Chromosome Numbers in the Scilleae

J. M. J. de Wet

Division of Botany, P. O. Box 994, Pretoria, South Africa

Received March 2, 1957

Cytological data often provide clues to the true relationships of taxonomic units. Lewitsky (1931 a, b) indicates how the karyotype may be applied taxonomically to any systematic unit. That there is a close correlation between morphological and cytological characters has been demonstrated in numerous genera and larger taxonomic units. The most outstanding example is the monograph of Babcock (1947) on the genus *Crepis*. In this genus a remarkable range of morphological types exist, extending almost continuously from primitive to advanced. Along with this morphological evidence for progressive evolution is also found an orderly progression in the modification of chromosome number and morphology.

The chromosome numbers of members belonging to the tribe Scilleae (Liliaceae) have been studied. These cytological data are correlated, where possible, with morphological observation.

Material and method

The material was collected in the veld and cultivated on the Prinshof Experiment Station. Herbarium material together with corresponding cytological slides are filed in the National Herbarium, Pretoria. Slides were prepared by Mr. J. A. Retief, of this office.

Root tips were fixed in Randolph's (1935) fluid for 24 hours, dehydrated in the usual manner and embedded in a paraffin-beeswax-rubber mixture. Sections were cut 18 microns thick and stained according to the method outlined by Stockwell (1934).

For meiotic observations, young inflorescences were fixed in 3:1 absolute ethyl alcohol and propionic acid for 24 hours. Anthers were squashed in propiono-carmin after Swaminathan, Magoon and Mehra (1954). Slides were made permanent as was indicated by McClintock (1929). Drawings were made with the aid of a camera lucida. The averages of 5 metaphase plates were used to construct the karyotypes. The magnification is $\times 4200$.

Results and discussions

The chromosome numbers counted are summarized in Table 1. The genera are treated in more detail later in the discussion.

Name	Origin	No.	2n	Fig.	Authority
<i>E. pole-evansii</i> N. E. Br.	Barberton	796	50	28	
<i>Drimiopsis</i> Lindl.					
<i>D. saundersiae</i> Baker	Zululand	689	20	27	
<i>D. crenata</i> v. d. Merwe	Pretoria	821	20	73	
<i>Pseudogaltonia</i> Kuntz					
<i>P. clavata</i> (Baker) Phill.	Windhoek	814	24	29	
<i>Rhadamanthus</i> Salisb.					
<i>R. convallarioides</i> Salisb.	Lockenburg	1290	20	30	
<i>Ornithogalum</i> Linn.					
<i>O. thermophyllum</i> Leighton	Clanwilliam	868	12	31	
<i>O. alticolum</i> forma	Tulbagh	388	12	32	
<i>O. lacteum</i> Jacq.	S. W. Cape	424	12	33	32, Nakajima, 1936
<i>O. hermanii</i> Leighton	Ex. Stellenbosch	425	12	34	
<i>O. species</i>	Sutherland	595	12	35	
<i>O. saundersiae</i> Baker	Barberton	672	12	36	
<i>O. karooicum</i> Leighton	Bulshoek	874	12	37	
<i>O. karooicum</i> Leighton	Clanwilliam	883	12		
<i>O. miniatum</i> Jacq.	Worcester	993	12	38	
<i>O. miniatum</i> Jacq.	Tulbagh	848	12		
var. <i>vandermerwei</i> (B.) Leighton	Ashton	951	24	39	
<i>O. synanthifolium</i> Leighton	Pietermaritzburg	990	12	40	
<i>O. zeyheri</i> Baker	Grahamstown	594	12	41	12, Neves, 1953b
<i>O. Zeyheri</i> Baker	Vantsdrift	127	14		
<i>O. thyrsoides</i> Jacq.	Kirstenbosch	431	12		12, Neves, 1953a
<i>O. thyrsoides</i> Jacq.	East London	1275	12	42	
<i>O. thyrsoides</i> forma	Piquetberg	913	12	43	
<i>O. thyrsoides</i> forma	Clanwilliam	873	12		
<i>O. flavissimum</i> Jacq.	Sutherland	1292	12	44	
<i>O. alticolum</i> Leighton	Tulbagh	839	12	45	
<i>O. ecklonii</i> Schlecht.	Bloemfontein	130	12	46	
<i>O. prasinum</i> Lindl.	Nylstroom	126	14		
<i>O. prasinum</i> Lindl.	Lichtenburg	129	14		
<i>O. prasinum</i> Lindl.	Hammanskraal	132	12	47	
<i>O. setifolium</i> Kunth.	Pretoria	803	12	48	
<i>O. setifolium</i> Kunth.	Potchefstroom	1229	12		
<i>O. setifolium</i> Kunth.	Bloubosput	1002	8	49	
<i>O. incospicuum</i> Baker	Pilgrimsrest	991	20	50	
<i>O. leipoldtii</i> Leighton	Malmesbury	925	10	51	
<i>O. maculatum</i> Thunb.	Clanwilliam	875	14	52	
<i>O. maculatum</i> Thunb.	Pakhuisberg	895	14		
var. <i>speciosum</i> Leighton	Paleisheuwel	910	14	53	
var. <i>splendens</i> Leighton	Clanwilliam	882	14		
<i>O. pretoriensis</i> Baker	Donkerhoek	183	50	55	
<i>O. saueolens</i> Jacq.	Van Rhynsdorp	653	36	56	

Table 1. Chromosome numbers

Name	Origin	No.	2n	Fig.	Authority
<i>Albuca</i> Linn.					
<i>A. nelsonii</i> N. E. Br.	East London	1013	20	1	
<i>A. setosa</i> Jacq.	Ermelo	1011	20	2	
<i>A. bainesii</i> Baker	Rustenburg	1042	20	3	
<i>A. bainesii</i> Baker	Nelspruit	1267	20		
<i>A. transvaalensis</i> Mogg	Pretoria	818	20	4	
<i>A. transvaalensis</i> Mogg	Pretoria	1297	20		
<i>A. pachychlamys</i> Baker	Pretoria	1268	40	6	
<i>A. flaccida</i> Baker	Clanwilliam	872	18	5	
<i>A. canadensis</i> (L.) Leighton	Leopoldtville	907	18	7	
<i>A. canadensis</i> (L.) Leighton	Piquetberg	860	18		
<i>Thuranthos</i> Wright					
<i>T. macranthum</i> (Bkr.) Wr.	Grootfontein	1283	20	8	
<i>Urginea</i> Steinh.					
<i>U. pretoriensis</i> Baker	Pretoria	135	20	74	
<i>U. langii</i> Brem.	Hammanskraal	192	20	9	
<i>U. langii</i> Brem.	Zoutpansberg	1271	20		
<i>U. burkei</i> Baker	Waterberg	1270	20	10	
<i>U. burkei</i> Baker	Pretoria	195	20		
<i>U. multisetosa</i> Baker	Pretoria	811	20	11	
<i>U. lydenburgensis</i> R. A. Dyer	Skukuza	1023	32	12	
<i>U. altissima</i> Baker	Nelspruit	1269	20	13	
<i>U. tenella</i> Baker	Pretoria	1042	20	14	
<i>U. depressa</i> Baker	Krugersdorp	1284	40	15	
<i>U. rubella</i> Baker	Hammansraal	134	42	16	
<i>U. epigea</i> R. A. Dyer	Zululand	191	32	17	
<i>U. epigea</i> R. A. Dyer	Pretoriuskop	1022	32		
<i>Galtonia</i> Dcne.					
<i>G. viridifolia</i> Verd.	Mt. aux-sources	1043	16	18	
<i>G. princeps</i> Dcne.	Kirtenbosch	1043a	16	68	
<i>Drimia</i> Jacq.					
<i>D. haworthioides</i> Baker	Bathurst	1005	20	19	
<i>D. elata</i> Jacq.	Weenen	1295	18	20	
<i>Dipcadi</i> Medic.					
<i>D. viride</i> Moench.	Kimberley	818	12	21	
<i>D. glaucum</i> Baker	Cultivated	817	18	22	18, Darington and Ammal, 1945
<i>Scilla</i> Linn.					
<i>S. firmifolia</i> Baker	Cultivated	759	18	23	
<i>S. natalensis</i> Planch.	Barberton	1116	32	24	
<i>Eucomis</i> L'Herit					
<i>E. vandermerwei</i> Verd.	Steenkampsberg	1010	20	25	
<i>E. regia</i> Ait.	Pretoria	452	30	26	

Name	Origin	No.	2n	Fig.	Authority
<i>Lachenalia</i> Jacq.					
<i>L. tricolor</i> Thunb.	Versveldpass	917a	14		14, 21 Moffet, 1936
var. <i>quadricolor</i> Baker	Versveldpass	917	14	57	
var. <i>aurea</i> Baker	Lambertsbay	1278	14	58	
<i>L. orchioides</i> Ait.	Porterville	856	16		16, 17, Moffet, 1936
<i>L. orchioides</i> Ait.	Paarl	972	16		
<i>L. orchioides</i> Ait.	Somerset	930	16		
<i>L. orchioides</i> Ait.	Piquetberg	959	16		
<i>L. glaucina</i> Jacq.	Somersetstrand	934	28		28, Moffet, 1936
<i>L. liliflora</i> Jacq.	Malmesbury	600	16	56	16, Moffet, 1936
<i>L. Loliflora</i> Jacq.	Malmesbury	924	16		
<i>L. unifolia</i> Jacq.	Lockenburg	615	22		22, Moffet, 1936
<i>L. unifolia</i> Jacq.	Graafwater	902	24		
<i>L. unifolia</i> Jacq.	Paleisheuwel	909	21		
<i>L. unifolia</i> Jacq.	Caledon	940	26		26, Moffet, 1936
<i>L. unicolor</i> Jacq.	Piquetburg	863	16		16, Moffet, 1936
<i>L. unicolor</i> Jacq.	Graafwater	904	16		
<i>L. unicolor</i> Jacq.	Paleisheuwel	908	16		
<i>L. unicolor</i> Jacq.	Porterville	958	16		
<i>L. contaminata</i> Ait.	Porterville	605	16	60	
<i>L. contaminata</i> Ait.	Porterville	858	16		
<i>L. ccontaminata</i> Ait.	Leopoldtville	906	16		
<i>L. contaminata</i> Ait.	Worceste	994	16		
<i>L. bachmanii</i> Baker	Malmesbury	604	16	61	
<i>L. hirta</i> Thunb.	Piquetberg	862	24	62	
<i>L. mutabilis</i> weet	Pakhuisbery	896	56		
<i>L. mutabilis</i> Sweet	Clanwilliam	960	14	63	
<i>L. elegans</i> Barker	Pakhuisberg	887	56		28, Moffet, 1936
<i>L. reflexa</i> Tunb.	Malmesbury	616	16	64	
<i>Schizocarphus</i> v. d. Merwe					
<i>S. gerrardi</i> v. d. Merwe	Ermelo	752	56	72	
<i>S. nervosus</i> v. d. Merwe	Rustenburg	819	28	54	
<i>S. nervosus</i> v. d. Merwe	Pretoria	1027	28		
<i>Sansevieria</i> Thunb.					
. <i>aethiopica</i> Thunb.	Pretoria	1108	14	65	
<i>S. grandis</i> Hook. F.	Nelspruit	1115	14	66	
<i>S. desertii</i> N. E. Br.	Zoutpansberg	1107	28	67	
<i>Chlorophytum</i> Ker.					
<i>C. longipedunculatum</i> Forbes	Kowynspass	822	14	69	
<i>C. capense</i> (L.) Kuntze	Carlisle	590	14	70	
<i>Bowiea</i> Harv.					
<i>B. volubilis</i> Harv.	Hoornsnek	1325	20	71	

Albuca Linn.: A large genus divided by Baker (1896) into three subgenera. These are distinguished from each other as follows. *Leptostyla* is characterized by a cylindrical style. The remaining two subgenera have the style prismatic. Subgenus *Falconera* and subgenus *Eualbuca* differ from each other in that the latter has the three outer stamens reduced and sterile.

Subgenus *Leptostyla* includes a single species, *A. shawii* Baker which was not available for study. Five species of subgenus *Falconera* were investigated. These are characterized by $2n=20$ and $2n=40$. The basic

Fig. 1-13

chromosome number appears to be $n=10$. Two species of *Eualbuca* were studied and found to have $2n=18$. Here we are dealing with a basic chromosome number $n=9$. The chromosomes of the species studies belonging to the latter subgenus, are much smaller than those of *Falconera* (compare figures 1-7). Evidently, subgenera *Falconera* and *Eualbuca* differ from each other, not only in a prominent morphological character, but also in chromosome number and morphology. Other morphological characters, however, are very similar and the type of variation observed between species in *Falconera* is also present in *Eualbuca*. This seems to indicate that they may have had a parallel development from very early in the history of the genus.

The loss of one chromosome pair in some of the original types could have given rise to *Eualbuca*. This may have had as a result, the loss of fertility in the three outer stamens. We may then predict that the subgenus *Leptostyla*, with its three rudimentary anthers, will also be found to have a basic chromosome number of $n=9$. The marked difference in the shape of the style between subgenera *Leptostyla* and *Eualbuca* may be the result of a later mutation.

The original basic chromosome number of *Albuca* appears to be $n=10$, but it is quite possible that this number became established from an earlier number of $n=5$. All the species investigated with $2n=20$ are characterized by 6 nucleoli during mitotic telophase. The species with $2n=18$ have only 4 nucleoli. The presence of 6 nucleoli seems to indicate that polyploidy has played a role in the evolution of species with $2n=20$. It was indicated by Gates (1942) and de Wet (1953) that the most common number of nucleoli encountered in diploids is 2 or 4. It was also indicated, however, that nucleoli numbers may not always be an indication of the degree of polyploidy.

Thuranthos Wright: An endemic genus described by Wright (1916) to include, originally, only *Drimia macrantha* Baker. *Thuranthos macranthum* (Bkr.) Wright is characterized by 20 somatic chromosomes, resembling those of *Urginea* in many details. Four nucleoli are regularly produced during telophase. In chromosome morphology *Thuranthos* differ from *Drimia* very conspicuously.

Urginea Steinh.: Widely distributed throughout Africa, the mediterranean region and India. Fifty-seven species have been described from South Africa (Phillips 1951). Ten of these were studied cytologically. A basic chromosome number of $n=5$ were previously proposed for the genus by Geitler (1928). The same author also indicated the presence of chromosome fragments ($2n=10+2f$) in *U. maritima*. Chromosome numbers of $2n=20$, 30 and $2n=40$ were observed in the same species by Raghavan and Venkatasubban (1940) and Sato (1943).

Chromosome numbers of $2n=20$, 30, 32 and $2n=40$ were observed in the South African species studies. Chromosome fragments were regularly observed in the chromosome complement *U. rubella* with $2n=40$.

Indications of polyploidy is present in most of the species. Two or more pairs of chromosomes resembling each other are almost always present. Meiotic behaviour, however, has not yet been studied. Nucleoli numbers produced, are either 4 or 6.

Urginea langii is of special interest. Morphologically it seems to form a steppingstone between the genera *Urginea* and *Ornithogalum*. It was described as *Urginea* but later transferred to *Ornithogalum wilmanae* by Leighton (1945). Cytologically it differs from other species of *Urginea* in its larger chromosomes, which in many respects remind one of those of *Ornithogalum*. The basic chromosome number is $n=10$, a number, although

commonly found in *Urginea*, is also present in South African species of *Ornithogalum*. These cytological observations support Leighton's (1945) conclusion that this species could be classified more naturally with *Ornithogalum*. Morphologically it possesses the diagnostic character of *Ornithogalum*, in that the filaments of the stamens are much flattened. On the other hand, the deeply tri-lobed capsule and flattened seeds are typical of the genus *Urginea*.

Another species with similar morphological characters is *O. virens* Lindl.

Figs. 14-25

which was discussed by Quintanilha and Cabral (1947). This species was found to have 6 somatic chromosomes resembling those of typical members of *Ornithogalum* in length.

Two more species of *Urginea* deserve special mentioning. These, *U. epigea* and *U. lydenburgensis* are characterized by $2n=32$. It was first thought that the basic chromosome number is $n=15$ and that the additional chromosomes represent fragments as is the case in *U. rubella*. In these two species the two additional chromosomes were observed in all the specimens studied. Morphologically these two species are also rather distinct in bulb structure.

Galtonia Decne.: Small endemic genus. One species, *G. candicans* has previously been studied by Newton (1924), recording $2n=16$. A similar

chromosome number was counted in *G. princeps* and *G. viridifolia* indicating a basic chromosome number of $n=8$.

Drimia Jacq.: An African genus with 26 species in South Africa. Only two have been studied cytologically. They differ from each other in chromosome number: *D. haworthioides* has $2n=20$ and *D. elata* has 18 somatic chromosomes.

Dipcadi Medic.: A large genus mostly confined to Africa. Only two species were available for study. La Cour (Darlington and Janaki Ammal, 1945) demonstrated $2n=18$ in *D. glaucum*. This count has been varified. A chromosome number of $2n=12$ was observed in *D. viride*. Still a third chromosome number of $2n=8$ was counted by Levan (1943) in the mediterranean species *D. serotinum*. Basic chromosome numbers of $n=4, 6$ and 9 have thus been observed.

Scilla Linn.: A large genus with a wide distribution. Many European and Oriental species have already been studied and an aneuploid series of basic number ($n=4, 6, 7, 8, 9, 10$ and 11) became evident (Sato, 1942, Maude, 1940, Battaglia 1952 a, b). The two species here investigated, *S. firmifolia* and *S. natalensis* are characterized by $2n=18$ and $2n=36$ respectively.

Schizocarphus v. d. Merwe: This genus has recently been removed from *Scilla* on the basis of prominent morphological characters. Cytologically they differ from each other prominently in that this new genus has much smaller chromosomes than those characteristic of *Scilla*. Chromosome numbers of $2n=58$ (Meiotic metaphase with $n=28$) and $2n=28$ were observed. The basic chromosome number of these two species is $n=14$. The much smaller chromosomes characteristic of *Schizocarphus* leads one to wonder whether this genus is really as closely related to *Scilla* as it was previously thought.

Eucomis L'Herit: An African genus of 14 species, 7 of which are known cytologically. Matsuura and Sutô (1935), Satô (1942) and Koeperich (1930) demonstrated $2n=30$ in *E. bicolor* and *E. undulata*, whereas *E. punctata* and *D. pallidiflora* are characterized by $2n=60$. The chromosome numbers reported for *E. undulata* and *E. punctata* have been confirmed. For *E. bicolor* a second chromosome number of $2n=32$ has been reported by Darlington (1926). Three species have been investigated for the first time. These are characterized by chromosome numbers; $2n=20$ (*E. vandermerwei*), $2n=30$ (*E. regia*) and $2n=50$ (*E. pole-evansii*). The first mentioned species is a small plant less than a foot high whereas *E. pole-evansii* is an extremely large plant.

The presence of a somatic chromosome number of $n=20$ seems to indicate that the other species are polyploids based on $n=10$. The triploid species ($2n=30$), *E. regia*, however, is characterized by a regular meiotic behaviour, indicating that allopolyploidy must have played a role in species evolution and that the original basic chromosome number could have been $n=5$.

Drimiopsis Lindl.: A relatively small genus with nine species recorded from South Africa. Two species were studied, both characterized by 20 somatic chromosomes.

Pseudogaltonia Kuntze: This monotypic genus was included in *Galtonia* by Baker (1896). Floral characteristics, however, lead to the description of a new genus *Pseudogaltonia* Kuntze. Cytologically they further differ in that *Galtonia* is characterized by $n=8$ and *Pseudogaltonia* by $n=12$.

Figs. 26-41

Rhadamanthus Salisb.: An endemic genus with two or three species. The type species *R. convallarioides* has been studied cytologically and found to have $2n=20$. The chromosomes of this species are characteristic. Two chromosome pairs are relatively long and the remaining eight pairs extremely short (figure 30).

Ornithogalum Linn.: The cytology of the European species of this genus have been studied by a number of workers. Most outstanding is the work of Neves (1952) who summarized all the available cytological data. Further studies were reported by Neves (1953 a and 1953 b). The species were subdivided by Baker (1896) into four subgenera. The South African representatives were studied morphologically by Leighton (1944 a, b and 1945) and a complete revision was presented. This new revision was followed in the identification

of the species. The majority of the species are characterized by 12 somatic chromosomes, indicating a common chromosome number of $n=6$. A number of species with $n=6$, however, are characterized in some specimens by an extra chromosome pair. These are *O. zeyheri*, *O. ecklonii* and *O. prasinum*. Morphologically these chromosome races cannot be distinguished and the extra chromosome pair evidently has little effect on the phenotypic appearance of the species. Two chromosome races were also encountered in *O. setifolium*. Here the $2n=12$ form is small whereas the $2n=8$ form is more robust. Floral

Figs. 42-56

morphology, however, is similar in these two forms.

One species, *O. maculatum* together with its two varieties, var. *speciosum* and var. *splendens* is characterized by $2n=14$. The extra chromosome pair has apparently been incorporated into the normal chromosome complement. Three species with a basic chromosome number of $n=5$ have also been encountered. All of these seem to show relationships with the genus *Urginea*, both cytologically as well as morphologically. *Ornithogalum sauveolens* also resembles the genus *Urginea* in some minor morphological characters but differs from this genus both in chromosome number and general chromosome morphology.

The varieties of some of the species studied differ from each other very conspicuously in chromosome morphology. This is especially obvious in *O. alticolum* forma (figure 32) and *O. alticolum* proper (figure 45) and *O. thyrsoides* (figure 42) and *O. thyrsoides* forma (figure 43). Cytological observations seem to indicate that, these particular forms at least, may be worthy of subspecies or even species rank. Morphologically these forms are distinct, to some extent at least, from the typical species in gross morphological appearance. This is also true in the two chromosome races of *O. setifolium*.

Figs. 57-74

Ornithogalum miniatum and its variety *vandermerwei* differ from each other in chromosome number. The latter being a tetraploid. Chromosome morphology, however, definitely proves that the variety must be of allopolyploid origin, rather than of an ordinary chromosome doubling.

Lachenalia Jacq.: An endemic genus of sixty-five species concentrated mostly in the south-western district of the Cape. Baker (1896) divides this genus into five subgenera as follows. A cylindrical perianth and dimorphic segments are characteristics of *Eulachenalia*. Subgenus *Erachyscypha* differ from the first mentioned in having nearly uniform segments. The perianth

in the remaining three subgenera is not cylindrical. It is oblong-cylindrical in *Orchiops*, campanulate and oblong-campanulate in *Chloriza*; and ventricate, oblique at the base in *Coelanthus*.

This genus together with *Schizocarphus* is characterized by chromosomes which are smaller in length and circumference than those of other members belonging to the Scilleae.

Eulachenalia: Three species are incuded by Baker (1896) all of which were studied cytologically by Moffet (1936). All these species are characterized by a basic chromosome number $n=7$. Two varieties of *L. tricolor*: var. *aurea* and var. *quadricolor* were also found to have $n=7$. They differ from each other very little in chromosome morphology (figures 57 and 58).

Brachyscypsa: The single species, *L. pusilla*, is not known cytologically.

Orchiops: Three of the species, *L. orchioides* ($2n=16, 17$), *L. glaucina* ($2n=28$) and *L. liliflora* ($2n=16$) were studied by Moffet (1936). Two basic chromosome numbers, $n=7$ and $n=8$, are evident. Four collections from different localities of *L. orchioides* ($2n=16$), two of *L. liliflora* ($2n=16$) and one of *L. glaucina* ($2n=28$) were studied and chromosome numbers similar to those previously reported were observed.

Chloriza: This subgenus includes the majority of species. Moffet (1936) studied *L. unifolia* ($2n=22, 26$), *L. rosea* ($n=14$), *L. pallida* ($2n=16$), *L. purpureo-caerulea* ($2n=16$), *L. unicolor* ($2n=16$) and *L. nervosa* ($2n=16$). This indicated basic chromosome numbers of $n=7, 8, 11$, and 13 . Four collections of *L. unifolia* were studied, each with a different somatic chromosome number namely $2n=21, 22, 24, 26$. The presence of a plant with $2n=21$ seems to indicate that triploidy may have played a role in the origin of the species. Abnormal chromosome pairing and random distribution to the gametes, commonly found in triploids, may have given rise to the different chromosome numbers observed. Meiosis, however, has not yet been studied in this triploid plant.

A number of other species were studied for the first time (table 1). These are characterized by basic chromosome number of $n=7, 8$ and 12 . *Lachenalia hirta* has $2n=24$, and may also be derived from an original triploid plant on the basis of $2n=7$. A diploid plant ($2n=14$) and one with $2n=56$ were observed for *L. mutabilis*. Morphologically these plants cannot be distinguished.

Coelanthus: Includes a single species, *L. reflexa* with $2n=16$.

It becomes quite evident that the subdivision of the genera in respect to basic chromosome number does not coincide with the morphological subdivision of Baker (1896). A morphological revision of the genus to fit in with the cytological data may be possible. Before this is attempted, a more complete picture of chromosome numbers in the genus should be available.

The remaining genera belonging to the Scilleae with representative in South Africa were not available for study. These are *Urgineopsis* Compton,

Litanthus Harv., *Hyacinthus* Linn., *Veltheimia* Gled. and *Massonia* Thunb. et. al. Of special interest is the latter, of which Phillips (1951) notes that, "the genera *Massonia*, *Polyxena*, *Neobakeria*, *Whiteheadia*, *Androsiphon* and *Amphisiphon* would repay careful re-examination. All agree in having connate stamens and it is probable that further study would reduce the species to one or two well defined genera". Karyological studies may help to determine the generic limits. A number of genera are not represented in South Africa. These are *Cammasia*, *Chionodoxa*, *Rhodocodon*, *Muscari* and *Puschkinia*. Some of the genera not studied in the present investigation are known cytologically. These are listed by Darlington and Janaki Ammal (1945), and are characterized by the following basic chromosome numbers. *Camassia* ($n=15$), *Chionodoxa* ($n=9$), *Hyacinthus* ($n=4, 8$ and 14), *Muscari* ($n=9$) and *Puschkinia* ($n=5$). A basic chromosome of $n=5$ ($n=10, 15$) is present in 7 of the 18 genera known cytologically. A similar number is also present in some species of two more genera. Other chromosome numbers may be regarded as polyploids or diploids on the basis of $n=6, 7, 8$ and 9 . Hybridization and allopolyploidy could have given rise to the basic numbers of $n=11$ and $n=13$ which are also present. Basic chromosome numbers of $n=3$ and 4 which were also observed may be the result of chromosome reductions from original types with $n=5$.

A number of genera were studied which do not belong to the Scilleae. *Sansevieria* is placed by Baker (1896) in the Moderaceae, Hutchinsonson (1934) in the tribe Draceae (family Agavaceae) but Phillips (1951) in the Liliaceae. This genus is characterized by large chromosomes and the South African species studied by $n=7$ Darlington and Janaki Ammal (1945) list basic chromosome numbers of $n=20$ and 21 in tropical African and Oriental species.

Chlorophytum, tribe Asphodeleae (Liliaceae) were also studied and found to have a basic chromosome number of $n=7$. A similar number was previously reported by Yamazaki (1936). *Bowiea* belonging to the Liliaceae, tribe Bowieae is characterized by a basic number of $n=10$. This genus was previously studied by D'Amato (1949).

Summary

The cytology of a number of genera belonging to the tribe Scilleae was investigated. Six genera and 68 species and varieties were previously unknown cytologically. The chromosome number is also reported in some species belonging to 3 genera not included in the Scilleae. The genera which were investigated, cytologically for the first time, are *Albuca* ($n=9$), *Thuranthos* ($n=10$), *Pseudogaltonia* ($n=12$), *Rhadamanthus* ($n=10$), *Drimia* ($n=9, 10$) and *Schizocarphus* ($n=14$). The relationships between the genera were pointed out where possible. The original basic chromosome number for the tribe Scilleae has been postulated as being $n=5$.

Literature cited

- Babcock, E. B. 1847. The genus *Crepis*. Univ. Calif. Publ. Bot. vols. 21 and 22: 1-1033.
- Bakers, J. G. 1896. Liliaceae. Flora Capensis 6: 253-528.
- Battaglia, E. 1952 a. Filogenesi del cariotipo nel genere *Scilla*. 2. Il cariotipo di *S. autumnalis* L., Soc. Toscana Sci. Nat. LIX: 130-145.
- 1952 b. Filogenesi del cariotipo nel genera *Scilla*. 3. *Scilla obtusifolia* Poir. var. *intermedia* (Guss) Bak., Soc. Toscana Sci. Nat. LIX: 146-161.
- D'Amato, F. 1949. Studio citologico ed embriologico di *Bowiea volobulis* Harv., Caryologia 2: 60-70.
- Darlington, C. D. 1926. Chromosome numbers in the Scilleae. Journ. Genetics 16: 237-281.
- and Janaki Ammal, E. K. 1945. Chromosome atlas of cultivated plants. George Allen and Unwin Ltd. London. 396 pp.
- de Wet, J. M. J. 1953. Nucleoli numbers in *Danthonia* polyploids. Cytologia 18: 229-234.
- Gates, R. R. 1942. Nucleoli and related nuclear structures. Bot. Rev. 8: 337-409.
- Geitler, L. 1929. Züchter 1: 243. Quoted by Darlington and Janaki Ammal, 1945.
- Hutchinson, 1934. Liliaceae. The families of flowering plants 2: 81-102.
- Koeperich, J. 1930. Cellule 39: 307. Quoted by Darlington and Janaki Ammal, 1945.
- Leighton, F. M. 1944 a. A revision of the South African species of *Ornithogalum* L. 1. So. Afr. Journ. Bot.
- 1944 b. A revision of the South African species of *Ornithogalum* L. 2. So. Afr. Journ. Bot. 10: 83-110.
- 1945. A revision of the South African species of *Ornithogalum* L. 3. So. Afr. Journ. Bot. 11: 111-122.
- Levan, A. 1943. The pigment content of polyploid plants. Hereditas 29: 255-268.
- Lewitsky, G. A. 1931 a. The karyotype in systematics. Bull. Appl. Bot. 27: 187-240.
- 1931 b. The morphology of chromosomes. Bull. Appl. Bot. 27: 19-174.
- Matsuura, H. and Sutô, T. 1935. Contributions to the idiogram study in Phanerogramous plants. Journ. Fac. Sci. Hokkaido, Univ. 5: 33-76.
- Maude, P. F. 1940. A list of chromosome numbers of species of British flowering plants. New Phytol. 38: 1-31.
- McClintock, B. 1929. A method for making aceto-carmines smears permanent. Stain Tech. 4: 53-56.
- Moffet, A. A. 1936. Cytologia 4: 490. Quoted by Darlington and Janaki Ammal, 1945.
- Nakajima, G. 1936. Chromosome numbers in some crops and wild Angiosperms. Jap. Jour. Genetics 12: 211-218.
- Neves, J. de B. 1952. Estudos cariologicos no genero *Ornithogalum* L., Dissertacao da Fac. Cien. Univ. Coimbra: 1-192
- 1953 a. Sobre a cariologia de *Ornithogalum thyrsoides* Jacq., Cienc. Madrid 18: 1-19.
- 1953 b. Sobre a emparelhamento somatico em *Ornithogalum zeyheri* Baker. Cienc. Madrid 19: 826-937.
- Newton, W. C. F. 1924. Studies on somatic chromosomes. 1. Pairing and segmentation in *Galtonia*. Ann. Bot. 38: 197-206.
- Phillips, E. P. 1951. The genera of South African flowering plants. Bot. Survey So. Afr. memoir 25: 176-196.
- Quintanilha, A. and Cabral, A. 1947. A new species of Liliaceae with six somatic chromosomes. So. Afr. Journ. Sci. 43: 167-170.
- Raghawan, T. S. and Venkatasubban, K. R. 1940. Cytologia 11: 55. Quoted by Darlington and Janaki Ammal, 1946.
- Randolph, L. F. 1935. A new fixing fluid and a revised schedule for the paraffin method in plant cytology. Stain Techn. 10: 95-96.
- Satô, D. 1942. Karyotype alteration and phylogeny in Liliaceae and allied families. Jap. Journ. Bot. 12: 57-161.

- Stockwell, P. 1934. A stain for difficult plant material. *Science* 80: 121-122.
- Swaminathan, M. S. Magoon, M. L. and Mehra, K. L. 1954. A simple propionic-acid carmine smear method for plants with small chromosomes. *Indian Journ. Genet. Plant Breed.* 14: 87-88.
- Wright, C. H. 1916. *Thuranthos*. *Kew Bull.* 1916: 233-234.
- Yamazaki, R. 1936. *Jap. Journ. Genet.* 12: 551. Quoted by Darlington and Janaki Ammal, 1945.
-