



B-chromosomes in Woody and Arborescent Angiosperm plants – A Review

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ABSTRACT

Literature on B-chromosomes in woody and arborescent Angiosperms has been reviewed. Among this group of plants supernumerary chromosomes are reported in representatives of 60 families and more than 330 species. Three families include the largest number of species with B chromosomes: Fabaceae (more than 80), Asteraceae (more than 70), Lamiaceae (more than 20). The number of Bs in woody and arborescent angiosperms varies from 1 to 10. Among woody plants with B-chromosomes there are trees, shrubs, subshrubs, lianas and climbing vines. As usual B-chromosomes are smaller than A-chromosomes and can be different types in morphology. The role of B-chromosomes in evolution and adaptation is discussed.

Keywords : B-chromosomes, additional chromosomes, supernumerary chromosomes, A-chromosomes, karyotype, angiosperms, woody plants.

B-chromosomes (Bs), supernumerary, accessory or additional chromosomes, are extra ones to ordinary chromosomes (A-chromosomes, As) of set. They are found in vertebrate and invertebrate animals, fishes, amphibians, fungi, ferns, gymnosperm and angiosperm plants (Müntzing 1958, 1966, 1967, 1974, Battaglia 1964, Orlov 1974, Moshkovich 1979, Rees 1974, Jones 1975, 1995, 2017, Volobuev 1981, Jones and Rees 1982, Muratova 2000, 2003, 2018, Jones and Houben, 2003, Green 2004, Palestis *et al.* 2004, Trivers *et al.* 2004, Jones *et al.* 2008, Kunakh 2010, Houben *et al.* 2011, 2013, 2014, Borisov 2014, Datta *et al.* 2016, Borisov and Myshliavkina 2019 and others). B-chromosomes are widely distributed among different organisms and are a general phenomenon in eucaryotes. Information on B-chromosomes in Gymnosperms was presented early (Muratova, 2018). The aim of this review is to present data on B-chromosomes in woody and arborescent plants of Angiosperms generated by different authors.

MATERIALS AND METHODS

In present review, the information available on B-chromosomes of woody and arborescent plants has been compiled from different sources. Data were obtained from scientific publications on cytogenetics, karyology and chromosome numbers of plants. In order to obtain the data, bibliographic resources, books, monographs (Darlington and Wylie 1955, Chromosome numbers of flowering plants 1969, Index to plant chromosome numbers 1973, 1974, 1977, 1981, 1984, 1985, 1988, 1990, 1991, 1994, 1996, 1998, 2000, 2003, 2006, 2010, Mehra 1976, Dmitrieva and Parfenov 1991, Chromosome numbers of flowering plants of the flora of the USSR 1990, 1993, Chromosome atlas of Chinese principal economic plants 1993, Khatoon and Ali 1993 and others) and electronic databases (B-chrom: a database on B-chromosomes of plants, animals and fungi.—URL:

<http://www.bchrom.csic.es>, Chromosome counts database: CCDB.—URL: <http://www.cddb.tau.ac.il/>, Index to Plant Chromosome Numbers. — URL: <http://www.tropicos.org/Project/IPCN>, The Plant rDNA database — URL: <http://www.plantrdnadatabase.com>) were used.

RESULTS AND DISCUSSION

It is known that B-chromosomes are available in 8.0% monocots and 3.0% eudicots: total 4.1% of angiosperms (Levin *et al.* 2005). Data on B-chromosomes in woody and arborescent flowering plants are given in Table. Up to now B-chromosomes were found in more than 330 woody species Angiosperms from 60 families. The families that include the largest number of species with B chromosomes are: Fabaceae (more than 80), Asteraceae (more than 70), Lamiaceae (more than 20).

The number of Bs in woody and arborescent angiosperms varies from 1 to 10. The highest number of B-chromosomes per cell was registered in this group of plants is 10. It is the next species: *Artemisia keiskeana* (Asteraceae), *Phyllanthus pulcher* (Phyllanthaceae), *Cestrum nocturnum* and hybrid between *Cestrum parqui* and *C. aurantiacum* from family Solanaceae (Masumoto *et al.* 1995, Soontornchainaksaeng and Chaiyasut 1999; Sýkorová *et al.* 2003a, b; Urdampilleta *et al.* 2015). It is interesting that in gymnosperms maximum number of B-chromosomes is the same and include 10 ones (Muratova 2018).

Monopholis jelskii (Asteraceae) has 9 B-chromosomes (Turner *et al.* 1967). There are some species have 8 B-chromosomes: *Leucaena diversifolia* and *L. pallida*, family Fabaceae; *Sida rhombifolia*, Malvaceae; *Smilax zeylanica*, Smilacaceae (Hazra and Sharma 1971, Pal and Sharma 1976, Pan and Brewbaker 1988). And many species include 7

supernumerary chromosomes in karyotype. They are: family Asteraceae – *Calea ternifolia*, *Mikania cordifolia*, *M. micrantha* (Sundberg *et al.* 1986, Maffei *et al.* 1998, 1999a, b); Fabaceae – *Pongamia pinnata* (Gill *et al.* 1990; Singhal *et al.* 1990; Kumari and Singhal 2003; Singhal and Gill 2003); Lamiaceae – *Teucrium montanum* (Feráková and Murín 1974); Phyllanthaceae – *Phyllanthus erythrinus* (Soontornchainaksaeng and Chaiyasut 1999); Punicaceae – *Punica granatum* (Mehra and Gill 1971; Gill *et al.* 1979, 1981b, d).

Among woody plants with B-chromosomes there are different types and sizes of trees – forest, fruit, ornamental, hardwood and softwood (gymnosperms), tall, large, small – *Betula papyrifera*, *Terminalia arjuna*, *Cornus rugosa*, *Joannesia princeps*, *Sapium insigne*, *Butea monosperma*, *Diospyros ebenum*, *Erythrina suberosa*, *Pongamia pinnata*, *Prosopis cineraria*, some *Quercus* species, *Litsea elongata*, *Machilus macrantha* and *M. odoratissima*, *Tamarindus indica*, *Ficus krishnae*, *Morus indica*, *Zizyphus jujuba*, *Santalum album*, *Saurauia napaulensis* and others. Many shrubs, bushes, subshrubs contain Bs in their karyotypes (species of *Artemisia*, *Baccharis*, *Senecio*, *Vernonia*, *Caragana*, *Crotalaria*, *Cassia*, *Genista*, *Ribes*, *Lonicera Sambucus*, *Bartlettia sordida*, *Montanoa tomentosa*, *Berberis julianae*, *Alhagi camelorum* and others). Some lianas and climbing vines – species of *Mikania* and *Clematis*, *Hiptage benghalensis*, *Piper schmidtii*), hemiparasitic shrubs, subshrubs and vines (*Phoradendron*, *Helicanthes elastica*, *Ligaria cuneifolia*, *Psittacanthus bolleanus*, *Taxillus cuneatus*) have B-chromosomes.

In general, B-chromosomes are smaller than A-chromosomes (Jones 1975, 1995, 2017, Moshkovich 1979, Jones and Houben 2003, Houben *et al.* 2013, 2014, Datta *et al.* 2016, Muratova 2018, and others). RN Jones (1995) estimated that about 40% of angiosperm taxa with B chromosomes had the size of 1/4 to 3/4 of the average of A chromosomes and about 25 % showed Bs size less than the smallest As. But “large” B-chromosomes were also reported among plants (Datta *et al.* 2016). In some taxa with small A-chromosomes additional ones can be distinguishable during meiotic studies or at mitosis (Butorina *et al.* 1975, Datta *et al.* 2016). In morphology B-chromosomes exist as metacentric (isochromosomes with medial centromere), submetacentric with subterminal centromere, acrocentric and telocentric or small fragments, points with uncertain position of centromere.

In many study cases presence of B-chromosomes is not associated with any phenotype features, particularly when the number of Bs is low. Genetic effects of B-chromosomes have a polygenic nature. They can influence the nuclear phenotype

and genome function, the duration of the cell cycle, cell size, genetic activity, nuclear DNA amount, behaviour of A-chromosomes during meiosis. At meiosis B-chromosomes affect the distribution and frequency of chiasmata. B-chromosomes are characterized by non Mendelian and irregular pattern of inheritance and do not recombine with any of set of A-chromosome during meiosis (Moshkovich 1979, Jones and Rees 1982, Raghuvanchi and Pande 1985, Jones 1995, Camacho *et al.* 2000, Jones and Houben 2003, Jones *et al.* 2008, Khunakh 2010, Houben *et al.* 2011, 2013, 2014, Borisov 2014, Valente *et al.* 2017, Borisov and Myshliavkina 2019).

In B-chromosomes of some plants and animals, secondary constrictions and satellites are found. These chromosomes usually contain ribosomal genes but sometimes they inactivate (Green *et al.* 1990, Beukeboom 1994, Donald *et al.* 1995, 1997, Marschner *et al.* 2007, Pellicer *et al.* 2008, Urdampilleta *et al.* 2015, Vanzela *et al.* 2017, and others). Some authors using FISH technique identified rRNA gene clusters 18-26S rDNA and 5S rDNA in Bs of woody plants (Sýkorová *et al.* 2003, Oliveira *et al.* 2012, Urdampilleta *et al.* 2015, Vanzela *et al.* 2017). Ribosomal RNA (rRNA) genes may play a role in the evolution of Bs, as these have been detected on Bs of many plant and animal species (Valente *et al.*, 2017).

A-chromosomes and B-chromosomes differ on organization of genetic material. Studies on some species have provided information about the occurrence of different repetitive DNA families in the Bs, such as AT-rich sequences, C-Giemsa and C-CMA₃ - DAPI bands, Ty3/gypsy retroelements, Gypsy LTR-RTs, BR23 signals and others (Camacho *et al.* 2000, Sýkorová *et al.* 2003, Fregonezi *et al.* 2004, 2007, Fernandes *et al.* 2008, Houben *et al.* 2011, 2013, 2014, Vanzela *et al.* 2017). Genes from other multigene families such as H1, H3 and H4 histones, U2 snRNA, transposable elements and satellite DNA, have also been found as components of Bs (Valente *et al.* 2017). B-chromosomes include many highly repeated DNA sequences with regular functions and usually don't have structure genes. But there are evidences in vertebrates that B chromosomes contain protein-coding genes (Trifonov *et al.* 2013, Makunin *et al.* 2014).

Many facts point that effects of B-chromosomes have adaptive character. Organisms with B-chromosomes are more polymorphic and adaptive to changing environments. B-chromosomes are widely distributed among plants and animals and compose system. The results obtained allow to consider that system of B-chromosomes is a general phenomenon in eucaryotes. This system is of great importance

and play a role for adaptation of populations and species. B-chromosomes also are as one of the factors of evolutionary processes in plants and animals (Mehra 1972, Jones 1975, Moshkovich 1979, Bedi 1991, Butorina *et al.* 2003, Kunakh 2010, Borisov 2014, Muratova 2018, and others). Origin and fixing of B-chromosomes gave the possibility to wide labile genome system and to raise adaptive possibilities of organisms.

CONCLUSION

In the present review, supernumerary chromosomes are reported in representatives of 60 families and more than 330 species of woody and arborescent Angiosperms. List of woody species with B-chromosomes continues to add as well as other plants and animals. Studies on role of B-chromosomes in evolution, their influence on organisms require further investigations including molecular organization of genomes.

Table : B-chromosomes in woody and arborescent Angiosperms

Species	Number of chromosomes, 2n	References
ACERACEAE JUSS.		
After different rearrangements and systematics treatments family is often considered as the tribe Acereae within the subfamily Hippocastanoideae, family Sapindaceae Juss. (The Plant List. – URL: http://theplantlist.org)		
<i>Acer caesium</i> Wall. ex Brand.	26+1-3B	Sindhu and Mann 1989, Gill and Singhal 1998
<i>Acer villosum</i> Wall.	26+1-2B	Mehra and Sareen 1969, Mehra 1972
ANACARDIACEAE LINDL.		
<i>Cotinus coggygria</i> Scop. (<i>Rhus cotinus</i> L.)	30+1-3B	Gill and Singhal 1998
<i>Rhus chinensis</i> Mill.	30+1-5B	Shang <i>et al.</i> 1990
<i>R. cotinus</i> L. (<i>Cotinus coggygria</i> Scop.)	30+1-2B	Sandhu and Mann 1988
ANNONACEAE JUSS.		
<i>Cymbopetalum brasiliense</i> Benth.	42+1B	Morawetz 1986
APIACEAE LINDL.		
<i>Centella asiatica</i> (L.) Urb.	22+1-2B	Raghuvanshi and Joshi 1968, Joshi and Raghuvanshi 1970b
ARECACEAE BERCHT. ET J. PRESL		
<i>Desmoncus</i> sp.	30+1B	Röser 1994
ASCLEPIADACEAE BORKH.		
<i>Hoya australis</i> R. Br. ex J. Traill.	22+1B	Nakamura 1996
<i>H. carnos</i> (L.) R. Br.	24+1B	Nakamura and Yuasa 1980
<i>H. neocaledonica</i> Schltr.	22+1B	Nakamura 1996
<i>Tromotriche revoluta</i> Haw.	22+2B	Albers and Meve 2001
ASTERACEAE BERCHT. ET J. PRESL (COMPOSITAE GISEKE)		
<i>Ajania fruticulosa</i> (Ledeb.) Poljakov	36+2-4B	Garcia <i>et al.</i> 2006
<i>Artemisia abrotanum</i> L.	18+4B	Korobkov and Kotseruba 2015
<i>A. arbuscula</i> Nutt.	18+1B	McArthur <i>et al.</i> 1981
<i>A. barrelieri</i> Besser	36+1B	Torrell <i>et al.</i> 2003
<i>A. cana</i> Pursh	18+1B	McArthur <i>et al.</i> 1981
<i>A. capillaris</i> Thunb.	18-20+1B	Masumori <i>et al.</i> 1973
<i>A. chamaemelifolia</i> Vill.	18+1B	Torrell <i>et al.</i> 1999, 2001
	18+1-5B	Pellicer <i>et al.</i> 2008
<i>A. ciniformis</i> Krasch. et Popov ex Poljakov	18+1B	Dolatyari <i>et al.</i> 2013
<i>A. ferganensis</i> Krasch. ex Poljakov	36+1B	Vallès <i>et al.</i> 2001

Species	Number of chromosomes, 2n	References
<i>A. frigida</i> Willd.	18+2B 18+3B	Bakshi <i>et al.</i> 1987 Stahevitch and Wojtas 1988
<i>A. furcata</i> M. Bieb.	18+1-3f	Dawe and Murray 1979
<i>A. gmelinii</i> Veber ex Stechm.	18+1B	Bhat <i>et al.</i> 1974 Gurmet <i>et al.</i> 2018
<i>A. glomerata</i> Ledeb.	18+1-4B	Korobkov 1972, 1981
<i>A. herba-alba</i> Asso	18+1B	Torrell <i>et al.</i> 2003
<i>A. incana</i> Druce	16+1-5B	Dolatyari <i>et al.</i> 2013
<i>A. keiskeana</i> Miq.	18+1-10B	Masumoto <i>et al.</i> 1995
<i>A. lithophila</i> Turcz. ex DC.	18+1f/B?	Pellicer <i>et al.</i> 2007
<i>A. maritima</i> L. ex Hook. f.	18+1?	Bakshi and Kichloo 1985
<i>A. nilagirica</i> (C.B. Clarke) Pamp.	18+1-4B	Bala <i>et al.</i> 2012; Gupta <i>et al.</i> 2014
<i>A. nova</i> A. Nelson	18+1B	McArthur <i>et al.</i> 1981
<i>A. oliveriana</i> J. Gay ex Besser	18+1B	Khatoon and Ali 1993
<i>A. pygmaea</i> A. Gray	18+1-2B	Garcia <i>et al.</i> 2007
<i>A. rigida</i> A. Gray	18+1-2B	Garcia <i>et al.</i> 2007
<i>A. santolinifolia</i> Turcz. ex Besser	36+4?	Krasnikov and Shirina 2006
<i>A. tridentata</i> Nutt.	18+1B	Torrell <i>et al.</i> 2003
<i>A. tripartita</i> Rydb.	18+1-2B 36+1B	Garcia <i>et al.</i> 2007; McArthur <i>et al.</i> 1981 McArthur <i>et al.</i> , 1981
<i>Baccharis decussate</i> (Klatt) Hieron.	18+4B	Turner <i>et al.</i> 1967
<i>B. magellanica</i> (Lam.) Pers.	18+1B	Hellwig 1990
<i>B. poeppigiana</i> DC.	18+1B	Hellwig 1990
<i>B. punctulata</i> DC.	18+4B	Rozenblum <i>et al.</i> 1985
<i>B. sordescens</i> DC.	18+1B	Keil and Stuessy 1977
<i>B. thesioides</i> Kunth	18+3-4?	Ward and Spellenberg 1988
<i>B. tricuneata</i> Pers.	18+1B?	Turner <i>et al.</i> 1967
<i>B. ulicina</i> Hook. & Arn.	18+3?	Wulff 1998.
<i>B. wrightii</i> A. Gray	18+2?	Weedin and Powell 1978
<i>Bartlettia sordida</i> (Less.) R. King & H. Robinson	32+1B	Watanabe <i>et al.</i> 1995
<i>Calea ternifolia</i> Kunth	38+4-7B 42+B's	Sundberg <i>et al.</i> 1986 Carr <i>et al.</i> 1999
<i>Coreocarpus parthenioides</i> Benth.	24+1-2B	Smith 1989
<i>Eriophyllum confertiflorum</i> (DC.) A. Gray	16, 32+B's 16, 32+1-6B	Mooring 1994 Mooring 2007
<i>Espeletia pycnophylla</i> Cuatrec.	38+2-3B	Carr <i>et al.</i> 1999
<i>Franseria chenopodiifolia</i> Benth. [<i>Ambrosia chenopodiifolia</i> (Benth.) W.W. Payne]	72+2B	Payne <i>et al.</i> 1964
<i>Gynoxys tomentosissima</i> Cuatrec.	40+?f	Turner <i>et al.</i> 1967
<i>Lepidaploa sericea</i> (Rich.) H. Rob.	34+B's	Carr <i>et al.</i> 1999
<i>Liabum eggersii</i> Hieron.	4 0 + 1 - 2	Robinson <i>et al.</i> 1985
<i>L. floribundum</i> Less.	38, 4 0 + 2 , 6 f 7	Robinson <i>et al.</i> 1985

Species	Number of chromosomes, 2n	References
<i>L. wurdackii</i> Ferreyra	36+5B	Carr <i>et al.</i> 1999
<i>Melampodium cinereum</i> DC.	20+2B 20, 40+f's	Stuessy <i>et al.</i> 2004
<i>Mikania congesta</i> DC.	34+1-3B	Watanabe <i>et al.</i> 1995
<i>M. cordifolia</i> (L. f.) Willd.	36+1-7B	Maffei <i>et al.</i> 1999b, Ruas <i>et al.</i> 2000
<i>M. micrantha</i> Kunth	36+1-7B 72+1-2B	Maffei <i>et al.</i> 1998, 1999a
<i>M. pyramidata</i> Donn. Sm.	38-40+5-6f	Robinson <i>et al.</i> 1989
<i>M. scandens</i> (L.) Willd.	34+1B	Watanabe <i>et al.</i> 1995
<i>Monopholis jelskii</i> S.F. Blake	60+8-9B	Turner <i>et al.</i> 1967
<i>Montanoa quadrangularis</i> Sch. Bip.	38+B's	Carr <i>et al.</i> 1999
<i>M. tomentosa</i> Cerv.	38+1	Keil <i>et al.</i> , 1988
<i>Olearia argophylla</i> (Labill.) Benth.	108+1B	Solbrig <i>et al.</i> 1964
<i>O. pimelioides</i> (DC.) Benth.	18+2B	Watanabe <i>et al.</i> 1996
<i>Neomirandea angularis</i> (B.L. Rob.) R.M. King & H. Rob.	50+0-1B	Watanabe <i>et al.</i> 1996
<i>N. biflora</i> R.M. King & H. Rob.	50+2-6B	Watanabe <i>et al.</i> 1996
<i>Parthenium argentatum</i> A. Gray	36+1-2B 36, 72+1-2B	Stebbins and Kodani 1944 Catcheside 1950
<i>Pseudocappia arenaria</i> Rydb.	36+1B	Turner and Lewis 1965
<i>Senecio bracteolatus</i> Hook. & Arn.	40+1B	Wulff 1984
<i>S. confusus</i> Britten	90+5B	Turner <i>et al.</i> 1962
<i>S. grandifolius</i> Less.	60+6-8f	Zhao and Turner 1993
<i>S. grisebachii</i> Baker	40+1B 40+1-2B	Dematteis and Fernandez 1998 Lopez <i>et al.</i> 2013
<i>Stevia salicifolia</i> Cav.	24+1B	Watanabe <i>et al.</i> 1995
<i>Vernonia brevifolia</i> Less.	32+1-3B	Dematteis 1997, Angulo and Dematteis 2009
<i>V. canescens</i> Sch. Bip.	66+1B	Galiano and Hunziker 1987
<i>V. cognata</i> Less.	68+1B-3	Jones 1979
<i>V. geminata</i> Kunth	20+1-6B	Oliveira <i>et al.</i> 2007, 2012
<i>V. glabrata</i> Less.	34B+	Jones 1979
<i>V. megapotamica</i> Spreng.	34+1B	Jones 1979
<i>V. sellowii</i> Less.	62+1-6B	Dematteis 1998
BERBERIDACEAE JUSS.		
<i>Berberis julianae</i> C. K. Schneid.	28+2B	Zhao <i>et al.</i> 1990
BETULACEAE GRAY		
<i>Betula papyrifera</i> Marshall	84+3-8B	Butorina <i>et al.</i> 1975, 2003
BIGNONIACEAE JUSS.		
<i>Cydista aequinoctialis</i> Miers	40+1-2B	Goldblatt and Gentry 1979
BUXACEAE DUMORT.		
<i>Sarcococca brevifolia</i> Stapf ex Gamble	28+1-2B	Bir and Chatha 1985
CAPPARACEAE JUSS.		
<i>Crataeva (Crateva) nurvala</i> Buch.-Ham.	26+1-3B	Gill <i>et al.</i> 1981c, Singhal <i>et al.</i> 1985b

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CAPRIFOLIACEAE JUSS.		
<i>Lonicera altaica</i> Pall.	36+1-4B	Solov'eva and Plekhanova 1992
<i>L. edulis</i> Turcz.	18+1-4B	Solov'eva and Plekhanova 1992
<i>L. pallasii</i> Ledeb.	36+1-2B	Solov'eva and Plekhanova 1992
<i>L. regeliana</i> Bohcarn.	18+1-2B	Solov'eva and Plekhanova 1992
<i>L. stenantha</i> Pojark.	36+1-3B	Solov'eva and Plekhanova 1992
<i>Sambucus adnata</i> Wall.	36+1B	Mehra and Bawa 1968; Mehra 1972, 1976
<i>S. canadensis</i> L.	36+1-2B	Mehra and Bawa 1968; Mehra, 1972, 1976
<i>S. nigra</i> L.	36+1-3B	Sandhu and Mann 1988, Gill and Singhal 1998
<i>S. racemosa</i> L.	36+1-2B	Löve and Löve 1982
<i>Viburnum alnifolium</i> Marshall	18+1-2B	Plante 1995
<i>V. chingii</i> P.S. Hsu	18+1-2B	Plante 1995
<i>V. foetens</i> Decne.	16+1B	Mehra 1976
CHENOPODIACEAE VENT.		
<i>Kochia prostrata</i> (L.) Schrad.	54+1B	Khatoon and Ali 1993
CHLORANTHACEAE R. BR. EX SIMS		
<i>Hedyosmum brasiliense</i> Mart.	16+1B	Morawetz 1986
COMBRETACEAE R. BR.		
<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight et Arn.	24+1-2B	Gill <i>et al.</i> 1981c, 1982, 1990; Singhal and Gill, 2003
CORNACEAE BERCHT ET J. PRESL		
<i>Cornus rugosa</i> Lam.	22+1B	Clay and Nath 1971
EBENACEAE GÜRKE.		
<i>Diospyros ebenum</i> J. Koenig	30+1-2B	Bir and Chatha 1985; Chatha and Bir 1987a; Gill and Singhal, 1998
<i>D. lotus</i> L.	20+1s	Chromosome atlas of Chinese fruit trees... 1993
EPACRIDACEAE R. BR.		
<i>Brachyloma preissii</i> Sond.	14+1B	Darlington and Wylie 1955
<i>Leucopogon oldfieldii</i> Benth.	22+1-4B	Smith-White 1955
EUPHORBIACEAE JUSS.		
<i>Alchornea cordifolia</i> (Schumach.) Müll. Arg.	36+1-2B	Gill and Obembe 1991
<i>Euphorbia rothiana</i> Spreng.	20+2B	Krishnappa and Reshme 1980
<i>E. royleana</i> Boiss.	120+1-2B	Bir <i>et al.</i> 1980; Gill <i>et al.</i> 1981a, d; Bedi <i>et al.</i> 1981b, 1985; Chatha and Bir 1987b
<i>Joannesia princeps</i> Vell.	22+1-2B	Gill <i>et al.</i> 1981a, d; Bedi <i>et al.</i> 1981a, 1985; Chatha and Bir 1987b; Bedi 1990a
<i>Sapium insigne</i> Benth. et Hook. f.	44+1-3B	Mehra and Gill 1968; Gill <i>et al.</i> 1973; Mehra 1976
<i>Tithymalus dulcis</i> Scop.	20+2-6B	Mesíček 1992
FABACEAE LINDL. (LEGUMINOSAE JUSS.)		
<i>Alhagi camelorum</i> Fisch.	16+2B	Al-Turki <i>et al.</i> 2000
<i>Anagyris foetida</i> L.	18+1-4B	Cusma Velari <i>et al.</i> 2012

Species	Number of chromosomes, 2n	References
<i>A. latifolia</i> Brouss. ex Willd.	18+1-2B	Cusma Velari <i>et al.</i> 2012
<i>Astragalus captiosus</i> Boriss.	16+2B	Sytin 1984
<i>A. lasioglottis</i> M. Bieb.	16+2B	Sytin 1984
<i>Bauhinia tomentosa</i> L.	28+1f	Gilland Husaini 1982
<i>Butea monosperma</i> Taub.	18+f	Kedharnath 1950
	18+1B	Anis 1983, Raghuvanshi and Pande 1985, Raghuvanshi, and Kesarwani 1989 Singhal and Gill 2003
<i>Caragana arborescens</i> Lam.	16+1B	Zhou <i>et al.</i> 2002
<i>C. chinghaiensis</i> Y.X. Liou	16+2B	Niu <i>et al.</i> 2006
<i>C. versicolor</i> Benth.	16+2B	Gu and Sun 1996
<i>Cassia hirsute</i> L.	16+1B	Gill and Husaini 1981, 1985; George and Bhavananda 1993
<i>C. podocarpa</i> Guill. et Perr.	16+1B	Gill and Husaini 1981, 1985
<i>Chamaecytisus proliferus</i> Link	52+1-2B	Cusma Velari <i>et al.</i> 2009b
<i>Crotalaria australis</i> (Baker f.) Baker f. ex I. Verd.	16+1B	Verma and Raina 1983
<i>C. brownei</i> DC.	16+1-2B	Gupta and Gupta 1977, 1978b
<i>C. confusa</i> Hepper	16+1B	Husaini and Gill 1985
<i>C. grahamiana</i> Wight & Arn.	16+1-2B	Verma and Raina 1983
<i>C. grantiana</i> Harv.	16+1-2B	Verma and Raina 1983
<i>C. juncea</i> L.	16+1-2B	Gupta and Gupta 1977
<i>C. leioloba</i> Bartl.	16+1B	Verma and Raina 1983
<i>C. leubnitziana</i> Schinz	16+1B	Verma and Raina 1983
<i>C. medicaginea</i> Lam.	16+1-3B	Gupta and Gupta, 1977, 1978a,b
<i>C. mucronata</i> Desv.	16+1-2B	Verma and Raina 1983
<i>C. retusa</i> L.	16+1-2B	Gupta and Gupta 1977, 1978a,b
<i>C. sericea</i> Retz.	16+1-2B	Gupta and Gupta 1977
<i>C. sphaerocarpa</i> Perr. ex DC.	16+1-2B	Verma <i>et al.</i> 1984
<i>C. trifolium</i> Willd.	16+1-2B	Verma <i>et al.</i> 1984
<i>Cytisus decumbens</i> Spach	48+1-2B	Cusma Velari <i>et al.</i> 2007
<i>C. fontanesii</i> Spach ex Ball	48, 50+1-2B	Cusma Velari <i>et al.</i> 2003b
<i>C. megalanthus</i> Pau & Font Quer	46+1-5B	Cubas <i>et al.</i> 2001
<i>C. multiflorus</i> Sweet	46+3B	González Zapatero and Elena Rosselló 1986
<i>C. orientalis</i> Loisel.	48, 50+1-2B	Cusma Velari <i>et al.</i> 2003b
<i>C. pseudoprocumbens</i> Margr.	48, 52+1-2B	Cusma Velari <i>et al.</i> 2007
<i>C. purpureus</i> Scop.	48+2B	Cusma Velari <i>et al.</i> 1999
<i>C. spinescens</i> C. Presl	104+1-2B	Cusma Velari <i>et al.</i> 2007
<i>C. valdesii</i> Talavera & P. E. Gibbs	46+1-3B	Cubas <i>et al.</i> , 2001
<i>Derris indica</i> (Lam.) Bennet	22+1-7B	Gill <i>et al.</i> 1981d
<i>Desmodium podocarpum</i> DC.	22+1-2B	Sandhu and Mann 1989
<i>Erythrina caffra</i> Thunb.	42+1-3B	Gill <i>et al.</i> 1981d; Singhal <i>et al.</i> 1985b, 1990; Singhal and Gill 2003

Species	Number of chromosomes, 2n	References
<i>E. suberosa</i> Roxb.	42+1-2B	Mehra and Hans 1969, 1971, Mehra 1972, Lewis 1974
<i>Genista acanthoclada</i> DC.	48+1-2B	Cusma Velari <i>et al.</i> 1997
<i>G. albida</i> Willd.	18+1-2B 36+1-3B	Cusma Velari <i>et al.</i> 2009a “-“
<i>G. arbusensis</i> Vals.	27+1-2B	Cusma Velari <i>et al.</i> 2001a
<i>G. cephalantha</i> Spach	26+2B	Cusma Velari <i>et al.</i> 2000
<i>G. cilentina</i> Vals.	48+1-4B	Bacchetta <i>et al.</i> 2012
<i>G. desoleana</i> Vals.	18+1-4B	Cusma Velari <i>et al.</i> 2011
<i>G. dorycnifolia</i> Font Quer	48+1-2B	Bacchetta <i>et al.</i> 2012
<i>G. fasselata</i> Decne.	48+1-6B	Cusma Velari and Feoli Chiapella 2011
<i>G. halacsyi</i> Heldr.	18+1-2B	Cusma Velari <i>et al.</i> 2009a
<i>G. hystrix</i> Lange	24, 26, 27 +1-2B	Cusma Velari <i>et al.</i> 2006b
<i>G. insularis</i> Bacch., Brullo et Feoli Chiapella	48+1-2B	Bacchetta <i>et al.</i> 2012
<i>G. involcrate</i> Spach	18+1-2B	Cusma Velari <i>et al.</i> 2002, 2009a;
	36+1-3B	Cusma Velari <i>et al.</i> 2009a
<i>G. libanotica</i> Boiss.	46+2-3B 48+1-2B	Cusma Velari <i>et al.</i> 2010 “-“
<i>G. lydia</i> Boiss.	48+1-2B	Cusma Velari <i>et al.</i> 2006b
<i>G. millii</i> Heldr. ex Boiss.	36+2B	Cusma Velari <i>et al.</i> 2009a
<i>G. pichisermolliana</i> Vals.	18+1-2B	Cusma Velari <i>et al.</i> 2011
<i>G. pulchella</i> Vis.	18+0-4B	Cusma Velari <i>et al.</i> 2009a
<i>G. sagittalis</i> L.	44+1-2B	Cusma Velari <i>et al.</i> 2008
<i>G. sakellariadis</i> Boiss. et Orph.	36+2B	Cusma Velari <i>et al.</i> 2009a
<i>G. salzmännii</i> DC.	18+1-2B	Cusma Velari <i>et al.</i> 2011
<i>G. spartioides</i> Spach	40+1-2B	Cusma Velari <i>et al.</i> 2003a
<i>G. subcapitata</i> Pandcet Nym.	18+1-2B	Cusma Velari <i>et al.</i> 2009a
<i>G. sulcitana</i> Vals.	18, 27+1-2B	Cusma Velari <i>et al.</i> 2001a, 2006b
<i>G. toluensis</i> Vals.	18+1-2B	Cusma Velari <i>et al.</i> 2011
<i>G. tournefortii</i> Spach	32+1-2B	Cusma Velari <i>et al.</i> 1999, 2006a
<i>G. triacanthos</i> Brot.	32+1-2B	Cusma Velari <i>et al.</i> 2006a
<i>G. tricuspidata</i> Desf.	48+1-4B	Cusma Velari <i>et al.</i> 2000
<i>G. tridentata</i> L.	28, 56+1-2B	Cusma Velari <i>et al.</i> 2008
<i>G. tyrrhena</i> Vals.	48+1-2B	Bacchetta <i>et al.</i> 2012
<i>G. valdes-bermejoi</i> Talavera et L. Sáez	48+1-2B	Cusma Velari <i>et al.</i> 2001b
<i>G. versicolor</i> Boiss.	36+2-4B 38, 39, 40 +1-3B	Cusma Velari <i>et al.</i> 2010 “-“
<i>Gliricidia sepium</i> (Jacq.) Kunth	22+1B	Rao 1972
<i>Hypocalyptus oxalidifolius</i> Baill.	20+1-2B	Goldblatt 1981
<i>Indigofera arrecta</i> Hochst. ex A. Rich.	16+2B	Sanjappa and Bhatt 1977, 1984

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<i>Laburnum alpinum</i> J. Presl	48+2B	Cusma Velari <i>et al.</i> 1997
<i>Leucaena diversifolia</i> Benth.	26, 52+1-8B	Pan and Brewbaker 1988
<i>L. pallida</i> Britton & Rose	52+1-8B	Pan and Brewbaker 1988
<i>Millettia brandisiana</i> Kurz	22+1-2B	Gill <i>et al.</i> 1981d; Singhal <i>et al.</i> 1984, 1985b, 1990
<i>Mimosa rubicaulis</i> Lam.	26+1-2B	Sandhu and Mann 1988
<i>Pongamia pinnata</i> (L.) Pierre [<i>Millettia pinnata</i> (L.) Panigrahi]	22+1-7B	Gill <i>et al.</i> 1990; Singhal <i>et al.</i> 1990, Kumari and Singhal 2003, Singhal and Gill 2003
<i>Prosopis cineraria</i> (L.) Druce (<i>Mimosa cineraria</i> L.)	28+1B	Rawat <i>et al.</i> 2007
<i>Spartocytisus supranubius</i> (L.f.) Christ ex G. Kunkel [<i>Cytisus supranubius</i> (L.f.) Kuntze]	48+1-4B	Cusma Velari and Feoloi Chiapella 1994
<i>Tamarindus indica</i> L.	24+1-4B	Gill <i>et al.</i> 1981d, 1990; Singhal <i>et al.</i> 1990; Singhal and Gill 2003
<i>Tephrosia konzattii</i> Standl.	22+2f	Wood 1949
FAGACEAE DUMORT.		
<i>Quercus mongolica</i> Fisch. ex Ledeb.	24+4B	Probatova <i>et al.</i> 2012
<i>Q. petraea</i> (Matt.) Liebl.	24+1B 24+1-3(B?)	Ohri and Ahuja 1990, Zoldos <i>et al.</i> 1998
<i>Q. robur</i> L.	24+1B	Ohri and Ahuja 1990
<i>Q. rubra</i> L.	24+1B	Ohri and Ahuja 1990
GARRYACEAE LINDL.		
<i>Aucuba japonica</i> Thunb.	32+1-2B	Yamamoto 1937, Viinikka 1970
GERANIACEAE JUSS.		
<i>Erodium chrysanthum</i> L'Hér. ex DC.	36+1-3B	Constantinidis 1996
<i>Pelargonium petroselinifolium</i> G. Don	18+1B	Gibby <i>et al.</i> 1996
<i>P. proliferum</i> Steud.	22+1B	Gibby <i>et al.</i> 1996.
GROSSULARIACEAE DC.		
<i>Ribes americanum</i> Mill.	16+B's	Meurman 1928
<i>R. x carrierei</i> C.K. Schneid. (<i>R. nigrum</i> × <i>R. sanguineum</i>)	16+B's	Meurman 1928
<i>R. x gordonianum</i> Lem. (<i>R. odoratum</i> × <i>R. sanguineum</i>)	16+1B	Meurman 1928
<i>R. nigrum</i> L.	16+1B	Ding 1996.
<i>R. sanguineum</i> Pursh	16+B's	Meurman 1928
LAMIACEAE LINDL.		
<i>Caryopteris foetida</i> Thell.	60+1-6B	Bedi <i>et al.</i> 1981b, 1985, Gill <i>et al.</i> 1981b, 1985, Chatha and Bir 1987b
<i>C. grata</i> Benth. et Hook. f.	60+1-6B	Bir <i>et al.</i> 1980, Gill <i>et al.</i> 1981d
<i>Clerodendron colebrookianum</i> Walp.	52+1-2B	Mehra and Bawa 1968, Mehra 1972, 1976
<i>Dicerandra cornutissima</i> Huck	32+1B	Huck and Chambers 1997
<i>D. cornutissima</i> Huck	32+1B	Huck and Chambers 1997
<i>D. densiflora</i> Benth.	48+1-2B	Huck and Chambers 1997
<i>D. frutescens</i> Shinnars	48+1-2B	Huck and Chambers 1997

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<i>D. immaculata</i> Lakela	48+1B	Huck and Chambers 1997
<i>D. linearifolia</i> (Elliott) Benth.	48+1B	Huck and Chambers 1997
<i>D. odoratissima</i> R.M. Harper	32+1-2B	Huck and Chambers 1997
<i>Lavandula latifolia</i> Medik.	72+3s	Fernandes and Leitão 1984
<i>Premna pinguis</i> C. B. Clarke	38+1-2B	Mehra 1976
<i>Salvia blancoana</i> Webb & Heldr. ex Walp.	16+1-2B	Afzal-Rafii 1976
<i>S. candelabrum</i> Boiss.	14+1-2B	Rosua and Blanca 1985
<i>S. dorisiana</i> Standl.	22+1B	Harley and Reynolds 1992
<i>S. fruticosa</i> Mill.	14+1-2B	Nakipogu 1993
<i>S. lavandulifolia</i> Vahl	14+1B	Rosua and Blanca 1985
<i>S. lycioides</i> A. Gray	22+1s	Ward and Spellenberg 1988
<i>Satureja spinosa</i> L.	30+2B	Montmollin 1986
<i>Scutellaria repens</i> Buch.-Ham. ex D. Don	20+1B	Gill 1974, 1984
<i>Teucrium montanum</i> L.	26+1-2B 26+1-7B	Mártonfi 1995 Feráková and Murín 1974
<i>T. polium</i> L.	26+3-4B	Puech 1990
<i>T. webbianum</i> Boiss.	26+3-4B 32+1B 48+1-2B	Puech 1990 Valdes-Bermejo and Sanchez Crespo 1978
<i>Thymus ovatus</i> Mill. (<i>T. pulegioides</i> L.)	28+2-3B	Dmitrieva and Parfenov 1991
LAURACEAE JUSS.		
<i>Beilschmiedia brandisii</i> Hook. f.	24+1-2B	Mehra 1976, Gill and Singhal 1998
<i>B. gammieana</i> King ex Hook. f.	24+1-2B	Mehra and Bawa 1968, Mehra 1972, 1976
<i>Litsea elongata</i> (Nees ex Wall.) Benth. et Hook. f.	24+1B	Mehra and Gill 1968, 1971, Mehra 1972, 1976
<i>Machilus macrantha</i> Nees	24+1B	Chatha and Bir 1987a, Gill and Singhal 1998
<i>M. odoratissimus</i> Nees	24+1-2B	Sandhu and Mann, 1988, Gill and Singhal, 1998
<i>Neolitsea zeylanica</i> (Nees & T. Nees) Merr.	48+4-5B	Mehra and Bawa 1968, Mehra 1972, 1976
LORANTHACEAE JUSS.		
<i>Helicanthes elastica</i> (Desr.) Danser	18+1-2B	Soman and Ramachandran 1987, Soman and Bhavanandan 1993
<i>Ligaria cuneifolia</i> Tiegh.	20+1-6B	Sanso and Seo 2005
<i>Psittacanthus bolleanus</i> (Torr.) Wiens	28+2B	Wiens 1964a
<i>Taxillus cuneatus</i> Danser	18+1-2B	Soman and Ramachandran 1987
LYTHRACEAE J. ST.-HIL.		
<i>Cuphea ericoides</i> Cham. et Schldl.	14, 28+1B	Graham and Cavalcanti 2001
<i>Lafoensia densiflora</i> Pohl	16+1-2B	Pierozzi and da Cruz 1989
MALPIGHIACEAE JUSS.		
<i>Banisteria laevifolia</i> A. Juss. [<i>Banisteriopsis laevifolia</i> (A. Juss.) B. Gates]	20+1-2B	Gill <i>et al.</i> 1981d, Singhal <i>et al.</i> 1985a
<i>Hiptage benghalensis</i> (L.) Kurz	56+1B 60+1-4B	Bir <i>et al.</i> 1980, Gill <i>et al.</i> 1981d, Singhal and Gill 1985, Singhal <i>et al.</i> 1985a Gill <i>et al.</i> 1990, Singhal and Gill 1985, Singhal <i>et al.</i> 1985a

Species	Number of chromosomes, 2n	References
MALVACEAE JUSS.		
<i>Grewia aspera</i> Roxb.	18+2B	Krishnappa and Munirajappa 1982
<i>Hibiscus fuscus</i> Garcke	32+2B	Kachecheba 1972
<i>H. obtusilobus</i> Garcke	14+1B	Khatoon and Ali 1993
<i>H. vitifolius</i> L.	34+1B	Skovsted 1941
<i>Sida rhombifolia</i> L.	14+1B 14+2B 28+1-8B	Skovsted 1941 Cheng and Tsai 1999 Hazra and Sharma 1971a, b
MELIOSMACEAE ENDL.		
Family is often considered as the subfamily Meliosmoideae within the family Sabiaceae Blume (Takhtajan 1997, 2009, The Plant List. – URL: http:// theplantlist.org)		
<i>Meliosma pungens</i> Hook. f.	32+1-3B	Gill <i>et al.</i> 1979, 1981b, Sandhu and Mann 1988
MENISPERMACEAE JUSS.		
<i>Cocculus laurifolius</i> DC.	26+1-3B	Bir <i>et al.</i> 1981, Gill <i>et al.</i> 1981d
<i>Stephania cephalantha</i> Hayata	22+1B	Wang <i>et al.</i> 2005
MORACEAE LINK		
<i>Ficus krishnae</i> C. DC.	26+1-2B	Joshi and Raghuvanshi 1970a
<i>Morus indica</i> L.	28+1-2B	Sandhu and Mann 1989, Gill and Singhal 1998, Singhal and Gill 2003
MUSACEAE JUSS.		
<i>Musa acuminata</i> Colla	22+ f(1B?)	Govindaswami 1965
<i>M. cavendishii</i> Lambert et Paxton	32+f(1B?)	Matsuura and Sutô 1935
<i>M. rubra</i> Wall. ex Kurz	22+1-4B	Agarwall 1983
MYRTACEAE JUSS.		
<i>Syzygium cumini</i> (L.) Skeels	22+1-3B	Sandhu and Mann 1988, Gill and Singhal 1998, Singhal and Gill 2003
PHYLLANTHACEAE MARTINOV		
<i>Antidesma diandrum</i> B. Heyne ex Roth.	26+1-2B	Mehra and Gill 1968, 1971, Mehra 1972, 1976
<i>Baccaurea sapida</i> Müll. Arg.	26+1-3B	Mehra 1976, Bedi <i>et al.</i> 1985, Chatha and Bir 1987b
<i>Breynia rhamnoides</i> Müll. Arg.	52+1-2B	Bir <i>et al.</i> 1980 Gill <i>et al.</i> 1981a, d, Bedi <i>et al.</i> 1985, Chatha and Bir 1987b; Bedi 1990a
<i>Phyllanthus erythrinus</i> Müll. Arg.	50+7B	Soontornchainaksaeng and Chaiyasut 1999
<i>Ph. parvifolius</i> Buch.-Ham. ex D. Don	52+1B	Sandhu and Mann 1989
<i>Ph. pulcher</i> (Baill.) Wall. ex Müll. Arg.	50+6-10B	Soontornchainaksaeng and Chaiyasut 1999
PIPERACEAE C. A. AGARDH		
<i>Piper schmidtii</i> Hook. f.	144+1f	Chatha and Bir 1987a
PLUMBAGINACEAE JUSS.		
<i>Plumbago capensis</i> Thunb.	14+1B	Bedi <i>et al.</i> 1980, 1985, Gill <i>et al.</i> 1981d, 1990, Chatha and Bir 1987b
POACEAE BARNHART (GRAMINEAE JUSS.)		
<i>Sasa kurilensis</i> Makino et Shibata	48+2B	Namikawa and Imakita 1992
<i>Sasamorpha borealis</i> (Hack.) Nakai	48+1-3B	Namikawa and Imakita 1992

Species	Number of chromosomes, 2n	References
POLYGALACEAE HOFFMANN. ET LINK		
<i>Polygala chamaebuxus</i> L.	44+1-4B	Mexmüller and Heubl 1983
<i>P. vayredae</i> Costa	28+1-2B	Mexmüller and Heubl 1983
PUNICACEAE BERCHT. ET J. PRESL		
Family is often considered as the subfamily Punicoideae within the family Lythraceae J. St.-Hil. (The Plant List, 2013 – www.theplantlist.org; Stepanyan-Gandilyan, 2017)		
<i>Punica granatum</i> L.	16+1-7B	Mehra and Gill 1971, Mehra 1972, 1976, Gill <i>et al.</i> 1979, 1981b, d, Singhal and Gill, 2003, Sheidai and Noormohammadi 2005, Sheidai <i>et al.</i> 2005, 2012, Sheidai 2007
RANUNCULACEAE JUSS.		
<i>Clematis buchaniana</i> DC.	16+1B	Bir and Thakur 1984, Bir <i>et al.</i> 1987
<i>C. cirrhosa</i> L.	16+1B	Constantinidis <i>et al.</i> 1997
<i>C. flammula</i> L.	16+1B	Kumar <i>et al.</i> 2008
<i>C. grata</i> Wall.	16+1B	Rani <i>et al.</i> 2011, 2014
<i>C. x hatherliensis</i> (C. orientalis L. x C. tangutica Korsh.)	16+1-2B	Shambulingappa 1965, 1966
<i>C. orientalis</i> L.	16+1-2B	Shambulingappa 1965, 1966, Kaur <i>et al.</i> 2011
<i>C. recta</i> L.	16+1B	Kirschner and Štěpánek 1992
RHAMNACEAE JUSS.		
<i>Pomaderris kumeraho</i> A. Cunn	24+f(1B?)	Hair 1963
<i>P. phyllicifolia</i> G. Lodd.	48+f(1B?)	Hair 1963
<i>Ziziphus jujuba</i> Lam. (<i>Z. mauritiana</i> Lam.)	48+1B	Khoshoo and Singh 1963
<i>Z. mauritiana</i> Lam. (<i>Z. jujuba</i> Lam.)	48+1-3B	Gill <i>et al.</i> 1988
ROSACEAE JUSS.		
<i>Cotoneaster alaunicus</i> Golitsin	68+1B	Krügel 1992
<i>Malus pumila</i> Mill. (<i>M. domestica</i> Borkh.)	34+5B	Chaudhary and Mehra, 1975
<i>Rosa rugosa</i> Thunb.	14+1B	Price <i>et al.</i> 1981
<i>R. sp.</i> (garden roses)	28+1-2B	Lata 1981, 1982a, b
<i>R. spinosissima</i> L.	28+1B	Darlington and Wylie 1955
<i>R. woodsii</i> Lindl.	14+1-2B	Erlanson 1933
<i>Rubus bohemii</i> Holub et Palek ex Holub	27+1f(B?)	Krahulcová and Holub 1998
<i>Sorbus meinichii</i> Hedl.	48+1-3s 49, 50+1s	Bolstad and Salvesen 1999 ““
RUBIACEAE JUSS.		
<i>Palicourea marcgravi</i> A. St.-Hil.	22+3B	Pinto-Maggio <i>et al.</i> 1997
<i>Plectronia ficiformis</i> Gamble	44+1-4B	Gill and Singhal 1998
RUTACEAE JUSS.		
<i>Citrus reticulata</i> Blancox <i>C. paradisi</i> Macfad.	18+1B	Raghuvanshi and Anis 1980
<i>Ruta angustifolia</i> Pers.	36+4B	Natarajan 1978
<i>Zanthoxylum alatum</i> Roxb.	66+1-4B	Sandhu and Mann 1988, Gill and Singhal 1998
SALICACEAE MIRB.		
<i>Salix salviifolia</i> Brot.	38+1-4B	de Almeida 1946

Species	Number of chromosomes, 2n	References
SANTALACEAE R. BR.		
<i>Santalum album</i> L.	20+1B	Selvaraj and Subramaniam 1982
SAPINDACEAE JUSS.		
<i>Aesculus hippocastanum</i> L.	40+1B	Mesićek 1992
SCROPHULARIACEAE JUSS.		
<i>Hebe insularis</i> (Cheeseman) Cocrayne et Allan This genus is often included in the family Plantaginaceae (The Plant List, 2013 –www.theplantlist.org)	20+1B	Hair 1967
SMILACACEAE VENT.		
<i>Smilax zeylanica</i> L.	34+1-8B	Pal and Sharma 1976
SOLANACEAE JUSS.		
<i>Cestrum diurnum</i> L.	16+1-6B	Sobti <i>et al.</i> 1979
<i>C. euanthes</i> Schldl.	16+1-3 B	Urdampilleta <i>et al.</i> 2015
<i>C. intermedium</i> Sendtn.	16+1-2B	Fregonezi <i>et al.</i> 2004, 2007
<i>C. nocturnum</i> L.	16+1-10B	Urdampilleta <i>et al.</i> 2015
<i>C. parqui</i> Benth. (<i>C. thrysoideum</i> Kunth)	16+1-3B	Urdampilleta <i>et al.</i> 2015
<i>C. parqui</i> L'Hér. x <i>C. aurantiacum</i> Lindl.	16+1-10B	Sýkorová <i>et al.</i> 2003a, b
<i>C. strigilatum</i> Ruiz et Pav.	16+1-2B	Fregonezi <i>et al.</i> 2004, 2007, Fernandes <i>et al.</i> 2008, Vanzela <i>et al.</i> 2017
<i>Lycium amoenum</i> Dammer	24+0-1B	Venter and Spiers 2008
<i>Solanum dulcamara</i> L.	24+1-2	Dmitrieva 1986, Parfenov and Dmitrieva 1988, Dmitrieva and Parfenov 1991
<i>S. gilo</i> Raddi (<i>S. aethiopicum</i> L.)	24+1-2B	Gill and Obembe 1991
<i>S. viarum</i> Dunal	24+1-2B	Dnyansagar and Pingle 1979
SYMPLOCACEAE DESF.		
<i>Symplocos crataegoides</i> Buch.-Ham. ex D. Don	22+1B	Mehra and Gill 1968, 1971, Mehra 1976
<i>S. glomerata</i> King ex Gamble	22+1-2B	Mehra and Bawa 1968, Mehra 1972, 1976
<i>S. ramosissima</i> Wall.	22+1B	Mehra 1976
TERNSTROEMIAACEAE MIRB. EXDC.		
<i>Saurauia napaulensis</i> DC. This genus is included now in the family Actinidiaceae Gilg & Werderm., tribe Saurauieae (Takhtajan 1997, 2009), The Plant List. – URL: http://theplantlist.org)	40+1B	Mehra 1976
ULMACEAE MIRB.		
<i>Celtis wightii</i> Planch. The genera Celtis and Trema are included now in the family Cannabaceae Martinov (The Plant List. – URL: http://theplantlist.org)	40+1-3B	Bir and Chatha 1985, Chatha and Bir 1987a, Gill and Singhal 1998
<i>Trema orientale</i> (L.) Blume	40+1-2B	Gill <i>et al.</i> 1981d, Bedi <i>et al.</i> 1981a, 1985, Bedi 1990b, Chatha and Bir 1987b, Gill <i>et al.</i> 1990
<i>T. politoria</i> (Planch.) Blume	20+1B	Mehra and Gill 1968, 1971, 1974; Mehra 1972, 1976; Gill <i>et al.</i> 1981d
URTICACEAE JUSS.		
<i>Boehmeria clidemioides</i> Miq.	24+1B	Zhang 1993

Species	Number of chromosomes, 2n	References
<i>Girardinia leschenaultiana</i> Decne.	24+1-2B	Bir and Chatha 1985, Chatha and Bir 1987a
VERBENACEAE J. ST.-HIL.		
<i>Vitex negundo</i> L.	32+2B	Bala and Gupta 2011
VISCACEAE MIERS		
Family is included now in the family Santalaceae R. Br. (The Plant List. – URL: http:// theplantlist.org)		
<i>Phoradendron californicum</i> Nutt.	28+2B	Wiens 1964
<i>Ph. lanatum</i> Trel.	28+3-4B	Wiens 1964
<i>Ph. puberulum</i> Trel.	28+2B	Wiens 1964
<i>Ph. robinsonii</i> Trel.	28+2-3B	Wiens 1964
<i>Ph. velutinum</i> Nutt.	28+3B	Wiens 1964

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