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CHROMOSOME NUMBERS OF SOME BRAZILIAN FLOWERING PLANTS

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ABSTRACT. Chromosome numbers are reported for the 18 Brazilian species listed in Table 1. They belong to diverse families and mostly come from forest areas in the state of São Paulo. Only two of the species have been counted previously and seven counts are the first for their genera.

In a recent comprehensive survey of angiosperm cytological data Raven (1975) summed up the prevailing situation for the neotropics with the comment: 'In general, it can be said that the plants of tropical America are very badly in need of cytological studies.' Brazil is fairly typical in this respect since great floristic diversity contrasts with sparse cytological information. Furthermore, most published lists of chromosome numbers of Brazilian species, including the admirable survey of 42 species by Bandel (1974), refer to the family Leguminosae (Irwin & Turner 1960; Turner & Irwin 1961; Coleman & Menezes 1980) and the only general list available seems to be that by Gadella et al. (1969) for 31 species.

With this in mind the opportunity was taken during recent ecological studies in SE Brazil to collect whenever possible seed of forest species to provide material for cytological studies. The 18 chromosome numbers reported here from diverse angiosperm families include new counts for 16 species, seven of which are also new for the genus. Most of the species are common members of gallery forest or remnants of drier 'planalto' forest in SE Brazil and several have distributions which extend to central and northern Brazil. One species is from cerrado (savannah) vegetation.

All counts with the exception of *Sterculia* are from root-tip material of plants established in cultivation at the University Botanic Garden, St Andrews. Seed of most species was collected at the Reserve of the Forestry Institute of Sao Paulo near Mogi Guaçu (see Gibbs & Leitão Filho (1978) for full details) and voucher herbarium specimens are at the University of Campinas (UEC) or St Andrews (STA).

Root-tips were treated with 0.05% colchicine and fixed in 3:1 ethanol/glacial acetic acid. Hydrolysis was carried out with 5N HCl, root-tips being first placed in cold HCl which was then heated in an oven at 60°C for 15 minutes before being squashed and stained in propionic-orcein. It was found that this method gave consistently adequate softening without affecting the staining. For species with very small chromosomes phase contrast microscopy was used. The counts are summarized in Table 1, illustrated in Plates 1 & 2 and Fig. 1, and briefly discussed below.

ASTERACEAE

Mutisia coccinea (2n = 52; Plate 1a). This new count and that reported for *M. clematis* by Powell & King (1969) suggest that the previous count of

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2n = c.54 by Diers (1961) for *M. acuminata* should also be 2n = 52. Wainberg & Cabrera (1965) cited 2n = 26 for *M. decurrens* and *M. spinosa* so there is clearly a polyploid series in the genus. Turner et al. (1967) reported n = 23 for *M. wurdackii* and Cave (1956–64) listed x = 23 for *Mutisia*. The karyotype is remarkably asymmetrical with a wide variation in chromosome length.

Stifftia chrysantha (2n = 54; Plate 2g). This is the first count for the small genus *Stifftia* which has some seven species in tropical South America, three of which occur in the state of São Paulo. The large chromosomes with heterochromatic staining in the partially contracted state are similar to those of *Mutisia*.

CAMPANULACEAE (LOBELIOIDEAE)

Centropogon cornutus (2n = 28; Plate 2b); **Siphycampylus macrodontus** (2n = 28; Plate 2d). The count for *S. macrodontus* agrees with that previously reported by Gadella et al. (1969) for *S. verticillatus*. Both counts tie in with the consistent x = 7 recorded for the Lobelioideae by Raven (1975).

CLUSIACEAE

Calophyllum brasiliensis (2n = 42; Fig. 1a). This new count differs from that of 2n = 32 for the Asian species *C. inophyllum* reported by Tixier (1953). Most chromosome numbers available for this family are for the genus *Hypericum*; Robson & Adams (1968) proposed x = 7, 8, 9 & 10 as basic numbers for the family, with x = 12 as the original basic number for *Hypericum*, but clearly more studies are desirable.

COMBRETACEAE

Terminalia brasiliensis (2n = 36; Plate 1b). Nanda (1962) cited n = 7 and n = 13 for Indian species of *Terminalia* but Raven (1975), who proposed a basic number of x = 12 for the family, has reported that these counts have not been reconfirmed. Mehra & Khosla (1969) and Sanjappa (1979a) cited n = 12 for a total of five Indian species, and Gill et al. (1979) reported n = 36 for *T. chebula*. Our new count suggests that *T. brasiliensis* is a hexaploid of x = 6.

EUPHORBIACEAE

Sebastiania klotschiana (2n = c. 134; Fig. 1c). Perry (1943) reported 2n = 56 for *S. ligustrina* from southern USA and Datta (1967) cited 2n = 28 for *S. chamaelea* from India so at first sight this new count would seem to be discordant. However, it is clear from the comprehensive survey of chromosome numbers in the Euphorbiaceae by Hans (1973) that high levels of

TABLE 1

Chromosome numbers of some Brazilian species

	2n	source
Asteraceae		
Mutisia coccinea St. Hil.	52*	Near Atibaia, SP, *Gibbs* 8393 (UEC)
Stifftia chrysantha Mik.	54†	São Paulo littoral, *Gibbs* 801 (STA)
Campanulaceae (Lobelioideae)		
Siphycampylus macrodontus (Thunb.) G. Don	28*	Near Atibaia, SP, *Taroda et al.* 10088 (UEC)
Centropogon cornutus (L.) Druce	28†	Ubatuba, SP, *Michelin Ramos et al.* 4797 (UEC)
Clusiaceae		
Calophyllum brasiliensis Camb.	42*	Mogi Guaçu, SP, *Gibbs* 803 (STA)
Combretaceae		
Terminalia brasiliensis Eichl.	36*	Mogi Guaçu, SP, *Gibbs* 804 (STA)
Euphorbiaceae		
Sebastiania klotschiana Muell. Arg.	c.134*	Mogi Guaçu, SP, *Gibbs* 805 (STA)
Lecythidaceae		
Cariniana estrellensis (Raddi) Ktze.	34†	Mogi Guaçu, SP, *Gibbs* 806 (STA)
Leguminosae (Caesalpinoideae)		
Schizolobium parahybum (Vell.) Blake	24†	Mogi Guaçu, SP, *Gibbs* 807 (STA)
Peltophorum dubium (Spreng.) Taub.	26*	Mogi Guaçu, SP, *Gibbs* 808 (STA)
(Mimosoideae)		
Anadenanthera colubrina (Vell.) Brenan	26*	Imbú, SP, *Gibbs* 809 (STA)
Enterolobium contortissiliquum (Vell). Morong.	26	Mogi Guaçu, SP, *Gibbs* 810 (STA)
Phytolaccaceae		
Gallesia gorarema (Vell.) Moq.	36†	Mogi Guaçu, SP, *Gibbs* 811 (STA)
Rubiaceae		
Genipa americana L.	22†	Mogi Guaçu, SP, *Gibbs* 812 (STA)
Sapindaceae		
Magonia pubescens St. Hil.	30†	Mogi Guaçu, SP, *Gibbs* 813 (STA)
Sterculiaceae		
Sterculia chicha St. Hil.	n = 20*	Campinas, SP, *Taroda* 530 (UEC)
S. striata St. Hil. & Naud.	n = 20*	Campinas, SP, *Taroda* 2187 (UEC)
Tiliaceae		
Luehea divaricata Mart.	36	Mogi Guaçu, SP, *Gibbs* 814 (STA)

* new count for the species
† new count for the genus

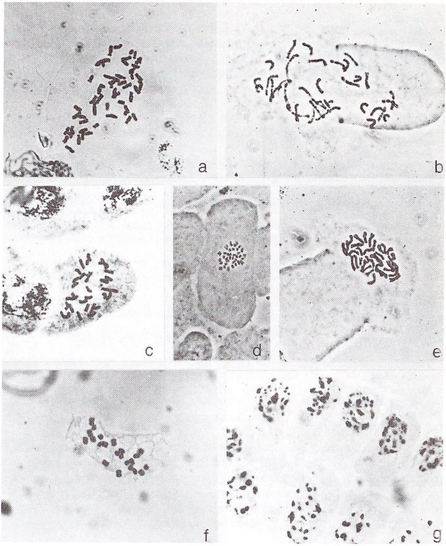

PLATE 1. Root-tip squash preparations. a, *Mutisia coccinea,* 2n = 52; b, *Terminalia brasiliensis,* 2n = 36; c, *Magonia pubescens,* 2n = 30; d, *Luehea divaricata,* 2n = 36; e, *Gallesia gorarema,* 2n = 36; f & g, *Genipa americana,* f, 2n = 22, g, showing chromocentres in interphase nuclei. All × approx. 2000.

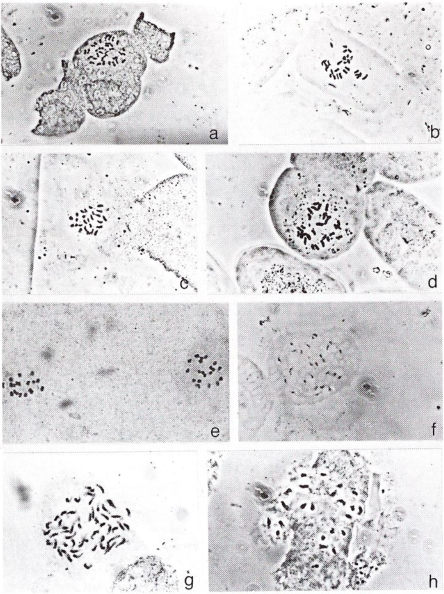

PLATE 2. a–d & f–h, root-tip squash preparations × approx. 2000; e, PMC × 650. a, *Cariniana estrellensis*, 2n = 34; b, *Centropogon cornutus*, 2n = 28; c, *Peltophorum dubium*, 2n = 26; d, *Siphycampylus macrodontus*, 2n = 28; e, *Sterculia chicha*, PMC MII, n = 20; f, *Enterolobium contortissiliquum*, 2n = 26; g, *Stifftia chrysantha*, 2n = 54; h, *Schizolobium parahybum*, 2n = 24.

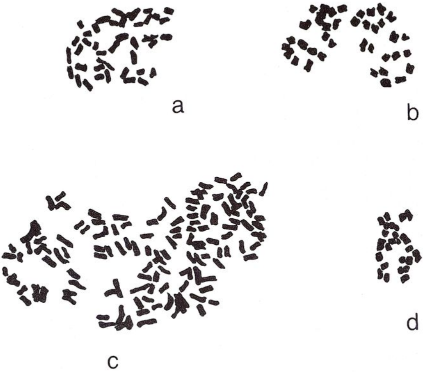

FIG. 1. Camera lucida drawings of squash preparations. a, c & d, root-tips × approx. 4000; b, PMC × approx. 850. a, *Calophyllum brasiliensis*, 2n = 42; b, *Sterculia striata*, MII, n = 20; c, *Sebastiania klotschiana*, 2n = c.134; d, *Anadenanthera colubrina*, 2n = 26.

polyploidy can occur in this family, e.g. *Acalypha wilkesiana* 32-ploid on x = 7, *Euphorbia ferox* 20-ploid on x = 10, and *Antidesma bunius* 18-ploid on x = 13. Furthermore, these high numbers occur as occasional species in genera with otherwise unexceptional chromosome numbers, as in *Excoecaria* (a neighbouring genus to *Sebastiania*) with *E. acerifolia* 2n = 24, *E. bicolor* 2n = 22 but *E. agallocha* 2n = 140. It is likely, therefore, that *S. klotschiana* represents an 18- or 20-ploid on a base number of x = 7.

LECYTHIDACEAE

Cariniana estrellensis (2n = 34; Plate 2a). Although Raven (1975) drew attention to the almost complete lack of chromosome data for this important, predominantly neotropical family, the absence of a previous count for the genus *Cariniana* is surprising since *C. estrellensis* and the congeneric *C. legalis* are both imposing trees of the forest remnants and city parks in SE Brazil. The new count reported here accords with that of n = 17 for *Bertholletia* rather than the n = 18 for *Couroupita* (Raven 1975). More recent counts for the family, published since Raven's survey, include the Old World taxa *Careya arborea* 2n = 26 (Sarkar et al. 1978a), *Planchonia valida* n = 13 (Sarkar et al. 1976) and *Chydenanthus excelsa* (*Barringtonia* *excela*) n = 13 (Sarkar et al. 1978b), and the New World taxa *Couroupita guianensis* n = 18 (Sanjappa 1979b) and *Gustavia angusta* 2n = 36 (Sarkar et al. 1978a). Although the data is still very sparse, these counts suggest that there may be a cytological division between the neotropical genera with x = 17 and 18 and the palaeotropical genera with x = 13.

LEGUMINOSAE

CAESALPINOIDEAE

Peltophorum dubium (2n = 26; Plate 2c); **Schizolobium parahybum** (2n = 24; Plate 2h). Raven (1975) suggests that x = 7 might be the original basic number for this subfamily with early polyploidy giving rise to derivative series. According to the survey by Bandel (1974) gametophytic numbers of n = 12 or n = 14 are commonly found in the Caesalpinoideae (respectively 38% and 30% of the counts available) but n = 13 was found to be relatively rare, occurring in only 5% of taxa. The count of 2n = 26 for *Peltophorum dubium* agrees with counts for the Indian species *P. pterocarpum* (Bir & Kumari 1975) and *P. vogelianum* (Bir & Sidhu 1978) but Sanjappa (1978) reports n = 14 for *P. inermis*.

MIMOSOIDEAE

Anadenanthera colubrina (2n = 26; Fig. 1d); **Enterolobium contortis-siliquum** (2n = 26; Plate 2f). The count for *Anadenanthera colubrina* is the same as that established for *A. falcata* by Bandel (1974) whose previous count for *Enterolobium contortissiliquum* is also confirmed.

PHYTOLACCACEAE

Gallesia gorarema (2n = 36; Plate 1e). This species is a large tree of the gallery forest whereas the sparse cytological data previously published for this family are for the herbaceous genera *Phytolacca, Petiveria* and *Rivina*. The new count agrees with the basic number of x = 9 suggested for the family by Raven (1975).

RUBIACEAE

Genipa americana (2n = 22; Plate 1f & g). This seems to be the first count for the genus although various species of *Genipa* are widely distributed in the forests of Brazil and Central America. The new count agrees with the basic number of x = 11 for the Rubiaceae as indicated by the chromosome numbers cited by Verdcourt (1958). Cytologically the material was remarkable for the very large chromocentres in all interphase nuclei.

SAPINDACEAE

Magonia pubescens (2n = 30; Plate 1c). Sapindaceae is a very versatile family cytologically with x = 11, 12, 13, 14, 15, & 16 in the small proportion of genera which have been examined cytologically (Raven 1975). The monospecific* Brazilian genus *Magonia,* which is widespread in cerrado (savannah) vegetation, conforms to the $x = 15$ of this series.

Sterculiaceae

Sterculia chicha ($n = 20$; Plate 2e) and **S. striata** ($n = 20$; Fig. 1b). The largest series of chromosome numbers published for *Sterculia* is that by Poty & Hamel (1968) for 10 palaeotropical species, six of which have $2n = 40$ and the rest $2n = 32$ or $2n = 34$. Tantra & Jong (1976) report $2n = 40$ for a further three Asian species, and the same diploid number is given by Bawa (1973) for *S. apetala,* the only previous count for a New World species. These two previously unpublished counts for Brazilian species were contributed by Prof. N. Taroda (University of Campinas) and support the prevailing $2n = 40$ for this genus. It is interesting to note that although Raven (1975) proposes a basic number of $x = 10$ for the family, Gadella et al. (1969) report $2n = 26$ for *Buettneria catalpifolia* from Brazil.

Tiliaceae

Luehea divaricata ($2n = 36$; Plate 1d). This count agrees with that previously reported by Gadella et al. (1969) and accords with $x = 9$ as one of the basic numbers of the family as proposed by Raven (1975).

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* Originally with two species but Joly et al. (1980) have recently united *M. glabra* with *M. pubescens*.

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