

CHROMOSOME CYTOLOGY IN RELATION TO CLASSIFICATION IN *NERINE* AND *BRUNSVIGIA* (AMARYLLIDACEAE)

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ABSTRACT

The chromosome cytology of 16 species of *Nerine* and 3 of *Brunsvigia* was studied. A diploid number and similar karyotype was found in all species. Differences in position and shape of satellite were found which can be correlated with morphological characteristics. Karyotypes are compared to classification systems of *Nerine* and several inconsistencies are revealed in some treatments. *Brunsvigia marginata*, usually treated as a species of *Nerine*, is critically analysed. When the cytology of *Nerine* and *Brunsvigia* are compared, *B. marginata* is shown to have a karyotype similar to the latter genus.

UITTREKSEL

CHROMOSOOM SITOLOGIE IN VERHOUDING TOT DIE KLASIFIKASIE VAN *NERINE* EN *BRUNSVIGIA* (AMARYLLIDACEAE).

Die chromosoom sitologie van 16 *Nerine*, en 3 *Brunsvigia* soorte was bestudeer. 'n Diploïede getal en eenderse kariotipe was in al die soorte gevind. Verskille in posisie en fatsoen was in die satelliet gevind; dit kan in korrelasie staan met morfologiese kenmerke. Kariotipes word vergelyk met die klassifikasie sisteme van *Nerine* en etlike teenstrydighede word in party verhandelinge openbaar. *Brunsvigia marginata*, wat gewoonlik as 'n soort *Nerine* behandel word, word krities geannaliseer. As die sitologie van *Nerine* en *Brunsvigia* vergelyk word, word dit bewys dat *B. marginata* 'n kariotipe het wat eenders is as die laasgenoemde soorte.

INTRODUCTION

The genus *Nerine* probably comprises some 25 species, although the most recent treatment (Traub 1967) recognises 30 and 2 more species have since been described. While not all species could be obtained for the present study, a total of 16 species was examined, representing a good selection of the range of variation found in the genus. Some difference of opinion exists over the classification of *Nerine*, particularly at the subgeneric level. The number of species and the criteria used for classification vary considerably in different treatments. In view of this, the present author has made a cytological study of the genus in the hope that chromosomal characters might be discovered which could be linked to certain morphological features and establish the classification on a firmer basis. Previous workers had reported differences in the diploid number and in satellite position, so that further cytological investigation seemed promising. The species known currently as *N. marginata* is treated as a *Brunsvigia* as a result of this investigation, and two other species of this genus were studied for karyotype comparison.

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MATERIALS AND METHODS

Except in a few cases it was not possible for the author to collect plants himself, but wherever possible plants were obtained from wild populations or from botanic gardens where species had not been long in cultivation, and the original locality was known, (table 1). With respect to the plants used in the study, Mr. G. McNeil and Mr K. Douglas and Kirstenbosch Botanic Gardens must be thanked for providing specimens.

Root tips were used to study mitotic metaphase. These were collected on warm afternoons. Cells were found to be actively dividing under such conditions. The root tips were pretreated in 0,05% colchicine for four hours and then fixed in acetic-alcohol 1:3 for several minutes. After fixation they were stored in 70% alcohol or macerated immediately in N HCl at 60°C for 6–8 minutes. Root apices were squashed in lacto-propionic orcein (A. F. Dyer 1963). Although preparations could readily be photographed (fig. 1), karyotypes were drawn with the aid of a camera lucida as this proved a more satisfactory method of representation. Idiograms were compiled from several karyotypes and hence represent the average rather than the single metaphase illustrated. The chromosomes in the idiograms are arranged in a sequence based on decreasing length

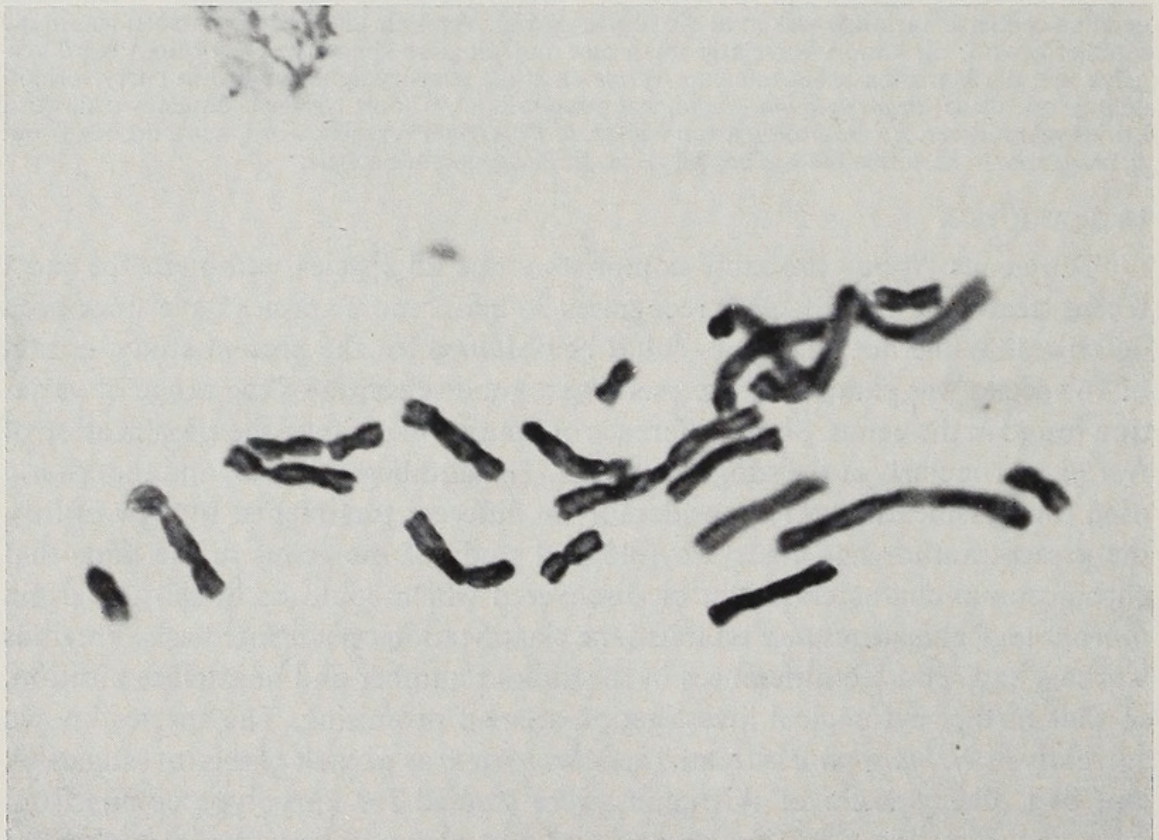


FIG. 1.

Metaphase in root tip cell of *Nerine angustifolia*. Satellites are visible on the two long chromosomes on the left.

except in the case where obvious homologues would otherwise be placed in different positions in comparable idiograms. To facilitate comparison the satellite is always shown above the centromere, whether located on the longer or shorter arm of the chromosome.

OBSERVATIONS

All species of *Nerine* and *Brunsvigia* examined proved to have a diploid number of 22. In general, the karyotypes were similar, all species having a pair

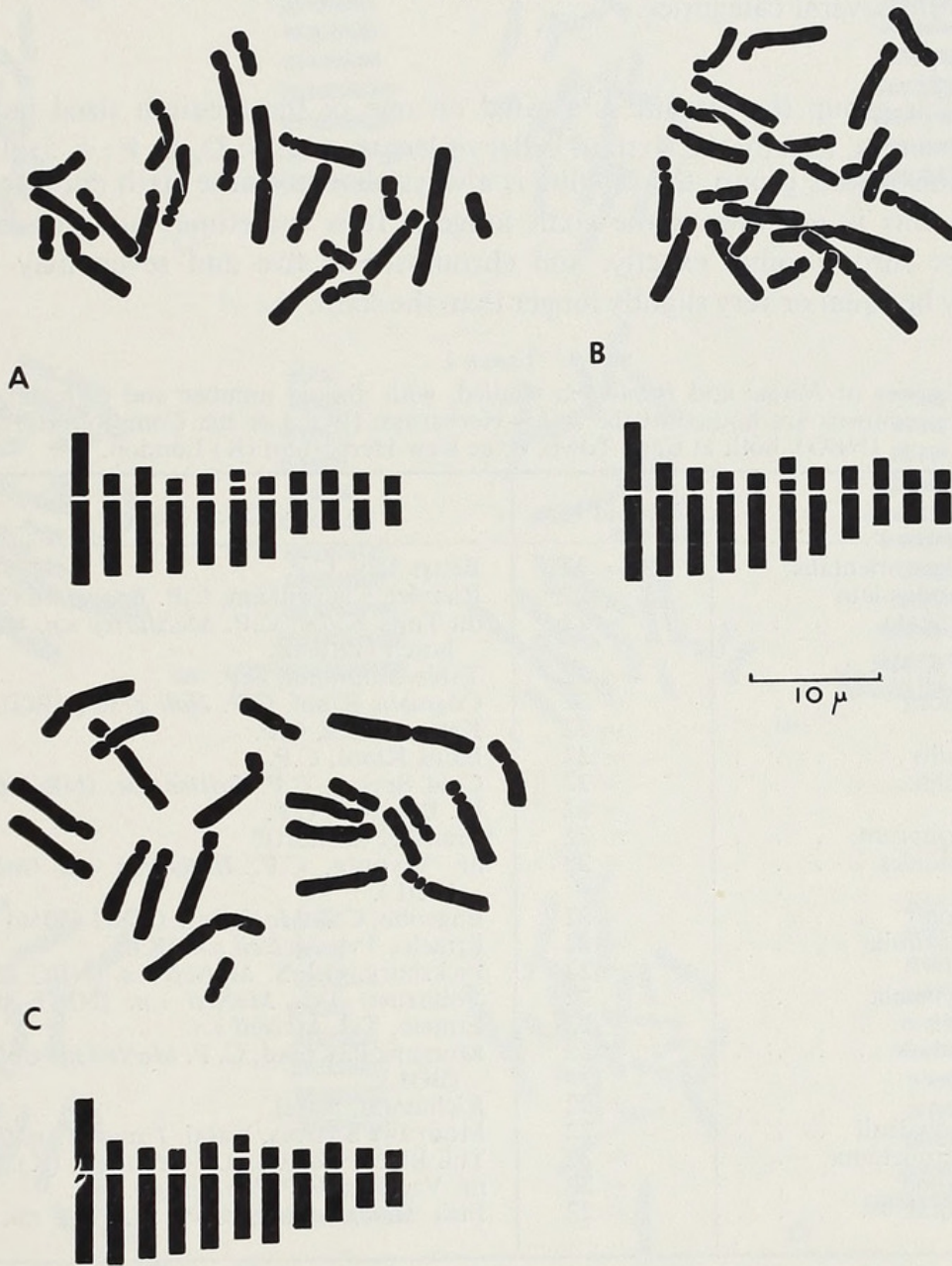


FIG. 2.

Metaphase and idiograms of *Brunsvigia*.
A. *B. appendiculata*; B. *B. orientalis*; C. *B. marginata*.

of very long, almost metacentric chromosomes, six pairs of somewhat smaller submetacentric to acrocentric shorter ones and four pairs of small chromosomes. Apart from minor differences in relative lengths of the arms of certain chromosomes, the position of the secondary constriction and the shape of the satellite were found to vary among different species of *Nerine* and *Brunsvigia*.

A. *Nerine*

Variation in shape and position of the satellite makes it possible to divide the genus into several categories.

Group 1.

In this group the satellite is located on one of the medium sized pairs of chromosomes, usually the sixth in order of length, (fig. 3: D, E, F; 4, 5). In the idiograms of this group, the satellite is always shown on the sixth chromosome though this is not always the sixth longest. It is sometimes not possible to measure chromosomes exactly, and chromosomes five and seven may occasionally be equal or very slightly longer than the sixth.

TABLE 1

List of species of *Nerine* and *Brunsvigia* studied, with diploid number and collecting data. Voucher specimens are housed at the Bolus Herbarium (BOL) or the Compton Herbarium (NBG), both at Cape Town, or at Kew Herbarium (K) London.

Species	Diploid No.	Collection Data
† <i>Brunsvigia orientalis</i>	2n = 22	Bettys Bay, C.P.
† <i>B. appendiculata</i>	= 22	Rietvlei, Clanwilliam, C.P. <i>Booyesen</i> 6 (NBG).
<i>B. marginata</i>	= 22	du Toits Kloof, C.P. <i>McMurtry s.n.</i> Kirstenbosch Gardens.
<i>Nerine sarniensis</i>	= 22	Table Mountain, C.P.
<i>N. flexuosa</i>	= 22	Cogmans Kloof, C.P. <i>Hall</i> 2736 (NBG).
	= 22	Keeromsberg, C.P.
<i>N. humilis</i>	= 22	Bains Kloof, C.P.
<i>N. filifolia</i>	= 22	Cold Spring, C.P. <i>Britten s.n.</i> (NBG 66395)
	= 22	Ft. Beaufort, C.P.
<i>N. masonorum</i>	= 22	*Transkei (ex hort)*
† <i>N. hesseoides</i>	= 22	nr. Vryburg, C.P. <i>Hutchison sub Goldblatt</i> (BOL).
† <i>N. gibsonii</i>	= 22	Engcobo, C.P. <i>McNeil s.n.</i> (NBG 85056)
<i>N. angustifolia</i>	= 22	Ermelo, Tvl. <i>McNeil s.n.</i> (K).
	= 22	Ficksburg, O.F.S. <i>McNeil s.n.</i> (NBG 88242).
<i>N. platypetala</i>	= 22	Volkstrust, Tvl. <i>McNeil s.n.</i> (NBG 88243).
† <i>N. krigei</i>	= 22	Ermelo, Tvl. <i>McNeil s.n.</i>
<i>N. undulata</i>	= 22	Morgans Bay road, C. P. <i>McNeil sub Goldblatt</i> (BOL).
† <i>N. alta</i>	= 22	Richmond, Natal.
<i>N. cf. bowdenii</i>	= 22	Mont aux Sources, Natal. <i>Trauseld s.n.</i> (PRE).
<i>N. duparquetiana</i> . . .	= 22	Tuli Block, Botswana. <i>McNeil s.n.</i> (K).
<i>N. laticoma</i>	= 22	nr. Vryburg, C.P. <i>McNeil s.n.</i> (K).
† <i>N. huttonii</i>	= 22	Fish River valley, C.P. <i>McNeil, s.n.</i> (K).

* Plants studied were obtained from Kirstenbosch and are believed to be descendants of the type collection from the Transkei made by Canon and Miss Mason.

† Counts for these species are new records.



FIG. 3.
Metaphase and idiograms of *Nerine*.
A. *N. huttonii*; B. *N. laticoma*; C. *N. duparquetiana*; D. *N. sarniensis*; E. *N. humilis*;
F. *N. flexuosa*.

The outstanding feature of the group is that the satellite is always distinct and the primary and secondary constrictions are placed well apart, (table 2). Within the group there are clearly defined categories as described in table 2. These subdivisions of group 1 probably reflect close relationships of species but this is not necessarily so.

TABLE 2
Comparison of karyotypes of species of *Nerine* studied.

GROUP 1. Satellite on chromosome 6.

- (i) Satellite and arms of chromosome subequal (Fig. 5).
N. angustifolia *N. platypetala*
N. gibsonii
N. krigiei (borderline between this and the following category).
- (ii) Satellite and short arm of chromosome subequal, much smaller than the long arm; satellite attached to long arm (fig. 4: D, E, F.).
N. bowdenii *N. undulata*
N. alta
- (iii) Satellite and short arm of chromosome much smaller than long arm; satellite small; satellite attached to short arm (fig. 3: D, E, F).
N. humilis *N. flexuosa*
N. sarniensis
- (iv) Satellite small; arms of chromosome subequal (fig. 4: D, E, F).
N. filifolia *N. masonorum*
N. hesseoides (borderline here, shows similarities with category (ii)).

GROUP 2. Satellite on a small chromosome; primary and secondary constrictions close together (fig. 3: A, B, C).

N. duparquetiana *N. laticoma*
N. huttonii

Group 2

In the second group the satellite is located on the longest of the four pairs of short chromosomes (fig. 3: A, B, C.). The primary and secondary constrictions are very close together, and the satellite is much larger than the short arm of the chromosome. This group is also characterised by having very acrocentric chromosomes (except for the longest chromosome pair) and comprises: *N. huttonii*, *N. laticoma* and *N. duparquetiana*.

B. *Brunsvigia*.

In the three species studied the karyotypes are all similar, and bear a resemblance to *N. sarniensis* (fig. 2). The satellite, located on one of the medium chromosomes, is difficult to see, particularly if considerable shrinkage has occurred. The primary and secondary constrictions are close together, leaving a very narrow band of chromosome material between the constrictions representing the short arm of the chromosome. In this group the satellite, attached to the short arm of the chromosome is slightly larger than the short arm. Some difficulty was experienced in deciding which constriction was the centromere in

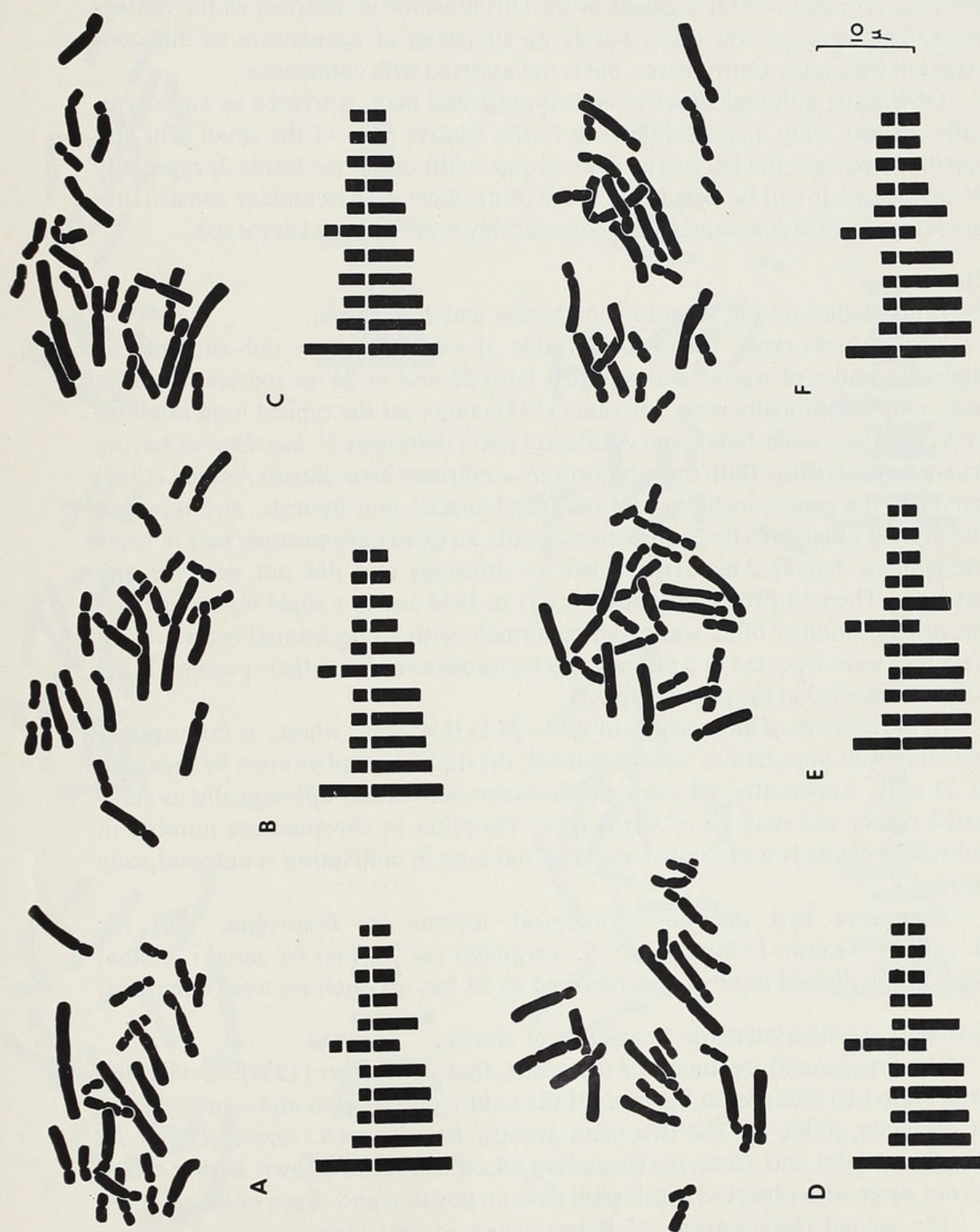


FIG. 4.

Metaphase and idiograms of *Nerine*.

A. *N. masonorum*; B. *N. hesseoides*; C. *N. filifolia*; D. *N. undulata*; E. *N. alata*; F. *N. bowdenii*.

Brunsvigia. As will be seen from the idiograms (fig. 2), the constriction between the long arm and central segment of the chromosome is regarded as the centromere. This decision was taken purely on similarity of appearance of this constriction with other centromeres, but is not asserted with confidence.

Obviously, although *Brunsvigia* as represented here, is treated as karyotypically distinct, only a small difference in the relative sizes of the small arm and satellite separates the karyotype from group 1 (iii) of *Nerine* (table 2) especially *N. sarniensis*. It will be noted that if the centromere and secondary constriction are reversed, then *Brunsvigia* has a considerably more distinct karyotype.

DISCUSSION

Previous studies on the karyology of *Nerine* and *Brunsvigia*.

The early workers, before 1950 (table 3) were obviously not sure of the diploid number of *Nerine* and reported both 22 and or 24 for species. Satellites were only occasionally seen. Iniryama (1937) reported the typical long satellites in *N. undulata* while James and Addicott (1941) described *N. bowdenii* as having a very large satellite. Both these reports are confirmed here. Janaki Ammal (1951) surveyed the genus, including both natural species and hybrids, and reported the diploid number to be 22 with occasionally an extra chromosome pair in some individuals. Janaki Ammal provided no drawings and did not describe any satellites. Then, in Professor Gouws' study in 1954 and in a short report in 1971, the diploid number of 22 was again confirmed, with an occasional record of 24. Satellites were reported in 5 of the 9 species he examined and their position is the same as reported in the present study.

In the absence of any records of $2n = 24$ in this work, where, as far as possible, only wild populations were examined, the diploid number must be regarded as 22 only. Apparently, an extra chromosome pair occurs sporadically in cultivated plants and may be of the B type. Variation in chromosome number in cultivated plants is well known and material long in cultivation is automatically suspect.

There are two previous cytological records in *Brunsvigia*, that for *B. cooperi* (Gouws 1954) and for *B. marginata* (as *Nerine*) by Janaki Ammal (1951). The diploid number was reported as 22 but no satellites were described.

Correlation with systematic treatments of *Nerine*.

The first general treatment of the genus, that of Herbert (1837), divided the genus into two sections on the basis of the nature of the petals and stamens, erect or declinate, (table 4). The two main groups, *Regulares* (*N. sarniensis* and *N. marginata* only) and *Distortae* (including all other species known at that time), do not agree with observed cytological data on position and shape of the satellite.

The second classification, of Baker, which is best seen in *Flora Capensis* (1896) is not a formal one and sections are not recognised, (table 4). The treat-

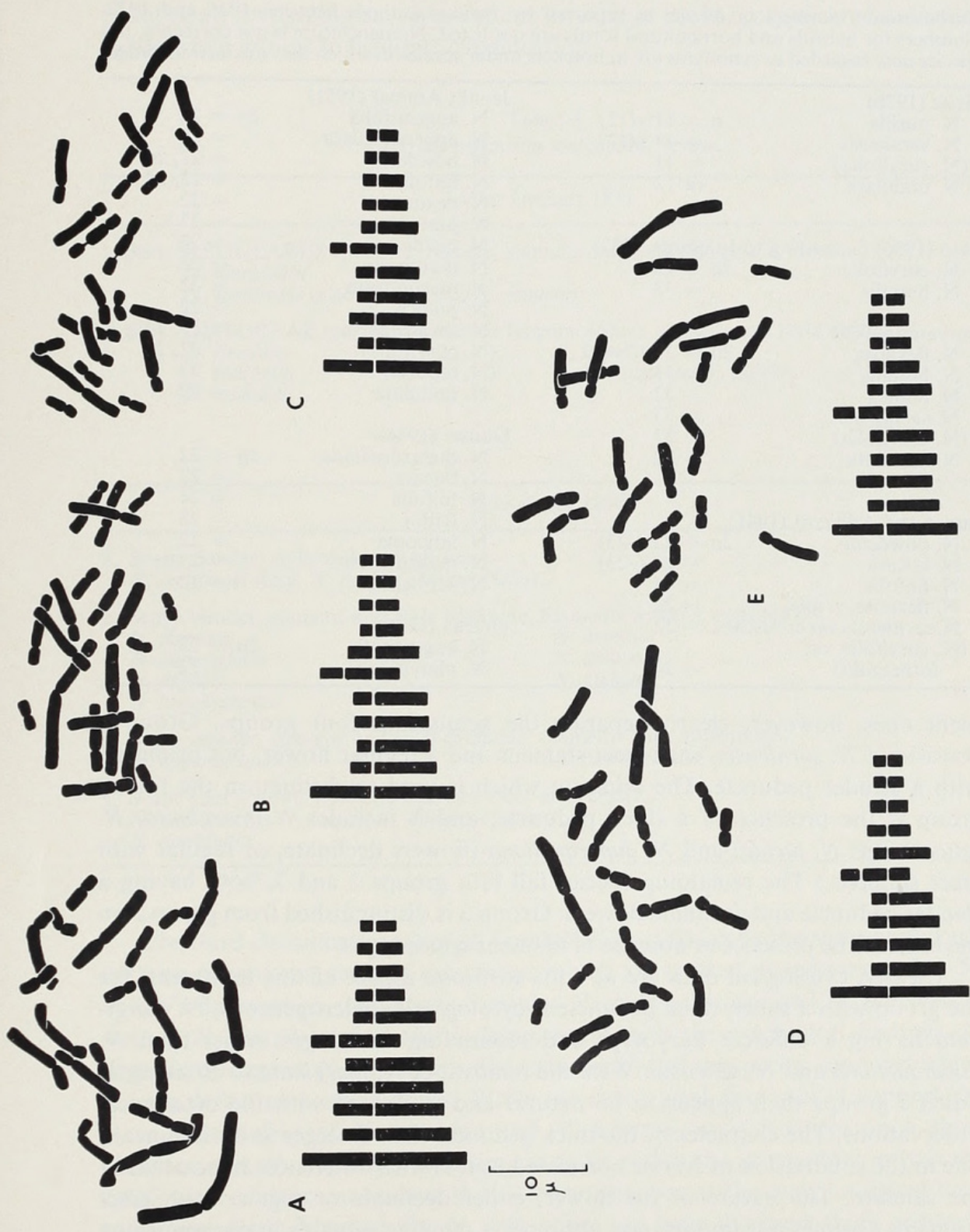


FIG. 5.
Metaphase and idiograms of *Nerine*.
A. *N. gibsonii*; B. *N. krigei*; C. *N. angustifolia* (Ficksburg); D. *N. platypetala*;
E. *N. angustifolia* (Ermelo).

TABLE 3

Chromosome numbers in *Nerine* as reported by various authors between 1926 and 1972. Numbers for hybrids and horticultural forms are not listed. Nomenclature is not corrected, but species now regarded as synonyms are in brackets under species in which they are now included.

Heitz (1926)		Janaki Ammal (1951)	
<i>N. pusilla</i>	n = 11 -(12)	<i>N. angustifolia</i>	2n = 22
<i>N. sarniensis</i>	= 11 -(12)	<i>N. appendiculata</i>	= 22
(<i>N. curvifolia</i>)	= 11	<i>N. bowdenii</i>	= 22, 24
<i>N. undulata</i>	ca 12	<i>N. filifolia</i>	= 22, 24
		<i>N. flexuosa</i>	= 22
		<i>N. humilis</i>	= 22
Sato (1936) (according to Iniryama 1937).		<i>N. lucida</i>	= 22
<i>N. curvifolia</i>	2n = 22	<i>N. marginata</i>	= 22
<i>N. humilis</i>	= 33	<i>N. masonorum</i>	= 22
		<i>N. pudica</i>	= 22
Iniryama (1937)		<i>N. sarniensis</i>	= 22, 24
<i>N. flexuosa</i>	2n = 33	(<i>N. curvifolia</i>)	= 22, 24
<i>N. humilis</i>	= 33	(<i>N. moorei</i>)	= 33
<i>N. pudica</i>	= 33	<i>N. undulata</i>	= 22
<i>N. sarniensis</i>	= 33		
(<i>N. curvifolia</i>)	= 33	Gouws (1954)	
<i>N. undulata</i>	= 22	<i>N. duparquetiana</i>	2n = 22
		<i>N. falcata</i>	= 22
James and Addicott (1941)		<i>N. filifolia</i>	= 24
<i>N. bowdenii</i>	2n = 22 (-23)	<i>N. frithii</i>	= 22
<i>N. falcata</i>	= 22 (-23)	<i>N. laticoma</i>	= 22
<i>N. filifolia</i>	= 24	<i>N. masonorum</i>	= 24
<i>N. flexuosa</i> v. <i>alba</i>	= 22	<i>N. sarniensis</i>	= 22
<i>N. sarniensis</i> var <i>coruscans</i>	= 22		
(<i>N. curvifolia</i> var <i>fothergillii</i>)	= 24	Gouws (1971)	
		<i>N. angustifolia</i>	2n = 22
		<i>N. platypetala</i>	= 22

ment does, however, clearly separate the genus into four groups. Group 1 consists of *N. sarniensis*, with erect stamens and a regular flower, but primarily with a slender peduncle. The criterion which is used to distinguish the fourth group is the presence of a thick peduncle, and it includes *N. marginata*, *N. laticoma* (as *N. lucida*) and *N. duparquetiana* (flowers declinate, or regular with erect stamens.) The remaining species fall into groups 2 and 3, both having a slender peduncle and declinate flowers. Group 3 is distinguished from group 2 on the basis of the presence or absence of filament appendages.

Clearly, cytological data are at odds with one aspect of this treatment, for the group with a short, thick peduncle is cytologically heterogeneous, *N. marginata* having a different karyotype and resembling *Brunsvigia* rather than *N. duparquetiana* and *N. laticoma*. With the removal of *N. marginata* to *Brunsvigia*, Baker's groups then appear to be natural and in accord with the cytological observations. The character of the thick peduncle then emerges as an important one in the subdivision of *Nerine* correlated as it is with differences in position of the satellite. The nature of the flower, either declinate or regular with erect stamens, assumes less importance, although it remains valuable in distinguishing *N. sarniensis*.

Lastly, whether or not the feature of appendaged stamens is a natural one, is not clear, for cytological observations reveal that the karyotypes are too similar in these two groups to facilitate classification.

TABLE 4
Early classification systems of *Nerine*.

After Herbert 1837	
1. Sect. REGULARES (perianth regular, stamens and style fasciculate, erect.)	
<i>N. marginata</i>	
<i>N. sarniensis</i> (also <i>N. corusca</i> , <i>N. venusta</i>)	
2. Sect. DISTORTAE (perianth distorted (zygomorphic), stamens and style declinate).	
<i>N. flexuosa</i>	<i>N. humilis</i>
<i>N. pulchella</i>	<i>N. laticoma</i> (as <i>N. lucida</i>).
<i>N. undulata</i>	
After Baker 1896	
1. Scape slender, style and stamens erect.	
<i>N. sarniensis</i> (incl. <i>N. moorei</i> , <i>N. curvifolia</i>).	
2. Scape slender, stamens and style declinate, filaments without appendages.	
<i>N. flexuosa</i>	<i>N. humilis</i>
<i>N. angustifolia</i>	<i>N. undulata</i>
<i>N. filifolia</i>	<i>N. pudica</i>
<i>N. brachystemon</i>	
3. Scape slender, stamens and style declinate, filaments with appendages.	
<i>N. appendiculata</i>	<i>N. pancratioides</i>
4. Scape short, stout, style and stamens erect or declinate.	
<i>N. laticoma</i> (as <i>N. lucida</i>) <i>N. duparquetiana</i>	
<i>N. marginata</i>	

The third classification, that of Traub (1967), is basically the same as Baker's with an altered sequence of the groups which are treated as sections (table 5). Traub's first section, *Laticomae*, includes *N. duparquetiana* and *N. laticoma* as well as *N. marginata* and this is inconsistent with the cytological findings. In Traub's treatment, *N. laticoma* is divided into several subspecies, amongst which are ssp *krigei* and ssp. *huttonii*. While the cytological data would support the close relationship of *N. laticoma* and *N. huttonii*, with satellites on a short chromosome, *N. krigei* does not appear to fit within the group. Not only is the cytological evidence at odds with the treatment, but at the morphological level too, some doubt is raised, for *N. krigei* does not have the short thick peduncle of *N. laticoma* and *N. huttonii*.

TABLE 5

Classification of *Nerine* after Traub (1967). The number of species placed in each section is given, but only those studied in the present paper are listed.

Sect. LATICOMAE peduncle short, stout, stamens and style erect or declinate.	
<i>N. marginata</i>	<i>N. duparquetiana</i>
<i>N. laticoma</i> (incl. <i>N. krigei</i> and <i>N. huttonii</i> , the latter two as subspecies).	
	3 sp.
Sect. NERINE peduncle slender, stamens and style erect.	
<i>N. sarniensis</i>	
	1 sp.
Sect. BOWDENII peduncle slender, stamens and style declinate, filaments without appendages.	
<i>N. flexuosa</i>	<i>N. humilis</i>
<i>N. undulata</i>	<i>N. bowdenii</i>
<i>N. alta</i>	<i>N. filifolia</i>
<i>N. angustifolia</i>	
	18 sp.
Sect. APPENDICULATAE peduncle slender, stamens and style declinate, filaments with appendages.	
<i>N. masonorum</i>	
<i>N. hesseoides</i>	
	8 sp.

Interspecific relationships in *Nerine*.

It is beyond the scope of this paper to comment on the validity or otherwise of various species of *Nerine*. It is of course likely that those species with very alike karyotypes are closely allied. Where morphological evidence also reveals similarity, a close relationship can be safely assumed. Small differences in karyotype do not exclude the possibility of close relationship or even conspecificity but the morphological data are, in the author's opinion, more meaningful. It would thus not be correct to base any opinion of species validity on the cytological evidence alone.

Conclusions on inter-relationships can still however be drawn from the karyotypes. It is very likely that the species of *Nerine* with the satellite on a small chromosome are allied and may even be subspecies of a large complex, as Traub's (1967) treatment of section *Laticomae* suggests.

In those species with the satellite on chromosome 6, the categories presented in table 2 represent groups of species usually treated as close allies. Thus those species in group 1 (ii), *N. bowdenii*, *N. alta* and *N. undulata* are placed consecutively in Traub's treatment. *N. krigei* may be allied to this group but it quite clearly is misplaced in the section *Laticomae* where Traub regarded it as a subspecies of *N. laticoma*.

Nerine angustifolia, *N. gibsonii* and *N. platypetala* would appear to be close allies, and this grouping is substantiated by the morphological evidence. The three species are very similar and were for some time regarded as a single entity. The cytological features would certainly not preclude this possibility.

The conclusion of Gouws (1971) that differences in karyotype between *N. angustifolia* and *N. platypetala* were evidence of the validity of these two species, cannot be supported. Gouws described a satellite in *N. platypetala* but did not observe one in *N. angustifolia* and the presence of the satellite in one and the absence in the other species was one of the primary reasons for his conclusion. As satellites were found in both species by the present author (fig. 1, fig. 5), the cytological evidence is not relevant to arguments on the validity of the species in question.

In group 1 (iii) *N. flexuosa* and *N. humilis* are undoubtedly closely allied, and morphological distinctions seem primarily those of size. *N. sarniensis* however, with a similar karyotype to the two former species is a very distinct entity from the morphological point of view.

The three species forming category (iv) do not appear to comprise a natural assemblage. Two of these, *N. hesseoides* and *N. masonorum* have appendages on the filaments and though the karyotypes are fairly similar, (fig. 4: A, B) the satellite chromosomes are different. *N. filifolia* on the other hand has a satellite chromosome similar to that of *N. masonorum* but in this case the remainder of the chromosomes are rather dissimilar. The general appearance of the karyotype of *N. filifolia* is reminiscent of *N. angustifolia* (fig. 1) and these two species may be closely allied.

The taxonomic position of *Brunsvigia marginata*.

The genus *Brunsvigia* was included in this study primarily because of the ambiguous position of *B. marginata*. This species has, since its description by Jacquin as a species of *Amaryllis*, been treated as *Brunsvigia* by Aiton and as *Nerine* by several authors. The situation was described by R. A. Dyer (1950–51) who, although treating the species as a *Nerine*, suggested that cytological study might prove rewarding.

The cytological evidence has indeed been helpful. The similarity of karyotype of *B. marginata* and the two other species of this genus which were examined (fig. 2: A, B, C), must be regarded as evidence of a close relationship. The less strong resemblance between the karyotypes of *B. marginata* and *N. sarniensis* has already been noted. The cytological evidence cannot therefore be regarded as conclusive and must be used in conjunction with the morphology.

An analysis of the morphological features of *Nerine* and *Brunsvigia* set out below, when taken together with the cytological data must, in the author's opinion, vindicate the treatment of *B. marginata* followed in this paper.

The bulbs of *Nerine* and *Brunsvigia* are similar in structure, although those of *Nerine* are usually much smaller. The flower of *Nerine* is either declinate with irregularly arranged petals or regular, with erect stamens, while the peduncle is either slender or stout. The fruits are poorly developed, depressed capsules

containing one or two fleshy seeds per locule, and the fruit wall, which is of a membranous texture, is usually split by pressure before the seeds are even fully developed.

The flowers of *Brunsvigia* are also declinate, or occasionally more or less regular and the petals are often joined at the base to form a tube. The peduncle is always comparatively thick while the fruit is an inflated, turbinate, three-winged capsule, often containing several seeds, the latter also being fleshy as in *Nerine*. *Brunsvigia* is peculiar in the way the inflorescence develops after flowering: the pedicels elongate and twist round until the umbel is quite spherical. Part of the peduncle is reputed to decay and the whole structure then detached, can be blown about by the wind during which time the seeds are shed. While the detachment of the inflorescence of *Brunsvigia* does not always occur, the fruits and the structure of the inflorescence in the fruiting stage are unmistakeable.

Brunsvigia marginata has the same fruit and exhibits the post fertilisation development of the umbel of a typical *Brunsvigia*. The leaves, which have not previously been mentioned, are large and broad and are prostrate. This type of leaf is unknown in *Nerine* but is found in several species of *Brunsvigia*. In fact the only resemblance which *B. marginata* bears to *Nerine* is the similarity of its flowers to *N. sarniensis*. Even here, the resemblance is more superficial than real, for the flowers of *B. marginata* have a well developed perianth tube while this feature is lacking in *N. sarniensis* and indeed in most other species of *Nerine*.

Thus to include *B. marginata* in *Nerine* would be to expand the limits of this genus and consistent treatment would compel inclusion of the genus *Brunsvigia* in *Nerine*. This treatment would be quite unsatisfactory and is also unnecessary. If *B. marginata* is included in *Brunsvigia*, then this genus and *Nerine* are easily delimited by differences in ovary, fruit and development of the umbel after fertilisation.

The resemblance of the karyotypes of *Brunsvigia* studied here to *N. sarniensis* may be fortuitous, but more likely, this indicates a close connection between *Nerine* and *Brunsvigia* through *N. sarniensis*, itself perhaps the least specialised of the *Nerines*.

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