6=0.9	1.2	2.0	sm

Table 61. Measurements of somatic chromosomes of *Chrysoglossum ornatum* at mitotic metaphase, 2n=36

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	2.0+2.0=4.0	4.4	1.0	m
2	1.9+2.0=3.9	4.3	1.0	m
3	1.5+1.9=3.4	3.7	1.2	m
4	1.6+1.6=3.2	3.5	1.0	m
5	1.5+1.5=3.0	3.3	1.0	m
6	1.5+1.5=3.0	3.3	1.0	m
7	1.5+1.5=3.0	3.3	1.0	m
8	1.4+1.6=3.0	3.3	1.1	m
9	1.4+1.6=3.0	3.3	1.1	m
10	1.1+1.8=2.9	3.2	1.6	m
11	1.1+1.8=2.9	3.2	1.6	m
12	1.3+1.5=2.8	3.1	1.1	m
13	1.1+1.7=2.8	3.1	1.5	m
14	1.3+1.5=2.8	3.1	1.1	m
15	1.3+1.3=2.6	2.8	1.0	m
16	1.1+1.5=2.6	2.8	1.3	m
17	1.0+1.6=2.6	2.8	1.6	m
18	1.0+1.6=2.6	2.8	1.6	m
19	1.0+1.5=2.5	2.7	1.5	m
20	1.0+1.5=2.5	2.7	1.5	m
21	1.1+1.3=2.4	2.6	1.1	m
22	1.1+1.3=2.4	2.6	1.1	m
23	1.0+1.4=2.4	2.6	1.4	m
24	1.0+1.4=2.4	2.6	1.4	m
25	1.0+1.3=2.3	2.5	1.3	m
26	0.9+1.4=2.3	2.5	1.5	m
27	1.0+1.1=2.1	2.3	1.1	m
28	1.0+1.1=2.1	2.3	1.1	m
29	1.0+1.0=2.0	2.2	1.0	m
30	0.9+1.0=1.9	2.1	1.1	m
31	0.8+1.1=1.9	2.1	1.3	m
32	0.8+1.0=1.8	2.0	1.2	m
33	0.8+0.9=1.7	1.9	1.1	m
34	0.8+0.9=1.7	1.9	1.1	m
35	0.8+0.9=1.7	1.9	1.1	m
36	0.6+0.9=1.5	1.6	1.5	m

Table 62. Measurements of somatic chromosomes of *Eriopsis biloba* at mitotic metaphase, 2n=40

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	1.3+1.8=3.1	3.9	1.3	m
2	1.5+1.5=3.0	3.8	1.0	m
3	1.1+1.9=3.0	3.8	1.7	m
4	1.0+1.9=2.9	3.6	1.9	sm
5	1.3+1.5=2.8	3.5	1.1	m
6	1.3+1.4=2.7	3.4	1.0	m
7	1.1+1.4=2.5	3.1	1.2	m
8	1.1+1.3=2.4	3.0	1.1	m
9	0.9+1.4=2.3	2.9	1.5	m
10	0.9+1.4=2.3	2.9	1.5	m
11	0.9+1.3=2.2	2.8	1.4	m
12	0.9+1.3=2.2	2.8	1.4	m
13	0.8+1.3=2.1	2.6	1.6	m
14	0.8+1.3=2.1	2.6	1.6	m
15	0.9+1.1=2.0	2.5	1.2	m
16	0.9+1.1=2.0	2.5	1.2	m
17	0.6+1.4=2.0	2.5	2.3	sm
18	0.9+1.0=1.9	2.4	1.1	m
19	0.4+1.5=1.9	2.4	3.7	st
20	0.4+1.5=1.9	2.4	3.7	st
21	0.8+1.1=1.9	2.4	1.3	m
22	0.8+1.0=1.8	2.3	1.2	m
23	0.4+1.4=1.8	2.3	3.5	st
24	0.4+1.4=1.8	2.3	3.5	st
25	0.3+1.5=1.8	2.3	5.0	st
26	—+1.8=1.8	2.3	—	—
27	0.7+1.0=1.7	2.1	1.4	m
28	0.6+1.1=1.7	2.1	1.8	sm
29	0.6+1.1=1.7	2.1	1.8	sm
30	0.6+1.1=1.7	2.1	1.8	sm
31	0.3+1.4=1.7	2.1	4.6	st
32	0.3+1.4=1.7	2.1	4.6	st
33	0.8+0.8=1.6	2.0	1.0	m
34	0.7+0.8=1.5	1.9	1.1	m
35	—+1.5=1.5	1.9	—	—
36	—+1.5=1.5	1.9	—	—
37	—+1.5=1.5	1.9	—	—
38	—+1.4=1.4	1.8	—	—
39	—+1.3=1.3	1.6	—	—
40	—+1.3=1.3	1.6	—	—

Table 63. Measurements of somatic chromosomes of *Grobya amherstiae* at mitotic metaphase, 2n=54

Chromosome	Length(μm)	Relative length	Arm ratio	Form
1	0.5+1.6=2.1	3.2	3.2	st
2	0.6+1.4=2.0	3.0	2.3	sm
3	0.5+1.3=1.8	2.7	2.6	sm
4	0.6+1.1=1.7	2.6	1.8	sm
5	0.5+1.1=1.6	2.4	2.2	sm
6	0.5+1.1=1.6	2.4	2.2	sm
7	0.5+1.1=1.6	2.4	2.2	sm
8	0.5+1.0=1.5	2.3	2.0	sm
9	0.5+1.0=1.5	2.3	2.0	sm
10	0.5+1.0=1.5	2.3	2.0	sm
11	0.6+0.9=1.5	2.3	1.5	m
12	0.5+0.9=1.4	2.1	1.8	sm
13	0.5+0.9=1.4	2.1	1.8	sm
14	0.5+0.9=1.4	2.1	1.8	sm
15	0.5+0.9=1.4	2.1	1.8	sm
16	0.5+0.9=1.4	2.1	1.8	sm
17	0.5+0.9=1.4	2.1	1.8	sm
18	0.5+0.9=1.4	2.1	1.8	sm
19	0.4+1.0=1.4	2.1	2.5	sm
20	0.5+0.8=1.3	2.0	1.6	m
21	0.5+0.8=1.3	2.0	1.6	m
22	0.6+0.7=1.3	2.0	1.1	m
23	0.6+0.7=1.3	2.0	1.1	m
24	0.6+0.6=1.2	1.8	1.0	m
25	0.6+0.6=1.2	1.8	1.0	m
26	0.6+0.6=1.2	1.8	1.0	m
27	0.6+0.6=1.2	1.8	1.0	m
28	0.6+0.6=1.2	1.8	1.0	m
29	0.6+0.6=1.2	1.8	1.0	m
30	0.5+0.6=1.1	1.7	1.2	m
31	0.5+0.6=1.1	1.7	1.2	m
32	0.5+0.6=1.1	1.7	1.2	m
33	0.5+0.6=1.1	1.7	1.2	m
34	0.5+0.6=1.1	1.7	1.2	m
35	0.5+0.6=1.1	1.7	1.2	m
36	0.5+0.6=1.1	1.7	1.2	m
37	0.5+0.6=1.1	1.7	1.2	m
38	0.4+0.6=1.4	1.5	1.5	m
39	0.4+0.6=1.4	1.5	1.5	m
40	0.4+0.6=1.4	1.5	1.5	m

Table 63. continued

41	0.4+0.6=1.0	1.5	1.5	m
42	0.4+0.6=1.0	1.5	1.5	m
43	0.4+0.6=1.0	1.5	1.5	m
44	0.4+0.5=0.9	1.4	1.2	m
45	0.4+0.5=0.9	1.4	1.2	m
46	0.4+0.5=0.9	1.4	1.2	m
47	0.4+0.5=0.9	1.4	1.2	m
48	0.3+0.6=0.9	1.4	2.0	sm
49	0.3+0.5=0.8	1.2	1.6	m
50	0.3+0.5=0.8	1.2	1.6	m
51	0.3+0.5=0.8	1.2	1.6	m
52	0.3+0.5=0.8	1.2	1.6	m
53	0.3+0.4=0.7	1.1	1.3	m
54	0.3+0.4=0.7	1.1	1.3	m

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