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Miscellaneous notes

AGAPANTHACEAE

CHROMOSOME COUNTS IN THE GENUS *AGAPANTHUS*

INTRODUCTION

The genus *Agapanthus* L'Hér. consists of ten species (Archer 2003), widely distributed in southern Eastern Cape, southern Western Cape, southern KwaZulu-Natal, Swaziland, Mpumalanga, Free State, Lesotho, Gauteng, Limpopo and Mozambique (Duncan 1998).

Very little morphological variation exists in the genus and the delimitation of species is mainly based on flower type and whether the taxon is deciduous or not (Leighton 1965). The species also hybridize quite freely when grown next to each other (Duncan 1998). Human intervention (selection) and especially the production of numerous cultivars (often resulting from interspecific hybrids) blur species lines. The extent of natural hybrids is not known.

The objective of this study was to determine somatic chromosome numbers in various subspecies and cultivated varieties of *Agapanthus*.

MATERIALS AND METHODS

Seeds of species of *Agapanthus* collected in the wild or cultivars obtained from nurseries, were germinated in a greenhouse at the University of the Free State, South Africa. Germinated plants were watered heavily a day before collecting the root tips. Root tips were treated with cold water at 4°C for 48 hours (Jong 1995). Then the root tips were fixed in Carnoy's fixative (Carnoy 1886) for 72 hours. The Carnoy's fixative was replaced by 70% ethanol. Root tips were hydrolysed with 1N hydrochloric acid for seven minutes and stained with Feulgen reagent for two hours in darkness (Darlington & La Cour 1976). The root tips were stored in 30% alcohol until squashing. Cover slips were treated with Mayr's albumen and squashes were made in aceto-orcein according to Darlington & La Cour (1976). Contrast between chromosomes and the cytoplasm was intensified by adding 45% acetic acid, saturated with iron acetate (Thomas 1940). Slides were made permanent by floating the cover slip off in acetic acid, dehydrating in alcohol and mounting in Euparol (Darlington & La Cour 1976).

Observation of the slides was done with an Olympus CH2 light microscope. Cell positions were located with an England Finder. At least ten cells per specimen were studied. Chromosomes in the cells were photographed with a Cool Pix digital camera, mounted on a Nikon Microphot FXA microscope.

RESULTS AND DISCUSSIONS

Results were obtained from five species, nine subspecies and 11 cultivars (Table 1). Chromosome numbers observed for *Agapanthus campanulatus* subsp. *campanulatus*, *A. praecox* subsp. *praecox* and *A. praecox* subsp. *orientalis* support previous findings.

Somatic chromosome numbers of 2n =28 + 0-2B, 30 and 30 + 0-2B were observed (Table 1). The 2n = 28 + 0-2B was observed in *A. inapertus* subsp. *intermedius*. This species was also the only one with a chromosome count less than 2n = 30. The species is morphologically different from other *Agapanthus* species since it is the only species with drooping flowers featuring the colours Aconite violet 937/3 and Victoria violet 738 (Leighton 1965).

Chromosome counts of 2n = 30 and 30 + 0-2B were the most frequent for the studied taxa and agree with previous observations (Guignard 1884; Belling 1928; Darlington 1933; Geitler 1933; Stenar 1933; Matsuura & Suto 1935; Mookerjea 1955; Lima-de-Faria & Sarvella 1958; Sharma & Sharma 1961; Riley & Mukerjee 1962; Sharma & Mukhopadhyay 1963; Vijavalli & Mathew 1990). B-chromosomes were present in all species of the genus. Chromosomes were considered to be B-chromosomes if the number of chromosomes varied between different unbroken cells of the same individual. However, not all subspecies of a species or all cultivated forms had B-chromosomes. In some cases these B-chromosomes occurred in taxa where they have not been described previously (Table 1). This study did not focus on the occurrence of B-chromosomes, therefore it was difficult to determine if B-chromosomes occur in all *Agapanthus* specimens and whether they are restricted to any part of the soma. It was also observed that the karyotype of *Agapanthus* comprised of chromosome pairs of different sizes.

The chromosome counts indicated that the basic chromosome number for *Agapanthus* is x = 15, with a reduction to x = 14 in at least *A. inapertus* subsp. *intermedius*. This is a high basic chromosome number and suggests a palaeoploid origin for *Agapanthus*. This study therefore added new information for *Agapanthus*, since Darlington (1933) only reported on the basic chromosome number of x = 15.

Further studies are needed to test the relationships in *Agapanthus* and especially the function (if any) and origin of the B-chromosomes. The other four species of *Agapanthus* should also be studied to determine their chromosome numbers and to see whether other basic chromosome numbers may be present.

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TABLE 1.—Specimens of *Agapanthus* taxa studied with their somatic (2n) chromosome numbers and voucher numbers or source

Taxon	2n	Voucher no. /source
A. africanus (L.) Hoffmanns.	30	Geitler 1933; as *A. umbellatus*: Guignard 1884; Belling 1928; Darlington 1933; Matsuura & Suto 1935; Mookerjea 1955; Lima-de-Faria & Sarvella 1958; Sharma & Mukhopadhyay 1963; Vijavalli & Mathew 1990
A. africanus (L.) Hoffmanns.	32	Stenar 1933
A. campanulatus F.M.Leight. subsp. *campanulatus*	30	*Spies 7391*; Riley & Mukerjee 1962
A. campanulatus F.M.Leight. subsp. *patens** (F.M.Leight.) F.M.Leight.	30	*Spies 7401*
A. caulescens Spreng. subsp. *angustifolius** F.M.Leight.	30 + 0-2B	*Spies 7388*
A. comptonii F.M.Leight. subsp. *comptonii**	30	*Spies 7399*
A. comptonii F.M.Leight. subsp. *longitubus** F.M.Leight.	30	*Spies 7389*
hybrid 424/82	30 + 0-2B	*Spies 7400*
A. excelsus	30	Matsuura & Suto 1935
A. globulosus	30	Sharma & Sharma 1961
A. inapertus P.Beauv. subsp. *intermedius** F.M.Leight.	28 + 0-2B	*Spies 7398*
A. inapertus P.Beauv.	30	Sharma & Sharma 1961; Riley & Mukerjee 1962; Sharma & Mukhopadhyay 1963
A. minimus	30	Riley & Mukerjee 1962
A. praecox Willd. subsp. *minimus* Nana*	30 + 0-2B	*Spies 7393*
A. praecox Willd. subsp. *minimus* Storms River*	30	*Spies 7386*
A. praecox Willd. subsp. *orientalis* (F.M.Leight.) F.M.Leight.	32 + 2B	Riley & Mukerjee 1962
A. praecox Willd. subsp. *orientalis* Blue*	30 + 0-2B	*Spies 7383*
A. praecox Willd. subsp. *orientalis* Blue & white*	30 + 0-2B	*Spies 7390*
A. praecox Willd. subsp. *orientalis* White*	30	*Spies 7387*
A. praecox Willd. subsp. *orientalis* Weaver*	30 + 0-2B	*Spies 7392*
A. praecox Willd. subsp. *orientalis* Mt Thomas*	30 + 0-2B	*Spies 7396*
A. praecox Willd. subsp. *praecox*	30	*Spies 7394*
A. praecox Willd. subsp. *praecox*	32	Riley & Mukerjee 1962
A. praecox Willd. subsp. *praecox* Azure*	30	*Spies 7385*
A. praecox Dwarf white*	30 + 0-2B	*Spies 7395*
A. praecox Floribunda*	30	*Spies 7403*
A. praecox Medium white*	30 + 0-2B	*Spies 7384*
Agapanthus L'Hér. sp.	29 & 30 + 2B	Riley & Mukerjee 1962

* first chromosome no. report.

REFERENCES

ARCHER, C. 2003. Agapanthaceae. In G. Germishuizen & N.L. Meyer, Plants of southern Africa: an annotated checklist. *Strelitzia* 14: 954.

BELLING, J. 1928. Contraction of chromosomes during maturation divisions in *Lilium* and other plants. *University of California Publications in Botany* 14: 335–343.

CARNOY, J.B. 1886. La cytodierese de l'oeuf. *Cellule* 3: 1–92.

DARLINGTON, C.D. 1933. Meiosis in *Agapanthus* and *Kniphofia*. *Cytologia* 4: 229–240.

DARLINGTON, C.D. & LA COUR, L.F. 1976. *The handling of chromosomes*. Allen & Unwin, London.

DUNCAN, G. 1998. *Grow agapanthus*. Kirstenbosch Gardening Series. Trident Press, Cape Town.

GEITLER, L. 1933. Das Verhalten der Chromozentren von *Agapanthus* während der Meiose. *Österreichische botanische Zeitschrift* 82: 277–282.

GUIGNARD, L. 1884. Recherches sur la structure et la division du noyau cellulaire chez les vegetaux. *Annales des sciences naturelles, botanique, sér.* 17: 5–59.

JONG, K. 1995. *Laboratory manual of cytological techniques*. Royal Botanic Gardens, Edinburgh.

LEIGHTON, F.M. 1965. The genus *Agapanthus* L'Heritier. *Journal of South African Botany*, Supplementary volume IV.

LIMA-DE-FARIA, A. & SARVELLA, P. 1958. The organization of telomeres in species of *Solanum, Salvia, Scilla, Secale, Agapanthus* and *Ornithogalum*. *Hereditas* 44: 337–346.

MATSUURA, H. & SUTO, T. 1935. Contributions to the idiogram study in phanerogamous plants. I. *Journal of the Faculty of Science, Hokkaido Imperial University*, ser. 5: 33–75.

MOOKERJEA, A. 1955. Cytology of amaryllids as an aid to the understanding of evolution. *Caryologia* 7: 1–71.

RILEY, H.P. & MUKERJEE, D. 1962. Chromosomes of some species of *Agapanthus*. *Cytologia* 27: 325–332.

SHARMA, A.K. & MUKHOPADHYAY, S. 1963. Chromosome study in *Agapanthus* and the phylogeny of its species. *Caryologia* 16: 127–137.

SHARMA, A.K. & SHARMA, A. 1961. An investigation of the cytology of some species of Liliaceae. *Genetica Iberica* 13: 25–42.

STENAR, H. 1933. Zur Embryologie der *Agapanthus*-Gruppe. *Botaniska Notiser* 1933: 520–530.

THOMAS, P.T. 1940. The Aceto-carmine Method for fruit material. *Stain Technology* 15: 167–172.

VIJAVALLI, B. & MATHEW, P.M. 1990. *Cytotaxonomy of the Liliaceae and allied families*. Continental Publishers, Kerala, India.

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