

THE KARYOTYPE OF *Alstroemeria diluta* EHR. BAYER SUBSP. *chrysantha* (ALSTROEMERIACEAE)

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ABSTRACT

The karyotype of *Alstroemeria diluta* subsp. *chrysantha* Ehr. Bayer from Chile was examined. The species has $2n = 2x = 16$ chromosomes, with $4m + 4sm + 2st-sat + 4t + 2t-sat$. The reported karyotype is very asymmetrical (AsK % = 71.4 and Syi = 40.0%). This karyotype is similar to that published previously for *Alstroemeria graminea* Phil.

Key words: *Alstroemeria*, karyotype, ornamental plant, Chile.

INTRODUCTION

In Chile there exist approximately 44 genera and 180 species of geophytes that have ornamental value, only being surpassed in number by attractive species in the flora of South Africa (Peñailillo, 2000). Among the species in Chile, almost 90% are endemic (Benoit, 1989), and they are especially concentrated in the families Alliaceae, Alstroemeriaceae, Amaryllidaceae, and Tecophilaceae.

Alstroemeria L. (Alstroemeriaceae) is an American monocot genus with about 50 species distributed principally in Chile and Brazil (Bayer, 1987; Muñoz and Moreira, 2003).

In Chile the genus contains 49 taxa, of which 40 are endemic (Muñoz and Moreira, 2003), primarily found in the Mediterranean region of the country. This region harbors about 47% of the total plant species found in Chile (Myers *et al.*, 2000), and many of these taxa have serious conservation difficulties due to small population sizes and recent impacts from human activities.

There exist a large number of Chilean species of *Alstroemeria* that are cultivated for ornamental use throughout the world, among these being *A. aurea* Graham, *A. pelegrina* L., *A. ligtu* L. and *A. magnifica* Herb. (Baeza *et al.*, 2008). In this context, *A. diluta* Ehr. Bayer is an endemic species that has great cultivation potential, especially in view of its beautiful flowers (Figure 1A-C), plus the fact that seeds are available commercially (Chileflora, 2010). This species is found from Carrizal

Bajo (28°08' S lat) in the Atacama Region, to Punta Curaumilla (33°05' S lat) in the Province of Valparaíso. It is characterized by having a small height (no taller than 15 cm), with outer tepals pink or yellowish and denticulate at the margin, and with internal tepals purple. It grows on old marine terraces with abundant large limestone gravel, but here being somewhat weak and poorly developed. It also grows more successfully on interior low hills that correspond to ancient Pliocene terraces (Paskoff, 1967). With regard to vegetation, this species is an important component of the coastal sclerophyllous forest, growing preferentially in degraded areas, and co-occurring with annual grasses in open prairies that are occasionally impacted by forest fires (Peralta, 1972).

This scientific note documents the karyotype of *Alstroemeria diluta* subsp. *chrysantha* Ehr. Bayer, including a comparison with *A. graminea* Phil., with which it shares many karyotypic similarities.

MATERIALS AND METHODS

Two populations of *Alstroemeria diluta* subsp. *chrysantha* were studied from Chile: (1) Región de Valparaíso, Provincia de Valparaíso, Punta Curaumilla, camping Las Gaviotas, 58 m.a.s.l. (33°05' S, 71°43' W), 11 December 2007, C. Baeza 4264 (CONC); (2) Jardín Botánico Nacional, Lote C, 71 m.a.s.l. (33°02' S, 71°29' W), 24 December 2007, P. Novoa s.n. (Herbario Jardín Botánico Nacional, Viña del Mar, Chile).

Study of the chromosomes, measurement, and construction of karyotypes, were done following methods described by Baeza *et al.* (2006). Root tips were obtained from plants cultivated in the greenhouse. For each population, five individual plants were examined (with 10 clear metaphase plates observed from each individual). The index of karyotypic asymmetry (AsK %) as defined

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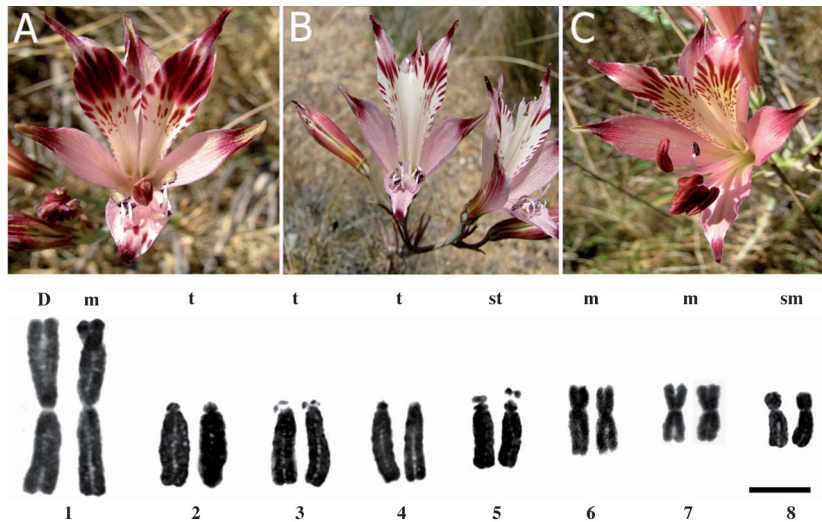


Figure 1. A-C. Photographs of *Alstroemeria diluta* subsp. *chrysantha*. D: Karyotype of *Alstroemeria diluta* subsp. *chrysantha*. Scale = 5 μm .

by Arano and Saito (1980), the Syi: asymmetry index of Venora *et al.* (2002), and the total diploid length of the chromosomes (LTC, μm) were used. The chromosomes were classified following Levan *et al.* (1964).

RESULTS AND DISCUSSION

Alstroemeria diluta subsp. *chrysantha* has $2n = 2x = 16$ chromosomes, with an asymmetrical karyotype and a haploid chromosome complement of $2m + 2sm + 1st\text{-sat} + 2t + 1t\text{-sat}$, i.e., 2 pairs of metacentric chromosomes (pairs 1 and 7), 2 pairs of submetacentrics (pairs 6 and 8), 1 pair of subtelocentric chromosomes with a satellite (pair 5), and 3 pairs of acrocentrics (pairs 2-4, with pair 3 containing a satellite) (Figure 1D, Table 1). The index of karyotypic asymmetry of Arano and Saito (AsK %) was 71.4, the Syi 40.0%, and the LTC 119.6 μm .

Alstroemeria diluta subsp. *chrysantha* has the most asymmetric karyotype and the lowest value of LTC known so far among all the perennial species of *Alstroemeria*. It is comparable only to the karyotype of the sole annual species in the genus, *A. graminea*, which has an even lower value of LTC and an even more asymmetrical karyotype (LTC = 10.8 μm ; AsK % = 80.1%; Sy I = 24.8%; Jara-Seguel *et al.*, 2004). Both species share very asymmetrical karyotypes, low values of LTC, and presence of only one pair of large metacentric chromosomes (pair 1).

Considering the distinctive cytological features and the beauty of the flowers of this species, it may well have excellent potential as an ornamental plant for gardens, terrace pots, or as cut flowers for the local, national, or international horticultural trade. In the past decade, this latter activity has become very important for the economy of Chile. In 2008, the total export value of cut flowers

Table 1. Chromosomes measurements of *Alstroemeria diluta* subsp. *chrysantha*. Average length of chromosomes calculated in percent of the mean diploid genome length.

Chromosome pair	Arm length	Short arm length	Relative total length	Absolute total length	Products	Chromosome type
1	6.92 \pm 0.10	6.49 \pm 0.16	13.41	16.00	1.07	m
2	5.86 \pm 0.16	0.58 \pm 0.18	6.44	7.68	10.10	t
3	5.60 \pm 0.20	0.80 \pm 0.12	6.40	7.64	7.00	t-sat
4	5.72 \pm 0.15	0.43 \pm 0.10	6.15	7.34	13.30	t
5	4.63 \pm 0.10	1.06 \pm 0.12	5.69	6.79	4.37	st-sat
6	3.10 \pm 0.12	1.58 \pm 0.14	4.68	5.58	1.96	sm
7	2.07 \pm 0.14	1.75 \pm 0.18	3.82	4.56	1.18	m
8	2.22 \pm 0.20	1.30 \pm 0.16	3.52	4.20	1.71	sm

SD: standard deviation; R: brachial index; m: metacentric; sm: submetacentric; st: subtelocentric; st-sat: subtelocentric with satellite; t: telocentric; t-sat: telocentric with satellite.

surpassed US\$3.3 million (FOB), with The Netherlands and the United States being the principal international markets (Reyes and Barrera, 2009).

Cytological characterization of a plant species with ornamental potential constitutes a valuable contribution toward protecting this biological resource, especially considering ongoing intensive searches for new genotypes of ornamental importance. Many European countries utilize Chilean species in programs for genetic improvement, but if the basic cytological information is not available, further development can be hindered. From a more national perspective, lack of biological information may lead to a neglect of this species as a valuable part of Chile's natural heritage, perhaps resulting in missed opportunities for successful revenue-sharing.

CONCLUSIONS

Alstroemeria diluta subsp. *chrysantha* is a perennial species of the genus that shows the most asymmetrical karyotype so far investigated. It is similar, however, to that of *Alstroemeria graminea*, the only annual species of the genus.

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RESUMEN

Karyotype of *Alstroemeria diluta* Ehr. Bayer subsp. *chrysantha* (Alstroemeriaceae). *Alstroemeria diluta* subsp. *chrysantha* Ehr. Bayer (Alstroemeriaceae) fue examinada citológicamente. Esta especie presenta un número cromosómico somático de $2n = 2x = 16$ cromosomas, con una fórmula haploide constituida por $4m + 4sm + 2st-sat + 4t + 2t-sat$ cromosomas. El cariotipo es muy asimétrico, con valores de $AsK \% = 71,4$ y $Sy_i = 40,0\%$. Estos resultados se compararon con los de *Alstroemeria graminea* Phil., especie que presenta un cariotipo muy similar.

Palabras clave: *Alstroemeria*, cariotipo, planta ornamental, Chile.

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