The LINNEAN SOCIETY of London BOTANICAL Journal of the Linnean Society

Botanical Journal of the Linnean Society, 2010, **163**, 234–278. With 5 figures

Variation in chromosome number and the basic number of subfamily Epidendroideae (Orchidaceae)

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Received 10 November 2009; revised 2 March 2010; accepted for publication 12 May 2010

The chromosome numbers of 21 genera and 44 species of subfamily Epidendroideae belonging to tribes Sobralieae, Epidendreae, Malaxideae and Vandeae, and subtribe Dendrobiinae, were determined. Chromosome numbers varied from $2n = 24$ in *Malaxis pubescens* to $2n = c.$ 240 in *Epidendrum cinnabarinum*. A revision of the chromosome numbers known for the subfamily was also performed, aimed at determining the basic numbers of the genera, subtribes and tribes. The first counts for 31 species and six genera of tribe Sobralieae and subtribe Ponerinae are presented. The basic number for each genus was evaluated. A predominance of $x = 20$ in genera of Epidendreae and Arethuseae, $x = 19$ in Vandeae and subtribe Dendrobiinae and $x = 15$ and 21 in Malaxideae was observed. Other tribes were more variable. A wide occurrence of $x = 19$ and 20 in Epidendroideae and of $x = 21$ in at least one genus of all tribes suggests that disploidy of one or a few chromosomes has played a decisive role in the establishment of the basic karyotypes. The karyotype variability observed in the subfamily is discussed in light of current phylogenetic proposals for the family. *Botanical Journal of the Linnean Society*, 2010, **163**, 234–278.

ADDITIONAL KEYWORDS: basic chromosome number – cytogenetics – disploidy – polyploidy.

INTRODUCTION

The analysis of chromosome numbers has been used to evaluate evolutionary and taxonomic relationships in diverse groups of plants. Studies of chromosomal variations in Orchidaceae have contributed to the better understanding of the taxonomy of this family at many hierarchical levels. Arditti (1992) reviewed some of the important aspects of the cytology of the orchid family, with emphasis on chromosomal variation. Brandham (1999) reviewed chromosomal variation in each genus of Apostasioideae Garay and Cypripedioideae Garay, but did not consider the probable basic numbers of higher taxonomic categories. Felix & Guerra (2000, 2005) examined the chromosomal variability in the cymbidioid clade (*sensu* Dressler, 1993) and in Cypripedioideae, Orchidoideae (including Spiranthoideae Dressler) and Vanilloideae Szlach. and concluded that $x = 7$ is the most probable basic number for the family Orchidaceae. The basic number corresponds to the haploid number encountered in a given taxon that explains in the most parsimonious manner the variation in chromosome numbers seen in that and related taxa (Guerra, 2000).

According to Chase, Freudenstein & Cameron (2003), orchids are subdivided into five subfamilies: Apostasioideae, Cypripedioideae, Vanilloideae, Orchidoideae and Epidendroideae Lindl. Epidendroideae comprise an estimated 18 000 species and 650 genera (Cribb & Chase, 2005), mainly epiphytic plants, distributed in tropical and subtropical regions throughout the world. Epidendroideae are highly diversified and no morphological synapomorphy is shared by all members of the group. They are subdivided into 16 tribes, of which Epidendreae Kunth, Cymbidieae Pfitzer, Dendrobieae Lindl. and Vandeae Lindl. account for approximately 15 000 species (Chase *et al*., 2003).

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Cymbidieae have corms or pseudobulbs and two to four pollinia bodies (Chase *et al*., 2003). The chromosome numbers in this tribe are quite variable, ranging from $n = 6$ in *Erycina pusilla* (L.) N.H.Williams & M.W.Chase (as *Psygmorchis pusilla* (L.) Dodson & Dressler) to $n = 84$ in two species of *Oncidium* Sw. (revised by Felix & Guerra, 2000). Epidendreae are subdivided into two main subtribes: Pleurothallidinae Lindl. and Laeliinae Benth. The former has 28 genera and approximately 4000 species, but chromosome numbers are available only for four genera and 36 species, with a predominance of $n = 20$ in *Pleurothallis* R.Br. *s.l.* and $n = 16$ in *Stelis*. Chromosome numbers are known for 14 out of 45 genera and 94 of 1788 species of Laeliinae, with a predominance of $n = 20$ in the majority of the genera (Tanaka & Kamemoto, 1984). Vandeae are comprised of two monophyletic subtribes having monopodial growth (Aeridinae Pfitzer with $x = 19$ and Angraecinae Summerh. with $x = 19$, 20, 21, 23, 24 and 25) (Carlsward *et al*., 2006) and subtribe Polystachiinae Schltr. which has sympodial growth and $x = 20$ (Jones, 1966). Subtribes Agrostophyllinae Szlach., Dendrobiinae Lindl. and Collabiinae Pfitzer do not have well-defined positions in Epidendroideae (Chase *et al*., 2003).

Although the molecular phylogenetics of Epidendroideae has been relatively well studied, it has never been cytotaxonomically evaluated. In the present study, we analysed 44 Brazilian species of Epidendroideae (*sensu* Chase *et al*., 2003) and critically reviewed the chromosome numbers for each genus and subtribe in order to establish the probable basic numbers of the subfamily. These data were compared with the classification system developed by Dressler (1993) and Chase *et al*. (2003), and with recent phylogenetic proposals by Pridgeon, Solano & Chase (2001), Freudenstein *et al*. (2004), Carlsward *et al*. (2006), Cameron (2005), van den Berg & Chase (2004a), van den Berg *et al*. (2005, 2009), among others.

MATERIAL AND METHODS

The large majority of the plants analysed here were collected in north-eastern Brazil. All of the material studied was cultivated at the Federal Rural University of Pernambuco, the Federal University of Paraíba or the Federal University of Pernambuco, except for some plants donated by private collectors. The species analysed, chromosome numbers counted here and previous counts are listed in Table 1. Samples of all materials were deposited in the PEUFR, HST and EAN herbaria. Identifications were based on Pabst & Dungs (1975, 1977), but the binomials were updated according to Govaerts *et al*. (2009; http://www.kew.org/wcsp/monocots/).

Chromosome analyses were undertaken using root tips pretreated with 0.002 M 8-hydroxyquinoline at 4 °C for 24 h. The material was then fixed in absolute ethanol/glacial acetic acid (3 : 1 v/v) for 3–24 h at room temperature 25 °C and stored at –20 °C. To prepare slides, root types were hydrolysed in 5 M HC1 at room temperature, frozen in liquid nitrogen to remove the coverslip and stained with 1% acetic haematoxylin (Guerra, 1999) or 2% Giemsa (Guerra, 1983).

The diversity in chromosome numbers in the epidendroid clade was examined by undertaking a revision based on the chromosome numbers compiled by Tanaka & Kamemoto (1984) and the indexes prepared by Fedorov (1969), Moore (1973, 1974, 1977), Goldblatt (1981, 1984, 1985, 1988), Goldblatt & Johnson (1990, 1991, 1994, 1996, 2000, 2003, 2006) and more recent papers. A separate list of chromosome numbers was then prepared, including the data from the present analysis (see also Appendix 1). In this table, the names of the genera, species and authors are cited as in the World Checklist of Monocotyledons (Govaerts *et al*., 2009) and previous names indicated in parentheses.

The data from Appendix 1 were synthesized in Table 2, showing the chromosome number variation in each genus. The numbers were ordered from the most to the least frequent, and the probable basic number for each genus was underlined, based on the frequency of each number in the genus and in the closest related genera. The chromosome numbers that were considered questionable (as they differed significantly from information available in the literature), and the occasional case of monosomy and trisomy were excluded from Appendix 1 and Table 2, and from the discussion, and are presented separately in Appendix 2.

RESULTS

The interphase nucleus structure and the chromosome number of a total of 44 species belonging to 21 genera, seven subtribes and four tribes of Epidendroideae (*sensu* Chase *et al*., 2003) were analysed. The structure of the interphase nuclei was quite variable among the species analysed. According to the classification of interphase nuclei suggested by Tanaka (1971) for Orchidaceae, the structural types varied from diffuse nuclei in *Campylocentrum pernambucense* Hoehne (Fig. 1B) and *Cattleya walkeriana* Gardner to complex chromocentric nuclei in *Prosthechea caetensis* (Bicalho) W.E.Higgins and *Malaxis excavata* Kuntze (Fig. 1C).

The species analysed here generally had small chromosomes, varying slightly in length, all species displaying meta- to submetacentric chromosomes and

Table 1. List of species analysed with respective provenances, voucher numbers, chromosome numbers (*n* and/or 2*n*), figures in the text, herbarium where each material was deposited, previous counts and sources

Taxa	Provenance*	Voucher no.	2*n*/*n*	Herbarium	Figs	Previous counts (2*n*)	Sources†
Subfamily Epidendroideae							
Tribe Sobralieae							
Elleanthus brasiliensis (Lindl.) Rchb.f.	Maranguape, CE	L.P.Felix, 8284	50	PEUFR	1A, 2A		
Sobralia liliastrum Lindl.	Camocim do São Felix, PE	L.P.Felix, 8213	48	PEUFR	2B		
	Palmeiras, BA	L.P.Felix, 9124	48	PEUFR			
S. sessilis Lindl.	Morro do Chapéu, BA	L.P.Felix, 7394	48	EAN	2C		
Tribe Epidendreae							
Subtribe Ponerinae							
Isochilus linearis (Jacq.) R.Br.	Taquaritinga do Norte, PE	L.P.Felix, 12715	40	EAN	2D		
Subtribe Bletiinae							
Bletia catenulata Ruiz & Pav.	Gilbués, PI	L.P.Felix, S/N	40	HST	2E		
Subtribe Laeliinae							
Brassavola tuberculata Hook.	Camocim do São Felix, PE	L.P.Felix, 9650	40	PEUFR		40	DA09
	Puxinanã, PB	L.P.Felix, 12728	40	EAN	2F		
B. nodosa (L.) Lindl.	Cultivated	L.P.Felix, 12725	40	EAN	2G	40	TK84
Cattleya amethystoglossa Linden & Rchb.f. ex R.Warner	Morro do Chapéu, BA	L.P.Felix, 9651	40	PEUFR	2H		
C. elongata Barb. Rodr.	Morro do Chapéu, BA	L.P.Felix, 12976	80	EAN	2I		
C. granulosa Lindl.	Natal, RN	L.P.Felix, 12977	40	EAN	2J		
	Alcaçuz, RN	L.P.Felix, 12978	40	EAN			
C. nobilior Rchb.f. var. *amaliae* Pabst	Cultivated	Unvouchered	42	–	2K		
C. nobilior var. *nobilior*	Cultivated, Ostetto Orquídeas	Unvouchered	42	–			
C. walkeriana Gardner	Cultivated, St Cruz 3263	Unvouchered	40	–		40	TK84
C. walkeriana var. *princeps* L.C.Menezes	Cultivated, St Cruz 3149	Unvouchered	*c.* 80	–	2L		
Cattleyella araguaiensis (Pabst) Van den Berg & M.W.Chase	Rio Araguaia, TO	L.P.Felix, 9360	40	EAN	1E, 2M		
Dimerandra emarginata (G.Mey.) Hoehne	Carmópolis, SE	L.P.Felix, 9652	40	PEUFR	2N	40	GJ90
Encyclia advena (Rchb.f.) Porto & Brade	Bonito, PE	L.P.Felix, 9638	40	HST	3A	40	TK84
	Brejo da Madre de Deus, PE	L.P.Felix, 12725	40	EAN			
E. flava (Lindl.) Porto & Brade	Araguaina, TO	LPFelix, 12723	40	EAN	3B		
E. oncidioides (Lindl.) Schltr.	Brejo da Madre de Deus, PE	L.P.Felix, 12727	40	EAN	3C		
	Esperança, PB	L.P.Felix, 12731	40	EAN			
Subtribe Laeliinae (cont.)							
Epidendrum avicule Lindl.	Brejo da Madre de Deus, PE	L.P.Felix, 8355	40	EAN	3G	40	TK84
E. cinnabarinum Salzm. ex Lindl.	Camocim do São Felix, PE	L.P.Felix, 9653	*c.* 240	PEUFR	3D	*c.* 240	G00, OL06
	Mamanguape, PB	L.P.Felix, 2165	*c.* 240	EAN			
	Serraria, PE	L.P.Felix, 11489	*n* = 108–124	EAN			
	Esperança, PB	L.P.Felix, 12989	*c.* 240	EAN			
E. difforme Jacq.	Cabo, PE	L.P.Felix, 8324	40	PEUFR	3F	39–40	TK84
E. ellipticum Graham	Camocim do São Felix, PE	L.P.Felix, 9435	68	PEUFR	3E	–	
E. latilabrum Lindl.	Taquaritinga do Norte, PE	L.P.Felix, 12736	40	EAN	3H	–	
E. nocturnum Jacq.	Belém, PA	L.P.Felix, 12667	80	EAN		40, 80	TK84
E. rigidum Jacq.	Brejo da Madre de Deus, PE	L.P.Felix, 12735	40	EAN	3I	–	
Jacquiniella globosa (Jacq.) Schltr.	Bonito, PE	L.P.Felix, 8385	38	PEUFR	3J	–	
	Taquaritinga do Norte, PE	L.P.Felix, 12721	38	EAN			
Laelia marginata (Rchb.f.) L.O.Williams	Bezerros, PE	L.P.Felix, 1038	40	EAN	3K	40	TK84
Prosthechea caetensis (Bicalho) Pabst	Morro do Chapéu, BA	L.P.Felix, 8644	80	PEUFR	4A	–	
P. fragrans (Sw.) W.E.Higgins	Brejo da Madre de Deus, PE	L.P.Felix, 12733	40	EAN	4B	40	TK84
	Alcaçuz, RN	L.P.Felix, 12732	40	EAN			
P. vespa (Vell.) W.E.Higgins	São Felix do Xingu, PA	L.P.Felix, 12979	40	EAN	4C	–	
Scaphyglottis fusiformis (Griseb.) R.E.Schult.	Bezerros, PE	L.P.Felix, 9640	40	PEUFR	4D	–	
Sophronitis lobata (Lindl.) Van den Berg	Cultivated	Unvouchered	40		–	–	
S. purpurata (Lindl. & Paxton) Van den Berg & M.W.Chase	Cultivated	Unvouchered	40		–	40	M77
Subtribe Pleurothallidinae							
Acianthera ochreata (Lindl.) Pridgeon & M.W.Chase	Bezerros, PE	L.P.Felix, 9641	40	PEUFR	4E	–	
Stelis sp.	Ibateguara, AL	L.P.Felix, 8271	32	EAN	4F	–	
Tribe Malaxideae							
Malaxis excavata (Lindl.) Kuntze	Bonito, PE	L.P.Felix, 8464	30	PEUFR	4G	–	
M. pubescens (Lindl.) Kuntze	Rio Grande, RS	L.P.Felix, 9022	24	PEUFR	4H	–	
Tribe Vandeae							
Subtribe Polystachiinae							
Polystachya estrellensis Rchb.f.	Itapororoca, PB	L.P.Felix, 798	80	EAN	–	80	TK84
Subtribe Angraecinae							
Campylocentrum amazonicum Cogn.	Acará, PA	L.P.Felix, 8490	80	EAN	4I	–	
C. crassirhizum Hoehne	Bezerros, PE	L.P.Felix, 8919	38	PEUFR	4J	–	
C. pernambucense Hoehne	São Vicente Ferrer, PE	L.P.Felix, S/N	38	EAN	4K	–	
	Areia, PB	L.P.Felix, 12982		EAN			
Unplaced subtribes within Epidendroideae							
Subtribe Dendrobiinae							
Bulbophyllum cribbianum Toscano	Rio de Contas, BA	L.P.Felix, 8831	38	PEUFR	4L	–	
B. sanderianum Rolfe	Brejo da Madre de Deus, PE	L.P.Felix, 12981	38	EAN	4M	–	
Bulbophyllum sp. 1	Campo Formoso, BA	L.P.Felix, 11802	38	EAN	4N	–	
Bulbophyllum sp. 2	Morro do Chapéu, BA	L.P.Felix, 11701	80	EAN	4O	–	

*Brazilian state abbreviations: AL, Alagoas; BA, Bahia; CE, Ceará; Pa, Pará; PB, Paraíba; PE, Pernambuco; PI, Piauí; RN, Rio Grande do Norte; RS, Rio Grande do Sul; SE, Sergipe; TO, Tocantins.

†Sources: TK84, Tanaka & Kamemoto (1984); GJ90, Goldblatt & Johnson (1990); G00, Guerra (2000); M77, Moore (1977); OL06, Conceição *et al.* (2006); DA09, Daviña *et al.* (2009).

Table 2. Chromosome numbers and probable base numbers (underlined) of tribes, subtribes and genera of subfamily Epidendroideae (*sensu* Chase *et al*., 2003), except those of the cymbidioid phylad previously published by Felix & Guerra (2000), including the number of genera and species in brackets

Subfamilies, tribes and subtribes, number of genera/species cytologically known and probable base number	Genera with the number of species known/analysed	Chromosome numbers*† and most probable base numbers (underlined)
TRIBE NEOTIEAE (6/191)		
	Aphyllorchis Blume (15/1)	*c.* 18
	Cephalanthera L.C.Rich. (14/10)	16–18, 17, 22
	Epipactis Sw. (21/19)	20, 18–30, 16–19
	Limodorum L. (1/1)	28–32
	Neottia L. (*Listera* included) (63/30)	18, 19–20–21, 17, 14–28–23
TRIBE SOBRALIEAE (4/237)		
Subtribe Sobraliinae (4/237)		
	Elleanthus Presl. (106/1)	25
	Sobralia Ruiz & Pavon (120/2)	24
TRIBE GASTRODIEAE (6/70)		
	Gastrodia R.Br.(41/4)	20, 19
TRIBE CALYPSOE (13/70)		
	Calypso Salisb. (1/1)	28
TRIBE EPIDENDREAE (86/5870)		
Subtribe Ponerinae (22/3)		
	Isochilus R.Br. (12/1)	20
Subtribe Bletiinae (3/48)		
	Bletia Ruiz & Pavon (30/2)	20, 30
Subtribe Pleurothallidinae (28/3021)		
$x = 20$	*Acianthera* Scheidw. (131/7)	20
	Anathallis Barb. Rodr. (89/1)	21
	Masdevallia Ruiz & Pavon (380/2)	18–22
	Pabstiella Brieger & Senghas (8/1)	16
	Pleurothallis R.Br. (1120/10)	19–20, 18, 34–36–42
	Scaphosepalum Pfitzer (41/1)	32
	Specklinia Lindl. (90/1)	10
	Stelis Sw. (370/7)	16–19, 17–21–32–38–39
Subtribe Laeliinae (van den Berg *et al*., 2000) (45/1788)		
$x = 20$		
	Brassavola R.Br. (20/4)	20
	Broughtonia R.Br.(6/1)	20
	Cattleya Lindl. (54/26)	20, 40, 21–27–30
	Catleyella Van den Berg & Chase (1/1)	20
	Caularthron Rafin. (4/1)	20
	Dimerandra Schltr. (6/2)	20
	Encyclia Hook. (154/7)	20
	Epidendrum L. (1125/38)	20, 14–40, 30–34, 12–15–19–26–35–60, 21–24–45–80–(108–124)–120
	Guarianthe Dressler & W.E.Higgins (5/1)	20
	Jacquiniella Schltr. (6/1)	19
	Laelia Lindl. (*s.l.*) (11/9)	20, 21, 22–30
	Leptotes Lindl. (6/1)	20
	Prosthechea (93/14)	20, 28–40
	Psychilis Raf. (17/1)	20
	Rhyncholaelia Schltr. (2/1)	20
	Scaphyglottis Lindl. (63/4)	20, 19
	Sophronitis Lindl. (57/19)	20, 40, 60
TRIBE PODOCHILEAE (21/1232)		
Subtribe Eriinae (11/725)		
	Ceratostylis Blume (145/1)	20
	Cryptochilus Wallich (4/2)	19
	Eria Lindl. (404/48)	19, 20, 18–22, 33–38
	Mediocalcar J.J.Sm. (24/4)	19
	Porpax Lindl. (13/3)	12, 21
	Pseuderia Schltr. (19/1)	20
	Trichotosia Blume (73/2)	19–22
Subtribe Podochilinae (4/208)		
	Podochilus Blume (60/1)	19
Subtribe Thelasiinae (6/299)		
$x = 16$	*Phreatia* Lindl. (201/1)	16
	Thelasis Blume (23/1)	16
TRIBE ARETHUSEAE (24/701)		
Subtribe Arethusinae (2/3)		
$x = 20$	*Anthogonium* Lindl. (1/2)	20–19–21
	Arethusa L. (1/1)	20
	Arundina Blume (1/1)	20, 16–19
	Calopogon R.Br. (5/5)	21, 13
	Eleorchis Maek. (2/1)	20

Table 2. *Continued*

Subfamilies, tribes and subtribes, number of genera/species cytologically known and probable base number	Genera with the number of species known/analysed	Chromosome numbers*† and most probable base numbers (underlined)
Subtribe Coelogyninae (20/274)		
$x = 20$	*Bletilla* Rchb.f. (9/3)	16, 32–38
	Coelogyne Lindl. (100/19)	20, 19, 21–40
	Dendrochilum Blume (100/2)	15–19
	Neogyna Rchb. f. (1/1)	21
	Otochilus Lindl. (4/3)	20
	Panisea Steudel (7/3)	20
	Pholidota Hook. (30/11)	20, 19, 21–22
	Pleione D.Don (15/11)	20, 19–40
	Thunia Rchb.f. (5/1)	20, 19
TRIBE MALAXIDEAE (7/1158)		
$x = 15, 21$	*Liparis* Rich. (418/52)	21, 15, 19, 10–20, 14–18–40, 11–13–28–34–38
	Malaxis Sw. (395/13)	21, 15–30, 14, 18–*c.* 20–22
	Oberonia Lindl. (308/30)	15, 30
TRIBE VANDEAE (157/1960)		
Subtribe Polystachyinae (4/228)		
$x = 20$	*Polystachya* Hook. (150/42)	20, 40, *c.* 60
Subtribe Aeridinae (98/1352)		
$x = 19$	*Acampe* Lindl. (7/4)	19, 18
	Aerides Lour. (25/10)	19, 38
	Arachnis Blume (11/1)	19
	Ascocentrum Schltr. (13/5)	19
	Biermannia King & Pantl. (10/1)	19
	Calymmanthera Schltr. (5/2)	19
	Chilochista Lindl. (20/3)	19
	Cleisostoma D.Don (87/17)	19, 20
	Cleisostomopsis Seidenf. (2/1)	19–20
	Cottonia Wight (1/1)	19–20
	Diplocentrum Lindl. (2/2)	19
	Diplopora Hook. (2/1)	8
	Drymoanthus Nicholls (4/3)	19, 38
	Esmeralda Rchb.f. (2/1)	21
	Euanthe Schltr. (1/1)	19
	Gastrochilus D.Don (55/9)	19, 17–20
	Gunnarella Senghas (9/1)	19
	Holcoglossum Schltr. (10/2)	19
	Hygrochilus Pfitzer (1/1)	19
	Luisia Gaudich. (39/9)	19, 20, 18
	Micropera Lindl. (18/2)	19
	Neofinetia Hu (2/1)	19
	Ornitochilus Lindl. (3/1)	19
	Papilionanthe Schltr. (10/6)	19, 20–38
	Paraphalaenopsis Hawkes (4/2)	19
	Pelatantheria Ridl. (7/2)	19
	Phalaenopsis Blume (62/23)	19, 38
	Pomatocalpa Breda (35/3)	19
	Pteroceras Hasselt ex Hassk. (24/2)	19
	Renanthera Lour. (33/7)	19
	Rhynchostylis Blume (3/3)	19
	Robiquetia Gaudich. (38/5)	19
	Sarcochilus R.Br. (25/2)	19–38
	Sedirea Garay & H.R.Sweet (2/1)	20
	Schoenorchis Blume (26/2)	19
	Seidenfadenia Garay (1/1)	19
	Smitinandia Holttum (3/2)	19
	Smithsonia C.J.Saldanha (3/2)	19
	Staurochilus Ridl. (14/1)	19
	Stereochilus Lindl. (7/1)	19
	Taeniophyllum Blume (185/5)	19–20, 28
	Thrixspermum Lour. (144/6)	19
	Trichoglottis Blume (64/4)	19
	Tuberolabium Yamam. (12/2)	15–19
	Uncifera Lindl. (6/3)	19
	Vanda Jones (57/21)	19, 38, 57
	Vandopsis Pfitz. (5/3)	19

Table 2. *Continued*

Subfamilies, tribes and subtribes, number of genera/species cytologically known and probable base number	Genera with the number of species known/analysed	Chromosome numbers*† and most probable base numbers (underlined)
Subtribe Angraecinae (18/445)		
$x = 19$	*Angraecum* Bory (219/28)	19, 25, 21, 20–23–24, *c.* 38–46
	Calyptrochilum Kraenzl. (2/2)	19
	Campylocentrum Benth. (73/4)	19–22–40
	Cryptopus Lindl. (4/1)	38
	Dendrophylax Rchb.f. (9/1)	44
	Jumellea Schltr. (58/1)	19–22
	Listrostachys Rchb.f. (2/1)	23
	Oeoniella Schltr. (2/1)	19
Subtribe Aerangidinae (32/315)		
$x = 25$	*Aerangis* Rchb.f. (490/15)	25, 21, 23–26–27–100
	Ancistrorhynchus Finet (16/9)	24, *c.* 25–36–48
	Angraecopsis Kraenzl. (21/5)	25, 24
	Bolusiella Schltr. (6/1)	25
	Chamaeangis Schltr. (10/2)	25–50
	Cribbia Senghas (4/1)	25
	Cyrtochis Schltr. (15/9)	23, 25–46–69–75
	Diaphananthe Schltr. (24/5)	25
	Eggelingia Summ. (3/1)	23
	Eurychone Schltr. (2/1)	25
	Microcoelia Lindl. (29/14)	24
	Microterangis Senghas (7/1)	25
	Mystacidium Lindl. (9/1)	24
	Podangis Schltr. (1/1)	23
	Rangearis Summ. (7/3)	23–46–50–54
	Rhipidoglossum Schltr. (37/6)	25, 50
	Solenangis Schltr. (6/2)	25
	Sphyrarhynchus Mansf. (1/1)	25
	Tridactyle Schltr. (43/3)	50, 25
UNPLACED SUBTRIBES		
Subtribe Agrostophyllinae (8/196)		
$x = 20$	*Agrostophyllum* Blume (91/5)	20, 19
	Earina Lindl. (6/3)	20
	Glossorhyncha Ridl. (80/2)	20
Subtribe Dendrobiinae (17/3332)		
$x = 19$	*Bulbophyllum* Thouars (1784/166)	19, 20, 18, 21, 10–40
	Dendrobium Sw. (1184/251)	19, 20–18, 38, 10–21–22
	Diplocaulobium Kraenzl. (99/5)	19
	Epigeneium Gagnep. (38/5)	20
	Flickingeria A.D.Hawkes (69/3)	19
	Geniorchis Schltr. (7/1)	19
	Saccoglossum Schltr. (5/1)	*c.* 20
	Trias Lindl. (12/1)	19
Subtribe Collabiinae (19/435)		
$x = 20$	*Acanthephippium* Blume (12/6)	24, 21–23
	Calanthe R.Br. (187/48)	20, 21, 19–22, 23, 10–30
	Cephalantheropsis Guillaumin (5/2)	20, 21
	Chrysoglossum Blume (6/1)	18
	Gastrorchis Thouars (8/4)	20
	Nephelaphyllum Blume (12/1)	18
	Pachystoma Blume (1/1)	20
	Phaius Lour. (48/11)	21, 22, 14–19–23–24
	Plocoglottis Blume (39/2)	19
	Spathoglottis Blume (45/8)	20, 18–19
	Tainia Blume (29/9)	20, 15–16–18–36–38

*Chromosome numbers are ordered from the more to the less frequent.
†Numbers connected with a rule (–) have equal frequencies.

symmetrical karyotypes. Chromosome numbers varied from $2n = 24$ in *Malaxis pubescens* Kuntze to $2n = c.$ 240 in *Epidendrum cinnabarinum* Salzm. ex Lindl.

In tribe Sobralieae Pfitzer, subtribe Sobraliinae Pfitzer, *Elleanthus brasiliensis* Rchb.f. had $2n = 50$ (Fig. 2A), whereas *Sobralia liliastrum* Lindl. and *S. sessilis* Lindl. had $2n = 48$ (Fig. 2A–C). The proportion of condensed chromatin per chromosome was more variable in the most asymmetric karyotypes, generally being greater in the largest chromosome pairs, as for example in *E. brasiliensis* (Fig. 1A).

In tribe Epidendreae, *Isochilus linearis* (Jacq.) R.Br. (Fig. 2D) and *Bletia catenulata* Ruiz & Pav. (Fig. 2E), from subtribes Ponerinae and Bletiinae had $2n = 40$, whereas subtribe Laeliinae, the most extensively

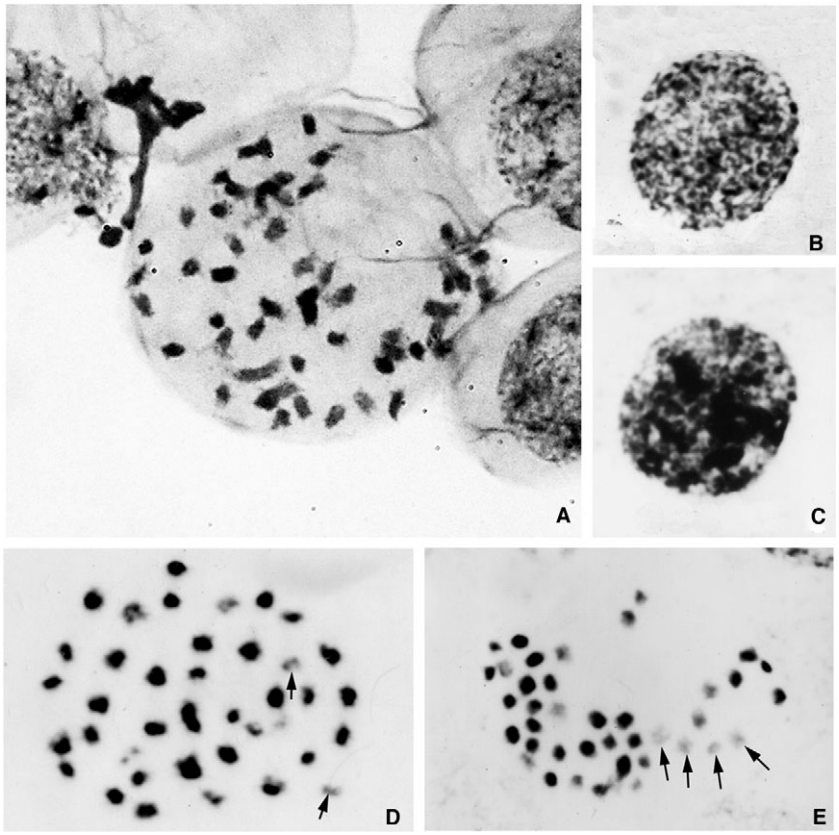

Figure 1. Prometaphase chromosomes and interphase nuclei of representatives of Sobraliinae, Laeliinae and Angraecinae. A, *Eleanthus brasiliensis* showing more condensed chromatin in two larger and 10 smaller chromosomes. B–C, interphase nuclei of the diffuse type in *Campylocentrum pernambucense* (B) and the complex chromocentric type in *Malaxis excavata* (C). D–E, *Jacquiniella globosa* (D) and *Catleyella araguaiensis* (E) showing late-condensed chromosomes (arrows).

studied subtribe, exhibited the greatest numerical chromosomal diversity, varying from $2n = 38$ to $2n = c.$ 240. These species had generally symmetrical karyotypes, with metacentric and submetacentric chromosomes, and prophase chromosomes with a similar condensation pattern. All species investigated of *Brassavola* R.Br. (Fig. 2F, G), *Encyclia* Hook. (Fig. 3A–C), *Sophronitis* Lindl., *Laelia marginata* (Lindl.) L.O.Williams (Fig. 3K) and *Scaphyglottis fusiformis* (Griseb.) R.E.Schult. (Fig. 4D) had $2n = 40$. In the genus *Cattleya* Lindl., *C. amethystoglossa* Linden & Rchb.f. ex R.Warner (Fig. 2H), *C. granulosa* Lindl. (Fig. 2J) and the accession Santa Cruz 3263 of *C. walkeriana* had $2n = 40$, whereas *C. nobilior* var. *nobilior* Rchb.f. and *C. nobilior* var. *amaliae* Pabst (Fig. 2K) had $2n = 42$. *Cattleya walkeriana* accession Santa Cruz 3149 (Fig. 2L) and *C. elongata* Barb.Rodr. were polyploids with $2n = c.$ 80 (Fig. 2I). *Prosthechea fragrans* (Sw.) W.E.Higgins (Fig. 4B) and *P. vespa* (Vell.) W.E.Higgins (Fig. 4C) had $2n = 40$, whereas *P. caetensis* (Fig. 4A) had $2n = 80$. In *Epidendrum* L., $2n = 40$ was observed in most species [*E. difforme* Jacq. (Fig. 3F), *E. avicula* Lindl. (Fig. 3G), *E. latilabre* Lindl. (Fig. 3H) and *E. rigidum* Jacq. (Fig. 3I)], whereas *E. ellipticum* Sessé & Moc. (Fig. 3E) and *E. cinnabarinum* Salzm. ex Lindl. (Fig. 3D) displayed $2n = 68$ and $2n = c.$ 240, respectively. Meiotic analysis of a sample of *E. cinnabarinum* collected in Serraria, Paraíba, revealed the formation of up to five tetravalents during diakinesis, and the occurrence of bridges and lagging chromosomes during anaphases I and II. Haploid numbers ranged from $n = 105$ to $n = 122$, in prometaphase II cells, to $n = 108$ to $n = 124$ in pollen mitosis (in a total of 66 cells analysed). *Jacquiniella globosa* (Jacq.) Schltr. with $2n = 38$ had large and small chromosomes. In several species of subtribe Laeliinae, including *Jacquiniella globosa* (Figs 1D, 3J), *Cattleyella araguaiensis* (Pabst) Van den Berg & M.W.Chase (Figs 1E, 2M) and *Epidendrum cinnabarinum* (Fig. 3D), some entire chromosomes were late condensing. These chromosomes were generally small (approximately 0.5 μm), difficult to visualize during prophase and apparently did not have

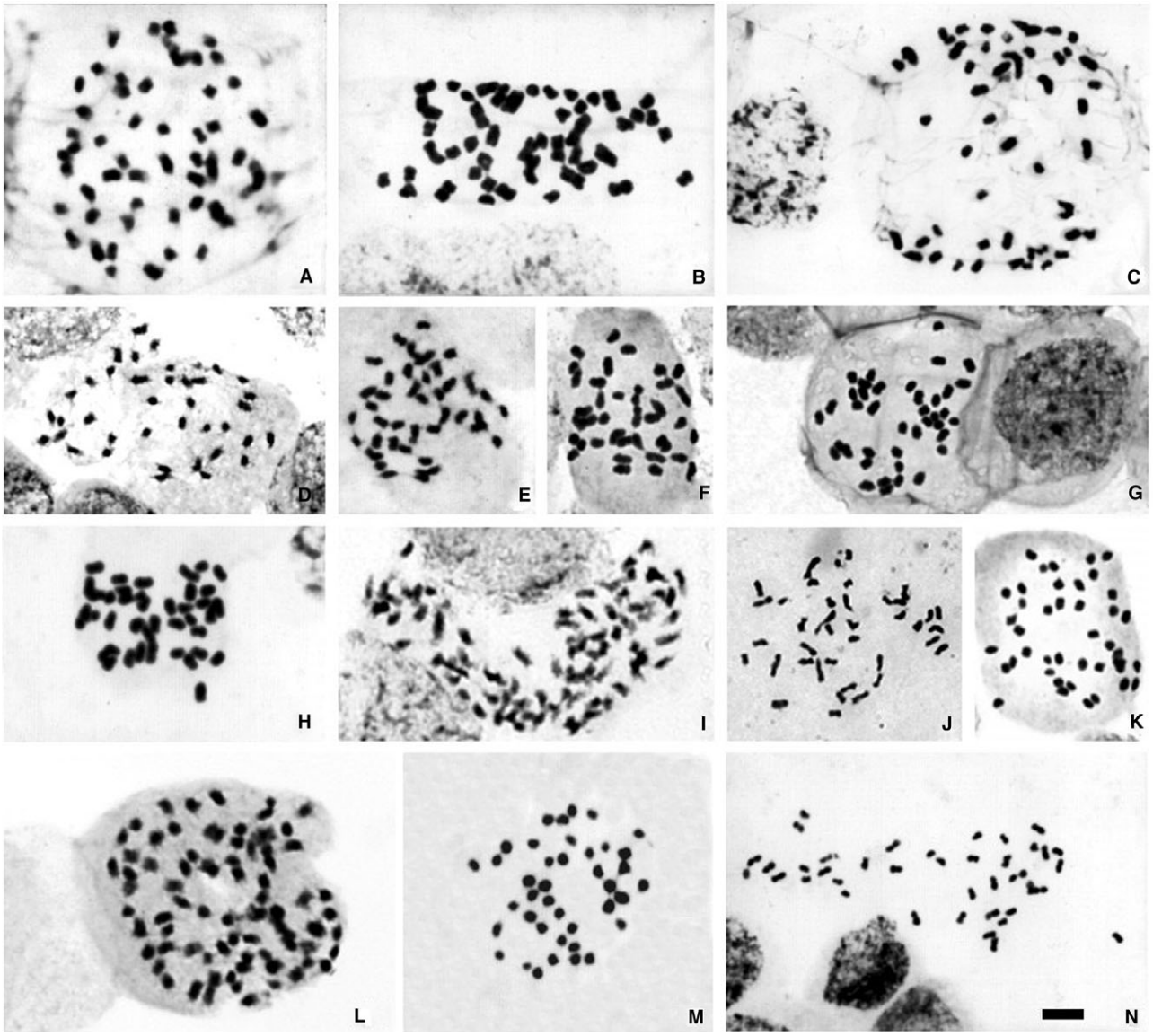

Figure 2. Chromosome complements of subtribes Sobraliinae, Ponerinae, Bletiinae and Laeliinae. A, *Eleanthus brasiliensis* ($2n = 50$). B, *Sobralia liliastrum* ($2n = 48$). C, *S. sessilis* ($2n = 48$). D, *Isochilus linearis* ($2n = 40$). E, *Bletia catenulata* ($2n = 40$). F, *Brassavola tuberculata* ($2n = 40$). G, *B. nodosa* ($2n = 40$). H, *Cattleya amethystoglossa* ($2n = 40$). I, *C. elongata* ($2n = 80$). J, *C. granulosa* ($2n = 40$). K, *C. nobilior* var. *amalieae* ($2n = 42$). L, *C. walkeriana* var. *princeps* ($2n = c.\ 80$). M, *Cattleyella araguaiensis* ($2n = 40$). N, *Dimerandra emarginata* ($2n = 40$). Scale bar in (O), 5 μm.

the condensed proximal chromatin observed in all other chromosomes.

In subtribe Pleurothallidinae, *Acianthera ochreata* (Lindl.) Pridgeon & M.W.Chase had $2n = 40$ (Fig. 4E) and *Stelis* sp. had $2n = 32$ (Fig. 4F), both with small chromosomes. The latter had a slightly asymmetric karyotype. *Malaxis excavata*, tribe Malaxideae, had $n = 15$ in the first microspore mitosis (Fig. 4G) and $2n = 30$ in somatic mitosis. *Malaxis pubescens* Kuntze showed $2n = 24$ and chromosomes larger than those of *M. excavata* (Fig. 4H). In the tribe Vandeae, *Polystachya estrelensis* Reichb.f. had $2n = 80$, and, in subtribe Angraecinae, *Campylocentrum crassirhizum* Hoehne (Fig. 4J) and *C. pernambucense* (Fig. 4K) had $2n = 38$, and *C. amazonicum* Cogn. had $2n = c.\ 80$ (Fig. 4I). In tribe Dendrobieae, *Bulbophyllum cribbianum* Toscano, *B. sanderianum* Rolfe and *Bulbophyllum* sp. 1 had $2n = 38$ (Fig. 4L–N), whereas *Bulbophyllum* sp. 2 (Fig. 4O) had $2n = 80$. In *B. sanderianum* and *Bulbophyllum* sp. 1, two of the four small chromosomes were only partially condensed during metaphase (Fig. 4M–N, arrows).

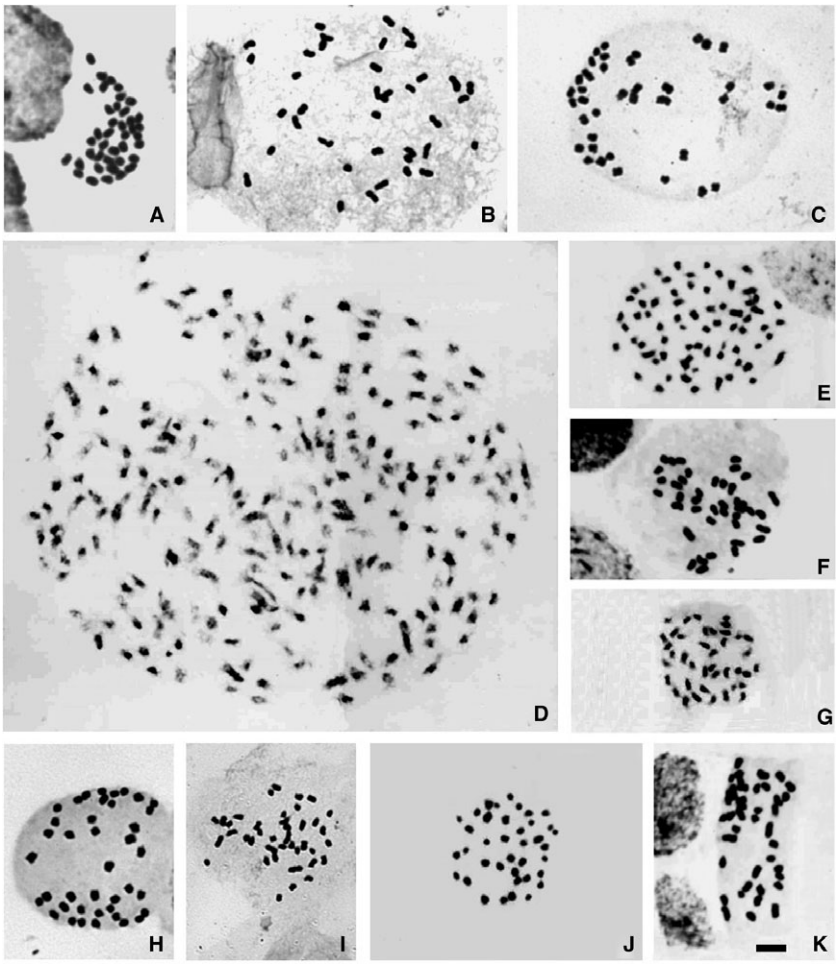

Figure 3. Chromosome complements of subtribe Laeliinae. A, *Encyclia advena* (2*n* = 40). B, *E. flava* (2*n* = 40). C, *E. oncidioides* (2*n* = 40). D, prometaphase of *Epidendrum cinnabarinum* (2*n* = *c.* 240). E, *E. elipticum* (2*n* = 68). F, *E. difforme* (2*n* = 40). G, *E. avicula* (2*n* = 40). H, *E. latilabre* (2*n* = 40). I, *E. rigidum* (2*n* = 40). J, *Jacquiniella globosa* (2*n* = 38). K, *Laelia marginata* (2*n* = 40). Scale bar in (I), 5 μm.

Appendix 1 lists the chromosome numbers of 115 genera and 844 species of subfamily Epidendroideae, compiled from the chromosome number indexes and our own data. Counts for the cymbidioid clade (*sensu* Dressler, 1993) published previously (Felix & Guerra, 2000) were not included here. Subfamily Epidendroideae (Table 2) shows a predominance of genera with the basic numbers $x = 19$ (tribes Podochyleae Pfitzer and Vandeae) and $x = 20$ (tribes Epidendreae, Arethuseae and Colabieae Pfitzer). Some disparate basic numbers are also observed, including $x = 16$ in *Stelis* (subtribe Pleurothallidinae), *Bletilla* Rchb.f. (Coelogyninae), *Phreatia* Lindl. and *Thelasis* Blume (Thelasiinae), and principally $x = 23$, 24 and 25 in various genera of Aerangidinae Summerh. Other tribes, such as Sobralieae and Neottieae, are currently insufficiently sampled or have variable basic numbers among genera.

DISCUSSION

The present work provides the first chromosome counts for 31 species, including the first counts for six genera (*Elleanthus* C.Presl, *Sobralia* Ruiz & Pav., *Isochilus* R.Br., *Cattleyella* Van den Berg & M.W.Chase, *Jacquiniella* Schltr. and *Acianthera* Scheidw.) and for subtribe Ponerinae and tribe Sobralieae. Previous chromosome counts were confirmed for *Dimerandra emarginata* (G.Mey.) Hoehne (Guerra, 1986), *Sophronitis purpurata* (Lindl. & Paxton) Van den Berg & M.W.Chase [as *Laelia purpurata* Lindl. & Paxton (Moore, 1977)], *Brassavola tuberculata* Hook. (Daviña *et al.*, 2009), *Encyclia advena* (Rchb.f.) Porto & Brade (as *E. megalantha* (Barb.Rodr.) Porto & Brade), *Epidendrum avicula* (as *Lanium avicula* Lindl. ex Benth.), *Laelia marginata* (Lindl.) L.O.Williams (as *Schomburgkia crispa* Lindl.)

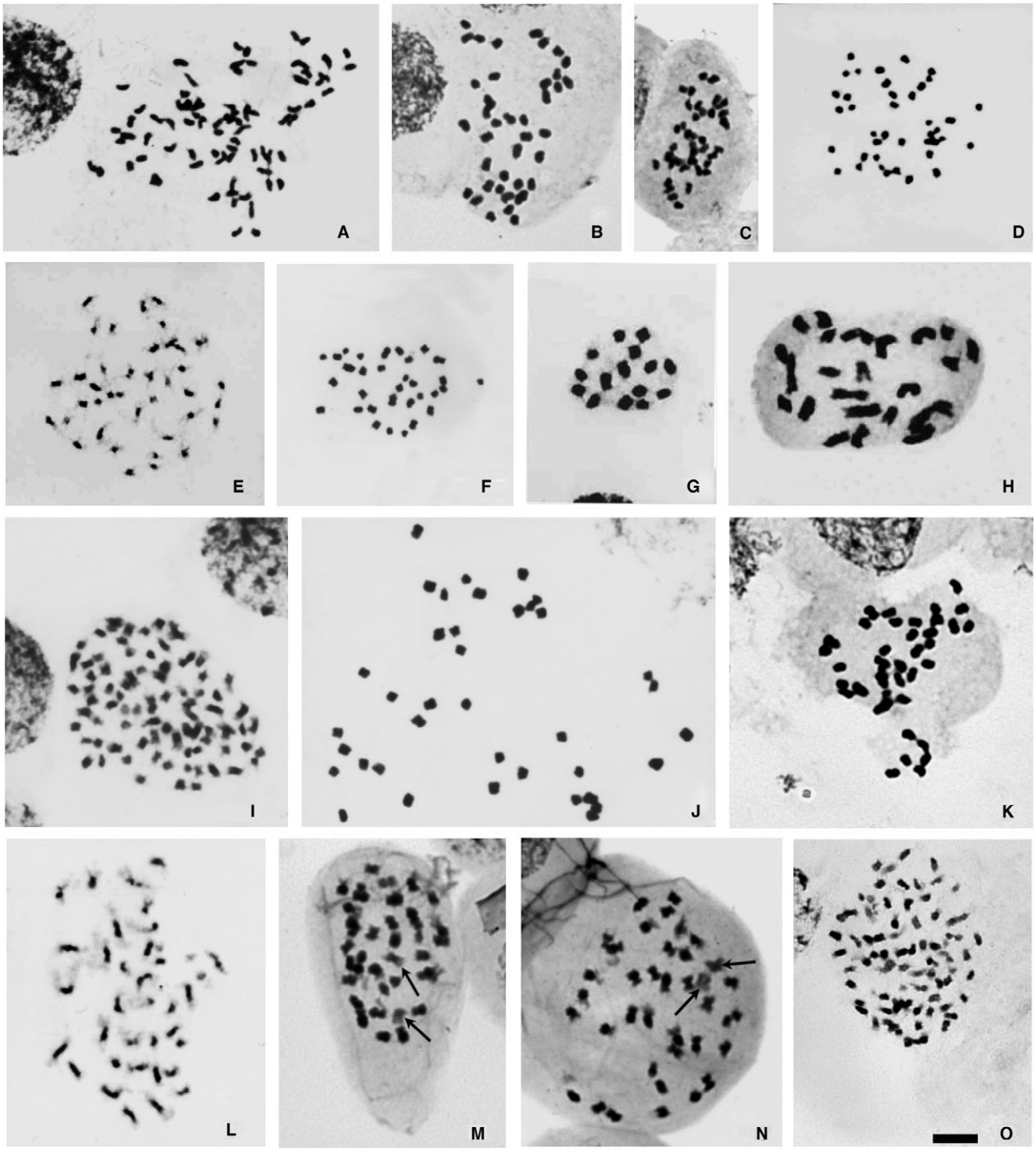

Figure 4. Chromosome complements of tribe Malaxideae, subtribes Laeliinae, Pleurothallidinae, Polystachyinae, Angraecinae and Dendrobiinae. A, *Prosthechea caetensis* ($2n = 80$). B, *P. fragrans* ($2n = 40$). C, *P. vespa* ($2n = 40$). D, *Scaphyglottis fusiformis* ($2n = 40$). E, *Acianthera ochreata* ($2n = 40$). F, *Stelis* sp. ($2n = 32$). G, metaphase of first mitotic division of microspore of *Malaxis excavata* ($n = 15$). H, *M. pubescens* ($2n = 24$). I, *Campylocentrum amazonicum* ($2n = c.$ 80). J, *C. crassirhizum* ($2n = 38$). K, *C. pernambucense* ($2n = 38$). L, *Bulbophyllum cribbianum* ($2n = 38$). M, *B. sanderianum* ($2n = 38$). N, *Bulbophyllum* sp. 1 ($2n = 38$). O, *Bulbophyllum* sp. 2 ($2n = c.$ 80). Scale bar in (P), 5 μm.

and *Prosthechea fragrans* (Sw.) W.E.Higgins (as '*Hormidium fragrans*'), all having $2n = 40$ (Tanaka & Kamemoto, 1984), *Polystachya estrellensis* Rchb.f and *Epidendrum nocturnum* Jacq. with $2n = 80$ (Blumenschein, 1960a), and *E. cinnabarinum*, with $2n = c.$ 240 (Guerra, 2000; Conceição, Oliveira & Barbosa, 2006). We found $2n = 40$ for *Epidendrum difforme*, previously reported as $2n = 39–40$ (Tanaka & Kamemoto, 1984). The count of $2n = 40$ for *Cattleya walkeriana* (accession Santa Cruz 3149) confirmed the only previous count for the species (Blumenschein, 1960a). Additionally, $2n = 80$ was found for another accession of *C. walkeriana*, indicating that this species has at least two ploidy levels.

There are records of chromosome numbers for five of the six recognized genera of tribe Neottieae, but its basic number is still unclear. According to Chase *et al*. (2003), this tribe comprises an early branching group of Epidendroideae. In Neottieae, $x = 20$ is the basic number in *Epipactis* Sw. and the orthoploid series $x = 14, 21 \pm 1$ occurs in *Neottia* L., *Limodorum* L. and *Cephalanthera* Rich., supporting the hypothesis of an ancestral basic number related to this series in the tribe and to the entire subfamily Epidendroideae (Fig. 5). Tribes Sobralieae and Calypsoe are also insufficiently investigated. The numbers of $n = 24$ and 25 for tribe Sobralieae diverge from the lower chromosome numbers observed in the majority of species of Epidendroideae. The count of $2n = 54$ for *Sobralia* × *amesiana* Hort.Sander (Vij & Shekhar, 1985) from West Bengal, India, was transferred to the table of excluded numbers (see also Appendix 2) as it appears to be a misidentification. This genus is exclusively American (Bechtel, Cribb & Launert, 1992) and this binomial was included by Govaerts *et al*. (2009) in the World Checklist of Orchidaceae as an 'unplaced name'.

Tribe Epidendreae, the largest group of subfamily Epidendroideae (Chase *et al*., 2003), has karyological reports for 27 genera and 163 species, corresponding to 31% of the genera but less than 3% of the species. These data indicate $n = 20$ as the most widely occurring number among the three subtribes. *Pleurothallis* and *Stelis* display an exceptionally high variation in chromosome numbers, with 13 different numbers among the 17 species investigated here for these genera. The number $2n = 20$ reported for *Specklinia grobyi* (Bateman ex Lindl.) Pridgeon & M.W.Chase (Nakata & Hashimoto, 1983) and for *Liparis cordifolia* Hook.f and *L. glossula* Rchb.f. (Goldblatt &

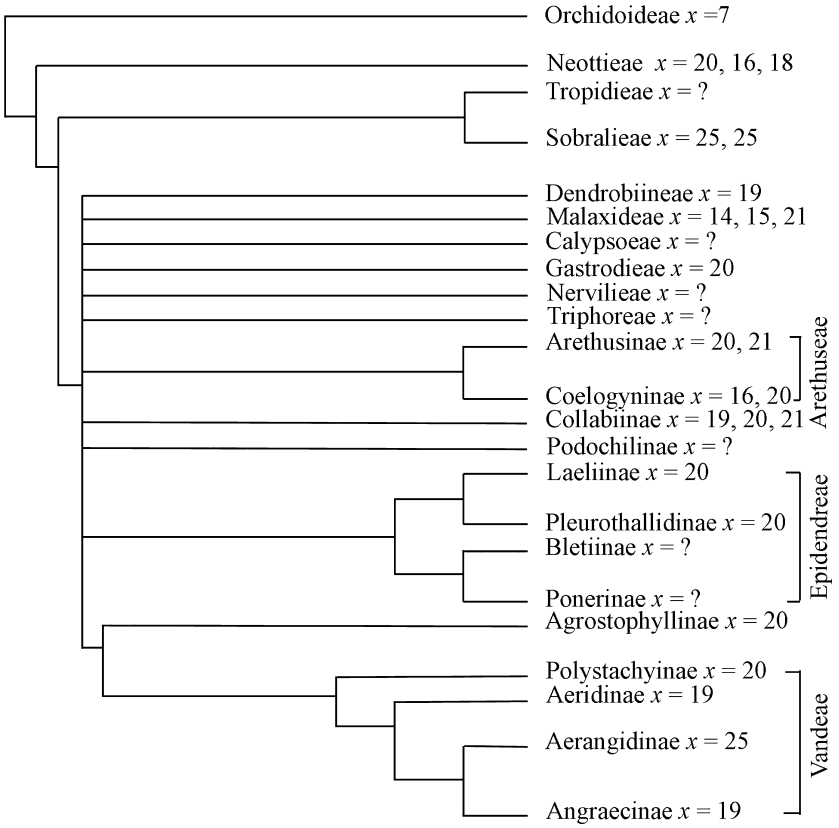

Figure 5. Partial cladogram of subfamily Epidendroideae, based on Chase *et al*. (2003), with the probable basic number indicated for each tribe and subtribe.

Johnson, 1994) is probably the lowest diploid number for the subfamily. It seems to represent two independent examples of intense dysploid reduction rather than the ancestral chromosome number of these genera (Guerra, 2008). Similarly low haploid numbers, not representatives of the basic number, have also been found in a few genera of subtribe Oncidiinae (Felix & Guerra, 1999, 2000) and in other families, for example $n = 6$ in Aristolochiaceae (Ohi-Toma *et al*., 2006) and $n = 2$ in Cyperaceae (Vanzela, Guerra & Luceño, 1996). Likewise, $n = 10$ in *Specklinia* Lindl. and *Liparis* Rich. can be a dysploid remnant of the ancestral number $x = 7$ or of a tetraploid lineage with $n = 14$.

In subtribe Laeliinae, $n = 20$ is observed in all of the genera, except *Jacquiniella*, a small genus previously included in subtribe Ponerinae (Dressler, 1993), which also has $n = 20$. Small variations around this number have been observed in some species of *Cattleya*, *Epidendrum*, *Laelia*, *Scaphyglottis*, and *Sophronitis*. *Cattleya nobilior* Rchb.f., for example, which is morphologically close to *C. walkeriana* (Pabst & Dungs, 1975), differs from the other species of *Cattleya* by having $2n = 42$, a rare number in this genus. *Jacquiniella globosa* (Jacq.) Schltr. and *Scaphyglottis reflexa* Lindl. (Sau & Sharma, 1983), both with $2n = 38$, were included recently in the *Scaphyglottis* alliance by van den Berg *et al*. (2009). Tetraploid species with $2n = 80$ occur in *Cattleya*, *Epidendrum*, *Prosthechea*, and *Sophronitis*. Intraspecific polyploidy occurred in *C. bicolor* Lindl. (Blumenschein, 1960a), in *Sophronitis* (Blumenschein, 1960b; Yamagishi-Costa & Forni-Martins, 2009) and in some species of *Epidendrum* (Blumenschein, 1960a; Pinheiro *et al*., 2009). This ploidy change seems to be related to morphological variants placed in distinct subspecies, as in *C. bicolor* ssp. *bicolor* with $2n = 40$ and *C. bicolor* ssp. *minasgeraensis* Fowlie with $2n = 80$ (Blumenschein, 1961). In *C. walkeriana* var. *princeps* (accession Santa Cruz 3149), the number $2n = 80$ reported here was observed only in a cultivated specimen.

In some lithophytic species of *Sophronitis*, the intraspecific polyploidy observed seems to be related to the acquisition of this habit, as has been reported for *Sophronitis longipes* (Rchb.f.) Van den Berg & M.W.Chase (Blumenschein, 1960b), *S. rupestris* Cogn. (Yamagishi-Costa & Forni-Martins, 2009), *Oncidium* aff. *flexuosum*, and *O. varicosum* Lindl. (Felix & Guerra, 2000). This tendency was also observed in the polyploids *Epidendrum cinnabarinum*, *C. walkeriana* var. *princeps*, and *C. elongata*, which have the lithophytic or terrestrial habit. Terrestrial species of subfamilies Vanilloideae and Cypripedioideae also have genome sizes notably higher than most epiphytic orchids. Leitch *et al*. (2009) suggested that orchids with large genomes are restricted to a terrestrial habit because of the water stress associated with the epiphytic habit. As species with large genome size usually have large guard cells and a slower response to water stress, they are better adapted to the terrestrial lifestyle, whereas species with small genome size are free to occupy both habits.

The only population analysed here of *E. elipticum*, from the *Epidendrum secundum* complex showed $2n = 68$. However, an analysis of six populations of this complex displayed $2n = 28$, 40, 48, 52, 56, 68 and 80 (Pinheiro *et al*., 2009). These data indicate that *E. secundum* is a highly polymorphic complex. It also showed intra- and inter-populational morphological variants (Pinheiro & Barros, 2007). It belongs to the Amphyglottidae group of *Epidendrum* (Pabst & Dungs, 1975), which comprises species with different chromosome numbers ($n = 12$, 14, 18, 19 and 28) (Hágsater & Arenas, 2005). In *E. cinnabarinum*, the count of $2n = c.$ 240 in four populations from Pernambuco and Paraíba and at least in one population from Bahia (Conceição *et al*., 2006) indicates that its ploidy is stable, in spite of some meiotic instability, as the occurrence of ring tetravalents and aneuploid spores, observed here, and anaphase bridges and lagging chromosomes, reported by Conceição *et al*. (2006).

In tribe Podochileae, $n = 19$ occurred in the majority of the genera of subtribe Eriinae and in the sole species of Podochilinae analysed, whereas, in subtribe Thelasiinae, $n = 16$ was found in the only two species studied. In subtribe Eriinae Benth., *Eria* Lindl. had $n = 19$ in 27 of the 54 species investigated. The other four genera, with few species investigated, had $n = 19$ (*Cryptochilus* Wall. and *Mediocalcar* J.J.Sm), $n = 20$ (*Ceratostylis* Blume), and $n = 12$ and 21 (*Porpax* Lindl.).

The tribe Arethuseae is monophyletic (Goldman *et al*., 2001), but do not have well-defined relationships with other Epidendroideae (Chase *et al*., 2003). In this tribe, $n = 20$ was the best represented haploid number in the genera of both subtribes that are cytologically known, with the exception of *Bletilla* with $n = 16$, and *Dendrochilum* Blume with $n = 15$ and $n = 19$.

Tribe Malaxideae has a great diversity in chromosome numbers, with $n = 21$ predominating in *Liparis* and *Malaxis* and $n = 15$ in *Oberonia*. The other genera are quite small and insufficiently studied. The most probable basic numbers for the tribe are $x = 15$ and $x = 21$, $n = 21$ being the most frequent haploid number and $n = 15$ the second most frequent and the only one that occurs in all three genera. The occurrence of $n = 14$ in some species of *Liparis* and *Malaxis*, and the high frequency of $n = 21$ in these two genera, suggest that these numbers may be related to the polyploid series $x = 7$, 14, 21 that is quite common in orchids (Felix & Guerra, 2000). *Liparis* and *Malaxis* are arti-

ficial cosmopolitan genera (Cameron, 2005), which may explain their large numerical chromosomal variations. Similarly, the large and chromosomally variable genus *Habenaria* (Orchidoideae) (Felix & Guerra, 1998, 2005) was also recognized as polyphyletic (Bateman *et al*., 2003). *Oberonia*, which is exclusively epiphytic (a type of habitat that is considered primitive in this subtribe), has $n = 15$ or 30 and is related to a group of 'primitive' epiphytic *Liparis* (Cameron, 2005). At least one of these *Liparis* species (*L. viridiflora*) has $n = 15$ (Mehra & Sehgal, 1980), indicating the karyological affinity between these two genera. The occurrence of $n = 15$ in Malaxideae further supports the hypothesis that the karyological evolution of the family was principally through dysploidy of approximately one chromosome in the three principal ploidy levels, $n = 7,\ 14,\ 21 \pm 1$ (Felix & Guerra, 2000, 2005).

In tribe Vandeae, a group of orchids principally known from the Old World, $n = 19$ predominates in subtribes Aeridinae and Angraecinae, whereas $n = 25$ predominates in Aerangidinae and $n = 20$ in Polystachyinae (*sensu* Chase *et al*., 2003). The latter is considered the sister group of the other subtribes of Vandeae (Chase *et al*., 2003; van den Berg *et al*., 2005; Carlsward *et al*., 2006). *Polystachya*, the largest genus of Polystachyinae and the only one with known chromosomal counts, had $n = 20$ in 35 of the 41 species analysed. This haploid number also occured in various genera of Aeridinae and in some Angraecinae, suggesting that $x = 20$ is the basic number for the tribe Vandeae and that $x = 19$ represents a secondary basic number. Subtribes Aerangidinae and Angraecinae are considered individually to be polyphyletic, but together they form the more widely circumscribed monophyletic clade Angraecinae *s.l.* (Carlsward *et al*., 2006). Cytologically, the two tribes have shown a distinct base number ($x = 19$ and $x = 25$) and at least Aerangidinae, with $x = 25$, seems to represent a well-defined branch of Epidendroideae.

Among the subtribes with undefined taxonomic positions (Chase *et al*., 2003), Agrostophyllinae and Collabinae predominantly have $n = 20$, whereas in Dendrobiinae $n = 19$ predominates in all genera except *Epigeneium* and *Saccoglossum* (both with $n = 20$ in the single species analysed). Therefore, Dendrobiinae may be cytologically related to tribe Vandeae, which includes some subtribes with $x = 19$. Among Dendrobiinae, the two genera largely investigated, *Bulbophyllum* and *Dendrobium*, showed relatively little variation. In contrast, in Collabiinae, the two genera with many species investigated, *Calanthe* and *Phaius*, exhibited a large variation in chromosome numbers.

A karyotypic aspect observed in four genera and seven species of subfamily Epidendroideae is the presence of one or more pairs of late-condensing chromosomes. Among orchids, this type of chromosome was recorded for the genus *Habenaria* (Felix & Guerra, 1998), in some species of subtribe Oncidiinae (Felix & Guerra, 2000) and in the genus *Spiranthes* of New Zealand (Dawson, Maloy & Beuzember, 2007). Late-condensing chromosomes have also been observed in other angiosperms, e.g. in some Velloziaceae (Melo *et al*., 1997) or in species of *Arachis* L. (Fabaceae) with the A genome, where they are used as a cytogenetic marker (Fernandez & Krapovickas, 1994). *Cattleyella araguaiensis*, a species recently separated from *Cattleya* (van den Berg & Chase, 2004b) stood out from the other species of *Cattleya* that were analysed by having at least one pair of late-condensing chromosomes.

The data presented here reaffirm the extensive variation in chromosome numbers encountered in subfamily Epidendroideae. Only five of the 128 genera with chromosome records for more than five species have stable chromosome numbers. As the large majority of these genera have haploid numbers between 15 and 25 (principally 19 and 20), each of these numbers may have arisen independently several times during the evolution of the family.

The principal karyological difference between tribes Epidendreae, Cymbidieae, Podochileae and Vandeae, together comprising the large majority of the Epidendroideae orchids, is the predominance of $n = 20$ in Epidendreae, $n = 21$ in Cymbidiae (Felix & Guerra, 2000) and $n = 19$ in the last two tribes. Multiples of $n = 7$, especially $n = 21$ or nearly 21, also predominate in the majority of the genera of subfamily Orchidoideae (Martínez, 1985; Yokota, 1990; Pridgeon *et al*., 1997; Felix & Guerra, 2005). Among orchids in general, $n = 21$ is a recurring chromosome number that appears to be related to the probable basic number of the family $x_1 = 7$ (Felix & Guerra, 1999, 2000, 2005). The principal polyploid series has been hypothesized to be $n = 7,\ 14,\ 21$, with a variation of ± 1 at each ploidy level (Felix & Guerra, 2005). According to this assumption, dysploid reduction occurred in the large majority of the tribes of Epidendroideae ($x = 21,\ 20,\ 19$), whereas ascending dysploidy occurred only in the subtribe Angraecinae *sl*. ($x = 25$).

ACKNOWLEDGEMENTS

The authors would like to thank CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) and CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) for their financial support and Celso Pires from Taquaritinga do Norte, Pernambuco, for granting us access to his private collection to perform the karyological analyses.

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Appendix 1. Chromosome numbers in epidendroid orchids, organized according to Chase *et al*. (2003), except the cymbidioid phylad *sensu* Dressler (1993).

TAXON	*n*	2*n*	Source
TRIBE NEOTTIEAE			
Aphyllorchis caudata Rolfe ex Downie		ca. 36	TK84
Cephalanthera damasonium (Mill.) Druce (as *C. alba*)		36	F69
C. damasonium (Mill.) Druce	18	36	TK84, G84, 88, GJ91, GJ96
C. longifolia (L.) Fritsch (as *C. ensifolia*)	16, 17	32, 34	TK84, G84, GJ90
C. epipactoides Fisch. & Meyer		32	G85, G88
C. erecta (Thunb.) Blume		34	TK84, G88, GJ91
C. erecta (Thunb.) Blume (as *C. shizuoi*)		32	F69, TK84
C. erecta f. *subaphylla* (Miyabe & Kudô) M.Hiroe (as *C. subaphylla*)		34	G85
C. falcata (Thunb.) Blume		34	TK84, G88, GJ91
C. longibracteata Blume		32	TK84, G88, GJ91
		34, 36	GJ94
C. longifolia (L.) Fritsch(as *C. grandiflora*)	18	36	TK84, G88
C. longifolia (L.) Fritsch (= *C. ensifolia*)	16	32	TK84, G84, G85, G88, GJ91
C. rubra (L.) Rich.		36	TK84, G84, G88, GJ91
		44	G85
		32, 36	F69
Epipactis. atrorubens (Hoff.) Schult. (as *E. atropurpurea*)	20	30, 38, 40, 60	TK84, G84, 85, 88, GJ03
E. atrorubens (Hoff.) Schult. (as *E. rubiginosa*)		40	F69
E. exilis P.Delforge (as *E. gracilis* B.Baumann & H.Baumann)		40	GJ03
E. fageticola (C.E.Hermos.) Devillers-Tersch.			
E. falcata Sw.		24	TK84
E. gigantea Dougl. ex Hook.	20	40	TK84
E. helleborine (L.) Crantz	20	40	G81, G84, G84, GJ91, GJ96, GJ03
	18, 18 + 2B	32, 38, 40	GJ06
E. helleborine subsp. *latina* Rossi & Klein	19		GJ91
E. helleborinae subsp. *tremolsii* Klein		40	G88, GJ91
E. helleborine subsp. *orbicularis* (K.Richt.) E.Klein (as *E. distans*)		40	GJ03
E. latifolia Sw.	20	40	G81, TK84, G84, GJ90, GJ94
E. leptochilla (Godf.) Godf.		36	TK84
E. leptochila subsp. *futakii* (Mered'a & Potucek) Kreutz (as *E. futakii*)		40	GJ03
E. microphylla (Ehrh.) Sw.		40	TK84, GJ03
E. muelleri Godfrey		38	GJ03
E. palustris (L.) Crantz	20	40	G81, TK84, G84, GJ91, GJ00, GJ03
E. papillosa Franch. & Savat.	20	40	TK84, GJ94
E. papillosa Franch. & Savat. (as *E. sayekiana*)		40	TK84
E. persica (Soó) Hausskn. ex Nannf.	20	40	TK84
E. phyllanthes G.E.Sm.		36	TK84
E. phyllanthes var. *phyllanthes* (as *E. confusa*)	20	40	TK84
E. placentina L.Bongiorni & P.Grunanger		38	GJ03
E. purpurata Sm. (as *E. pseudopurpurata*)		40, ca. 40	G88, GJ96, GJ03
E. royleana Lindl.	20	40	TK84, G84, GJ90
E. veratrifolia Boiss. & Hohen. (as *E. consimilis*)	20	40	TK84, G85, GJ90, GJ91, GJ94
Limodorum abortivum (L.) Sw.		56, 64	GJ03
Neottia asiatica Ohwi		36	TK84
		50	A08
N. camtschatea (L.) Rchb.		40	G88
N. cordata (L.) Rich. (as *Epipactis cordata*)		40 (34 + 6B)	G85
N. inayatii (Duthie) Beaverd	21	42	TK84, G84, GJ90
N. listeroides Lindl.	20	40	TK84, GJ90, GJ94
N. nidus-avis (L.) Rich.	18	36	TK84, G88, GJ91,
TRIBE SOBRALIEAE			
Elleanthus brasiliens Rchb.f.		50	PW
Sobralia sessilis Lindl.		48	PW

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
TRIBE GASTRODIEAE			
Gastrodia cunninghamii Hook.f.		40	D07
G. minor Petrie		40	D07
G. aff. *sesamoides*		38–40	D07
Gastrodia sp.		38–40	D07
TRIBE CALYPSOEAE			
Calypso bulbosa (L.) Oakes		28	G84
TRIBE EPIDENDREAE			
Subtribe Ponerineae			
Isochilus linearis (Jacq.) R.Br.		40	PW
Subtribe Bletiinae			
Bletia catenulata Ruiz & Pavon		40	PW
B. catenulata (as *B. rodriguesii* Cogn.)		40	TK84
B. purpurea (Lam.) DC. (as *B. verecunda*)		60	TK84
Subtribe Pleurothallidinae			
Acianthera ochreata (Lindl.) Pridgeon & M.W.Chase		40	PW
A. aurantiolateritia (Speg.) Pridgeon & M.W.Chase (as *Pleurothallis aurantiolateritia*)		40	G85
A. brevipes (H. Focke) Pridgeon & M.W.Chase (as *P. brevipes*)		43	G85
*A. aff. casapens*is (Lindl.) Pridgeon & M.W.Chase (as *Pleurothallis aff. cofeicola*)		40	G85
A. luteola (Lindl.) Pridgeon & M.W.Chase (as *Pleurothallis luteola*)		40	G85
A. teres (Lindl.) Borba (as *Pleurothallis teres*)		40	G85
A. pubescens (Lindl.) Pridgeon & M.W.Chase (as *Pleurothallis vittata*)	21		TK84
Anathallis obovata (Lindl.) Pridgeon & M.W.Chase (as *P. obovata*)		43, 42, 45	G85
Masdevallia civilis Rchb.f. & Warsc.		36	G85
M. coccinea Linden ex. Lindl.		44	TK84
Pabstiella tripterantha (Rchb.f.) F. Barros (as *P.procumbens*)	16		TK84
Pleurothallis alopex Luer		36	G85
P. bivalvis Lindl.		77	G85
P. bivalvis Lindl. (as *P. chanchamayoensis*)		84	G85
P. carinata Schweinf.		40	G85
P. matudana C.Schweinf.		68, 72	G85
P. revoluta (Ruiz. & Pav.) Garay		40, 80, ca. 80	G85, GJ94
P. ruscifolia (Jacq.) R.Br.		38	G85
P. saccatilabia Schweinf.		38	G85
P. tridentata Klotz		36	G85
P. xanthochlora Rchb.f.		40	G85
Pleurothallis sp.		38	G85
Scaphosepalum verrucosum (Rchb.f.) Pfitzer (as *Masdevallia ochthodes*)		64	TK84
Specklinia grobyi (Bateman ex Lindl.) F.Barros (as *Pleurothallis grobyi*)		20	G85
Stelis argentata Lindl.		38	G85
S. ciliaris Lindl.	16		TK84
S. gelida (Lindl.) Pridgeon & M.W.Chase (as *Pleurothallis gelida*)		32, 64	G85
S. pachyglossa (Lindl.) Pridgeon & M.W.Chase (as *Pleurothallis pachyglossa*)		38	G85
S. restrepioides (Lindl.) Pridgeon & M.W.Chase (as *Pleurothallis restrepioides*)		76, 78	G85
S. segoviensis (Rchb.f.) Pridgeon & M.W.Chase (as *Pleurothallis segoviensis*)		42	G85
S. velaticaulis (Rchb.f.) Pridgeon & M.W.Chase (as *Pleurothallis velaticaulis*)		34	G85
Subtribe Laeliinae			
Brassavola cucullata R.Br.		40	TK84
B. grandiflora Lindl.	20		TK84
B. nodosa Hook.		40	TK84, PW
B. tuberculata Hook.		40	DA09, PW
B. tuberculata Hook. (as *Brassavola perrinii*)	20	40	TK84
Broughtonia sanguinea (Sw.) R.Br.	20		TK84
Cattleya amethystoglossa Linden & Rchb.f. ex R.Warner		40	PW
C. bicolor Lindl.		40, 80	TK84
C. bicolor var. *bicolor* (as *C. bicolor* var. *measuresiana*)		80	TK84
C. dormaniana Rchb.f.		40	TK84
C. dowiana Bateman	20	40	TK84
C. dowiana var. *aurea* (Linden) B.S.Williams & Moore		40	TK84
C. elongata Barb. Rodr.		80	PW
C. forbesii Lindl.		54–60	TK84
C. gaskelliana (N.E.Br.) B.S.Williams	20	40	TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
Cattleya granulosa Lindl.		40	PW
C. guttata Lindl.		40	TK84
C. harrisoniana Bateman ex Lindl.	20	40	TK84
C. intermedia Graham ex Hook.		40	TK84
C. intermedia var. *alba*		41 + 1f	TK84
C. labiata Lindl.	20	40	M73, TK84
		46	TK06
C. labiata var. *amesiana*	20, 21	40, 41	TK84
C. lueddemanniana Rchb.f.		40	TK84
C. mossiae C.Parker ex Hook.	20	40	TK84
C. nobilior Rchb.f.		42	PW
Cattleya nobilior var. *amaliae* Pabst		42	PW
C. percivaliana (Rchb.f.) O'Brien	20	40	TK84
C. tigrina Rich. (as *C. leopoldii*)		40	TK84
C. trianae Linden & Rchb.f.	20	40	TK84
C. velutina Rchb.f.		40	TK84
C. walkeriana Gardn.		40	TK84, PW
C. walkeriana var. *princeps* L.C.Menezes		80	PW
C. warnerii T.Moore ex Warner		40	TK84
Cattleya warscewiczii Rchb.f. (as *C. gigas*)	20	40	TK84
Cattleya sp.		46, 56, 76	GJ91
Cattleyella araguiensis (Pabst) van den Berg		40	PW
Caularthron bicornutum (Hook.) Raf.	20	40	M73
Dimerandra emarginata (Meyer) Hoehne		40	G88, PW
D. stenopetala Schltr.		40	TK84
Encyclia advena (Rchb.f.) Porto & Brade		40	PW
Encyclia advena (as *E. megalantha*)		40	TK84
E. flava (Lindl.) Porto & Brade		40	PW
E. patens Hook. (as *E. odoratissima*)		40	TK84
E. oncidioides (Lindl.) Schltr.		40	PW
E. serroniana (Barb. Rodr.) Hoehne (as *E. odoratissima* var. *serroniana*)		40	TK84
E. tampensis (Lindl.) Small (as *Epidendrum tampense*)	20	40	TK84
Epidendrum angustatum (T.Hashim.) Dodson (as *Neolehmannia angustata*)		36	GJ94
Epidendrum appendiculatum T.Hashimoto		38	GJ94
E. avicula Lindl.		38, 40	TK84, G, J94, DA09, PW
E. avicule Lindl. (as *Lanium avicula*)		40	
E. blepharistes Barker ex Lindl. (as *E. funckii*)		40	GJ94
E. calanthum Rchb.f. & Warsc.		30	PI09
E. ciliare L.	20	40	TK84, G85
	20	40, 80, 160	TK84
E. cinnabarinum Salzm.	108–124	ca. 240	PW
E. cochlidium Lindl.		28	PI09
E. cooperianum Bateman (as *E. longispathum* Barb. Rodr.)		40	TK84
E. cristatum Ruiz & Pavon (as *E. raniferum* Lindl.)	20	40	TK84
E. denticulatum Barb. Rodr.		40	TK84, PI09
E. difforme Jacq.		39–40	TK84
		40	PW
E. diffusum Sw.	20	40	TK84
E. elipticum Grah.		56	TK84
		68	PW
E. elongatum Jacq.			
E. flexuosum G.Mey		24	PI09
E. fulgens Brongn.		28	PI09
E. fulgens Brongn. (as *E. mosenii*)		24	TK84
E. ibaguense Kunth		70	PI09
E. lanipes Lindl.		40	G85
E. latilabrum Lindl.		40	PW
E. loefgrenii Cogn.		40	TK84
E. magnoliae Muhl. (as *E. conopseum*)	20	40	TK84
E. myrmecophorum Barb. Rodr.		120	PI09
E. munroeanum		40	TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
E. nocturnum Jacq.	20		TK84
		ca. 80	TK84
		40, 80	TK84
		80	PW
Epidendrum nocturnum var. *guadeloupense*		42–48	TK84
E. obrienianum Rolfe		40	G81
E. paniculatum Barb. Rodr. (as *E. floribundum* Kunth)		40	TK84
E. patens Sw.		40	TK84
E. propiquum Rich. & Gall.		40	TK84
E. puniceoluteum F.Pinheiro and F.Barros		52	PI09
E. purpureum Barb. Rodr.		56	TK84
		120	PI09
E. radicans Pav.	19		M73
		40, 70	TK84
		60	PI09
E. rigidum Jacq.		40	TK84, PW
E. secundum Jacq.		28, 40, 48, 52, 68,	PI09
E. secundum Jacq. (as *E. brachyphyllum*)	30		TK84
E. secundum Jacq.		56	TK84
Epidendrum aff secundum (as *Epidendrum* aff. *brachyphyllum*)	14		TK84
E. xanthinum Lindl.		ca. 80	TK84
		40	G88
		28, 30, 60	PI09
Guarianthe aurantiaca (Bateman ex Lindl.) Dressler & W.E.Higgins (as *Cattleya aurantiaca*)		40	TK84
G. bowringiana (O'Brien) Dressler & W.E.Higgins (as *Cattleya bowringiana*)	20	40	TK84
Jacquiniella globosa (Jacq.) Schltr.		38	PW
Laelia albida Bateman ex Lindl.		42, ca. 63	TK84
L. anceps Lindl.		40	TK84
Laelia anceps subsp. *dawsonii* (J.Anderson) Rolfe (as *L. anceps* var. *sanderiana*)		40	TK84
L. autumnalis (Lex.) Lindl.		41, 42	TK84
L. gouldiana Rchb.f.		40, 60	TK84
L. peciosa (Kunth) Schltr. (as *L. grandiflora*)	20		TK84
L. marginata (Lindl.) L.O.Williams		40	PW
L. marginata (Lindl.) L.O.Williams (as *Schomburgkia crispa* Lindl.)		40	TK84
L. rubescens Lindl.	20	40	TK84
L. rubescens Lindl. (as *L. peduncularis*)		40–44	TK84
Leptotes unicolor Barb. Rodr.		40	TK84, DA09
Prosthechea brassavolae (Rchb. f.) W. E. Higgins (as *Epidendrum brassavolae*)	20	40	TK84
P. caetensis (Bicalho) W.E.Higgins		80	PW
P. calamaria (Lindl.) W.E.Higgins (as *Hormidium calamarium*)		40	TK84
P. campylostalix (Rchb. f.) W.E.Higgins (as *Epidendrum campylostalix*)	20	40	TK84
P. citrina (Lex.) W.E.Higgins (as *Cattleya citrina*)			
P. cochleata (L.) W.E.Higgins (as *E. cochleatum*)	20	40	TK84
P. fragrans (Sw.) W.E.Higgins		40	PW
P. fragrans (Sw.) W.E.Higgins (as *Hormidium fragrans*)		40	TK84
P. glumacea (Lindl.) W.E.Higgins (as *Hormidium glumaceum*)		40	TK84
P. lindenii (Lindl.) W.E.Higgins (as *E. lindenii*)		56	TK84
P. linkiana (Klotzsch) W.E.Higgins (as *Epidendrum linkianum*)	ca. 20		TK84
	20	40	TK84
P. mariae (Ames) W.E.Higgins (as *E. marieae*)		40	TK84
P. ochracea (Lindl.) W.E.Higgins (as *Epidendrum ochraceum*)	20	40	TK84
P. prismatocarpa (Rchb.f.) W.E.Higgins (as *Epidendrum prismatocarpum*)		40	TK84
P. vespa (Vell.) W E Higgins		40	PW
Prosthechea vespa (Vell.) W E Higgins (as *Hormidium variegatum*)		40	TK84
Psychilis atropurpurea (Willd.) Sauleda (as *Epidendrum atropurpureum*)	20	40	TK84
Rhyncholaelia digbyana (Lindl.) Schltr. (as *Brassavola digbyana*)		40	TK85
Scaphyglottis reflexa Lindl. (as *Hexisea reflexa*)	19	38	G85
S. prolifera (R.Br.) ex Lindl.) Cogn.		40	GJ94
S. fusiformis (Griseb.) R.E.Schult.		40	PW
Sophronitis briegeri (Blumensch. ex Pabst) Van den Berg & M.W.Chase (as *Laelia briegeri*)		80	TK84
S. caulescens (Lindl.) Van den Berg & M.W.Chase (as *Laelia calulescens*)		80	TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
S. cernua Lindl.		40	TK84, DA090
S. cinnabarina (Bateman ex Lindl.) Van den Berg & M.W.Chase (as *Laelia cinnabarina*)		40	TK84
S. crispata (Thunb.) Van den Berg & M.W.Chase (as *Laelia crispilabia*)		80	TK84
S. crispata (Thunb.) Van den Berg & M.W.Chase (as *Laelia flava*)		40	TK84
S. crispata (Thunb.) Van den Berg & M.W.Chase (as *Laelia rupestris*)		80	TK84
S. esalqueana (Blumensch. ex Pabst) Van den Berg & M.W.Chase (as *Laelia esalqueana*)		40	TK84
S. fournieri (Cogn.) Van den Berg & M.W.Chase (as *Laelia oestemayeri*)		40	TK84
S. harpophylla (Rchb. f.) Van den Berg & M.W.Chase (as *Laelia hapophylla*)		40	TK84
S. lobata (Lindl.) van den Berg & M.W.Chase		40	PW
S. longipes (Rchb. f.) Van den Berg & M.W.Chase (as *Laelia longipes*)		40, 60, 80	TK84
S. milleri (Blumensch. ex Pabst) Van den Berg & M.W.Chase (as *Laelia milleri*)		40	TK84
S. mixta (Hoehne) Van den Berg & M.W.Chase (as *Laelia mixta*)		40	TK84
S. perrinii (Lindl.) Van den Berg & M.W.Chase (as *Laelia perrini*)	20		TK84
S. pumila (Hook.) Van den Berg & M.W.Chase (as *Laelia pumila*)		40	TK84
S. purpurata (Lindl. & Paxton) van den Berg & M.W.Chase		40	PW
S. purpurata (Lindl. & Paxton) van den Berg & M.W.Chase (as *Laelia purpurata*)		40	M77
S. tereticaulis (Hoehne) Van den Berg & M.W.Chase (as *Laelia tereticaulis*)		80	TK84
TRIBE PODOCHILEAE			
Subtribe Eriinae			
Ceratostylis subulata Blume		40	G88
Cryptochilus lutea Lindl.	19		M73
C. sanguineus Wall.	19		M73
Eria acervata Lindl.		38	G85, G88, GJ91, GJ96
E. alba L.		40	G81
E. amica Rchb.f. (as *E. confusa*)	20		M77
	18		G88, GJ94
E. bambusifolia Lindl.	19	38	G81, GJ91
E. biflora Griff.	21	42	G81, G84
E. brachystachya Rchb.f.		44	TK84
E. bractescens Lindl.		40	TK84
		38	G88
E. bulbophylloidea Tang & Wang		42	GJ91, GJ96
E. clemensiae Leavitt		44	TK84
E. corneri Rchb.f.		36	TK84, G88
E. corneri Rchb. f. (as *E. yakuschimensis*)		36	TK84
E. coronaria (lindl.) Rchb.f.	18	36	M73, G88
E. crassicaulis Hook.f.	19		G81
E. crassipes Ridl. (as *E. reptans*)		40	TK84
		76	G88
E. cymbidifolia Ridl.		42 ± 2	TK84
E. dalzellii Lindl.		24 + 5–7B	TK84
		24 + 10B	G84
		24 + 5B	G84
		42	G84
E. excavata Lindl.	20		M73
		38	G84
E. exilis Hook.f.		38	TK84
E. feddeana Schltr.		38	G88
E. ferruginea Lindl.		38	G84
E. fitzalanii F.Muell. (as *E. solomonensis*)		38	G88
Eria floribunda Lindl.		44	TK84
		38	G88
E. floribunda Lindl. (as *E. giungii*)	20		TK84
E. gigantea Ames		66	TK84
E. graminifolia Lindl.	19	38	M73, G84
E. hyacintoides (Blume) Lindl.		38	G88
E japonica Maxim.(as *E. arisanensis*)		40	TK84
E. javanica (Sw.) Blume		36	G88
Eria lasiopetala (Willd.) Ormerod (as *E. flava*)		40	G81
		38	G84
E. microchilos Lindl.		24 + 5–11B	TK84, G84
E. muscicola Lindl.	18		G81

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
E. mysorensis Lindl.		38	TK84
E. ovata Lindl.		38	G88
E. ovata Lindl. (*E. luchensis*)	18	36	M77, TK84
E. ovata var. *retroflexa* (Lindl.) Garay & H.R.Sweet (as *E. nudicaulis*)		40	G85
E. pachystachya Lindl.		38	G88
E. paniculata Lindl.	19 + 0–2B		G81, GJ91
E. pannea Lindl.		38	G88, GJ91
E. philippinensis Ames		40	TK84
		38	TK84
E. queenslandica T.E.Hunt		38	G88
E. reticosa Wight		42	TK84
E. retusa (Blume) Rchb.f.		38	G88
E. ringens Rchb.f.		44	TK84
E. spicata (D.Don) Hand-Mazz.		38	G81, GJ94
E. spicata (D.Don) Hand-Mazz. (as *E. convallarioides*)	20		M73
	19	38	TK84, G88
E. stricta Lindl.		40	G88
E. tomentosa Hayata		38	G88
E. woodiana Ames		44	TK84
E. yakushimensis Nakai			
Eria sp.		38	G84
Eria sp.		38	GJ91
Eria sp.		38	GJ96
Mediocalcar agathodaemonis J.J.Sm.		38	G88
M. latifolium Schltr.			
M. paradoxum subsp. *latifolium* (Schltr.) Schuit. (as *M. latifolium*)		38	G88
M. aff. *pygmaeum*		85	G88
M. uniflorum Schltr. (as *M. sepikanum*)		38	G88
Porpax fibuliformis King & Pantl.		24	G85
P. jerdoniana (Wight) Rolfe		42	G84
P. meriax King & Pantl.	12		TK84
Pseuderia smithiana C.Schweinf.		40	GJ03
Trichotosia lagunensis (Ames) Schuit. & de Vogel (as *Eria lagunensis*)		44	TK84
T. pulvinata (Lindl.) Kraenzl. (as *Eria rufinula*)		38	G88
Subtribe Podochilinae			
Podochilus cultratus Lindl.	19		M73
Subtribe Thelasiinae			
Phreatia elegans Lindl.		32	G81
Thelasis capitata Blume		32	G88
TRIBE ARETHUSEAE			
Subtribe Arethusinae			
Anthogonium gracile Lindl.		42	M73
	20		M73
	19	38	M73, G84
Anthogonium sp.		42	G84
Arethusa bulbosa L.		40	G84
Arundina graminifolia (D.Don) Hochr.	20	40	M73, G81, G84, G85, GJ90
A. graminifolia (D.Don) Hochr. (as *A. bambusifolia*)	20	40	G84, G85
A. graminifolia (D.Don) Hochr. (as *A. chinensis*)		38	GJ91, GJ96
Arundina sp.	16	32	TK84
Arundina spp.		40	G84
Calopogon barbatus (Walter) Ames		42	M77
C. multiflorus Lindl.		42	M77
C. pallidus Chapm.		42	M77
C. pulchellus (Salisb.) R.Br.			
Calopogon tuberosus (L.) Britton, Sterns & Poggenberg		42	M77
C. tuberosus (L.) Britton (as *C. pulchellus*)	ca. 13	ca. 26	TK84
Eleorchis japonica (A.Gray) Maek.		40	M73
Subtribe Coelogyninae			
Bletilla formosana (Hayata.) Schltr.		36	M73
	18		TK84
B. hyacinthia	16		TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
B. striata (Thunb.) Rchb.f.	16	32	M73, TK84 G88, GJ90
		32, 64	GJ90
		32, 76	GJ91, GJ96
B. striata (Thunb.) Rchb.f. (as *B. striata* var. *albomarginata*)		32	TK84
Coelogyne barbata Griff.	20		M73, G84
C. beccarii Rchb.f.		40	G88
C. corymbosa Lindl.	20		M73
C. cristata Lindl.	20	40	M73, M77, G88, GJ94
C. fimbriata Lindl.	20 + 1f	40	G81, GJ90, GJ91, GJ96
C. flaccida Lindl.	20	40	M73, G84, G85
C. fragrans Schltr.		40	G88
C. fuscescens Lindl.	20	40	M73, G85, GJ06
C. longipes Lindl.	20	40	M73, G84, GJ91
C. macdonaldii F.Muell. & Kraenzl.		40	GJ03
C. macdonaldii (as *C. lamellata*)		40	G88
C. micranta Lindl.	21		M77
C. nitida Lindl.	20		G85
C. nitida (Wall. ex D.Don) Lindl. (as *C. ochracea*)	20		M73, G85
C. ocultata Hook.f.	20		M73
		38	G81
C. ovalis Lindl.	20	40	M73, G84 G88, GJ90, GJ94
		80	GJ96
C. prolifera Lindl.	20		M77
C. prolifera Lindl. (as *C. flavida*)	20		M73
C. punctulata Lindl.	19 + (0–2B)	38	M77, GJ91, GJ96
C. speciosa (Blume) Lindl. (as *Pleione speciosa*)		80	GJ91
C. stricta (D.Don) Schltr. (as *C. elata*)	20		M73
C. viscosa Rchb.f.		40	G88
Dendrochilum longifolium Rchb.f. (as *D. bartonii* (Ridl.) Schltr.)		38	G88
D. uncatum Rchb.f. (as *D. formosanum*)		30	M74
Neogyna gardneriana (Lindl.) Rchb.f. (as *Coelogyne gardneriana*)	21		M77
Otochilus albus Lindl.	20		M73
O. fuscus Lindl.	20	40	M73, G85
O. porrectus Lindl.	20	40	M73, G85, G88
Panisea demissa (D.Don) Pfitzer (as *P. parviflora* Rchb.)		40	G85
P. tricallosa Rolfe		40	GJ91
P. uniflora (Lindl.) Lindl. (as *Coelogyne uniflora*)	20		M73
Pholidota articulata Lindl.	20 + O-3B	40	M73, TK84, GJ96
		38	GJ96
P. articulata Lindl. (as *P. articulata* var. *griffithii* Lindl.)	20		G81, GJ91
P. articulata Lindl. (as *P. griffithii* Hook.)		40	G85
P. chinensis Lindl.		40	M73
P. imbricata Lindl. (as *P. conchoidea*)	20		TK84
P. imbricata (Roxb.) Lindl.	20	40	M73, G84, GJ94
P. imbricata Lindl. (as *P. calceata*)		40	G85
P. pallida Lindl.		40	G84
P. protracta Hook.f.	20	40	M73, G85
P. recurva Lindl.	20		M73, TK84
P. rubra Lindl.		40	G85
Pleione bulbocodioides (Franch.) Rolfe		40	G88, GJ91, GJ96
P. bulbocodioides (Franch.) Rolfe (as *P. pogonioides*)		80	M73
P. coronaria P.J.Cribb & C.Z.Tang		40	GJ96
P. formosana Hayata		40 + 0–2B	M73, GJ90, GJ91
		40	GJ06
P. formosana Hayata (as *P. priscei*)		38, 40, 42	GJ91, GJ96
P. forrestii Schltr.		40	M73, GJ91
P. hookeriana (Lindl.) B. S. Williams	20	40	M73, G84, GJ91
Pleione humilis Lindl.	20	40 + 0–1B	M73, G84, GJ91
P. limprichtii Schltr.		40, 80	M73, GJ91
P. maculata Lindl.		40	M73, G84, GJ91
P. praecox Lindl.	20	40	M73, G84, GJ91, GJ94
	20 + 0–3B		G81
P. scopulorum W.W.Sm.		40	GJ91

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
P. yunnanensis (Rolfe) Rolfe		40	GJ91, GJ96
Thunia alba Rchb.f.	20	40	M73, GJ90, GJ94
	ca. 40		G81
		ca. 40	G85
T. alba Rchb.f. (as *T. marshalliana* Rchb.f.)	20		M73
		38	G81
T. alba (Lindl.) Rchb.f. (as *Phaius albus*)		42	G84
		40	G85
T. alba var. *bracteata* (Roxb.) N.Pearce & P.J.Cribb (as *T. venosa* Rolfe)	20		G81
TRIBE VANDEAE			
Subtribe Polystachyinae			
Polystachya adansoniae Rchb.f.		40	M73, G84
P. affinis Lindl.		40	M73, G84
P. albescens Summerh.		40	M73
P. albescens subsp. *imbricata* (Rolfe) Summerh.		ca. 40	TK84
P. bancoensis Van der Burg		40	G84
P. bennettiana Rchb.f. (as *P. stricta*)		40	TK84
P. caespitifica subsp. *hollandii* (L. Bolus) P.J.Cribb & Podz. (as *P. holandii*)		40	TK84
P. caloglossa Rchb.f.		40	M73
P. campyloglossa Rolfe		ca. 80	TK84
P. concreta (Jacq.) Garay & H.R.Sweet (as *P. extinctoria*)	40	80	TK84
P. cooperi Summerh.		40	TK84
P. coriscensis Rchb.f.		40	M73
P. cultriformis Lindl.		38, 39	TK84
P. dendrobiiflora Rchb.f. (as *P. tayloriana*)		40	TK84
P. doggettii Rendle & Rolfe		81	TK84
P. dolichophylla Schltr.		40	M73
P. estrellensis Rchb.f.		80	TK84, PW
P. eurygnatha Summerh.		40	TK84
P. falax Kraenzl.		40	TK84
P. foliosa (Hook.) Rchb.f. (as *P. clavata*)		ca. 80	TK84
P. fulvilabia Schltr.		40	TK84
P. fusiformis Lindl.		ca. 40	TK84
P. galeata (Sw.) Rchb.f.		40	M73, G84, TK84
P. isochiloides Summerh.		40	TK84
P. laxiflora Lindl.		40	M73, TK84
P. mauritiana Spreng. (as *P. tessellata*)		40	TK84
P. modesta Rchb.f.		ca. 40	TK84
P. mukandaensis De Wild.		40	M73
P. nyanzoensis Rendle		40	M73
P. odorata Lindl.		40, 80	M73
		40	TK84
P. polychaete Kraenzl.		40	M73, G84
	ca. 20		TK84
P. pubescens Rchb.f.		ca. 120	TK84
P. ramulosa Lindl.		40	M73, TK84
P. rhodoptera Rchb.f.		40, 41	M73
	19		TK84
P. ruwenzoriensis Rendle		40	TK84
P. stauroglossa Kraenzl.		40	TK84
P. stuhlmanii Kraenzl.		40	TK84
P. subulata Finet		40	TK84
P. supfiana Schltr.		40	M73
P. transvaalensis Schltr.		40	TK84
P. zambesiaca Rolfe (as *P. hislopii*)		80	TK84
Polystachya sp.		40	M73
Subtribe Aeridinae			
Acampe ochracea (Lindl.) Hochr.		38	TK84, G88
A. pachyglossa Rchb.f.		38	G85
A. praemorsa (Roxb.) Blatter & McCann		38	TK84
A. praemorsa (Roxb.) Blatt. & McCann (as *A. papillosa*)		38	M73
	18	36	G81, GJ94
	18, 19		TK84
Acampe praemorsa (Roxb.) Blatter & McCann (as *A. wightiana*)		38	TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
A. praemorsa (Roxb.) Blatter & McCann (as *Saccolabium papilosum*)		38	M73
A. rigida Buch.-Ham. ex Sm.) P.F.Hunt	19		G85
A. rigida (Buch.-Ham. ex Sm.) P.F.Hunt (as *A. longifolia*)	19	38	G81, TK84
A. rigida (Buch.-Ham. ex Sm.) P.F.Hunt (as *Aerides rigida*)	19		G84
A. rigida (Buch.-Ham. ex Sm.) P.F.Hunt (as *Saccolabium longifolium*)	19		M73
Aerides crassifolia Par & Rchb.f.		38	TK84
A. crispa Lindl.	19	38	TK84, G85
*A. falcata*Lindl. & Paxt.	19	38	TK84
A. houlettiana Rchb.f.			
A. lawrenceae Rchb.f.		40	TK84
	19	38	TK84
A. maculosa Lindl.		38	M73, TK84, G84
A. multiflora Roxb.	19	38	M73, TK84
A. multiflora Roxb. (as *A. affine*)		38	G85
A. odorata Lour.	19	38	M73,TK84, G85, GJ94
A. odorata Lour. (as *A. suavissima*)		ca. 38	M73
		38	TK84
A. odorata Lour. (as *A. odorata* var. *immaculata*)		76	TK84
A. ringens Fischer		38	TK84
A. rosea Lodd. ex Lindl. & Paxton (as *A. fieldingii*)		38	G85
A. rosea Lodd. ex Lindl. & Paxton (as *A. williamsii*)		38	M73, G88
Arachnis labrosa (Lindl. & Paxton) Rchb.f. (as *Armodorum labrosum*)		38	G88
Ascocentrum ampulaceum (Roxb.) Schltr.		38	M73
A. curvifolium (Lindl.) Scltr.		38	M73
A. himalaicum (Deb, Sengupta & Malick) Christenson (as *Holcoglossum junceum*)		38	GJ96
A. miniatum (Lindl.) Schltr.		38, ca. 38	M73
A. rubescens (Rolfe) P.F.Hunt (as *Saccolabium rubescens*)	19–20		TK84
Biermannia bimaculata (King & Pantl.) King & Pantl.	18		G81
Calymmanthera major Schltr.		38	G88
C. paniculata J.J.Sm.		38	G88
Chilochista lunifera J.J.Sm.		38	TK84
C. usneoidese (Don) Lindl.		38	M73
C. lunifera (Rchb.f.) J.J.Sm. (as *Sarcochilus luniferum*)	19		M73
Cleisostoma appendiculata (Hook.f.) (as *Sarcanthus appendiculatus*)		38	M73, TK84
C. discolor Lindl. (as *Sarcanthus termissus*)		38	M77
C. duplicilobum (J.J.Sm.) Garay (as *Sarcanthus. carinatum*)		38	M73
C. filiforme (Lindl.) Garay (as *S. filiformis*)	19		M73
C. fuerstenbergianum Kraenzl. (as *Sarcanthus flagelliformis*)		38	M73
C. paniculatum (Ker Gawler) Garay		38	GJ91
C. peninsularis (Dalz.) (as *S. peninsularis*)		38	G81, G85
C. recemiferum (Lindl.) Garay		38	G88
C. recemiferum (Lindl.) Garay (as *S. recemiferum*)	19		G81
Cleisostoma racemiferum (Lindl.) Garay (as *Sarcanthus palidus*)		38	M73
C. recurvum (Hook.) ined. (as *C. rostratum*)		38	GJ91
C. striathum (Rchb.f.) Garay	19, 20		TK84
C. striatum (Rchb.f.) N. E. Br. (as *Cleisostoma brevipes*)	36		M77
C. strongyloides (Ridl.) Garay as (*S. strogyloides*)		38	M73
C. subulatum (Blume) as (*S. subulatus*)	19	38	M73, G88
C. williamsonii (Rchb.f.) Garay (as *S. williamsonii*)	19		M77
Cleisostoma sp. as (*Sarcanthus* sp.)		38	TK84
Cleisostomopsis eberhardtii (Finet) Seidenf. (as *Saccolabium eberhardtii*)	19–20		TK84
Cottonia peduncularis (Lindl.) Rchb.f.	19	38	G88, GJ90
C. peduncularis (Lindl.) Rchb.f. (as *C. macrostachya*)		40	G84
Diplocentrum congestusm Wight	19	38	TK84, G88, GJ90
D. recurvum Lindl.		38	TK84
Diploprora championii (Lindl.) Hook.f. (as *D. uraiense*)		16	M74
Drymoanthus adversus (Hook.f.) Dockrill		76	D07
D. flavus St.George & Molloy		38	D07
D. minimus (Schltr.) Garay		38	D07
Esmeralda clarkei Rchb.f. (as *Arachnis clarkei*)		42	GJ91, GJ96
Euanthe sanderiana (Rchb.f.) Schltr. (as *Vanda sanderiana*)	19	38	TK84
Gastrochilus calceolaris (Sm.) D.Don	19	38	M73, GJ94
G. dasypogon (Lindl.) Ktze.		38	M73
G. dasypogon (as *Saccolabium dasypogon*)		38	TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
G. distichus (Lindl.) Kuntze (as *Saccolabium distichum*)	19		M73
G. inconspicuus (Hook.f.) Kuntze (as *L. inconspicua* Hook.f.)	19		M73, G85, G88
G. intermedius (Griff. ex Lindl.) Kuntze (as *Saccolabium calceolare*)	38		M73
G. japonicus Schltr.		40	TK84
		38	TK84
G. japonicus (Makino) Schltr. (as *G. somai*)		30	M74
G. maculatus Kuntze			
G. matsuran (Makino) Schltr.		34	TK84
G. pseudodistichus (King & Pantl.) Schltr. (as *Saccolabium pseudodistichus*)	19		M73
Gunnarella robertsii (Schltr.) Senghas (as *Chamaeanthus robertsii*)		38	G88
Holcoglossum amesianum (Rchb.f.) Christenson (as *Vanda amesiana*)		38	TK84
H. kimballianum (Rchb.f.) Garay (as *V. kimballiana*)		38	TK84
Hygrochilus parishii (Veitch & Rchb.f.) Pfitzer (as *Vanda parishii*)	19	38	M73, TK84
Luisia boninensis Schltr.		40	TK84
L. brachystachys (Lindl.) Blume	20		M73
L. liukiuensis Schltr.		38	M73
L. macrantha Blatt. & McC.		38	TK84, G88
L. tenuifolia Blume	19	38	TK84, G88
L. tenuifolia (as *L. tenuifolia* var. *evangelinae*)		38	G88
L. teres Blume (= *L. teretifolia*)	18		TK84
L. trichorhiza Blume	19	38	M73, G81, G88
L. tristis (G. Forst.) Hook.f. (as *L. teretifolia*)	19	38, ca. 38	M73, G88
L. volucris Lindl.	19		G85
Micropera mannii (Hook.f.) Tang & F.T.Wang (as *Sarcochilus manni*)		38	G85
M. rostrata (Roxb.) N.P.Balakr. (as *Sarcochilus purpureus*)		38	M73, TK84
Neofinetia falcata (Thunb.) Hu		38	TK84
Ornithochilus difformis (Wall. ex Lindl.) Schltr. (as *Ornithochilus fuscus* Wall.)	19	38	G81, TK84, G88
Papilionanthe biswasiana (Ghose & Mukerjee) Garay (as *Aerides biswasianum*)	19		M73
P. hookeriana (Rchb.f.) Schltr. (as *Vanda hookeriana*)	19	38	TK84
P. teres (Roxb.) Schltr.		38	G88
P. teres (Roxb.) Schltr. (as *Vanda teres*)	19	38	TK84, G85
		40	GJ91, GJ96
Papilionanthe tricuspidata (J.J.Sm.) Garay (as *Vanda tricuspidata*)		76	TK84
P. uniflora (Lindl.) Garay (as *A. longicornu*)	19	38	M73, G85
Papilionanthe vandarum (Rchb.f.) Garay (as *Aerides vandarum*)		38	G85
Paraphalaenopsis denevei (J.J.Sm.) A.D.Hawkes		38	G84
P. serpentilingua (J.J.Sm.) A.D.Hawkes		38	G84
Pelatantheria ctenoglossa Ridl.		38	M73
P. scolopendrifolia (Makino) Aver. (as *Sarcanthus scolopendrifolium*)		38	TK84
Phalaenopsis amabilis Blume	19	38	M73, G81, TK84
P. amabilis var. *grandiflora*		38	TK84
P. amboinensis T.J.Sm.	19	38	M73, G81
P. aphrodite Rchb.f.	19	38	M73, G81
P. buyssoniana Rchb.f. (as *Doritis bruysoniana*)		76	TK84
P. cornu-cervi Blume & Rchb.f.		38	G81
P. deliciosa Rchb.f. (as *Doritis wightii*)	19		M73
P. equestris Rchb.f. (=*P. rosea*)	19	38	M73, G81
P. equestris (Schauer) Rchb.f. (as *P. rosea*)	19		G81
P. esmeralda Rchb.f. (=*Doritis pulcherrima*)	19	38	TK84
P. fuscata Rchb.f.		38	G81
P. gigantea J.J.Sm.		38	G81
P. lindenii Loker		38	TK84
P. luedemanniana Rchb.f.	19	38	M73, G81
P. luedemanniana var. *boxallii*		38	G81
P. luedemanniana var. *ochracea*		38	G81
P. mannii Rchb.f.	19	38	M73, G81
P. mannii Rchb.f. (as *P. boxallii*)		38	TK84
P. mariae Burbidge		38	G81
P. parishii Rchb.f.		38	G81
P. parishii Rchb.f. (as *P. decumbens*)		38	TK84
P. pulcherrima (Lindl.) J.J.Sm. (as *Doritis pulcherrima*)	19	38	TK84
P. pulcherrima var. *buyssoniana*		76	TK84
P. sanderiana Rchb.f.	19	38	M73, G81
P. schilleriana Rchb.f.		38	G81, TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
P. speciosa Rchb.f.		38	G81
P. stuartniana Rchb.f.	19	38	M73, G81
P. taenialis (Lindl.) Christenson & Pradhan (as *Doritis taenialis*)		40	M73, G81, GJ94
P. tetraspsis Rchb.f.		38	G81
P. violacea Teijsm. & Binn.		38	G81
Pomatocalpa marsupiale (Kraenzl.) J.J.Sm.		38	G88
P. kunstleri (Hook.f.) J.J.Sm. (as *Sarcanthus kunstleri*)		38	TK84
P. spicatum Breda (as *Cleisostoma mannii*)		38	G85
Pteroceras longicalcareum (Ames & Rolfe) Garay (as *Sarcochilus longicalcareum*)		38	TK84
P.teres (Blume) Holttum (as *Sarcochilus palawanensis*)		38	TK84
Renanthera coccinea Lour.		38	TK84, GJ96
R. elongata Lindl.	19	38	TK84
R. histrionica Rchb.f.	19	38	TK84
R. imschootiana Rolfe	19		TK84
R. matutina Lindl.	19	38	TK84
R. monachica Ames	19	38	TK84
R. storiei Rchb.f.	19	38	M73, TK84
Rhynchostylis coelestis Rchb.f.		38	M73
R. gigantea Ridl.		38	TK84
R. gigantea (as *Saccolabium albo-lineatum*)	19–20		TK84
R. gigantea (as *V. densiflora*)		38	TK84
R. retusa (L.) Blume	19	38	G81, TK84, G88,
Robiquetia bertoldii (Rchb.f.) Scltr.		38	GJ03
R. bertoldii (as *R. mimus* (Rchb.f.) Garay)		38	G88
R. mooreana (Rolfe) J.J.Sm.		38	G88
R. spathulata (Blume) J.J.Sm.		38	TK84
R. succisa (Lindl.) Seidenf. & Garay (as *R. paniculata*)		38	M73
R. wassellii Dockr.		38	G88
Sarcochilus fitzgeraldii F.Muell.		76	GJ96
S. hartmannii F.Muell.		38	D07
Schoenorchis gemmata (Lindl.) J.J.Sm. (as *Cleisostoma gemmatum*)	20		TK84
Sedirea japonica (Rchb.f.) Garay & H.R.Sweet (as *Aerides japonica*)		38	M73
Schoenorchis gemmata (Lindl.) Sm.		38	G88
S. micrantha Reinw. ex Blume (as *Ascocentrum micranthum*)	19	38	G81, M73
Seidenfadenia mitrata (Rchb.f.) Garay (as *Aerides mitrata*)		38	M73
Smitinandia micrantha (Lindl.) Holttum		38	G88
S. micrantha (Lindl.) Holttum (as *Cleisostoma micranthum*)	19	38	TK84, G88, GJ94
Smithsonia maculata (Dalzell) C.J.Saldanha (as *Gastrochilus maculatus*)		38	GJ90
S. viridiflora (Dalzell) C.J.Saldanha (as *Gastrochilus dalzelianus*)		38	GJ90
Staurochilus fasciatus (Rchb.f.) Ridl. (as *Trichoglottis fasciata*)		38	M73
Stereochilus erinaceus (Rchb.f.) Garay (as *Sarcanthus erinaceus*)		38	TK84
Taeniophyllum crepidiforme King. & Pantl.	19		TK84
T. elmeri Ames		40	TK84
T. fasciola (G.Forst.) Rchb.f.		56	G88
T. glandulosum Blume (as *T. aphyllum*)		38	TK84
T. philippinensis Rchb.f.		40	TK84
Thrixspermum acuminatissimum (Blume) Rchb.f.		38	M73
T. carinatifolium Ridl.		38	G88
T. centipeda Lour.		38	GJ96
T. graeffei Rchb.f.		38	G88
T. japonicum Rchb.f. (as *Sarcochilus japonicum*)		38	TK84
T. pygmaeum (King & Pantl.) Holttum (as *Sarcochilus pigmaeum*)	19		G81
Trichoglottis cirrhifera Teijsm. & Binn.		38	M73
T. rosea (Lindl.) Ames		38	M73
T. tenera (Lindl.) Rchb.f. (as *Saccolabium tenerum*)		ca. 38	M73
T. triflora (Guillaumin) Garay & Seidenf. (as *Saccolabium triflorum*)	19–20		TK84
. *kotoense* Yamam. (as *Saccolabium kotoense*)		30	M74
T. rhopalorrhachis (Rchb.f.) J.J.Wood (as *Saccolabium rhopalorrhachis*)		38	G88
Uncifera obtusifolia Lindl.	19		G84
U. obtusifolia (as *Saccolabium obtusifolia*)	19		M73
Uncifera sp.		38	TK84
Vanda alpina Lindl.	19	38	TK84, G85
V. coerulea Griffith	19	38	TK84, G85, GJ91, GJ96

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
V. coerulescens Griff.	19	38	M73, TK84, GJ91, GJ96
V. concolor Blume		76	TK84
		38, 76	GJ91, GJ96
V. cristata Lindl.	19	ca. 38, 38	M73, G81, TK84, G85, GJ00
			GJ00
V. dearei Rchb.f.		38	TK84
V. denisoniana Benson & Rchb.f.		38, 76	TK84
V. denisoniana (as *V. denisisoniana* var. *hebraica* Rchb. f.		76	GJ91, GJ96
V. flabellata (Rolfe ex Downie) Christenson (as *Aerides flabellata*)		38	TK84, GJ91, GJ96
V. lamellata Lindl.		38	TK84
V. lamellata var. *boxallii* Rchb.f.	19	38	TK84
V. lilacina Teijsm. & Binn. (as *V. laotica*)		38	TK84
V. luzonica Loher ex Rolfe	19	38	TK84
V. pumila Hook.f.		38	GJ91, GJ96
V. spatulata Spreng.	38	76	TK84, G88
		114, 115	TK84
V. stangeana Rchb.f.	19	38	M73, G85, G88
V. subconcolor Tang & Wang		38	GJ91, GJ96
V. tessellata (Roxb.) Hook.		38	TK84
V. tessellata (Roxb.) Hook. ex G.Don (as *V. roxburghii*)	19	38	G81, TK84, G85
V. testacea (Lindl.) Rchb.f.	19	38	M73, GJ90
V. testacea (Lindl.) Rchb.f. (as *A. wrightiana*)		38	M77
V. testacea (Lindl.) Rchb.f. (as *V. parviflora*)	19	38	G81, G88, G85, GJ94
V. tricolor Lindl.	19	38	TK84
V. tricolor Lindl. (as *V. suavis*)		38	TK84
V. tricolor var. *suavis*	19	38	TK84
Vanda sp.		38	GJ96
Vanda sp.		57	GJ96
Vandopisis gigantea (Lindl.) Pfitzer		38	M73
V. lisochiloides Pfitzer		38	TK84
V. undulata (Lindl.) J.E.Sm.	19	38	G84, GJ06
V. undulata (Lindl.) J.J.Sm. as *Stauropsis undulatum*)		38	GJ96
Subtribe Angraecinae			
Angraecum aichlerianum Kraenzl.		38	M73
A. aporoides Summerh.		48	G85
A. arachnites Schltr.		38	M73
A. bancoense Burg		50	G50
A. birrimense Rolfe		38	G84
A. calceolus Thouars		38	M73, G85
A. calceolus Thouars (as *A. onocentrum*)		38	M73
A. caricifolium Perrier		38	G85
A. compressicaule H.Perrier		42–48	TK84
A. cultriforme Summerh.		38	G85
A. distichum Lindl.		50	G84
A. doratophyllum Summerh.		92	G85
A. eburneum Bory		40	TK84
Angraecum eburneum subsp. *giryamae* (Rendle) Senghas & P.J.Cribb (as *A. giryamae*)		38	M73
A. eichlerianum Kraenzl.		38	TK84, GJ91
A. erectum Summerh.		63	M73
		42	G85
A. gabonens Summerh.		46	G85
A. guillauminii H.Perrier		50	TK84
A. infundibulare Lindl.		38	M73
A. leonis (Rchb.f.) Vietch		38	G85
		40	TK84
A. moandense De Wild. (as *A. chevaleri*)		ca. 38	M73
A. multinominatum Rendle		42	M73
A. podochiloides Schltr.		50	G85
A. pungens Schltr.		46	G85
A. sacciferum Lindl.		ca. 76	M73
A. scottianum Rchb.f.		38	M73

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
A. sesquipedale Thouars		38	G85
A. subulatum Lindl.		50	G84
Calyptrochilum christianum (Rchb.f.) Summerh.		38	G84
C. emarginatum (Sw.) Schltr.		38	G84
Campylocentrum amazonicum Cogn.		80	PW
C. crassirhizum Hoehne		38	PW
C. neglectum (Rchb.f. & Warm.) Cogn.		38	DA09
C. pernambucense Hoehne		38	PW
Cryptopus elatus (Thouars) Lindl.		95	M73
		76	G85
Dendrophylax monteverdi (Rchb.f.) Ackerman & Nir (as *Campylocentrum moteverdii*)		44	G88
Jumellea walleri (Rolfe) la Croix (as *Jumellea filicornoides*)		38–40	M73
Listrostachys pertusa (Lindl.) Rchb.f.		46	G84
Oeoniella stachys Schltr.		38	TK84
Subtribe Aerangidinae			
Aerangis biloba (Lindl.) Schltr.		50	M73
A. biloba (Lindl.) Schltr. (as *Angraecum bilobum*)	25	50	TK84
A. brachycarpa (A.Rich.) Durand & Schinz		50	G85
A. calantha (Schltr.) Schltr.		46	G85
A. citrata (Thouars) Schltr.		ca. 50, ca. 50	M73, G85
A. collum-cygni Summerh. (as *A. compta*)		51	M73
A. cryptodon Rchb.f.		50	G85
A. kirkii (Rchb.f.) Schltr.		52	G85
A. kotschyana (Rchb.f.) Schltr.		50, ca. 50	M73
A. luteoalba var. *rhodosticta* (Kraenzl.) J. Stewart		42	G85
Aerangis luteoalba var. *rhodosticta* (Kraenzl.) J.Stewart (as *A. rhodosticta*)		42	M73, G85
A. modesta (Hook.f.) Schltr. (as *Angraecum sanderianum*)	25		TK84
A. somalensis (Schltr.) Schltr.		54	G85
A. ugandensis Summerh.		ca. 50, 50	M73, G85
Aerangis sp.		50, ca. 50, 200	M73
Ancistrorhynchus capitatus (Lindl.) Summerh.		72	G85
A. clandestinus (Lindl.) Schltr.		48	M73, G85
A. crystalensis Crib & Van der Lan		48	GJ91
A. metteniae (Kraenzl.) Summerh.		48	G85
A. ovatus Summerh.		48	G85
Ancistrorhynchus recurvus Finet		ca. 50	M73
A. straussii (Schltr.) Schltr.		48	GK91
A. tenuicaulis Summerh.		48	GJ91
Ancistrorhynchus sp.		96	G85
Angraecopsis amaniensis Summerh.		48	G88
A. breviloba Summerh.		50	M73
A. gracillima (Rolfe) Summerh.		50	G85
A. pusilla Summerh.		50	G85
A. trifurcata Schltr.		50	GJ91
Bolusiella batesii (Rolfe) Schltr.		50	G84
Chamaeangis odoratissima (Rchb.f.) Schltr.		50	M73, G85
C. vesicata (Lindl.) Schltr.		95–100	M73
Cribbia brachyceras (Summerh.) Senghas (as *Rangaeris brachyceras*)		50	M73, G85
Cyrtorchis arcuata (Lindl.) Schltr.		ca. 150	M73
C. arcuata subsp. *arcuata* (as *C. arcuata* subsp. *variabilis*)		46	G85, GJ91
C. arcuata subsp. *whytei* (Rolfe) Schltr.		138	G85
C. aschersonii (Kraenzl.) Schltr.		46	G84
C. brownii (Rolfe) Schltr.		46	G85
C. chailluana (Hook.f.) Schltr.	22–23		TK84
C. hamata (Rolfe) Schltr.		46	G84
C. monteiroae (Rchb.f.) Schltr.		46	G85
C. praetermissa Summerh.		46, 92	G85
C. ringeus (Rchb.f.) Summerh.		46	G85
Cyrtochis spp.		46, 50	M73
Diaphananthe fragrantissima (Lindl.) Schltr.		50	G85

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
D. pellucida (Lindl.) Schltr.		50	G85, GJ91
D. plehniana (Schltr.) Schltr.		50	M.73
Diaphananthe sp.		ca. 50	M73
Diaphananthe sp.		50	GJ91
Eggelingia gabonensis Cribb & Van der Lan		46	GJ91
Eurychone rothschildiana (O' Br.) Schltr.		50	M73, GJ91
Microcoelia bispiculata L.Jonsson		48	G84
M. bulbocalcarata L.Jonsson		48	G84
M. caespitosa (Rolfe) Summerh.		48	G84
M. exilis Lindl.		48	G84, G85, G88, GJ91
M. gilpinae (Rchb.f. & S.Moore) Summerh.		48	G84
M. globulosa (Hochst.) L.Jonsson		48	G84
M. hirschbergii Summerh.		48	G84
M. koeleri (Schltr.) Summerh.		48	G84
M. macrantha (H.Perr.) Summerh.		48	G84
M. macrorhynchia (Schltr.) Summerh.		48	G85
M. megalorrhyza (Rchb.f.) Summerh.		48	G88
M. obovata Summerh.		48	G84
M. physophora (Rchb.f.) Summerh.		48	G84
M. stolzii (Schltr.) Summerh.		48	G84, G88
Microterangis hildebrandtii (Rchb.f.) Senghas (as *Chameangis hildebrandtii*)		50	G85
Mystacidium capense (L.f.) Schltr.		48	G85
Podangis dactyloceras (Rchb.f.) Schltr.		46	GJ91
Rangaeris amaniensis (Kraenzl.) Summerh.		92	GJ91
R. musicola (Rchb.f.) Summerh.		ca. 100	M73
R. rhipsalisocia (Rchb.f.) Summerh.	54II	ca. 108	M73
		46	G84
Rhipidoglossum brevifolium Summerh. (as *Diaphananthe brevifolia*)		50	G85
R. cuneatum (Summerh.) Garay (as *Diaphananthe cuneata*)		ca. 50	M73
R. densiflorum Summerh. (as *Diaphananthe densiflora*)		50	M73
R. pulchellum (Summerh.) Garay (as *Diaphananthe pulchella*)		50	G85
R. rutilum (Rchb.f.) Schltr. (as *Diaphananthe rutila*)		100	M73, G85
R. xanthopollinium (Rchb.f.) Schltr. (as *Diaphananthe xanthopollinia*)		50	G85
Solenangis clavata (Rolfe) Schltr.		50	G84
S. scandens (Schltr.) Schltr.		50	G84
Sphyrarhynchus achiliebenii Mansf.		50	GJ91
Tridactyle anthomaniaca (Rchb.f.) Summerh.		ca. 100	M73
T. tridactylites (Rolfe) Schltr.		ca. 100	M73
Tridactyle sp.		ca. 50	M73
UMPLACED SUBTRIBES			
Subtribe Agrostophyllinae			
Agrostophyllum brevipes King & Pantl.	20		M73
A. callosum Rchb.f.	20	40	M73, G85
		38	TK84
A. myrianthum King & Pantl	20		M73
A. planicaule (Wall. ex Lindl.) Rchb.f. (as *A. khasianum*)	20	40	M73, G85
A. uniflorum Schltr.		38	G88
Earina aestivalis Cheeseman		40	D07
E. autumnalis (G.Forst.) Hook.f.		40	D07
E. mucronata Lindl.		40	D07
Glossorhyncha chlorantha van Royen		40	G88
G. macdonaldii Schltr.		40	GJ06
Subtribe Dendrobiinae			
Bulbophyllum acuminatum (Ridl.) Ridl. (as *Cirrhopetalum acuminatum*)		38	TK84
B. aff. *acuminatum*		38	G88
B. acutibracteatum var. *rubrobrunneopapillosum* (De Wild.) J.J.Verm. (as *B. fuscoides*)		ca. 38	M73
B. acutissepalum De Willd.		38	G88
B. adenopetalum Lindl.		38	M73
B. aeolium Ames		40	TK84
B. andersonii J.J.Sm. (as *C. andersonii*)		38	TK84
B. affini Lindl.		36	TK84
	20		M73

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
B. alagense Ames		40	TK84
B. ambrosia (Hance) Schltr.		38	G88, GJ91, GJ96
B. andersonii Kurz.		38	G85
B. anteniferum Rchb.f.		40	TK84
B. apodum Hook.f.		38	M73
B. apodum Hook.f. (as *B. ebulbum*)		38	G85
B. argyropus (Endl.) Rchb.f. (as *Adelopetalum argyropus*)		36	D07
B. aurantiacum F.Muell.		38	G85
B. auratum Rchb.f.	20		TK84
B. aureolabellum T.P.Lin (as *C. gracillimum*)		ca. 38	TK84
B. baileyi F.Muell.		38	G85
B. barbigerum Lindl.		38	M73, G85
B. biantennatum Schltr.		38	G85
B. biflorum Teijsm. & Binn.,		38	G88
B. bisetum Lindl.		40	G84
B. boninense J.J.Sm. (as *C. boninense*)		20	TK84
B. braccatum Rchb.f.	20		TK84
B. caespitosum Thou (as *B. Caespitosum*)	20		TK84
B. canlanoense Ames		40	TK84
B. caulflorum Hook.f.	21		TK84
B. careyanum Spreng.	19 + 0–1B	38	M73, TK84
B. cauliflorum Hook.f.	21		G81
B. cerinum Schltr.		38	G88
B. clandestinum Lindl. (as *B. sparsifolium*)		38	G85
B. clavatum Thouars		38	G88
B. cochleatum var. *tenuicaule* (Lindl.) J.J.Verm. (as *B. tenuicaule*)	19	38	TK84
B. cocoinum Bateman ex Lindl.		38	M73, G85
B. congolanum Schltr.		38	M73, G85
B. cornutum Ridl.		38	TK84
B. cornutum (as *C. cornutum*)	19		TK84
B. crassifolium Thouars		38	G88
B. crassipes Hook.f.		38	G88
B. cribbianum Toscano		38	PW
B. cumingii (Lindl.) Rchb.f.		40	TK84
B. cumingii (Lindl.) Rchb.f. (as *C. cumingii*)		38	TK84
B. cumingii (Lindl.) Rchb.f. (as *C. stramineum*)		38–40	TK84
B. cylindraceum Lindl.	19		G84
	20		M73
B. daloaense Cribb & Perez-Vera		38	G85
B. denisii J.J.Wood.		38	G88
B. densiflorum Rolfe	19		M73
B. drymoglossum Maxim.		40	TK84
B. elassonotum Summerh.		38	G85
B. elliottii Rolfe (as *B. malawiense*)		38	G85
Bulbophyllum elisae F.Muell.		38	G88
B. emiliorum Ames & Quisumb.		40	TK84
B. encephalodes Summerh.		38	G85
B. eublepharum Rchb.f.	19		M73
B. evrardii Gagnep.		38–42	TK84
B. exiguum F.Muell.		ca. 38	G88
B. falcatum (Lindl.) Rchb.f.		38	M73
B. falcatum var. *velutinum* (Lindl.) J.J.Verm. (as *B. melanorhachis*)		38	G88
B. falcatum var. *velutinum* (Lindl.) J.J.Verm. (as *B. rhizophorae*)		38	G88
B. fascinator (Rolfe) Rolfe		38	G88
B. flavidum Lindl.		40	M73
		38	G84
B. fletcherianum Rolfe		38	G88
B. formosum Schltr.		38	G88
B. fritillariflorum J.J.Sm.		38	G88
B. frostii Summerh.		38	M73
B. gamblei Hook.f.	20		M73
	19		G88
B. gibbosum (Blume) Lindl.		38	G85
B. grandiflorum Blume		38	M73, G85

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
B. grandiflorum Blume		38	M73
B. griffithii Rchb.f.	19		G81
B. gymnopus Hook.f.	19		M77
B. imbricatum Lindl.		38	M73, G84
B. imbricatum Lindl. (as *B. linderi*)		38	G88
B. inconspicuum Maxim.		38	M73
B. intertextum Lindl.		38	M73, G85
B. intricatum Seidenf.		38	G88
B. ipanemense Hoehne		38	G85
B. japonicum Makino		40	M73
B. khasyanum Griff.	20		G84
B. lasiochilum Par. & Rchb.f.(as *Cirrhopetalum lasiochilum*)		38	TK84
B. leopardinum Lindl.	19		M73
B. leptanthum Hook.f.	19		G81
B. lepidum (Blume) J.J.Sm.		38	G85
B. lepidum (as *C. lepidum*)		38	TK84
B. levanae var. *giganteum* Quisumb. & C. Schweinf.		60	TK84
B. aff. *levatii*			
B. lobbi Lindl.		39	M73
B. logiflorum Thouars		38	G85
B. logiflorum Thouars (as *C. longiflorum*)		38–40	TK84
B. longiscapum Rolfe		38	G88
B. lupulinum Lindl.		38	M73
		40	M73
B. macraei (Lindl.) Rchb.f.		38	G88
B. macranthum Lindl.		38	G85
B. maculosum Ames (as *C. maculosum*)		38	TK84
B. mahonii Rolfe		38	G85
B. makoyanum Rchb.f.		38–40	TK84
B. mandibulare Rchb.f.		38	G88
B. mastersianum J.J.Sm. (as *C. mastersianum*)		38	TK84
B. maximum (Lindl.) Rchb.f.		38	G85
B. maximum (Lindl.) Rchb.f. (as *B. oxypterum*)		38	G85
B. medusae (Lindl.) Rchb.f.		38	G85
B. miniatum Hort. ex F. Moore		38	G85
B. minutipetalum Schltr.		38	M73
		36	GJ96
B. morphologorum Kraenzl.		38	G88
B. mundulum (W. Bull) J.J.Sm. (as *C. mundulum*)		38	TK84
B. mysorense (Rolfe) J.J.Sm. (as *C. mysorense*)		ca. 38	TK84
B. neilgherense Wight		40	TK84
B. nutans Thou.		38	M73
B. odoratissimum (Sm.) Lindl.	19	38	TK84, G88
B. odoratum var. *odoratum* (as *B. elatius*)		38	M73
B. oreonastes Rchb.f.		38	G85
B. oreonastes Rchb.f. (as *B. zenkerianum*)		38	G85
Bulbophyllum ornatissimum J.J.Sm. (as *C. ornatissimum*)		38–40	TK84
		ca. 38	TK84
B. orthoglossum Kraenzl.		38	G85
B. oxychilum Schltr. (as *B. buntingii*)		38	G88
B. pallidiflorum Schltr.		38	G88
B. parvulum Lindl. (as *C. parvulum*)	19		TK84
B. patens King		57	G85
B. pahudii (de Vriese) Rchb.f. (as *B. virescens*)		38	M73
B. penicillium Par. & Rchb.f.	19		G81
B. peninsulare Seidenf.		38	G88
B. phalaenopsis J.J.Sm.		38	G85
B. picturatum Rchb.f.		38	G85
B. picturatum (as *C. picturatum*)		48	TK84
B. pipio Rchb.f.		38	G84
B. polyrhizum Lindl.	19		M73
B. protractum Hook.f.	19	38	G84, G85
B. pulchrum (N.E.Br.) J.J.Sm.		38	G85

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
B. pulchrum (as *C. pulchrum*)		38	TK84
B. purpureorhachis (De Willd) Schltr.		38	G85
B. raui Arora		40	TK84, G88, GJ94
B. reflexiflorum H.Perrier		38	TK84
B. refractum Rchb.f.		38	G88
B. refractum Rchb.f. (as *C. refractum*)	19		G88, GJ94
B. reptans Lindl.	19 + 0–1B	38	G81, G88, GJ94
B. retusiusculum Rchb.f.	19		G84
B. retusiusculum Rchb.f. as *B. micholitzii*)		38	M73, G85
B. rigidum King & Pantl.		38	G85
B. robustum Rolfe (as *C. robustum*)		38	TK84
B. rothchildianum (O'Brien) J.J.Sm.		38	G88
B. roxburghii (Lindl.) Rchb.f.		38	G88
B. rufinum Rchb.f.		38	G88
B. rugosibulbon Summerh.		38	G88
B. saltatorium Lindl.		38	G85
B. saltatorium var. *calamarium* (Lindl.) J.J.Verm. (as *B. calamarium*)	19	38	M73, G85
B. saltatorium var. *albociliatum* (Finet) J.J.Verm. (as *B. distans*)		38	G85
B. saltatorium var. *albociliatum* (Finet) J.J.Verm. (as *B. nudiscapum*)		38	G85
B. sanderianum Rolfe		38	PW
B. sandersonii (Oliv.) Rchb.f.		38	G85
B. saurocephalum Rchb.f.	20		TK84
B. schinzianum Kraenzl.		38	G85
B. schiazianum Kraenzl. (as *B. phaepogon*)		38	M73, G85
B. secundum Hook.f.	19		M73
	20		TK84
B. sociale Rolfe		38	M73
B. stenobulbon E.C.Parish & Rchb.f.		38	G88
B. stenobulbon E.C.Parish & Rchb.f. (as *B. clarkeanum*)	19		M73
B. sterile (Lam.) Suresh (as *C. caudatum*)	19		TK84
B. striatum Rchb.f.	19		M73
B. tentaculgerum Rchb.f.		38	G84
B. tetragonum Lindl. (as *B. wrightii*)		38	G84
B. trachyantum Kraenzl.		38	G85
B. tricanaliferum J.J.Sm.		38	G88
B. tridentatum Kraenzl.		38	G88
B. trimeni (Hook.f.) J.J.Sm.		38	G88
B. triste Rchb.f.	19		M73, G81
B. tseanum Hu & Barr.		39	G88
B. tuberculatum Colenso (as *Adenopetalum tuberculatum*)		38	D07
B. umbellatum Lindl.		38	TK84, GJ94
B. umbellatum Lindl. (as *C. umbellatum*)		38	TK84, G88
B. unicaudatum Schltr.		38	G88
B. unifoliatum De Wild.		38	G85
B. vagans Ames & Rolfe		95	G85
B. vaginatum (Lindl.) Rchb.f. (as *C. vaginatum*)		38	TK84, G88
B. velutinum (Lindl.) Rchb.f.	19		M73
		40	G84
Bulbophyllum viridiflorum Lindl.	19 + 1B		G88
B. viridiflorum (as *C. viridiflorum*)	19 + 0–3B		TK84, GJ94
B. wallichii Rchb.f. (as *C. wallichii*)	18		TK84
B. wallichii Rchb.f. (as *B. refractoides*)	19		M73
B. wendlandianum (Kraenzl.) J.J.Sm.		57	G88
B. winkleri Schltr.		38	G84
B. zenkerianum Kraenzl.		38	G85
Bulbophyllum sp.		40	TK84
Bulbophyllum sp.		38	PW
Bulbophyllum sp.		80	PW
Bulbophyllum sp nv.		38 + Bs	G88
Bulbophyllum sp nv.		38	G88
Dendrobium acinaciforme Roxb.	19	38	G81, G84, G88 GJ90
D. acerosum Lindl.		38	G84, G88
D. acuminatissimum Lindl.		40	TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
D. acuminatum (Rolfe) Kraenzl. (= *D. lyonii*)		38	TK84
		40	GJ90
D. adae F.M.Bayley		38	G88
D. aduncum Wall. ex Lindl.		38	G85, GJ90
		40	G88, GJ90
D. aemulum R.Br.		38	G84, GJ90
D. agrostophyllum F.Muell.		38	GJ90
	20	40	G84
D. alaticaulinum Royen		38	G85, G88
D. albayense Ames		40	TK84
D. albosanguineum Lindl. & Paxton		40	G88, GJ90
D. anosmum Lindl. (as *D. leucorhodum*)		38	TK84
D. anosmum Lindl. (as *D. superbum*)		38	G84, GJ90
D. antennatum Lindl. (as *D. dalbertisii*)		38	M73
D. aphyllum (Roxb.) C.E.C.Fisch. (as *D. macrostachyum*)		38	M73, M77
D. aphyllum (Roxb.) C.E.C.Fisch. (as *D. pierardii*)	19	38	M73, G84, G85, GJ90
D. atroviolaceum Rolfe		38	M73, G88
D. aurantiroseum P.Royen ex T.M.Reeve		76	G88
D. baileyi F.Muell.		38	G85
D. barbatulum Lindl.		38	G84, GJ90
D. bellatullum Rolfe		38	G85
D. bensoniae Rchb.f.		38	G88, GJ90
D. bicallosum Ridl.		40	TK84
D. bicameratum Lindl.	19 + 0–4B	38	G81, G85, G88, GJ90, GJ94
D. bifalce Lindl.		38	G85
D. biflorum (Forst.) Sw.		38	G85
D. bigibum Lindl.	19	38	TK84, G84, GJ90
D. bigibbum Lindl. (as *D. phalaenopsis*)	19	38	TK84, G84, GJ90
D. bilobum Lindl.		38	G85
D. brymerianum Rchb.f.		38	TK84, GJ90
D. bulbophylloides Schltr.		38	G88
D. bullenianum Rchb.f.		38	M73, GJ90
D. bullenianum Rchb.f. (as *D. topaziacum*)		38	TK84
D. calcaratum A.Rich.		38	G85
D. camaridiorum Rchb.f.		38	G85
D. canaliculatum R.Br.		38	M73, GJ90
	19	38	G84
D. candidum Wall.	19	38	G81, TK84, G84, G88, GJ90
D. capilipes Rchb.f.		38	TK84
D. capituliflorum Rolfe		38	G85, GJ90
D. capra J.J.Sm.	19		G84
D. cariniferum Rchb.f.		38	M73
D. catenatum Lindl. (as *D. tosaense*)	19	38	M73, G84
		40	TK84
D. cathcartii Hook.f.	19		M73
D. chameleon Ames		38	G85
D. chrysanthum Wall.	20	40	G81, TK84, G88, GJ94
	19	38	G81, TK84, G85, GJ90
		76	GJ06
D. chryseum Rolfe		38	GJ06
D. chryseum Rolfe (as *D. clavatum*)	19	38	M73, G81, G85, G88
D. chryseum Rolfe (as *D. denneanum*)	19	38	G88, GJ90
D. chrysotoxum Lindl.	19	38	M73, TK84, G84 G88, GJ90
Dendrobium chrysocrepis E.C.Parish & Rchb.f. ex Hook.f.		ca. 76	TK84
D. clavator Ridl.		38	GJ90
D. coelogyne Rchb.f.		40	G85, GJ90
D. compactum Rolfe	20	40	G84, GJ90
D. compressum Lindl. (as *D. platycaulon*)		38	TK84
D. connatum Schltr.		38	G85, G88
D. crassifolium Schltr.		38	G88
D. crassinodes Benson & Rchb.f.		38	TK84, G84, GJ90

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
D. crepidatum Lindl.		38	M73, TK84, M77, G88
D. crispilinguum Cribb.		38	G85
D. cruentum Rchb.f.		40	M73, TK84
		38 + 1B	G81
D. crumenatum Sw.		38, 38 + 0–2B	M73, TK84, G84, G85
D. crumenatum Sw. (as *D. kwashotense*)		38	M74
D. crystallinum Rchb.f.		38	M73, G88
D. chryseum Rolfe (as *D. flaviflorum*)		38	M74
D. cruttwellii T.M.Reeve		38	G85
D. cucumerinum Maclay ex Lindl.		38	G84, GJ90
D. cumulatum Lindl.		40	G85
D. cunninghamii Lindl.		38	G85
D. cunninghamii Lindl. (as *Winika cunninghamii*)		40	D07
D. cuthbertsonii F.Muell.		76	G88
D. cuthbertsonii F.Muell. (as *D. sophronites*)		38	G84, GJ90
D. cyanocentrum Shltr.		38	G88
D. cymbidioides (Blume) Lindl.		40	G84, GJ90
D. delacourii Guill. (= *D. ciliatum*)		38	M73
	20	40	G84, G88
D. × *delicatum* (F.M.Bailey) F.M.Bailey		38	G85, G88
D. denneanum × *D. moschatum* (Buch.-Ham.) Sw.		44	GJ06
D. densiflorum Wall.		38	G81, G85, G88
	20 + (0–2B)	40, 40 + 1–3f	M73, G81, TK84, G84, G85, GJ90
D. denudans D.Don	20	40	G81, G84, GJ90
D. devonianum Paxton	19	38	M77, TK84, G88
D. dicuphum F.Muell.		38	TK84
		39	G84, GJ90
D. dichaeoides Schltr.		38	G88
D. dilonianum Hawkes & Helter		38	G88
D. distichum Rchb.f.	19	38	M73, G84, GJ90
D. dixanthum Rchb.f.		40 + 2–4f	M73, G84, G85, GJ90
D. draconis Rchb.f.		38	M73, G85
D. engae Reeve		36	G85, G88, GJ90
D. epiphedum Lindl.	20		G81
D. equitans Kraenzl.		38	G84, GJ90
D. equitans Kraenzl. (as *D. batanense*)	19	38	G85
D. falconeri Hook.f.		38	G84, G88, GJ90
D. farmerii Paxt.		40	M73, M77, G84
D. farmerii var. *aureoflava* Hook.f.		40	M73, G85
D. fellowsii F.Muell. (as *D. bairdianum*)		36	G88
D. fimbriatum Hook.	20	40	M73, G85, G88
	19	38, 38 + 0–2B	G81, TK84, G88, GJ90, GJ94
D. fimbriatum Hook. (as *D. normale*)		38	G81, GJ90
D. findlayanum Par. & Rchb.f.		38	M73, G84, JG90
D. finetianum Schltr.		40	GJ96
D. finisterrae Schltr.		38 + 2B	G85
		40	G84, GJ90
D. flamula Schltr.		38	TK84
D. fleckeri Rupp. & C.T.White		38	G88
D. forbesii Ridl.		38 + 2B	G85
		40	G84
D. formosanum Roxb. ex Lindl.	19	38	M73, M77, G84, GJ90
D. friedericksianum Rchb.f.		38	M73, G84, G85, GJ90
D. gibsoni Paxton	19	38	G81, G88, GJ90
D. goldfinchii F.Muell.		38	G85
D. goldschmidtianum Kraenzl. (as *D. miyakei*)		38	M74, GJ90
D. goldschmidtianum Kraenzl. (as *D. victoriae-reginae* var. *miyakei*)			
D. gordonii S.Moore		38	TK84
Dendrobium gouldii Rchb.f.		38	M73, G85, GJ90
D. gracilicaule F.Muell.		38	G85
D. gracilicaule var. *howneanum* Miden		38	TK84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
D. gratiosissimum Rchb.f.		38	G85
D. griffithianum Lindl.		40	G85
D. guerreroi Ames & Quisumb.		40	G84
D. haemoglossum Thwaites (as *bambusiaefolium*)		38	G85, GJ90
D. hancokii Rolfe		40	G88
D. heishanaense Hayata		38	M74
D. helix Cribb		38	G85
D. hellwigianum Kraenzl.		38	G85
D. hendersonii A.D.Hawkes & A.H.Heller		38	TK84
D. herbaceum Lindl.		38	G84, GJ90
D. hercoglossum Rchb.f.		38	G85
D. hercoglossum Rchb.f. (as *D. wangi*)		38	G88
D. heterocarpum Wall.		38	M73, M77, TK84
			G84, G85, GJ90
D. hookerianum Lindl.	20	40	G81, G85, GJ90
D. indivisum var. *indivisum* (as *D. porphyrophyllum*)	19		TK84
D. infudibulum Lindl.	19	38	M73, TK84, G88, GJ90
D. infudibulum Lindl. (as *D. jamesianum*)		38	TK84
D. insigne (Blume) Rchb.f.		36 + 2f	G88, GJ90
D. jenkinsii Wall. ex Lindl.		38	TK84
D. jenkinsii Wall. ex Lindl. (as *D. aggregatum* var. *jenkinsii*)		38	G85
D. johanis Rchb.f.	19		TK84
D. johnsoniae F.Muell.		38	G88
D. jonesii var. *jonesii* (as *D. fusiforme*)		38	TK84
D. jonesii var. *jonesii*. (as *D. ruppianum*)		38	G85, GJ90
D. kauldorumii T.M.Reeve		36	G85, G88
D. kingianum Bidw.		76	TK84
		ca. 76	TK84
D. leucocyanum T.M.Reeve		38	G88
*D.*aff. *leucohybos*		38	G88
D. lichenastrum (F.Muell.) Kraenzl.		38	G85
D. linawianum Rchb.f.		38, 40, 76	G88
D. lindleyi Steud.		38	G85, G88, GJ90
D. lindleyi Steud. (as *D. aggregatum*)	19	38	M73, TK84, GJ90
D. lineale Rolfe		38	G85
D. lineale Rolfe (as *D. grantii*)		38	M73
D. lineale Rolfe (as *D. veratrifolium*)		38	TK84
D. linguella Rchb.f.		38	M73, G85
D. linguiforme Sw.		38	G85, GJ90
		40	G84
D. lituiflorum Lindl.		38	M73, GJ90
D. lodgesii Rolfe		38	G85, G88
D. longicalcaratum Hayata		38	M74
D. longicornu Lindl.	19	38	G81, G85, GJ90
		43	G84
D. lohohense Tang & Wang		38	G88
D. lyoni Ames	20	40	G84
D. macranhum A.Rich.		38	G85
D. macrophyllum A.Rich.		38	G85, GJ90
		38 + 2f	G88
D. macrophyllum A.Rich. (as *D. musciferum*)		38, 38 + 3f	TK84
D. macrophyllum A.Rich. (as *D. polysema*)		38, 38 + B	G85, GJ03
D. mannii Ridl.		38	GJ90
D. mayandyi T.M.Reeve & Renz		36	G85
D. microbulbon Blatter & McCann	19	38	G84, GJ90
D. microchilos Dalzell		38	TK84
D. mirbelianum Gaudich.		38	M73, TK84
D. mohlianum Kraenzl.		38	G85, GJ03
D. moniliforme (L.) Sw.		ca.38	M73
		38	M73, G84, G85, G88
		38, 38 + 1-≈3f	TK84
D. moniliforme (L.) Sw. (as *D. monile*)		38	M73, GJ90
D. monophyllum F.Muell.		38	G85, GJ90

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
D. mooreanum Lindl.		36	G88
D. morrisonii Schltr.		38	GJ03
Dendrobium mortii F.Muell.		38	G88
D. moschatum Sw.	19	38	M73, G81, G84, GJ90
D. mutabile (Blume) Lindl.		40	G85
D. nanum Hook.f. (as *D. mabelae*)		38	G84
D. nebularum Schltr.		38	G88
D. nindii W.Hill (as *D. toffti*)		38	TK84
D. nobile Lindl.	19	38	M77, TK84, G85, G88, GJ90, GJ06
		ca. 57	TK84
		38–40	TK84
		57	TK84
D. nobile Lindl. misc. cultivars		38, 57, 76	GJ03
D. ochreatum Lindl.		38	G85, G88, GJ90
D. oreodoxa Lindl.		38	G85
		40	G85
D. ovatum (Willd.) Kraenzl.		40	TK84
		38	GJ90
D. palpebrae Lindl.		40	TK84, GJ90
D. parcum Rchb.f. (as *D. parcoides*)	20		TK84
D. papilio Lohner		38	G85
D. parishii Rchb.f.		38	M73, G84, G88, GJ90
D. parishii Rchb.f. (as *D. rhodopterigium*)		38	G84
D. patentilobum Ames & Schweif.		38	G88
D. pendulum Roxb.		38	G85
D. petiolatum Schltr.		38	G88
D. philippinensis Ames		38	TK84
D. pinifolium Ridl.		40	G88
D. platygastrium Rchb.f.		40	G85, GJ90
D. plicatile Lindl.		38	G84
D. polyanthum Wall. ex Lindl. (as *D. cretaceum*)		38 ± 1f	TK84
D. polyanthum Wall. ex Lindl. (as *D. primulinum*)	19	38	M73, G88, GJ90, GJ94
D. polyschistum Schltr.		38	G88
D. porphyrochilum Lindl.	19		G81
D. praecinctum Rchb.f. (as *D. pauciflorum*)		38	G88, GJ90
D. pseudoglomeratum T.M.Reeve & J.J.Wood		38	G88
D. pugioniforme A.Cunn.		38	G85, GJ90, GJ96
D. pulchellum Roxb. ex Lindl.		40	M73
		38	TK84
D. punamense Schltr.		38	G85
D. pygmaeum Sm. (as *Ichthyostomum pygmaeum*)		38	D07
D. ramosii Ames		40	G84, GJ90
D. regium Prain		38	TK84
D. revolutum Lindl.		40	M73, G84
D. rhytidothece Schltr.		38	G88
D. rhodostictum F.Muell. & Kraenzl.		36	G85
D. rigidum Lindl.		38	G85, G88, GJ90
D. ruckeri Lindl. (as *D. ramosum*)		40	TK84
D. ruginosum Ames		36	G85
D. salascense (Blume) Lindl.		38	G85
D. sanderae Rolfe	20	40	TK84, GJ90
D. scabrilingue Lindl.		38	M73, G84, GJ90
D. schneiderae F.M.Bailey		38	G88, GJ90
D. schoeninum Lindl. (as *D. beckleri*)		38	G85, GJ90
	19	38	G84
D. schuetzei Rolfe	20	40	TK84
D. schulteri J.J.Sm.		38	TK84
D. secundum (Blume) Lindl.	20	40	M73, TK84, G84, GJ90
D. senile Par. & Rchb.f.		38	M73, G88
D. signatum Rchb.f. (as *D. hildebranditii*)		38, 38 + 1f	M73, TK84, G88
D. smillie F.Muell.		38	TK84, G88, GJ90
D. smillie F.Muell. (as *D. ophioglossum*)		38	G84

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
D. speciosum Sm.		38	G85
D. speciosum Sm. (as *D. speciosum* var. *fusiforme*)		38	TK84
D. speciosum var. *hillii* Mast.		38	TK84
D. spectabile (Blume) Miq.		38	M73, G85
D. sphenochilum F.Muell. & Kraenzl. (as *D. confusum*)		38	G88
D. spurium (Blume) J.J.Sm.		40	TK84
D. stuposum Lindl.		40	G85, G88, GJ90
Dendrobium stratiotes Rchb.f.		38	M73, TK84
D. strebloceras Rchb.f.		38	M73
D. striaenopsis M.A.Clem. & D.L.Jones (as *D. phalaenopsis* var. *schroederianum*)	19	38	TK84
D. striolatum Rchb.f.		38	G85
D. stuposum Lindl.		40	GJ90
D. subclausum var. *phlox* (Schltr.) J.J.Wood (as *D. phlox*)		38	G85, G88, GJ90
D. × *suffusum* Cady		57	G85
D. sulphureum Schltr.		76	G85
D. subulatum (Blume) Lindl.		38	GJ90
D. sulcatum Lindl.		40	GJ90
D. × *superbiens* Rchb.f.	19	38	G81, TK84, GJ90
D. sutepense Rolfe ex Downie		38	M73, GJ90
D. tangerinum P.J.Cribb		38	G85
D. taurinum Lindl.		38	TK84
D. tenuissimum Rupp		38	G88
D. teretifolium R.Br.		76	G85
D. teretifolium var. *fasciculatum* Rupp		40	G84
D. terminale E.C.Parish & Rchb.f.		40	G88
		38	G84
D. terrestre J.J.Sm.		36	G85
D. tetragonum var. *giganteum* P.A.Gilbert		38	G88
D. thyrsiflorum Rchb.f. ex André	20	40	M73, TK84, G85, G88, GJ90
D. tokai Rchb.f.	19	38	TK84
D. toressae (F.M.Bailey) Dockrill		38	G85
D. tortile Lindl.		38	M73, G85, GJ90
D. transparens Wall. ex Lindl.	20	40	M73, TK84, GJ90
	19	38	G84, G85
D. trigonopus Rchb.f.		38	M73, TK84, G88
D. undulatum R.Br.	19	38	M73, TK84
D. undulatum var. *broonfieldii*	19		TK84
D. unicum Scidenf.		38	G85, G88
D. uniflorum Griff.		40	GJ90
D. vagans Schltr. (as *D. semanii*)		38	G85
D. vannouhuysii J.J.Sm.		38	G85
D. ventricosum Kraenzl.		38	TK84
		20	TK84
D. venustum Teijsm. & Binn. (as *D. ciliatum*)		40	GJ90
D. verruciferum Rchb.f.		41	GJ96
D. vexillarius J.J.Sm.		38	G85
D. victoria-reginae Loher		38	M73, G85
D. violaceum Kraenzl.		38	G85
D. violaceum Kraenzl. (as *D. quinquecostatum*)		38	G84, GJ90
D. wardianum R.Warner	19	38	G81, TK84, GJ90
		ca. 57	TK84
		40	TK84
D. wassellii S.T.Blake		38	G85, GJ90
D. wightii A.D.Hawkes & A.H.Heller (as *D. graminifolium*)		38	TK84
D. williamsianum Rchb.f.		38	G88, GJ90
D. williamsonii Day & Rchb.f.		57	G81, GJ90
		38	G85
D. woodsii P.J.Cribb		36	G85
Dendrobium sp.		40	G81
Dendrobium sp.		38	G81
Dendrobium sp.		40	G85
Dendrobium spp.		40, 42	GJ90
Diplocaulobium aratriferum (J.J.Sm.) P.F.Hunt & Summerh.		38	G88

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
D. chrysotropis (Schltr.) A.D.Hawkes		38	G88
D. chrysotropis (Schltr.) A.D.Hawkes (as *Dendrobium chrysotopis*)		38	TK84
D. aff. *fariniferum* (Schltr.) Carr		38	G88
D. hydrophilum (J.J.Sm.) Kraenzl.		38	G88
D. mekynosepalum (Schltr.) Kraenzl.		38	G88
Epigeneium amplum (lindl.) Summerh.	20		G81
E. fuscescens (Griff.) Summerh. (as *Dendrobium fuscescens*)		40	G88, GJ90
E. nakaharaei (Schltr.) Summerh. (as *D. nakaharaei*)		40	G85, GJ90
Epigeneium nakaharaei (Schltr.) Summerh. (as *D. sanseiense*)		40	G84
E. rotundatum (Lindl.) Summerh. (as *D. rotundatum*)	20	40	M73, G88, GJ90
Flickingeria comata (Blume) A.D.Hawkes (as *Dendrobium fimbriatolabellum*)		18	TK84
F. macraei (Lindl.) Seidenf. (as *Dendrobium macraei*)	19	38	M73, G81, GJ90
F. scopa (Lindl.) Brieger (as *D. scopa*)		38	GJ90
Genyorchis pumila (Sw.) Schltr.		38	G85
Saccoglossum verrucosum L.O.Williams		ca. 40	G88
Trias stocksii Benth. ex Hook.		38	TK84
Subtribe Collabiinae			
Acanthephippium bicolor Lindl.	24 II	48	G84
A. pictum Fukuy		48	G85
A. striatum Lindl.		48	G84, G85
A. striatum Lindl. (as *A. sinense*)		42	GJ96
A. splendidum J.J.Sm.		46	GJ06
A. sylhetense Lindl.		48	G85
Acanthephippium sp.		48	G84
Calanthe actinomorpha Fukuy.		40, 38	G85
C. alismifolia Lindl.	22	44	M73, G81
	20		G81
C. alismifolia Lindl. (as *C. faurieii*)		40	TK84
C. alismifolia Lindl. (as *C. japonica*)		40	G84, TK84, G85
C. alismifolia Lindl. (as *C. okinawaensis*)		40	G84
C. alpina Hook.f. ex Lindl.	20		M73
C. alpina Hook.f. ex Lindl. (as *C. schlechteri*)		42	G84
C. arcuata Rolfe (as *C. caudatilabella*)		40	G85
		38	GJ94
C. argenteostriata C.Z.Tang & S.J.Cheng		45	GJ94
C. arisanensis Hayata		40	G85, GJ94
C. aristulifera Rchb.f.		40	TK84, G84, GJ94
C. aristulifera Rchb.f. (as *C. eliptica*)		40	G85
C. aurantiaca Ridl.		40	G84, G88
C. biloba Lindl.	40		M73, TK84
		38	M73, G81
C. brevicornu Lindl.	20		M73
C. cardioglossa Schltr.		ca. 44	TK84
		46	GJ94
C. chevalleri Gagnep.	20		TK84
C. chloroleuca Lindl.	20	40	G81, G88
C. clavata Lindl.	20	40	M77, G85, GJ94
C. coreana Nakai		40	GJ91
C. conspicua Lindl.		40	GJ94
C. cremeoviridis J.J.Wood		46	GJ94
C. davidii Franch. (as *C. bungoana*)		42	G84
C. davidii Franch. (as *C. matsudae*)		40	G85, GJ94
C. densiflora Lindl.	20	40	G84, G85, GJ94
C. discolor Lindl.		40	M73, G84, G88, GJ91, GJ96
C. discolor Lindl. (as *C. discolor* var. *kanashiroi*).		40	G84, TK84
C. graciliflora Hayata		40	G85, GJ94
C. graciliflora Hayata (as *C. hamata*)		40	G88, GJ94
C. hancockii Rolfe		40	GJ94
C. hattorii Schltr.		40	G81, G84
C. hennisii Loher		42	GJ94
C. herbacea Lindl.		40 + 0–2B	M73G81, GJ94
	21	42	G81, GJ94
C. hirsuta Seidenf.		46	GJ94

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
C. izu-insularis (Satomi) Ohwi & Satomi		40	G84
C. lyroglossa Rchb.f.		40	G84, G85, GJ94
C. lyroglossa Rchb.f. (as *C. foertermannii*)		40	TK84
C. lyroglossa Rchb.f. (as *C. liukiuensis*)		40	M73
C. mannii Hook.f.	20	40	M77, G81, G84, G88
C. musca (D.Don) Lindl.		40	G84
C. nipponica Makino		38	G84
C. oblanceolata Owi & T.Koyama		40	G84
C. plantaginea Lindl.		40	M73, GJ94
C. puberula Lindl.	20	40 + 0–1B	G81, G88, GJ94
C. puberula Lindl. (as *C. reflexa*)		40	M73, G84, G85, GJ90, GJ94,
C. pulchra (Blume) Lindl.		40	G84, G88
Calanthe rosea (Lindl.) Benth.		44	GJ94
C. rubens Ridl.		40 + 0–2B	G84, G88, GJ94
C. rubens Ridl., (as *C. elmeri*)		44	GJ94
C. speciosa (Blume) Lindl. (as *C. formosana*)		40	G85, GJ94
C. speciosa (Blume) Lindl. (as *C. yushuni*)		20	M74
C. striata R.Br.	20	40	M77
C. striata R.Br. (as *C. striata* var. *sieboldii*)		40	G85
C. striata R.Br. ex Lindl. (as *C. bicolor*)		40	G84
C. striata R.Br. ex Lindl. (as *C. sieboldii*)		40	G84, GJ90, GJ94
C. succedanea Gagnep.		44	GJ94
C. sylvatica (Thouars) Lindl.		40	GJ94
C. sylvatica (Thouars) Lindl. (as *C. longicalcarata*)		40	G85
C. sylvatica (Thouars) Lindl. (as *C. masuca*)	20	40	M73, GJ94
C. tricarinata Lindl.	20	40	M73, G85 GJ94
		40, 60	TK84
C. triplicata (Willemet) Ames		40	G84, G85, G88, GJ94
C. triplicata (Willemet) Ames (as *C. triplicata* var. *angraecifolia*)		40	GJ96
C. triplicata (Willemet) Ames (as *C. furcata*)		40	M73
C. triplicata (Willemet) Ames (as *C. veratrifolia*)		40 + 0–2B	TK84, G84, G88
C. trulliformis King & Pantl.,	20		M73
C. ventilabrum Rchb.f. (as *C. langei*)		40	GJ96
C. vestita Wall. ex Lindl.	20		TK84
	21	42	GJ94
Calanthe sp.	20		M73
Calanthe sp		40	TK84
Cephalantheropsis calanthoides (Ames) T.S.Liu & H.J.Su (as *C. koshunensis*)		40	GJ94
C. obcordata (Lindl.) Ormerod (as *C. gracilis*)	20	40	M73, G88, GJ94
C. obcordata (Lindl.) Ormerod (as *Calanthe venusta*)		40	TK84
C. obcordata (Lindl.) Ormerod (as *Phaius gracilis*)		42	G85
Chrysoglossum ornatum Blume		36	GJ91
Gastrorchis francoisii Schltr.		40	GJ06
G. humblotii (Rchb.f.) Schltr.		40	GJ06
G. humblotii humblotii var. *schlechteri* (H.Perrier) Senghas ex Bosser & P.J.Cribb		40	GJ06
G. lutea (Ursch & Toill.-Gen. ex Bosser) Senghas		40	GJ06
G. tuberculosa (Thouars) Schltr.		40	GJ06
Nephelaphyllum cordifolium (Lindl.) Blume		36 + 3–7B	G81
Pachystoma pubescens Blume (as *Pachystoma senile*)	20	40	G81, G88, GJ94
Phaius elatus		42	TK84
P. flavus (Blume) Lindl.		42	G85, GJ90, GJ96
P. flavus (Blume) Lindl. (as *P. maculatus*)	21		G81
P. flavus (Blume) Lindl. (as *P. minor*)			
P. flavus (Blume) Lindl. (as *P. minor* f. *punctatum*)		44	TK84
P. luridus Thwaites		44	GJ90
P. mannii Rchb.f.		28	G84
P. mindorensis Ames		42	TK84
P. mishmensis (Lindl. & Paxton) Rchb.f.		42	G81
	22 + 2f		G88
P. mishmensis (Lindl. & Paxton) Rchb.f. (as *P. gracilis*)		42	G85
P. pulchellus Kraenzl.		40	GJ06
P. pulchellus var. *sandrangatensis* Bosser		40	GJ06

Appendix 1. *Continued*

TAXON	*n*	2*n*	Source
P. tankervilliae (Aiton) Blume	23		G81
		42	G85
		48	G84, G88
	22 + 2B		GJ90
		38	GJ90, GJ96
P. tankervilliae (Aiton) Blume (as *P. grandifolius*)		38	M73
P. wallichii Lindl.		48	M73
	21		M73
Phaius sp.		38	GJ90
Phaius sp.		38	GJ96
Plocoglottis javanica Blume		38	G84, G88
P. lowii Rchb.f.		38	G84
Spathoglottis affinis de Vries		40	G84
S. aurea Lindl. (as *S. microchilina*)		40	G84, G88, GJ96
S. pacifica Rchb.f.		40	GJ06
S. paulinae F.Muell. (as *S. rivularis*)		40	G88
S. petri Rchb.f.		40	GJ06
S. plicata Blume	20	40	TK84, G84 G88
S. plicata Blume (as *S. spicata*)		40	G85
S. pubescences Lindl.		36	M77
	19		TK84
S. unguiculata (Labill.) Rchb.f.		40	GJ06
Tainia bicornis Benth.	15 + 1–3B		G88
T. latifolia Benth.		40	G81
		32	G84
T. latifolia (Lindl.) Rchb.f. (as *T. khasiana*)		32	G84
T. laxiflora Makino		36 + 0–9B	TK84
T. minor Hook.f.	20	40	G85
T. penangiana Hook.f.		ca. 72	TK84
T. penangiana Hook.f. (as *T. hookeriana*)		40	G84, GJ91, G96
T. viridifusca (Hook.) Benth. ex Hook.f.	20		G81
Tainia spp.		32, 40	G84
Tainia sp. (as *Ania* sp.)		76	GJ96

F69 = Fedorov, 1969; M73 = Moore, 1973; M74 = Moore, 1974; M77 = Moore, 1977; G81 = Goldblatt, 1981; TK84 = Tanaka and Kamemoto, 1984; G84 = Goldblatt, 1984; G85 = Goldblatt, 1985; G88 = Goldblatt, 1988; GJ90 = Goldblatt and Johnson, 1990; GJ91 = Goldblatt and Johnson, 1991; GJ94 = Goldblatt and Johnson, 1994; GJ96 = Goldblatt and Johnson, 1996; Goldblatt and Johnson, 2000; Goldblatt and Johnson, 2003; Goldblatt and Johnson, 2006; FG98 = Felix and Guerra, 1998; DA09 = Davinha *et al*. (2009); PI09 = Pinheiro *et al*. (2009); D07 = Dawson *et al*. (2007); PW = Present work.

Appendix 2. Species with chromosome numbers uncertain or unimportant to evolutionary interpretation of the group. Abbreviation according to Table 1.

TAXON	*n*	2*n*	Source
Acampe papillosa (L.) Lindl.[1]	36		G88
A. papillosa (L.) Lindl.[1]	18	36	G81, GJ94
	18, 19		TK84
Aerangis compta Summ.[2]		51	M73
A. hitchongii[9]		40	TK84
Aerides multiflorus Roxb.[3]		40 (22)	TK84
A. odoratum Lour.[1]	18	36	G84, GJ94
	20	40	TK84
A. suavissima Lindl.[1,4]		ca. 38	M73
Anthogonium gracile Lindl.[1]	27		M73
Arundina bambusifolia Lindl.[1]	21		G81
A. graminifolia (Don) Hochr.[1]		32	TK84
		42	TK84
Bletilla formosana (Hay.) Schltr.[6]		16	M74
B. striata (Thumb.) Rchb.f.[4]		ca. 38	M73
Bulbophyllum cylindraceum Lindl.		42	G84
B. distans Lindl.[2]		57	M73
B. leopardinum Lindl.[1]	18		G81
B. lobbi Lindl.[1,2]		38–42	TK84
B. mastersianum J.J.Smith (as *C. mastersianum*)[3]		38–40	TK84
B. odoratissimum (Sm.) Lindl.[1]	29		G81
B. oreonastes Rchb.f.[1]		80	M73
B. patens King[2]		57	G85
B. reptans Lindl.[1]		42	G81, GJ90
B. vagans Ames & Rolfe[2]		95	G85
B. wendlandianum (Kraenzl.) U.Dammer[2]		57	G88
Calanthe argenteo-striata C.Z.Tang & S.J.Cheng[2]		45	GJ94
C. brevicornu Lindl.[1,3]	24		M73, GJ94
		38(57)	TK84
C. brevicorum[9]	24		G81
C. chloroleuca Lindl.[1]		28	M73, G81
C. discolor var. *amaniana* (Fukuyama) Nasamune[5]		60	G84
C. longicalcarata Hay.[6]		20	M74
C. masuca Lindl.[1]		52	M73
	21		G81
C. matsudai Hayata[1]		44	G85
C. puberula Lindl.[1]		42	G81
C. reflexa Maxim.[1]		42	G85
C. tricarinata Lindl.[1,5]		42	M73
		60	TK84
C. triplicata (Willemet) Ames[6]		20	G85
Calanthe sp.		20	M74
Calanthe sp. (Thailand)[9]		58	TK84
Cattleya bicolor Lindl. var. *measuresiana*[5]		80	TK84
C. forbesii Lindl.[3]		54–60	TK84
C. intermedia Grah.[1,3]		46, 55, 76	GJ96
C. intermedia var. *alba*[7]		41 + 1f	TK84
C. labiata Lindl.[1]		42	TK84
C. labiata var. *amesiana*[3]	20, 21	40, 41	TK84
Cattleya sp.[1,3]		46, 56, 76	GJ91
Cephalanthera damasonium (Mill.) Druce[1]		54	G85
		32	TK84

Appendix 2. *Continued*

TAXON	*n*	2*n*	Source
C. longibracteata Blume[3]		30, 42	TG84, G88
C. longifolia (L.) Fritsch[3]		16–34 + 2B, 33	G84, G88
C. rubra (L.) Rich.[1]	24	48	TK84, G91
Cleisostoma micranthum (como *Sarcanthus micranthus*)[1]		36	M74
C. pallida (como *S. palidus* Lindl.)[1]	16		TK84
Coelogyne corymbosa Lindl.[1]		38	G84
C. elata Lind.[1]		43	M73
	22	44	G81
		44	G81
C. micranthum Lindl.[1]		76	M77
Cyrtochis arcuata subsp. *variabilis* Summ.[5]		138	G85
Cryptopus elatus (Thouars) Lindl.		95	M73
Dendrobium agregatum Roxb.[3]		32–35	TK84
D. amoenum Wall.[5]		80	GJ90
D. anceps Sw.[1]	18 + 0–6B		GJ90
D. aphyllum (Roxb.) Fischer[1]		40	G88
D. bicameratum Lindl.[1]		40	M73, GJ90
D. brymerianum Rchb. f.[1]		40	TK84, G88
D. candidum Wall.[5]		57	G88
D. chrysanthum Wall.[5]		76	G88
D. chrysotoxum Lindl.	20	40	TK84
D. crumenatum Sw.[1]		40	TK84
D. densiflorum Lindl.[1]		42	GJ90
D. delicatum Bailey[5]		ca. 57	TK84
D. dicuphum F. Muell.[2]		39	G84, GJ90
D. digibum var. *compactum* C.T. White[3,5]		ca. 57	TK84
D. distichum Rchb. f.[5]		57	TK84, G84
D. dixanthum Rchb. f.[2]		41	TK84
D. fimbriatum Hook.[1]	18		GJ90
D. fimbriatum var *oculatum*[1,2]		43	G88
D. gibsoni Lindl.[1]		40	G85
D. hercoglossum Rchb.f.[5,1]		57	G88
		36	G81
D. kingianum Bidw.[4,]	20	ca.57, 74, 112–114	TK84
C. bowringiana Weitch ex Gardn.[1,5]	21	41	TK84
		42	TK84
		60	TK84
D. kingianum var. *album*[4]		ca.57, ca. 76	TK84
D. leonis Rchb.f.[1]		40	M73
D. lodgesii Rolfe[1]		40	TK84
D. longicornu Lindl.[2]		43	G84
D. longispicatum[9]		38	TK84
D. macrostachyum Lindl.[1]	20		M73
D. moschatum Sw.[1,2]		39	M73
D. nagasaki[9]		38	G84
D. nakaharaei Schltr.[1]		30	M74
D. nobile Lindl.[1]		40	G85
D. nobile var. *nobilius*[4,5]		ca. 57	TK84
D. nobile var. *virginale*[5]		57	TK84

Appendix 2. *Continued*

TAXON	*n*	2*n*	Source
D. parishii Rchb.f.[1,5]		40	G81
		76	GJ90
D. phlox var. *flava*[9]		38	G84
D. pierardii Roxb.[1,3]		40	G81
	19–20	38, 57	TK84
D. primulinum Lindl.[1,5]		40	G81
		57	G81, GJ90
D. pitcherianum Rchb.f.[9]		38	G85
D. sawianum Lindl.[9]		38	M77
D. senile Par. & Rchb.f.[1]		40	G84
D. sophronites Schltr.[4,5]		ca. 80	TK84
D. suffusum Cady[5]		57	G85
D. toressae (Bailey) Dockr.[4]		ca. 36	G88
D. transparens Wall.[1]		(30)	TK84
D. ventricosum Kraenzl.[1]		20	TK84
D. verruciferum Rchb.f.[2]		41	GJ96
D. wardianum Warm.[1]	20	40	G85
D. wardianum var.*album*[4,5]		ca. 57	TK84
D. williamsonii Day & Reich.[5]		57	GJ90
Doritis taenialis Benth.[1,5]	19	57	G88, GJ94
Epidendrum atropurpureum Willd.[3,5]		80–90	TK84
E. difforme Jacq. (= *Neolehmannia difforme*)[3]		39–40	TK84
E. nocturnum Jacq.[3,4]		45–85, ca. 80	TK84
E. nocturnum var. *guadetoupense*[3]		42–48	TK84
E. radicans Pav.[3]		48–57	TK85
		57, 62	GJ91, GJ96
	19		M73
		40, 70	TK84
Eria acervata Lindl.[1]	20		G81
E. alba L.[1]		34	M77
E. biflora Griff.[1]		46	G88
E. coronaria Rchb.f.[3]	17, 19, 22, 26		G84
E. dalzellii Lindl.[1]		24 + 5–7B	TK84
		24 + 10B	G84
		24 + 5B	G84
E. microchilos Lindl.[1]		24 + 5–11B	TK84, G84
E. graminifolia Lindl.[1]		42	G88
E. noodiana[9]		44	TK84
E. ovata Lindl.[1]		44	TK84
E. pannea Lindl.[1]	18		M73
E. spicata (D.Don) Hand-Mazz.[1]		20 + 2B	G88
Holcoglossum junceum Tsi[5]		57	GJ96
Laelia peduncularis Lindl.[1]		40–44	TK84
Listera cordata (L.) R.Br.[3]		39–42, 44	G85
Listera ovata (L.) R.Br.[3,4]		34–36	G85, GJ91
		ca. 38	GJ00
	16	17, 20, 32, 35, 37, 39, 40, 42, 44	TK84, G85, G88
Luisia teres Blume (= *L. teretifolia*)[1]	21		TK84
L. trichorhiza Blume[1]	20		M73
Mediocalcar aff. *pygmaeum* Schltr.[5]		85	G88

Appendix 2. *Continued*

TAXON	*n*	2*n*	Source
Microcoelia caespitosa (Rolfe) Summ.[2]		47	G84
Neotia listeroides Lindl.[1,3]		36, 46	TK84
N. nidus-avis (L.) Rich.[1]	16		TK84
		60	gj90
N. nigra (L.) Rchb.f.[5]		60	GJ94
Nephelaphyllum cordifolium Lindl.[1]		36 + 4–10B	G81
		18 + 4–10B	G84
	18 + 3–8B		GJ90
Ornithochilus fuscus Wall.[1]		(36)	TK84
Phaius albus Lindl.		44	M73
P. mishmensis Rchb.f.[1,4]	31		M73
		ca. 50	G81
Phalaenopsis amabilis Blume[5,2]		114	TK84
		69 + 3f	TK84
P. schilleriana Rchb.f.[5]		76	TK84
Pholidota bicolor Lindl.[9]		44	G85
P. calcarata Rchb.f.[9]	21		M77
P. yunnanensis (Rolfe) Rolfe		120	M73
Pleione bulbocodioides (Franch.) Rolfe[5]		120	GJ91
P. forresttii Schltr.[1,2]		38, 39, 42, 44	GJ91, GJ96
P. humilis Lindl.[5]		60	GJ91
P. praecox var. *wallichiana*[9]		40	M73
P. versailles[9]		80	M73
Polystachya cultriformis Lindl.[1,2]		38, 39	TK84
P. galeata (Sw.) Rchb.f.[4]		ca. 40	TK84
P. rhodoptera Rchb.f.[1]	19		TK84
Renanthera coccinea Lour.[5,2]	54 + 1	ca. 114, 115	M73, TK84, GJ96
Saccolabium calceolare Lindl.[3,1,2,6]		19–20	TK84
S. papilosum Lindl.[1,2,6]		19	G85
S. japonicus Miq.		36	TK84
Sarcanthus crinaceous[9]		38	M73
Spatoglottis plicata Blume[1,6,5]		18	M74
		60	G84
Taeniophyllum aphyllum Makino[1]		24	TK84
Tainia spp.[8]		32, 40	G84
Thunia alba Rchb.f.[1,4]		42	M73
		44	G81
		36	G81
Tunia alba Rchb.f.[1,4]		ca. 40	G81
		ca. 40	G85
		38	G88
T. marshaliana Rchb.f.[4]		ca. 40	G81
Vanda alpina Lindl.[1]	10		M73
V. coerulea Griffith[1]		(36)	TK84
V. coerulescens Griff.[1]		40	G85
V. cristata Lindl.[1]		(36)	TK84
V. densiflora Lindl.[1]		36(42)	TK84
V. luzonica Loher ex Rolfe[1]		42	TK84
V. parviflora Lindl.[1,4]		ca. 40	M73
V. pumila Hook.f.[1,5]		40	G85
		72, 76	GJ91, GJ96
V. polyantha (W.W.Sm.) Tang & Wang[9]		38	GJ91, GJ96
V. roxburghii R.Br.[1]		(42)	TK84

Appendix 2. *Continued*

TAXON	*n*	2*n*	Source
V. spatulata Spreng.[5]		114	TK84, G88
		114, 115	TK84
V. suavis Lindl.[9]		38	TK84
V. teres Lindl.[1]		(36)	TK84
V. tricolor Lindl.[1,4]		ca. 16	TK84
		ca. 18, ca. 20	TK84
		28	TK84
V. tricolor var. *suavis*[1,4]	ca. 16		TK84
	ca. 18		TK84
Vanda sp.[5]		57	GJ96

1 Chromosome number clearly conflicting with previous counts to the species or the genus;
2 Odd diploid numbers;
3 Poorly defined count;
4 Imprecise counts (ca.) substituted by another more precise record;
5 Occasional polyploids in this species;
6 Apparently haploid number;
7 Occasional aneuploids;
8 Different chromosome numbers reported for several undetermined species.
9 Misidentification.