



CHILEAN PLANTS CYTOGENETIC DATABASE: COVERAGE, FEATURES AND USAGES

BASE DE DATOS CITOGÉNÉTICOS DE PLANTAS CHILENAS: COBERTURA, CARACTERÍSTICAS Y USOS

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ABSTRACT

Chilean Plants Cytogenetic Database (CPCD) is a resource available on line in electronic format, which provides a cytogenetics catalogue for continental and insular Chilean vascular plants. In this report, we made reference to the CPCD, discussing aspects on its coverage, features and usages. Currently, the database stores cytogenetic information for 247 species, 107 genera, and 55 families belonging to Pteridophyta, Pinophyta, and Magnoliophyta.

Key words: chromosome number, karyotype, Chilean Plants

RESUMEN

La Base de Datos Citogenéticos de Plantas Chilenas (CPCD) es un recurso disponible en formato electrónico en línea, que provee de un catálogo citogenético para plantas vasculares de Chile continental e insular. En esta comunicación hacemos referencia a la CPCD, discutiendo aspectos sobre su cobertura, rasgos y usos. Actualmente, la base de datos contiene información citogenética para 247 especies, 107 géneros y 55 familias pertenecientes a Pteridophyta, Pinophyta y Magnoliophyta.

Palabras clave: número cromosómico, cariotipo, plantas chilenas

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INTRODUCTION

The electronic databases have taken relevance in biological investigation from the beginning of the genomic revolution. The most used databases –the so-called GenBank– are a tool related to the molecular biology but with multiple applications in different fields of the biological sciences. These databases contain public available nucleotide sequences and protein translation for more than 260,000 species (Benson *et al.*, 2013). Other available databases most related to cytology store information on genome size (or DNA C-values) for a high number of Eukaryote species including plants, animals, fungi, and algae (more than 10,000 species according to Gregory *et al.*, 2006). In the specific case of plants, current reports estimate that the only existing electronic catalogue on genome sizes comprises data for more than 8,000 species of around the world (Bennett and Leitch, 2016). Thus, this database provides a truly comprehensive catalogue on plant genome size, and represents a much-needed resource for cytogeneticists, with innumerable applications that have been broadly discussed in the literature (Bennett and Leitch, 2005; Leitch *et al.*, 2005; Peruzzi *et al.*, 2009; Roa and Pires de Campos Telles, 2017).

Regarding on line resources for plant chromosomes, fourteen cytogenetic databases in electronic format are available around the world (Peruzzi and Bedini, 2014). For all of them, data have been obtained from different bibliographic sources, being chromosome number ($2n$, n) the main presented character. Chilean plants have a scarce representation in most databases, even though many species have been included during the last decades in the Index to Plant Chromosome Number (IPCN, Goldblatt and Johnson, 2006), together with species from other latitudes. This low representation of Chilean plants in databases makes it difficult to conduct literature reviews aimed to explain tendencies on chromosome evolution in a wide geographic scale, including species from continental and insular Chile. It is important to remark that continental Chile is a mosaic of environments along its latitudinal configuration, having more than 4,000 km in length from 18° S to 56° S, with marked climatic North to South gradients. In addition, the longitudinal gradient of Chile is marked by differences in altitudes (up to 6,000 m.a.s.l.) which originate a variation of microclimates and, thus, of environments, many of which are favorable for plant growth. Of this territory, 55% is covered by vegetation

with 45% of floristic endemism. In addition, insular Chile is also an interesting mosaic with 320 km² in surface, and an endemism that varies between 64% and 87% (Villagrán and Hinojosa, 2005; CONAF, 2013; Urbina-Casanova *et al.*, 2015). Therefore, cytogenetic studies on spatial scale on the Chilean flora are of relevance to analyze tendencies on genome variation along geographic gradients. The first review reporting the state of the art on cytogenetic of Chilean angiosperms emphasized on these matters as well as on the difficulties encountered to compile the information, specifically for data documented in the oldest literature (Jara-Seguel and Urrutia, 2012). At present, theoretical and/or empirical investigations on different fields of biology (*i.e.*, cytogeography, genomics, taxonomy, evolution, and/or palaeobotany) require the data to be readily available and compiled from diverse sources. Thus, at present, databases constitute a valuable resource in which the information can be easily accessible to the scientific community (Gregory *et al.*, 2006; Jara-Seguel and Urrutia, 2012; Roa and Pires de Campos Telles, 2017).

In this communication we make reference to the Chilean Plants Cytogenetic Database (CPCD, Jara-Seguel and Urrutia, 2016), and discuss aspects on its coverage, features and uses.

COVERAGE, FEATURES AND USAGES

The CPCD provides the first electronic catalogue exclusive for the Chilean flora, and was launched for the first time in September 2010, with 101 recorded species. Since then, two updates were made, the first in March 2011, which increased the number of species to 163 (release 2.0), and the second in June 2016, in which this number was increased to 247 (release 3.0). The latter number of species represents almost 4.8% of the Chilean Vascular Plants. The adscription of the species to families and/or genera was based on the classification given in the original source cited in the references. The CPCD assembles information obtained from 88 bibliographic sources covering 55 years of investigation on the topic. In total, CPCD contains information for 247 species representing 107 genera and 55 families belonging to Pteridophyta, Pinophyta, and Magnoliophyta. As remarkable contribution, the database includes a wide gamma of cytogenetic characters [chromosome number, karyotype morphology, banding patterns (C, Ag-NOR, CMA3 and DAPI), nuclear DNA

Table 1. Cytogenetic data for each plant division recorded in the Chilean Plants Cytogenetic Database (CPCD) and the current percentage of species representation in the database regarding to the total Chilean vascular flora.

Division	Chromosome number (2n)		Ploidy level	DNA C-values (pg)	Number of families in CPCD	Number of species in CPCD	Number of species in Chile	Representation of species in CPCD (%)
	Min	Max						
Pteridophyta	44	328	2, 3, 4, 8	-	5	24	167 ⁽¹⁾	14.3
Pinophyta	22	44	2, 4	10.2 - 25.8	2	3	16 ⁽²⁾	18.7
Magnoliophyta	8	94	2, 4	1.46 – 39.4	48	220	4.946 ⁽²⁾	4.4

(1)Based in Rodríguez (1995).

(2)Based in Marticorena (1990).

content (C-value) and/or fluorescent *in situ* hybridization (rDNA 5S, 18S, 28S)], which is advantageous regarding other databases focused only on chromosome numbers or rDNA chromosome location. Moreover, all bibliographic references are appended to the cytogenetic data of each species. Several statistical details on the database coverage are summarized in Table 1.

The cytogenetic data comprised in the CPCD increases the potential applications of the accumulated knowledge on genome structure and diversity of Chilean native plants, focused on relevant cytogenetic characters. In general, it is remarkable that the higher number of species included in the database (196 continental species) are representative of discontinuous latitudinal strips localized between 18° S and 53° S, and most of them (192 species) are found within the Chilean Hotspots (Myers *et al.*, 2000). Nevertheless, cytogenetic data of species that inhabit in the Juan Fernández Archipelago and Isla de Pascua are also included (51 insular species).

The database is a comprehensive, ordered, easily accessible and useful catalogue for experimented and incipient cytogeneticist interested in cytogenetic aspects of Chilean plants or for comparative investigations with co-familial members that inhabit other geographic regions. The database is of free access, and the traffic has increased steadily since its launching in September 2010, with more than 7,400 visitors belonging to 46 countries of around the world. From the time of launching and on, the database has been cited in seven publications, some of them analyzing

tendencies on chromosome number variation of global or local floras (Jara-Seguel and Urrutia, 2012; Peruzzi *et al.*, 2012; Rice *et al.*, 2015), and others discussing the usefulness of databases assembling data on plant rDNA chromosome localization or genome size (García *et al.*, 2012; Dagher-Kharrat *et al.*, 2013). Recently, CPCD has been included in the largest community resource of plants chromosome numbers at the worldwide level (see CCDB, Rice *et al.*, 2015), which may increase its visibility and use. It is also listed as an on line resource for chromosome numbers among other 17 databases available around the world (Peruzzi and Bedini, 2014). In fact, the data on Chilean plants pooled in the CPCD not only have been used to analyze tendencies, but have also served as substrate to propose new quantitative methods to analyze large data sets of chromosome numbers of animals and plants (see Peruzzi *et al.*, 2014). Thus, the CPCD is a valuable tool for generating knowledge in different cytogenetic fields.

FUTURE PROSPECTS

The CPCD could be annually or biannually updated, as new cytogenetic information may published or obtained from old sources. However, for continuously being an important source of information for cytogeneticists and/or taxonomists, it is necessary to increase the number of cytogenetic studies in all taxonomic divisions that represent the Chilean plant biodiversity.

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