MISCELLANEOUS CHROMOSOME COUNTS IN ANGIOSPERMS, II. INCLUDING NEW FAMILY AND GENERIC RECORDS[1]

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ABSTRACT

The following chromosome counts are reported: *Ferraria glutinosa* $2n = 40$ (Iridaceae); *Mortoniella pittieri* $2n = 32$ (Apocynaceae); *Nemopanthus mucronata* $2n = 20$ (Aquifoliaceae); *Balanites aegyptica* $2n = 18$ (Balanitaceae); *Balanops australina* $2n = 42$ (Balanopaceae); *Neochamaelea pulverulentum* $2n = 36$ (Cneoraceae); *Wendtia gracilis* $2n = 18$ (Ledocarpaceae); *Grevea eggelingii* $2n = 24$ (Montiniaceae); *Trophis phillipinensis* $2n = 28$ (Moraceae); *Uncarina grandidieri* $2n = 36$ (Pedaliaceae); *Holodiscus discolor* $n = 18$ (Rosaceae); *Meliosma panamensis* $2n = 32$ (Sabiaceae); *Trigonia virens* $2n =$ ca. 20 (Trigoniaceae); *Vochysia lomatophylla* $2n = 22$ (Vochysiaceae); *Teedia lucida* $2n = 38$ (Scrophulariaceae). Counts include three first reports for a family and 10 first reports for genera.

Since the publication of Raven's (1975) review of cytology in relation to angiosperm phylogeny which focused attention on important gaps in the chromosome record, a concerted effort has been made by Raven, myself, and others (Goldblatt, 1976a, 1978; Goldblatt & Endress, 1977) to obtain material of cytologically unknown taxa for study. This paper which presents counts in several rare or taxonomically critical groups, as well as some counts of less importance, conveniently included here, is one of a series arising from Raven's study.

Counts presented here include reports for 15 species, each a different family, and three of which, Vochysiaceae, Trigoniaceae, and Balanopaceae are first records for these families. In addition, first generic reports are presented for *Nemopanthus* (Aquifoliaceae), *Neochamaelea* (Cneoraceae), *Wendtia* (Ledocarpaceae), *Holodiscus* (Rosaceae), *Uncarina* (Pedaliaceae), *Trophis* (Moraceae), *Grevea* (Montiniaceae), *Teedia* (Scrophulariaceae), and *Mortoniella* (Apocynaceae). Significance of the counts obtained in relation to taxonomy or phylogeny is discussed briefly after each count.

Counts recorded as haploid are from pollen mother cells, and those given as diploid are from mitosis in root tips. Methods employed are the same as I have described previously (Goldblatt, 1978).

MONOCOTYLEDONS

IRIDACEAE

Ferraria glutinosa (Baker) Rendle, $2n = 40$. Namibia (South West Africa), Ovamboland, Oshikango, *Rodin 9360* (MO).

Ferraria glutinosa, the only tropical African species of this predominantly

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Southwestern Cape-Namaqualand genus, is evidently tetraploid, this being the first reported count for this species. A base number of $x = 10$ is well established for *Ferraria* in western South Africa, with reports of $2n = 20$ and $2n = 60$ for species from this area (Goldblatt, 1971).

DICOTYLEDONS

APOCYNACEAE

Mortoniella pittieri Woodson, $2n = 32$. Nicaragua, Dept. Chontales, N of Cuapa, *Stevens 6170* (MO).

The count of $2n = 32$ for *Mortoniella* is unusual for Apocynaceae in which $2n = 22$ is frequent, and $x = 11$ probably basic (Raven, 1975). The number in *Mortoniella* probably represents polyploidy on the base of $x = 8$, which has been found in a few genera and is the lowest number recorded for the family.

AQUIFOLIACEAE

Nemopanthus mucronata (L.) Trel, $2n = 40$. U.S.A., Caledonia Co., Vermont, West Burke, *Conant 3408* (MO).

This is the first count for *Nemopanthus,* the monotypic North American member of the bigeneric Aquifoliaceae. The base number for *Nemopanthus,* evidently $x = 20$, is the same as that for *Ilex* (Frierson, 1959; Goldblatt, 1976a) and confirms $x = 20$ as basic for Aquifoliaceae.

BALANITACEAE

Balanites aegyptica (L.) Delile, $2n = 18$. Rhodesia, Chipoli near Shamva, cult. Missouri Botanical Garden, *Goldblatt 4649* (MO).

Previous counts in the monogeneric Balanitaceae are $2n = 18$ and 16 for *Balantes aegyptica* and $2n = 16$ for *B. wilsoniana* (Mangenot & Mangenot, 1957, 1962; Pathak et al., 1949). The count obtained here is undoubtedly $2n = 18$, and suggests that the earlier report of $2n = 16$ in *B. aegyptica* may be erroneous, and possibly also that for *B. wilsoniana.* A base number of $x = 9$ seems likely for Balanitaceae.

BALANOPACEAE

Balanops australina F. Muell., $2n = 42$. Australia, Queensland, State Forest Reserve 607, *Dockrill 1405* (QRS).

This is the first count for *Balanops,* and for Balanopaceae, a monogeneric Australasian family of unknown affinity. The family is commonly placed near the predominantly Northern Hemisphere Fagales, either within this order (Cronquist, 1968) or in a separate order in the Betulales-Fagales line of evolution (Takhtajan, 1969). Dahlgren (1975) tentatively places Balanopales between Fagales and Cunoniales in his Hamamelidanae. The treatment of Thorne (1976) is exceptional in placing Balanopaceae in Pittosporales-Daphniphyllineae, the other family of this suborder being Daphniphyllaceae. The number recorded here for *Balanops,* $n = 21$, contributes little evidence on the relationships of the genus. Fagales have typically high base numbers of $x = 13$ (*Nothofagus*) and 12, but also $x = 8$ in

Carpinaceae (Raven, 1975). Notably, however, the isolated *Trigonobalanus* has $n = 22$ which may be significant in relation to Balanopaceae. Daphniphyllaceae have $n = 16$ (Fedorov, 1969).

CNEORACEAE

Neochamaelea pulverulentum (Vent.) Erdtm., $2n = 36$. Spain, Canary Islands, Tenerife, Adej, cult. Missouri Botanical Garden, *Goldblatt 4650* (MO).

Cneoraceae comprises two genera, the ditypic *Cneorum* of the western Mediterranean and Cuba and the monotypic *Neochamaelea* of the Canary Islands. The count for *Neochamaelea*, $2n = 36$, is the first report for the genus and is the same number as already recorded in the Mediterranean *Cneorum tricoccum*. (Goldblatt, 1976a).

LEDOCARPACEAE

Wendtia gracilis Meyer, $2n = 18$. Chile, Prov. Bio-Bio, Dept. La Laja, *Marticorena, Quevada & Rodíguez 984* (MO).

This is the first count for *Wendtia* and the second for the family, a segregate of Geraniaceae not always accorded familial status. The previous count in Ledocarpaceae was for *Balbisia verticillata* Cav., also $2n = 18$ (Diers, 1961).

MONTINIACEAE

Grevea eggelingii Milne-Redh., $2n = 24$. Tanzania, Mikumi National Park, *Wingfield s.n.* (ref. 'ole *Sayalel 1209* (DSM)).

This is the first chromosome count for *Grevea*, one of only two genera of Montiniaceae, an Afro-Madagascan family. The other genus, *Montinia*, has $n =$ ca. 34 (Goldblatt, 1976a). Chromosomes of *Grevea* are unusually large, and differ in this respect, as well as in number, from those of *Montinia* which has very small chromosomes. Cytological data are consistent with the comments of Metcalfe (in Milne-Redhead, 1955), based on anatomical characters, that the two genera are not particularly close allies.

Relationships of Montiniaceae are obscure, although the family has been associated with Onagraceae and Myrtales in a general way (Milne-Redhead, 1955). Anatomical data, specifically absence of intraxylary phloem in both genera, militate against this view. Other phylogenists have placed the family in or near Saxifragaceae (Cronquist, 1968, in Grossulariaceae; Takhtajan, 1969, in Saxifragales after Hydrangeaceae; Hutchinson, 1967, in Escalloniaceae; and Thorne, 1977, as Montinioideae).

Recently, Dahlgren et al. (1977) have shown that Montiniaceae (*Montinia* only examined) has iridoid compounds, making it unlikely that the family is related to Myrtales or Saxifragales, both of which lack iridoids. These workers proposed a relationship for the family close to Cornales, where Dahlgren (1975) places Escalloniaceae, Hydrangeaceae, and several other families sometimes placed in or near Saxifragales. Chromosome number of *Grevea* is alone of little help in assessing the affinities of Montiniaceae, but the number in *Grevea*, $n = 12$, is consistent with placement in Cornales, many families and genera of which have

base numbers at the paleotetraploid level (Goldblatt, 1978), including Escalloniaceae with $n = 12$, Cornaceae, $n = 13$ and 11, Curtisiaceae, $n = 13$.

MORACEAE

Trophis phillipinensis (Bur.) Corn., $2n = 28$. Indonesia, S. Celebes, 60 km from Macassar, *Meijer 10865* (MO).

The present count of $2n = 28$, a new generic record, is consistent with the known cytological pattern in Moraceae in which most genera have numbers in the range $2n = 28$–24 (Raven, 1975).

PEDALIACEAE

Uncarina grandidieri (Baill.) Stapf, $2n = 36$. Madagascar, southwest of Island, *Hardy s.n.* (PRE).

Counts in this small Indo-African family are in the range $2n = 32$–26 with one diploid record of $2n = 16$, suggesting $x = 8$ for the family. This first report for the arborescent *Uncarina* does not conform with the known pattern and suggests that $x = 9$ rather than 8 (Raven, 1975) may be basic for Pedaliaceae. *Uncarina* may well occupy a primitive position in the family, which comprises mostly perennial herbaceous forms.

ROSACEAE

Holodiscus discolor (Pursh) Max. var. *franciscana* (Rydb.) Jeps., $n = 18$. U.S.A., California, cult. Rancho Santa Ana Botanic Garden, (progeny of) Monterey Co., Carmel Valley, *Thorne 31461* (RSA).

This report is the first count for the genus *Holodiscus*. The haploid number of $n = 18$ is consistent with its position in subfamily Spiraeoideae ($x = 9$, Goldblatt, 1976b).

SABIACEAE

Meliosma panamensis Standl., $2n = 32$. Ecuador, Río Palenque, *Dodson & Gentry 6584* (MO).

The report of $2n = 32$ for this New World species of *Meliosma* corresponds with the several other counts for the genus, all $n = 16$ (Fedorov, 1969).

SCROPHULARIACEAE

Teedia lucida Rudolphi, $2n = 38$. South Africa, Cape, Worcester district, slopes of Jonas Kop, *Goldblatt s.n.* (no voucher).

Teedia is a small genus of only two species, confined to the Cape floristic region. Although it is somewhat isolated taxonomically within Scrophulariaceae, it has recently been linked to *Oftia*, also a South African genus (Dahlgren & Rao, 1971). Traditionally, though probably incorrectly, *Oftia* has been assigned to the predominantly Pacific Myoporaceae. Dahlgren and Rao's suggestion of a close relationship of *Oftia* with Scrophulariaceae and with *Teedia* in particular has been accepted by Dyer (1975) in a recent generic flora of southern Africa. Ad-

ditional support for this treatment has been provided by Niezgoda & Tomb (1975), who have shown that pollen of *Oftia* is unlike Myoporaceae and does resemble that found in some Scrophulariaceae. The present count for *Teedia* of $n = 19$ corresponds with the basic chromosome number in *Oftia*, also $x = 19$ (Goldblatt, 1976a). Myoporaceae, in contrast, have chromosome numbers based on $x = 9$ (Raven, 1975). Cytology thus provides additional evidence of a close relationship between *Teedia* and *Oftia*, particularly as $x = 19$ is an unusual number in Scrophulariaceae, having been recorded previously only in unrelated Australian members of the family (Briggs & Ehrendorfer, 1976).

TRIGONIACEAE

Trigonia cf. *virens* Macbr., $2n$ = ca. 20. Peru, Loreto, Río Yavari, *Gentry 20867* (MO).

The count for *Trigonia* obtained here is reported with some hesitation since there is doubt about its accuracy. The plants available for study were seedlings which grew poorly, producing very little root tip material for examination. I have decided to report the count since it is the first for Trigoniaceae, and as such is of interest. Trigoniaceae are a small family, generally accepted as belonging to Polygalales, and probably closely related to Malpighiaceae and Polygalaceae in both of which a fairly wide range of chromosome numbers has been found. The number in *Trigonia* is consistent with its position in Polygalales.

VOCHYSIACEAE

Vochysia lomatophylla Standl., $2n = 22$. Peru, Dept. Loreto, Río Tamishacu, *Gentry 25861* (MO).

This is the first chromosome count for this predominantly Neotropical family which consists mainly of canopy trees. The karyotype found here is distinctive. It consists of ten pairs of small chromosomes, ca. 2 μm in size, and acrocentric to submetacentric, and one large acrocentric pair, ca. 3 μm long with conspicuous, large satellites, some 2 μm long. Vochysiaceae is usually assigned to Polygalales, and is related to Trigoniaceae ($2n$ = ca. 20), Polygalaceae (cytologically diverse), and Malpighiaceae ($x = 6$: $2n = 24$, 22 and 20 frequent). The number found in *Vochysia lomatophylla* is consistent with numbers recorded in related families. Vochysiaceae is, however, a fairly large family of some 200 species in six genera, and more counts are required before further conclusions can be drawn about the taxonomic significance of the chromosome number found here, and the unusual, and most likely, derived karyotype.

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