PRELIMINARY CYTOLOGY OF AUSTRALASIAN IRIDACEAE[1]

PETER GOLDBLATT[2]

ABSTRACT

Native Australasian Iridaceae are poorly known cytologically with only *Libertia*, $x = 19$, well studied. In other genera *Patersonia* is shown to have $n = 11$ (not 12 as previously reported), 21 and 31, *Diplarrhena* has $n = 15$–16, and *Orthrosanthus laxus*, a high polyploid, $n = 75$–80. The only non-African species of *Dietes*, *D. robinsoniana*, from Lord Howe Island, has $n = 10$ which agrees with $x = 10$ known for the African species. An artificial hybrid *D. robinsoniana* × *D. iridioides* also has $n = 10$. Affinities of the Autralasian Iridaceae are discussed in relation to the cytology and morphology.

There are five or perhaps six native genera and some 26 species of Iridaceae in Australasia, few compared to the other southern continents where the family is well represented. Two Australasian genera, *Libertia* and *Orthrosanthus* are shared with South America and one, *Dietes*, with Africa, while *Diplarrhena*, *Patersonia*, and also *Isophysis* (if this is admitted to the family) are endemic. *Patersonia* actually extends to New Guinea and Borneo, though it is centered in temperate Australia.

The affinities of the endemic genera are not clear, while the relationship of the Australasian species of *Dietes* to the rest of this essentially African genus has been the subject of considerable interest. Cytology has been of great value in interpreting relationships of Iridaceae in Africa (Goldblatt, 1971, 1976a) and seems likely to be of value in the New World also. The Australasian species and genera are hardly known cytologically except for *Libertia* (Hair et al., 1967), and with this in mind I have undertaken this study. Results to date have been somewhat meager but seem worth reporting, in spite of remaining gaps in the record. Hopefully results will stimulate further investigation of the family in Australasia.

MATERIALS AND METHODS

Seeds and plants of native Australian species were obtained from Kings Park and Botanic Garden, Perth; from Winifred Curtis and Desmond Morris, Tasmania; and from the Royal Botanic Gardens, Sydney. The hybrid *Dietes robinsonia* × *D. iridioides* was made by M. Boussard, Verdun, France, from parent plants of wild origin. Unfortunately, with few exceptions material is not represented by vouchers collected in the wild, and I have been able to make vouchers of only the few which grew to flowering at the Missouri Botanical Garden.

All counts were made from mitotic preparations. Root tips obtained from actively growing plants were pretreated in 0.003 M hydroxy-quinoline, fixed in Carnoy's solution, hydrolyzed in 10% HCl for 6 minutes at 60°C and squashed

[1] This study was supported by grants BMS 74-18905 and DEB 76-19907 from the United States National Science Foundation. I wish to thank Winifred Curtis and Desmond Morris of Tasmania for material of *Diplarrhena* studied, and Dr. M. Boussard for plants of his hybrid *D. robinsoniana* × *D. iridioides*.

[2] B. A. Krukoff Curator of African Botany, Missouri Botanical Garden, Post Office Box 299, St. Louis, Missouri 63166.

ANN. MISSOURI BOT. GARD. 66: 851–855. 1979.

0026-6493/79/0851–0855/$00.65/0

TABLE 1. Chromosome numbers in Australasian Iridaceae. Counts in **bold** type are new reports.

Species	Diploid no. $2n$	Collection Data
Dietes		
D. robinsoniana (F. Muell.) Klatt	**20**	Lord Howe Is., ex Hort. Kew, no voucher.
D. robinsoniana × *D. iridioides*	**20**	(Parents of wild origin) voucher cult. at Missouri Botanical Garden, *Goldblatt 4673* (MO).
Diplarrhena		
D. moraea Labill.[a]	**30–32**	Tasmania, Linda, *Curtis s.n. sub Goldblatt 4674* (MO); Tasmania, Rekuna, *Morris s.n.* (no voucher).
Libertia		
L. puchella (R. Br.) Spreng.	38	New Guinea (Borgmann, 1964); New Zealand (Hair et al., 1967).
L. ixioides (Forst. f.) Spreng.	12*x*	New Zealand (Hair et al., 1967).
L. grandiflora (R. Br.) Sweet	6*x*, 12*x*	New Zealand (Hair et al., 1967).
L. peregrinans Ckn. & Allan	6*x*	New Zealand (Hair et al., 1967).
Orthrosanthus		
O. laxus (Endl.) Benth.	**150–160**	W. Australia, Helena Valley, Perth, *Demarz 7171* (PERTH).
Patersonia		
P. occidentalis R. Br.	24	W. Australia (Goldblatt, 1971).
	22	W. Australia, Perth distr., *Demarz s.n.* (no voucher).
P. sericea R. Br. ex Ker	**22**	New South Wales, Clarence, no voucher or NSW.
P. umbrosa Endl.	**22**	W. Australia, Lort River, *Demarz 4938* (PERTH).
P. fragilis (Labill.) Asch. & Graeb.	**42**	New South Wales, Clarence, *Hind 788* (NSW).
P. sp.	**62**	Tasmania, Murchison highway, *Curtis s.n.* (no voucher).

[a] W. Curtis (pers. comm.) suggests *D. latifolia* Benth. is distinct from *D. moraea* Ladill. in which case the plants above are *D. latifolia*.

in lacto-propionic orcein. Species studied, numbers obtained and collection information is listed in Table 1.

OBSERVATIONS

Dietes

The Australasian species of *Dietes, D. robinsoniana,* has a diploid number of $2n = 20$. A hybrid, *D. robinsoniana* × *D. iridioides,* raised by M. Boussard also has $2n = 20$. The African species of *Dietes* are either diploid, $2n = 20$, or tetraploid, $2n = 40$ (Goldblatt, 1971, and unpublished data; Chimphamba, 1974). The karyotypes of the Australasian and African species are similar, with chromosomes of the same size and general morphology. There seems little doubt that *D. robinsoniana* is correctly placed in *Dietes*.

Patersonia

The only previous count in *Patersonia*, $2n = 24$ for *P. occidentalis*, (Goldblatt, 1971) is incorrect. Repeated counts for this species have consistently yielded $2n = 22$. The karyotype comprises fairly small chromosomes ranging from 1.5–3 μm. There are three pairs of larger chromosomes and a pair of conspicuously large satellites. *Patersonia sericea* and *P. umbrosa* also have $2n = 22$, and an identical karyotype, while *P. fragilis* is polyploid with $2n = 42$. Though $2n = 44$ would be expected, I have not been able to demonstrate more than 42 chromosomes. An as yet undetermined Tasmanian *Patersonia* seems hexaploid, but here, although $2n = 66$ would seem likely, I could only count $2n = 62$. Aneuploid reduction may have taken place in these polyploid species if the counts are correct. Clearly, more studies are needed in *Patersonia*, especially in the polyploids. For accurate results in species with higher numbers meiotic studies are recommended.

Diplarrhena

A diploid number of $2n = 30$–32 was obtained for this endemic Australian genus consisting of either one (Geerinck, 1974) or two species (Bentham, 1873; Curtis, pers. comm.). The karyotype consists of fairly small chromosomes, ranging from 1.5–3 μm in size. Doubt as to the correct number is due to difficulty in interpreting two possible small chromosomes of somewhat less that 1μm in length, which may be satellites, though I could not demonstrate any connection between these and any of the larger chromosomes. An exact chromosome count thus awaits further investigation.

Orthrosanthus

One species, *Orthrosanthus laxus*, was examined, which proved to be a high polyploid with the diploid number in the range $2n = 150$–160. Chromosomes are very small and an accurate count will probably be obtained only from meiotic study. The tiny chromosomes are similar in size to those I have seen in the related *Libertia*, which has a base number of $x = 19$ (Hair et al., 1967; Borgmann, 1964).

Discussion

With the exception of *Dietes* and *Isophysis*, the Australasian genera of Iridaceae are believed to be related in a general way to one another and to several New World genera including *Sisyrinchium*, *Tapeinia*, *Chamelum* and their allies. *Isophysis*, with its superior ovary, is rather isolated and is not always accepted as belonging to Iridaceae. It was first associated with this family by Hutchinson (1934). *Dietes*, all but one species of which are African, belongs to Iridoideae-Irideae in Iridinae (Goldblatt, 1976b) (or close to this subtribe), and is allied to the northern temperate genus *Iris*, and to the African *Moraea*. It is intermediate in many ways between these two genera (Goldblatt, 1976a, 1976b).

Libertia, *Orthrosanthus*, and *Diplarrhena* are usually allied with the New World *Sisyrinchium* in Sisyrichieae-Sisyrinchiinae (Diels, 1930). Recently Geerinck (1974) placed *Libertia pulchella* in *Sisyrinchium* and suggested that the two genera are very closely related. Chromsosome numbers, however, do not support this treatment, nor do they provide evidence for a particularly close relationship of *Sisyrinchium* with *Libertia* or *Diplarrhena*. *Sisyrinchium* has $x = 9$ ($n = 9, 8, 17$) and its close ally *Phaiophleps* also has $x = 9$, while *Libertia*, with much smaller chromosomes, has $n = 19$, and *Diplarrhena* has $n = 15(-16)$.

Alternative treatments such as that of Pax (1888) place *Diplarrhena* and *Libertia* together in Libertiinae separate from Sisyrinchiinae, with *Orthrosanthus* in Aristeinae, the latter otherwise entirely African. The separation of *Orthrosanthus* and *Libertia* in different subtribes seems unjustified, since both have long style branches, not known in *Aristea* and its close relatives. *Orthrosanthus* seems best placed close to *Libertia*, whether included in Sisyrinchiinae or separated in Libertiinae, a treatment which appears to have merit on the cytological data available to date.

Patersonia, also placed in Sisyrinchieae, is usually referred to Aristeinae (Diels, 1930; Hutchinson, 1934, as Aristeae) which includes the African *Aristea*, the three shrubby South African genera, *Klattia*, *Witsenia* and *Nivenia*, all with $x = 16$, and *Ona*, *Chamelum*, and *Solenomelus* in South America, cytologically unknown. The base number for *Patersonia*, apparently $x = 11$ from this study, suggests no close connection with *Aristea*, though chromosome size is similar. Morphology suggests *Patersonia*'s closest ally may be *Aristea*, both genera having simple styles with expanded stigma lobes. These are fringed in *Patersonia* but entire in *Aristea*. Other features, such as the long perianth tube, united filaments, much reduced inner tepals, and well-developed inflorescence spathes in *Patersonia* argue against anything more than a distant relationship between these genera. Cytological differences appear to reinforce this view. Interestingly, *Patersonia* is the only Australasian or New World genus examined by Cheadle (1964) which has xylem as primitive as that found in *Aristea* and its close African allies *Witsenia*, *Klattia*, *Nivenia*. In this respect *Aristea* and *Patersonia* stand apart from Sisyrinchiinae (*Sisyrinchium*, *Diplarrhena Libertia* and *Orthrosanthus*). Other South American genera placed with *Patersonia* in Aristeinae were not examined by Cheadle, and their relationship to either Sisyrinchinae or Aristeinae must rest on morphology alone.

In summary, it appears from the admittedly meager cytological evidence that *Patersonia*, *Libertia*, *Diplarrhena* and *Dietes* are not especially closely related to one another. *Dietes robinsoniana* clearly belongs in *Dietes* and the relationship of this genus with *Iris* and *Moraea* seems clear; however, for the remainder little more can be said than that they have generally primitive features for Iridaceae and placement in Sisyrinchieae seems reasonable. They do not seem particularly closely related to one another or to genera elsewhere, with the exception of a likely link between *Libertia* and *Orthrosanthus*. Best treatment might be placement in separate subtribes. Association of *Patersonia* with the Aristeinae, especially *Aristea* appears to have some merit but morphology and cytology suggest that this relationship if in fact correct is rather distant, though they may possibly be included within a subtribe.

For the Australian region additional counts would be useful in further elaborating the cytological pattern in *Patersonia*, and a firm count for *Orthrosanthus*