CHROMOSOME NUMBERS OF SOME MONOCOT SPECIES FROM TON-NGA-CHANG WILDLIFE SANCTUARY, SOUTHERN THAILAND

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ABSTRACT. Chromosome counts in the root tip cells of 22 species belonging to 12 genera of Araceae, Commelinaceae, Costaceae and Zingiberaceae from Ton-Nga-Chang Southern Thailand were determined by the Feulgen Squash method. Chromosome numbers of *Alpinia conchigera* Griff. (2n=48), *Amischotolype marginata* Hassk. (2n=36), *Amomum biflorum* Jack. (2n=48), *Aneilema conspicuum* (Blume) Kunth (2n=28), *Commelina* cf. *paleata* Hassk. (2n=60), and *Homalomena* cf. *humilis* (Jack) Hook.f. (2n=78), are reported for the first time. The species, *Amomum aculeatum* Roxb. (2n=52), *Costus speciosus* (A.Koenig) Sm.(2n=20) and *Etlingera littolaris* (A.Koenig) Giseke (2n=50) are different from earlier reports.

INTRODUCTION

Chromosome studies of Thai plants have long been undertaken. Recently, Larsen & Saksuwan Larsen (1994) recorded chromosome numbers of *Spatholirion ornatum* (Commelinaceae), Ladda *et.al.* (1996) reported chromosome numbers of 10 species of Zingiberaceae and Soontornchainakseang & Chaiyasut (1999) published 36 species of Euphorbiaceae.

Ton-Nga-Chang Wildlife Sanctuary in Southern Thailand is one of the primary rain forests which harbours a high diversity of plant species, but very few from this area have been studied cytologically. As chromosome numbers provide valuable data for systematics and population studies of plant taxa, there is a need for more cytological research.

MATERIALS AND METHODS

All species investigated were collected from Ton-Nga-Chang Wildlife Sanctuary, Songkhla province and cultivated in the nursery of the Department of Biology, Prince of Songkhla University. Root tips were pretreated in a saturated solution of Paradichlorobenzene (PDB) at 12°c for four hours, then fixed with Carnoy's fluid at 12°c for 24 hours, washed with 95% ethanol and preserved in 70% ethanol at 12°c. Prior to staining, the materials were hydrolysed with 1N HCl for four minutes at 60°c, washed with tap water, stained and squashed in carbol fuchsin. Chromosome numbers at the metaphase stage of 20 cells of each species were counted using an Olympus BHA microscope. The best metaphase preparations were photographed using a Nikon OPTIPHOT-2 phase contrast microscope at 100 x magnification with a Nikon FX series UFX-DX II camera. Voucher specimens are deposited in PSU.

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RESULTS AND DISCUSSION

Chromosome numbers of 22 Thai species of Araceae, Commelinaceae, Costaceae, and Zingiberaceae were obtained. Comparisons with previous studies by other authors are shown in Table 1.

Araceae: Chromosome numbers of *Homalomena* cf. *humilis* (two forms : white and red spath) are 2n=78 (Fig. 1). Larsen (1969) reported chromosome numbers of 2n=42 for *H. occulta* (x=7) and 2n=34 for *H. rubescens*. Thus, variations in chromosome numbers of the genus *Homalomena* have been observed.

Commelinaceae: Basic numbers of Commelinaceae range from x=4 to 29. Aneuploidy within *Aneilema, Commelina, Cyanotis* etc. is common at the diploid level (Dahlgren et al. 1985). Somatic numbers of *Amischotolype marginata* and *Aneilema conspicuum* are 2n=36 and 28 respectively (Figs. 2–3), which are the first report for these two species. Goldblatt & Johnson (1991) reported that *Amischotolype hispida* has 2n=30, suggesting that chromosome numbers of species within the genus *Amischotolype* are variable. The genus *Aneilema* has several chromosome numbers, e.g. 2n=20, 25, 26, 30 and 40; n=13, 14, 16, 26 and 29 (Goldblatt 1984, 1985, 1988; Darlington & Wylie 1955).

In *Commelina*, the basic numbers of x=11, 13, 14 and 15 have been published (Chimphamba, 1973). The chromosome counts of 2n=22 for *C. benghalensis* (Fig. 4) and 2n=30 for *C. diffusa* (Fig. 5) agree with Faden & Suda (1980). Another species, *Commelina* cf. *paleata* has 2n=60 (Fig. 6) which is also the first record.

Faden & Suda (1980) showed that the basic numbers of *Commelina benghalensis* and *C. diffusa* were 11 and 15 respectively, suggesting the diploid condition. Possibly, *Commelina* cf. *paleata* is tetraploid.

Costaceae: In the genus *Costus*, the somatic numbers of *C. speciosus* are 2n=18, 27 and 36 (x=9), with 2n=18 is the most frequent (Darlington & Wylie, 1955). In this study, *C. speciosus* with two forms of oblanceolate and elliptic-oblong leaves possess the same chromosome numbers of 2n=20 (Fig. 7), suggesting that x=10 may be the secondary basic number of *Costus*.

Zingiberaceae: In this study, the somatic numbers of Zingiberaceae range from 2n=22 to 55 which are diploid and polyploid. Chen (1989) reported that the genera of Asian Zingiberaceae have different basic numbers, x=8, 9, 10, 11, 12, 14, 16, 17, 21 and 25.

Alpinia: *A. conchigera* and *A. mutica* have 2n=48 (Figs. 8–9) which agrees with the *Alpinia* group (2n=4x=48 and n=24) as reported by Chen & Huang (1996). The chromosome numbers of *A. conchigera* is here reported for the first time. Obviously, these two species of *Alpinia* are tetraploid.

Amomum: Four species of *Amomum* were studied: three of them, *A. uliginosum, A. biflorum* and *A.* sp., have the same number, 2n=48; *A. aculeatum* has 2n=52 (figs. 10–13).

According to Beltran & Kiew (1984) and Chen & Huang (1996), chromosome numbers of *Amomum* are 2n=4x=48 (n=24). From this study, three Thai species of *Amomum* are tetraploid. However, 2n=52 was also found in *A. magniferum* (Darlington & Wylie, 1955). Such differences are probably due to nondisjunction during cell division or having a secondary basic number of x=13 which is a new record. The chromosomes in *A. aculeatum* should be further analysed to elucidate the differences. The somatic chromosome number of *A. biflorum* is 2n = 48, which is a new record.

Boesenbergia: According to previous reports (Beltran & Kiew, 1984; Eksomtramage & Boontum, 1995; Eksomtramage *et al*., 1996), *Boesenbergia* has basic numbers of x=10 and 12. In this study, *Boesenbergia curtisii* has 2n=24 (Fig. 14), indicating the diploid condition.

Elettariopsis: The somatic number of *E. curtisii* and *E. triloba* is 2n=48 (Figs. 15?16). The results correspond to the gametic number (n=24) which is reported for Malayan *Elettariopsis* (Beltran & Kiew, 1984). Chen & Huang (1996) concluded that basic number of *Elettariopsis* was x=12, suggesting that *E. curtisii* and *E. triloba* are tetraploid (2n=4x=48).

Etlingera: Two species of *Etlingera*, *E. elatior* and *E. littolaris* (two forms: lip entirely red and lip red with yellow margins) were studied. *E. elatior* has a chromosome number of 2n=48 (Fig. 17). Since *Etlingera* has basic number of x=12, and meiosis in *E. elatior* (syn. *Nicolaia elatior*) showed not only 24 bivalents at metaphase I but also regular segregation at anaphase I (Beltran & Kiew, 1984), we conclude that *Etlingera elatior* is tetraploid (allotetraploid or amphidiploid).

Our observation of 2n=50 in *E. littolaris* (both forms) (Fig.18) does not agree with a previous count of 2n=48 from Chinese material (Chen & Huang, 1996). The existence of aneuploidy in *Zingiber officinale* (2n=22, 24) has been reported (Beltran & Kiew, 1984). As *E. littolaris* can be propagated from rhizomes, if aneuploidy occurs in the cells of the propagated rhizome, then new plants with different chromosome numbers could arise.

Globba: *G. fasciata* shows 32 chromosomes in somatic metaphase (Fig. 19). This result agrees with the report of Newman *et al.* 1986 (see Goldblatt & Johnson 1990). Since *Globba* has basic numbers of x=8, 11, 12 and 16 (Mahanty 1970 and Beltran & Kiew 1984), *G. fasciata* may be diploid (x=16) or polyploid (x=8). Further studies on meiosis and karyotype in *G. fasciata* are necessary to determine ploidy level.

Zingiber: According to Beltran & Kiew (1984) most Indian and Malayan species of *Zingiber* were diploid (2n=22); only one Japanese species, *Z. mioga* was pentaploid (2n=5x=55). According to this study, the chromosome numbers found in *Z. zerumbet*, *Z. spectabile* and *Z.* sp. are 2n=22 , 22 and 55 respectively (Figs. 20–22), confirming that the Thai *Zingiber* species are diploid and pentaploid.

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Table 1. Chromosome numbers of Thai Araceae, Commelinaceae, Costaceae and Zingiberaceae compared with records by other authors.

Species	2n * (this study)	Previous records		
		n**	2n	Authors
Araceae				
1. *Homalomena* cf. *humilis* (Jack) Hook.f.	78	-	-	-
Commelinaceae				
2. *Amischotolype marginata* Hassk.	36	-	-	-
3. *Aneilema conspicuum* (Blume) Kunth	28	-	-	-
4. *Commelina benghalensis* L.	22	11	22	Faden & Suda 1980
5. *C. diffusa* Burm. f.	30	15	30	Faden & Suda 1980
6. *Commelina* cf. *paleata* Hassk.	60	-	-	-
Costaceae				
7. *Costus speciosus* (A.Koenig) Sm.	20	-	18,27,36	Darlington & Wylie 1955
Zingiberaceae				
8. *Alpinia conchigera* Griff.	48	-	-	-
9. *A. mutica* Roxb.	48	-	48	Mahanty 1970
10. *Amomum aculeatum* Roxb.	52	24	-	Beltran & Kiew 1984
11. *A. biflorum* Jack.	48	-	-	-
12. *A. uliginosum* A.Koenig	48	24	-	Beltran & Kiew 1984
13. *Amomum* sp.	48	-	-	-
14. *Boesenbergia curtisii* (Bak.) Schltr.	24	-	24	Eksomtramage et. al. 1996
15. *Elettariopsis curtisii* Bak.	48	24	-	Beltran & Kiew 1984
16. *E. triloba* (Gagnep.) Loes.	48	24	-	Beltran & Kiew 1984
17. *Etlingera elatior* (Jack.) R.M. Smith	48	24	-	Beltran & Kiew 1984
18. *E. littoralis* (A.Koenig) Giseke				
red-yellow form	50	-	48	Chen & Huang 1996
red form	50	-	-	-
19. *Globba fasciata* Ridl	32	-	32	Newman et al. 1986 (see Goldblatt & Johnson 1990)
21. *Zingiber spectabile* Griff.	22	11	-	Beltran & Kiew 1984
20. *Z. zerumbet* (L.) Sm.	22	-	22	Darlington & Wylie 1955
22. *Zingiber* sp.	55	-	-	-

*somatic numbers
**gametic numbers

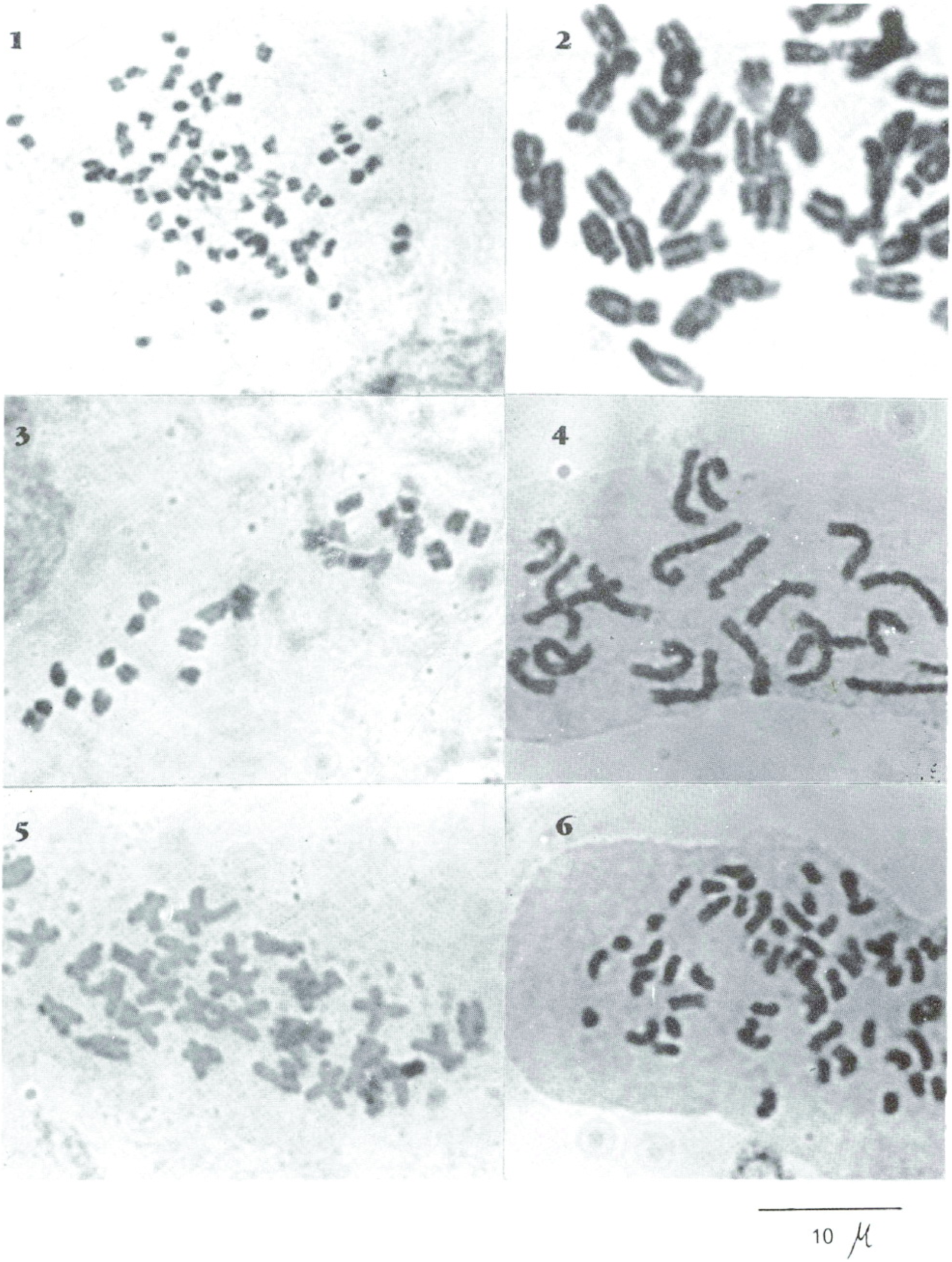

Figure 1–6. Chromosome at metaphase stage;

Fig. 1. *Homalomena* cf. *humilis*, 2n = 78
Fig. 2. *Amischotolype marginata*, 2n = 36
Fig. 3. *Aneilema conspicuum*, 2n = 28
Fig. 4. *Commelina benghalensis*, 2n = 22
Fig. 5. *Commelina diffusa*, 2n = 30
Fig. 6. *Commelina* cf. *paleata*, 2n = 60

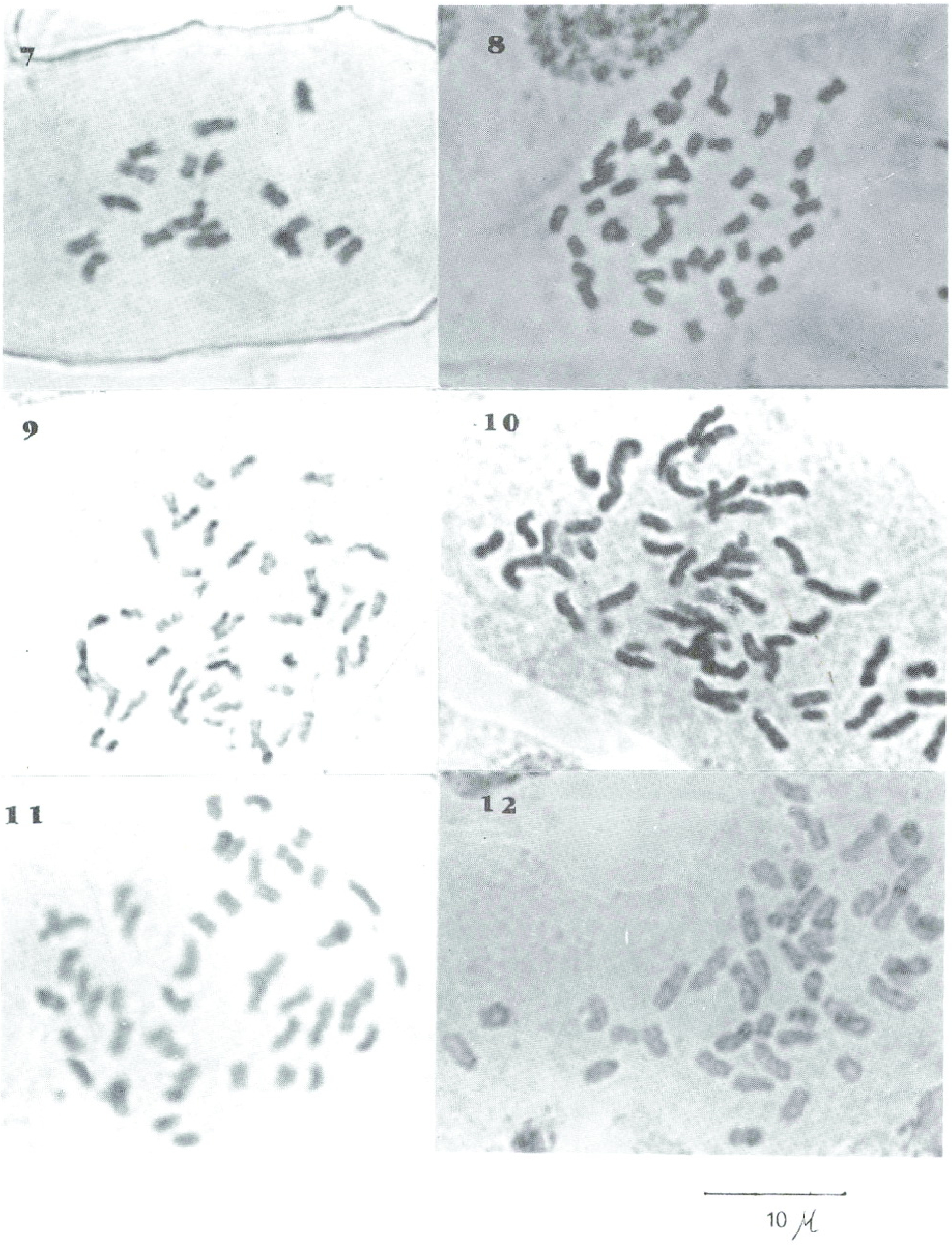

Figure 7–12. Chromosome at metaphase stage;
Fig. 7. *Costus speciosus*, 2n = 20
Fig. 8. *Alpinia conchigera*, 2n = 48
Fig. 9. *Alpinia mutica*, 2n = 48
Fig. 10. *Amomum aculeatum*, 2n = 52
Fig. 11. *Amomum biflorum*, 2n = 48
Fig. 12. *Amomum uliginosum*, 2n = 48

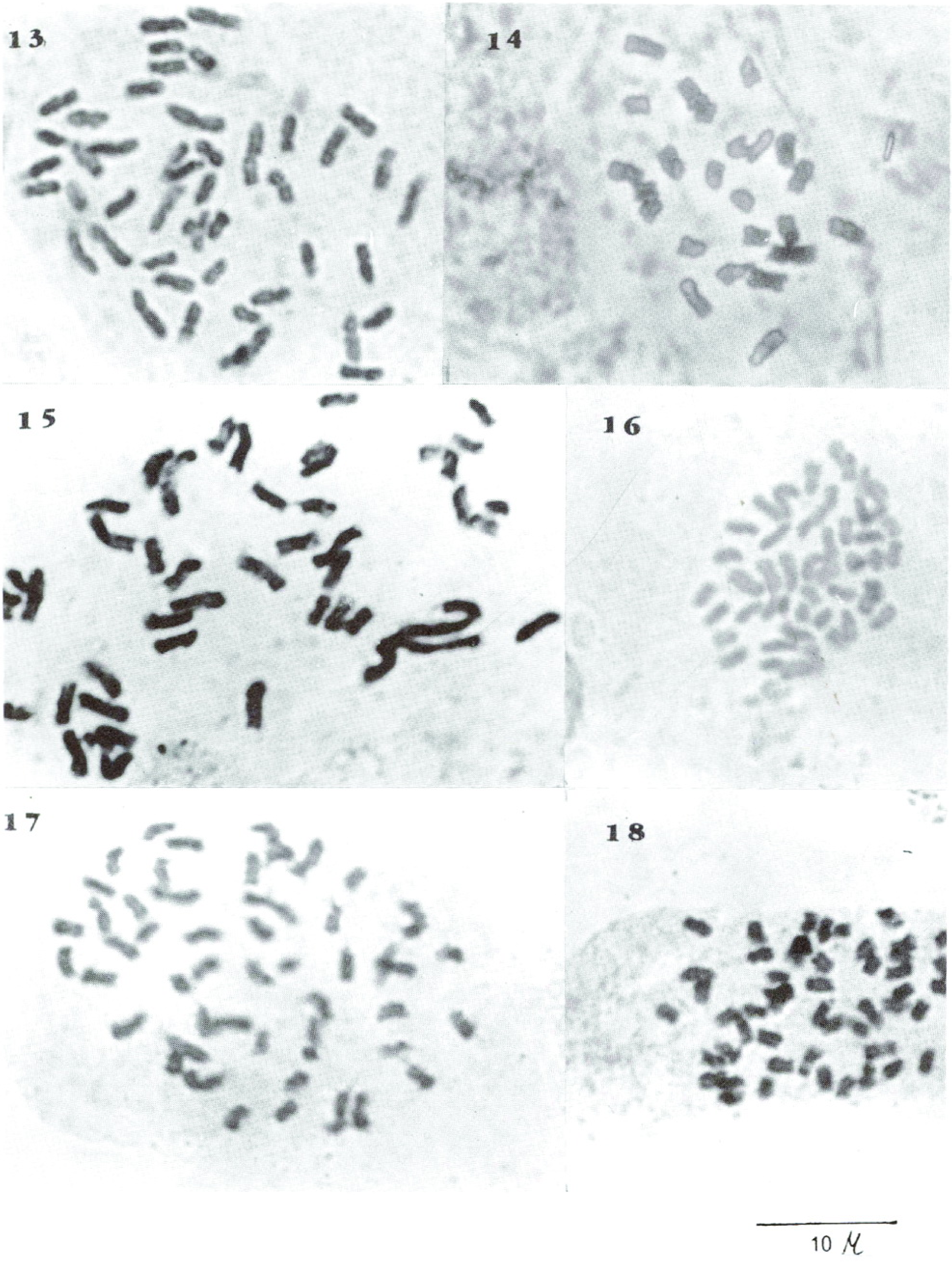

Figure 13–18. Chromosome at metaphase stage;
Fig. 13. *Amomum* sp., 2n = 48
Fig. 14. *Boesenbergia curtisii*, 2n = 24
Fig. 15. *Elettariopsis curtisii*, 2n = 48
Fig. 16. *Elettariopsis triloba*, 2n = 48
Fig. 17. *Etlingera elatior*, 2n = 48
Fig. 18. *Etlingera littolaris*, 2n = 50

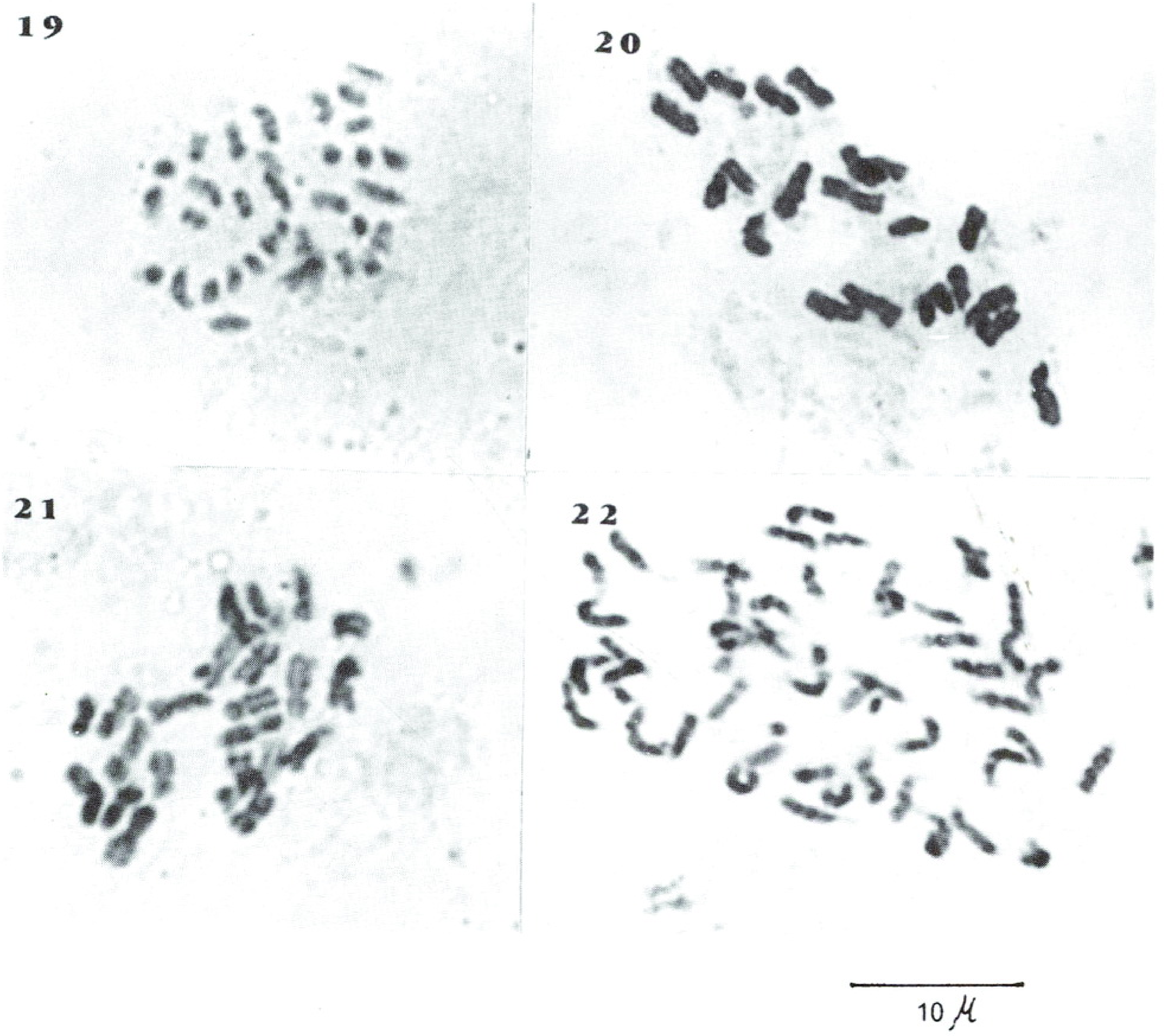

Figure 19–22. Chromosome at metaphase stage;
Fig. 19. *Globba fasciata*, 2n = 32
Fig. 20. *Zingiber zerumbet*, 2n = 22
Fig. 21. *Zingiber spectabile*, 2n = 22
Fig. 22. *Zingiber* sp., 2n = 55

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