Plant species in recreational spaces of Initial Education Establishments of Bahía Blanca District (Buenos Aires, Argentina): Analysis of its diversity and educational role

Especies vegetales en espacios recreativos de Establecimientos de Educación Inicial del Partido de Bahía Blanca (Buenos Aires, Argentina): análisis de su diversidad y rol educativo

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Resumen

Introducción y objetivos: Las especies vegetales cultivadas en Establecimientos Educativos son diversas reflejando el costumbrismo de la población local. Su presencia podría contribuir a la revalorización de la flora local, actuando como disparadores pedagógicos y, a la vez, cumplir una función ornamental. Los objetivos de este estudio son inventariar las especies vegetales en espacios recreativos de los jardines de infantes del Partido de Bahía Blanca y relevar información relacionada con la presencia de dichas especies, así como el conocimiento general que tienen los directivos/docentes sobre las mismas.

M&M: Se realizó un censo florístico en 85 establecimientos públicos y privados y se encuestó/entrevistó a la persona responsable a fin de registrar información complementaria en relación a las especies y el rol que cumplen en la institución.

Resultados: Se identificaron 272 especies pertenecientes a 86 familias botánicas. Se encontró un 88% de exóticas y 12% de nativas, siendo el 1,45% endémicas de Argentina. El 100% de los jardines de infantes con plantas tienen especies exóticas, el 43% especies nativas y el 10% endémicas. Los docentes reconocen falta de conocimiento del entorno botánico, mencionan interés en capacitarse en el tema.

Conclusiones: La diversidad de especies de plantas en los espacios recreativos de los jardines de infantes es alta, siendo en su mayoría exóticas. Es importante una planificación de las especies de plantas en estas instituciones para que puedan ser utilizadas como recursos didácticos.

Palabras clave

Argentina, espacio verde urbano, especies vegetales, diversidad de plantas, jardines de infantes, planta ornamental, recurso didáctico.

Summary

Introduction and aims: The plant species grown in Educational Establishments are diverse, reflecting the customs of the local population. Their presence could contribute to the revaluation of local flora, acting as pedagogical triggers and fulfilling an ornamental function simultaneously. The objectives of this study are to inventory the plant species in recreational spaces of the kindergartens of the Bahía Blanca District and to collect information related to the presence of these species, as well as the general knowledge that managers/teachers have about them.

M&M: A floristic census was carried out in recreational spaces of 85 public and private kindergartens. Directors/teachers were surveyed/interviewed to record complementary information about the species and their role in the institution.

Results: Two hundred seventy-two species belonging to 86 botanical families were identified. 88% were found to be exotic, and 12% were native, with 1.45% being endemic to Argentina. 100% of all kindergartens that present plants have exotic species, 43% 43% native species and 10% endemic species. The teachers recognize a need for knowledge of the botanical environment and mention an interest in training on the subject.

Conclusions: The diversity of plant species in the recreational spaces of kindergartens is high, most of them being exotic. It is important to plan plant species in these institutions so that they can be used as teaching resources.

Key words

Argentina, didactic resource, kindergarten, ornamental plant, plant species, plant diversity, urban green space.

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Introduction

Since the beginning, humans had a close relationship with plants. In a broad sense, their life had always depended primarily on them. The use of vegetables as a resource base has not deprived human beings of noticing the beauty of their shapes, colours, movements, and smells; for this reason, plants have also had ornamental importance from the same moment humans noticed their presence. Throughout history, aesthetic valorization and the necessity to keep specific memories of homelands vivid have caused many plant species to be moved to places far away from their natural habitats. In this way, many plant species have once moved to new regions, colonized new environments and caused ecological impacts on the invaded ecosystems (Richardson *et al.*, 2000; Gil Otaiza *et al.*, 2006).

This accidental or forced colonization, coupled with the reduction of natural spaces due to the advance of urbanization, are indisputable factors promoting biological invasion processes, the second most important cause of loss of biodiversity nowadays (Vitousek *et al.*, 1997). Some countries, such as Australia, where cities have specialized government commissions in urban tree planning, have achieved the incorporation of native plants into the ornamentation of public spaces (Kendal *et al.*, 2012; Shaw *et al*., 2017). In others, groups of specialists from research centres, conservationist groups, or landscape architects try to spread the importance of eradicating invasive species, giving priority to the cultivation of native ones (Mack *et al.*, 2000; Kumschick *et al.*, 2015; Brzuszek *et al*., 2017; Bünzli, 2017).

Green spaces and other areas assigned for public recreation in cities are now considered well-designed and preserved resources that collaborate extensively with improving life quality (Dearborn & Kark, 2010). This aspect is increasing value, considering the world population increment, which generates a significant change in the urban structure, making green spaces progressively smaller due to the need to use the land for housing (Acar *et al.*, 2007; Kendal *et al.*, 2012).

Ornamental plants in squares, public spaces, streets, and gardens, among others, provide aesthetic value, shade, protection, aromatization, etc. Generally, the choice of an ornamental plant is based on trendy species that usually are not native to that place (Acar *et al.*, 2007). Ornamental plants non-native to a specific place do not probably adapt well to their new environments, generating displeasure in addition to a useless economic expense, or they can adapt so and spread to such an extent that they become invasive (Vitousek *et al.*, 1997; Mack *et al.*, 2000; Brooks *et al.*, 2004). Usually, the plants chosen to cultivate in public spaces require little care, survive inclement weather, are often non-native to that habitat, and are selected by their aesthetic characteristics. Despite this, in recent years, the production and commercialization of endemic and native plants for gardening has increased in different countries, like Brazil, China and EEUU (Liu *et al.*, 2003; Heiden *et al.*, 2006; Tangren *et al*., 2022).

In Argentina, towards the end of the ‘90s, the use of native plants as ornamentals was not widely exploited; only a few species were commercialized and cultivated (Mascó *et al.*, 1998). However, in recent years, there has been an increase in the establishment of native plant nurseries and the commercialization of this type of species in traditional stores. In some Argentinean cities, initiatives to use native species in the ornamentation of green spaces are being registered (Rovere, 2022). Most cultivated species are exotic, particularly in Bahía Blanca city (Buenos Aires, Argentina). It is a city with a visually “unattractive” native vegetation (grass steppe, xerophilous, psammophilous or halophilous shrub) (Arana *et al.*, 2021) and with a strong influence of European colonizers who brought their customs and beliefs contributing to the introduction, rooting and cultivation of foreign plant species for ornamental purposes (Negrin & Zalba, 2008).

Cultivating species native to each region as ornamental can improve the role of ornamental plants in biodiversity and attract local wildlife (insects, butterflies, birds, etc.) by providing them with shelter and food (Smith *et al.*, 2006). That is why, within the current framework of the planet’s valorization, the cultivation of native plants (in each region) is a powerful tool to promote the conservation of biodiversity (Mack *et al.*, 2000; Negrin & Zalba, 2008). Encouraging the use of native plant species in recreational spaces of educational institutions is a fundamental point for the knowledge of native species and the revaluation of the country’s vegetation (Biondi

et al., 2008; Heiland, 2021). In Brazil, besides being typical of the place, the species used to landscape the schoolyards must meet certain conditions of aptitude to cohabit with the students and the geographic environment (Biondi *et al.*, 2008). The landscaping of educational institutions with appropriate designs improves the visual and environmental quality (Cadorin *et al.*, 2011), aspects that maximize educational and recreational activities generating a motivating force for learning (Biondi *et al.*, 2008).

This work aimed to inventory the diversity of species in outdoor and indoor spaces of kindergartens in Bahía Blanca District to relate to the selection criteria of the plant species and the general knowledge that directors/teachers have about the plants at the education institution.

Materials and Methods

General characteristics of the Bahía Blanca district

Bahía Blanca District is located in the southwest of Buenos Aires Province, 700 km south of Buenos Aires City, the capital of Argentina. Its urban centres include the capital city of Bahía Blanca (38°43´2´´S and 62°15´54´´W) and the localities Cabildo, General Daniel Cerri, Grünbein and Ingeniero White. Among the urban localities, there are rural areas and four protected areas: the Municipal Coastal Reserve, the Gaviota Cangrejera and the Bahía Blanca, Falsa and Verde Provincial Nature Reserves and the Cueva de Los Leones Private Reserve. There are 335.190 inhabitants in the whole district, with 90% in urban settlements and the remaining 10% in rural areas (INDEC, 2023). The climate is temperate and is characterized by an average annual temperature of 15°C with well-marked thermal stations and extreme temperatures between -5°C and 39°C; the rains reach 600 to 700 mm annually, and the prevailing winds are of the north and northwest quadrant with average speeds of 24 km/h (Capelli de Steffens *et al.*, 2006).

Bahía Blanca District, in terms of biogeographic regions, extends in the transition between the Pampeano Austral and Espinal regions. The predominant vegetation is the grass steppe alternating with some areas in which xerophytic species, such as *Colletia paradoxa* (Spreng.) Escal., *Discaria americana* Gillies & Hook., among others, predominate. There are also some bush remains made up of xerophytic trees or shrubbery. In the coastal areas, there are plains and marshes with crab beds where characteristic halophilic vegetation is found (*Allenrolfea patagonica* (Moq.) Kuntze, *Cyclolepis genistoides* Gillies ex D. Don, *Sarcocornia perennis* (Mill.) A.J. Scott, *Sporobolus* R.Br. spp., etc.) (Arana *et al.*, 2021).

Census of plant species in Initial Education Institutions

We performed a census of all plant species in 85 public and private kindergartens and childcare centres recognized by the administration in charge, called "Dirección General de Cultura y Educación" (i.e. General Directorate of Culture and Education) of Buenos Aires Province. The surveys were carried out between 2010 and 2012, generating periodic updates every three years, the last being in 2022. In addition to identifying the species, the mode of cultivation (inside or outside built structures, on the ground or in flowerpots) was recorded for each and the specific area where they are located.

To identify the plant species cultivated in the kindergartens, we used a bibliography focused on cultivated ornamental plants and specific for Argentina (Dimitri, 1988; Innes & Glass, 1997; Sajeva & Constanzo, 2001; Bryan, 2002; Dirr, 2002; Schmid, 2002; Llamas, 2003; Armitage, 2004, 2011; Austin, 2005; Hurrell *et al*., 2006, 2007). Those specimens whose taxonomic identification was doubtful and required consultation with experts or determination with taxonomic keys were preserved and deposited in the Herbarium of the INBIOSUR CONICET-UNS (BBB) (Table 1). The scientific names and their taxonomic position were updated following the international WFO (2023), IPNI (2023) and TROPICOS (2023) database. To determine the status (exotic, native or endemic, Argentina), a specialized bibliography was used (Cabrera & Zardini, 1993; Antón & Zuloaga, 2023).

Surveys and interviews to directors/teachers in charge of Initial Educational Institutions

In the case of the surveys, the person in charge of each educational establishment was asked about their consent to respond, assuming the confidentiality of the information provided. It is essential to clarify that the people in charge of the educational institution at the time of the visits were not always the directors; in some cases,

they were teachers; this is why we will refer to directors or teachers. Although it was thought about conducting surveys in some establishments, the survey became a semi-structured interview due to the predisposition of the person surveyed and the conversation that took place.

For the interviews and surveys, prior informed consent was requested from each kindergarten director/teacher. It was investigated to register information about whether the building was built especially for a kindergarten, if the plants had been there since its inauguration if there had been any planned landscaping of the site, if they know plants in general, if they know (even by name) any of the plants in the establishment and if they use plants as teaching resources (native/exotic concepts, environmental conservation, etc.). Any other information that the person interviewed highlighted as necessary was also registered.

To perform this work, authorizations were processed at the Jefatura Distrital de Educación of Bahía Blanca City, which endorsed the study and allowed the necessary data to be obtained.

Results

Census of plant species in Initial Education Institutions

The overall number of plants per kindergarten varies greatly from two institutions with no plants, some with two or three species, to others with a more significant number of species. The vast majority (71 kindergartens) have between five to twenty different species; twelve kindergartens presented more than 30 species (one about 48 different ones).

Two hundred seventy-two ornamental species belonging to 86 botanical families were identified (Table 1). The species of the *Rosa* genus could not be determined (Table 1). The families with the most significant species were Asteraceae and Fabaceae, with 19, and Crassulaceae and Rosaceae, with 17 species (Table 1).

The most frequent species in the kindergartens were: *Chlorophytum comosum* (Thunb.) Jacques (83%), *Epipremnum aureum* (Linden ex André) G.S. Bunting (51%), *Pelargonium hortorum* L.H. Bailey (43%), *Fraxinus pennsylvanica* Marshall (36%), *Hedera helix* L. (31%), *Syngonium podophyllum* Schott (29%), *Asparagus setaceus* (Kunth) Jessop and *Cupressus sempervirens* L. (26%), *Iris* x *germanica* L. (25%), *Rosa* L. sp. (23%), *Schefflera digitata* J.R. Forst. & G. Forst. (23%), *Lampranthus spectabilis* (Haw.) N.E. Br. (21%), *Nephrolepis cordifolia* (L.) C. Presl (21%), *Nerium oleander* L. (22%) and *Aspidistra elatior* Blume (19%) (Table 1).

From the total number of surveyed species, 240 (88%) were exotic, and 32 (12%) were natives of Argentina, of which only four were endemic to our country (Table 1). In all kindergartens with plants, exotic species were registered, native ones were registered in 43% of the educational institutions, and endemic species were registered in only 10%.

Native species to Argentina presented a maximum of two species per kindergarten, while the endemic species were found in different establishments. Native species corresponded to the families Amaryllidaceae, Anacardiaceae, Apocynaceae, Asteraceae, Bignoniaceae, Bromeliaceae, Cactaceae, Cannaceae, Commelinaceae, Convolvulaceae, Fabaceae, Malvaceae, Nephrolepidaceae, Oxalidaceae, Passifloraceae, Phytolaccaceae, Portulacaceae, Solanaceae and Verbenaceae (Table 1). The most frequently native species found were: *Nephrolepis cordifolia* (observed in 21% of the kindergartens), *Canna indica* L. (in 15% of them), *Erythrina crista-galli* L., *Jacaranda mimosifolia* D. Don and *Schinus molle* L. (in 13%), *Lantana camara* L., *Oxalis articulata* Savigny, *Parasenegalia visco* (Lorentz ex Griseb.) Seigler & Ebinger (in 7%) and *Portulaca grandiflora* Hook. (in 6%).

From the 28 native species to Argentina, 12 species were native to the Bahía Blanca region (43%): *Araujia sericifera* Brot., *Commelina erecta* L., *Dichondra microcalyx* (Hallier f.) Fabris, *Erythrostemon gilliesii* (Hook.) Klotzsch, *Neltuma alba* (Griseb) C.E. Hughes & G.P. Lewis, *Nicotiana glauca* Graham, *Nothoscordum gracile* (Aiton) Steran, *Oxalis articulata*, *Wedelia glauca* (Ortega) Hoffm., *Passiflora caerulea* L., *Schinus molle* and *Tillandsia aeranthos* (Loisel.) L.B. Sm. (Table 1). Of the four endemic species to Argentina, only two were naturally distributed in to the Bahía Blanca region: *Ipheion uniflorum* (Graham.) Raf. and *Soehrencia candicans* (Gillies ex Salm-Dyck) Schlumpb. (Table 1).

Table 1. Ornamental species found in the kindergartens of Bahía Blanca District (Buenos Aires, Argentina). Abbreviation: Exo.: exotic; Nat.: native; End.: endemic. (*) indicates the species of which a herbarium specimen was made. Abbreviations= SA: Status for Argentina, SBB: Status for Bahía Blanca region, NEP: Number of establishments that present it.

Family	Species	SA	SBB	NEP
Acanthaceae	*Acanthus mollis* L.	Exo.	Exo.	3
Acanthaceae	*Justicia brandegeeana* Wassh. & L.B.Sm.	Exo.	Exo.	1
Aizoaceae	*Drosanthemum floribundum* (Haw.) Schwantes	Exo.	Exo.	1
Aizoaceae	*Glottiphyllum oligocarpum* L. Bolus	Exo.	Exo.	1
Aizoaceae	*Lampranthus spectabilis* (Haw.) N.E. Br.	Exo.	Exo.	17
Aizoaceae	*Mesembryanthemum cordifolium* L.f.	Exo.	Exo.	5
Altingiaceae	*Liquidambar styraciflua* L.	Exo.	Exo.	1
Amaranthaceae	*Beta vulgaris* L.	Exo.	Exo.	4
Amaranthaceae	*Spinacia oleracea* L.	Exo.	Exo.	1
Amaryllidaceae	*Agapanthus africanus* (L.) Hoffmanns.	Exo.	Exo.	10
Amaryllidaceae	*Allium cepa* L.	Exo.	Exo.	2
Amaryllidaceae	*Allium triquetrum* L.	Exo.	Exo.	2
Amaryllidaceae	*Clivia miniata* (Lindl.) Bosse	Exo.	Exo.	9
Amaryllidaceae	*Crinum* x *powellii* Hort. ex Baker *	Exo.	Exo.	1
Amaryllidaceae	*Ipheion uniflorum* (Graham.) Raf.	End.	Nat.	2
Amaryllidaceae	*Narcissus pseudonarcissus* L.	Exo.	Exo.	2
Amaryllidaceae	*Nothoscordum gracile* (Aiton) Steran*	Nat.	Nat.	1
Anacardiaceae	*Schinus molle* L.	Nat.	Nat.	11
Apiaceae	*Apium graveolens* L.	Exo.	Exo.	1
Apiaceae	*Daucus carota* L.	Exo.	Exo.	1
Apiaceae	*Petroselinum crispum* (Mill.) Fuss	Exo.	Exo.	3
Apocynaceae	*Araujia sericifera* Brot. *	Nat.	Nat.	2
Apocynaceae	*Catharanthus roseus* (L.) G. Don	Exo.	Exo.	1
Apocynaceae	*Nerium oleander* L.	Exo.	Exo.	18
Apocynaceae	*Orbea variegata* (L.) Haw.	Exo.	Exo.	1
Apocynaceae	*Trachelospermum jasminoides* (Lindl.) Lem.	Exo.	Exo.	14
Apocynaceae	*Vinca major* L.	Exo.	Exo.	8
Araceae	*Aglaonema commutatum* Schott	Exo.	Exo.	1
Araceae	*Arum italicum* Mill.	Exo.	Exo.	5
Araceae	*Caladium bicolor* (Aiton) Vent.	Exo.	Exo.	2
Araceae	*Dieffenbachia seguine* (Jacq.) Schott	Exo.	Exo.	4
Araceae	*Epipremnum aureum* (Linden ex André) G.S. Bunting	Exo.	Exo.	42
Araceae	*Monstera deliciosa* Liebm.	Exo.	Exo.	1
Araceae	*Spathiphyllum wallisii* Regel	Exo.	Exo.	5
Araceae	*Syngonium podophyllum* Schott	Exo.	Exo.	24
Araceae	*Zantedeschia aethiopica* (L.) Spreng.	Exo.	Exo.	5

Family	Species	SA	SBB	NEP
Araliaceae	*Hedera helix* L.	Exo.	Exo.	26
Araliaceae	*Schefflera digitata* J.R. Forst. & G. Forst.	Exo.	Exo.	19
Arecaceae	*Chamaerops humilis* L.	Exo.	Exo.	2
Arecaceae	*Rhapis excelsa* (Thunb.) A. Henry	Exo.	Exo.	2
Arecaceae	*Washingtonia filifera* (Gloner ex Kerch., Burv., Pynaert, Rodigas & Hull) de Bary	Exo.	Exo.	1
Asparagaceae	*Agave americana* L.	Exo.	Exo.	3
Asparagaceae	*Albuca bracteata* (Thunb.) J.C. Manning & Goldblatt	Exo.	Exo.	1
Asparagaceae	*Asparagus asparagoides* (L.) Druce	Exo.	Exo.	2
Asparagaceae	*Asparagus densiflorus* (Kunth) Jessop	Exo.	Exo.	12
Asparagaceae	*Asparagus setaceus* (Kunth) Jessop	Exo.	Exo.	22
Asparagaceae	*Aspidistra elatior* Blume	Exo.	Exo.	16
Asparagaceae	*Chlorophytum comosum* (Thunb.) Jacques	Exo.	Exo.	69
Asparagaceae	*Cordyline australis* (G.Forst.) Endl.	Exo.	Exo.	3
Asparagaceae	*Dracaena fragans* (L.) Ker. Gawl.	Exo.	Exo.	8
Asparagaceae	*Dracaena reflexa* var. *angustifolia* Baker	Exo.	Exo.	2
Asparagaceae	*Dracaena trifasciata* (Prain) Mabb.	Exo.	Exo.	3
Asparagaceae	*Drimiopsis maculata* Lindl. & Paxton	Exo.	Exo.	1
Asparagaceae	*Ruscus aculeatus* L.	Exo.	Exo.	8
Asparagaceae	*Yucca filamentosa* L.	Exo.	Exo.	2
Asphodelaceae	*Aloe arborescens* Mill.	Exo.	Exo.	4
Asphodelaceae	*Aloe maculata* All.	Exo.	Exo.	12
Asphodelaceae	*Aristaloe aristata* (Haw.) Boatwr. & J.C. Manning *	Exo.	Exo.	2
Asphodelaceae	*Haworthiopsis fasciata* (Willd.) G.D.Rowley *	Exo.	Exo.	2
Asphodelaceae	*Phormium tenax* J.R. Forst. & G. Forst.	Exo.	Exo.	3
Aspleniaceae	*Asplenium nidus* L.	Exo.	Exo.	1
Asteraceae	*Argyranthemum frutescens* (L.) Sch. Bip. *	Exo.	Exo.	1
Asteraceae	*Bellis perennis* L.	Exo.	Exo.	5
Asteraceae	*Calendula officinalis* L.	Exo.	Exo.	8
Asteraceae	*Cichorium intybus* L.	Exo.	Exo.	3
Asteraceae	*Delairea odorata* Lem. *	Exo.	Exo.	1
Asteraceae	*Dimorphotheca fruticosa* (L.) Less.	Exo.	Exo.	8
Asteraceae	*Euryops pectinatus* Cass.	Exo.	Exo.	4
Asteraceae	*Farfugium japonicum* (L.) Kitam.	Exo.	Exo.	9
Asteraceae	*Felicia amelloides* (L.) Voss	Exo.	Exo.	1
Asteraceae	*Gazania rigens* (L.) Gaertn.	Exo.	Exo.	10
Asteraceae	*Gerbera jamesonii* Bolus ex Hook. f.	Exo.	Exo.	1
Asteraceae	*Helianthus tuberosus* L.	Exo.	Exo.	2
Asteraceae	*Jacobaea maritima* (L.) Pelser & Meijden	Exo.	Exo.	2
Asteraceae	*Leucanthemum vulgare* Lam.	Exo.	Exo.	2
Asteraceae	*Senecio angulatus* L. f. *	Exo.	Exo.	1
Asteraceae	*Senecio madagascariensis* Poir. *	Exo.	Exo.	1

Family	Species	SA	SBB	NEP
Asteraceae	*Tagetes erecta* L.	Exo.	Exo.	8
Asteraceae	*Taraxacum officinale* F.H. Wigg.	Exo.	Exo.	2
Asteraceae	*Wedelia glauca* (Ortega) Hoffm.	Nat.	Nat.	1
Balsaminaceae	*Impatiens balsamina* L.	Exo.	Exo.	8
Begoniaceae	*Begonia aconitifolia* A.DC.	Exo.	Exo.	1
Begoniaceae	*Begonia cucullata* Willd.	Exo.	Exo.	12
Begoniaceae	*Begonia rex* Putz.	Exo.	Exo.	1
Berberidaceae	*Nandina domestica* Thunb.	Exo.	Exo.	3
Bignoniaceae	*Campsis radicans* (L.) Seem.	Exo.	Exo.	3
Bignoniaceae	*Catalpa bignonioides* Walter	Exo.	Exo.	5
Bignoniaceae	*Handroanthus impetiginosus* (Mart. ex DC.) Mattos *	Nat.	Exo.	2
Bignoniaceae	*Jacaranda mimosifolia* D.Don	Nat.	Exo.	11
Bignoniaceae	*Podranea jasminoides* (Lindl.) K.Schum.	Exo.	Exo.	3
Bignoniaceae	*Podranea ricasoliana* (Tanfani) Sprague	Exo.	Exo.	6
Brassicaceae	*Lobularia maritima* (L.) Desv.	Exo.	Exo.	3
Brassicaceae	*Matthiola incana* (L.) W.T.Aiton	Exo.	Exo.	1
Brassicaceae	*Raphanus raphanistrum* subsp. *sativus* (L.) Domin	Exo.	Exo.	2
Bromeliaceae	*Aechmea fasciata* (Lindl.) Baker	Exo.	Exo.	1
Bromeliaceae	*Tillandsia aeranthos* (Loisel.) L.B.Sm.	Nat.	Nat.	2
Buxaceae	*Buxus sempervirens* L.	Exo.	Exo.	11
Cactaceae	*Opuntia sulphurea* Gillies ex Salm-Dyck	Nat.	Exo.	3
Cactaceae	*Schlumbergera russelliana* (Hook.) Britton & Rose	Exo.	Exo.	2
Cactaceae	*Schlumbergera truncata* (Haw.) Moran	Exo.	Exo.	1
Cactaceae	*Soehrencia candicans* (Gillies ex Salm-Dyck) Schlumpb.	End.	Nat.	1
Campanulaceae	*Lobelia erinus* L.	Exo.	Exo.	4
Cannaceae	*Canna indica* L.	Nat.	Exo.	13
Caprifoliaceae	*Abelia* x *grandiflora* (Rovelli ex André) Rehder	Exo.	Exo.	10
Caprifoliaceae	*Lonicera japonica* Thunb.	Exo.	Exo.	4
Casuarinaceae	*Casuarina cunninghamiana* Miq.	Exo.	Exo.	3
Caryophyllaceae	*Dianthus plumarius* L.	Exo.	Exo.	7
Celastraceae	*Euonymus japonicus* Thunb.	Exo.	Exo.	11
Comelinaceae	*Commelina erecta* L.	Nat.	Nat.	7
Comelinaceae	*Tradescantia fluminensis* Vell.	Nat.	Exo.	4
Comelinaceae	*Tradescantia pallida* (Rose) D. R. Hunt	Nat.	Exo.	10
Convolvulaceae	*Convolvulus arvensis* L.	Exo.	Exo.	1
Convolvulaceae	*Dichondra microcalyx* (Hallier f.) Fabris	Nat.	Nat.	6
Convolvulaceae	*Ipomoea batatas* (L.) Lam.	Exo.	Exo.	1
Crassulaceae	*Aeonium arboreum* Webb & Berthel.	Exo.	Exo.	1
Crassulaceae	*Aeonium gomerense* (Praeger) Praeger	Exo.	Exo.	1
Crassulaceae	*Crassula arborescens* Willd.	Exo.	Exo.	1

Family	Species	SA	SBB	NEP
Crassulaceae	*Crassula brevifolia* Harv.	Exo.	Exo.	2
Crassulaceae	*Crassula subacaulis* subsp. *erosula* (N.E.Br.) Toelken	Exo.	Exo.	3
Crassulaceae	*Crassula multicava* Lem.	Exo.	Exo.	15
Crassulaceae	*Crassula ovata* Druce	Exo.	Exo.	4
Crassulaceae	*Kalanchoe blossfeldiana* Poelln.	Exo.	Exo.	6
Crassulaceae	*Kalanchoe daigremontiana* Raym.-Hamet & H.Perrier	Exo.	Exo.	6
Crassulaceae	*Kalanchoe fedtschenkoi* Raym.-Hamet & H.Perrier	Exo.	Exo.	3
Crassulaceae	*Hylotelephium telephium* (L.) H. Ohba	Exo.	Exo.	4
Crassulaceae	*Sedum clavatum* R.T. Clausen	Exo.	Exo.	1
Crassulaceae	*Sedum dendroideum* Moc. & Sessé ex DC.	Exo.	Exo.	3
Crassulaceae	*Sedum lucidum* R.T. Clausen	Exo.	Exo.	1
Crassulaceae	*Sedum pachyphyllum* Rose	Exo.	Exo.	2
Crassulaceae	*Sedum palmeri* S. Watson	Exo.	Exo.	1
Crassulaceae	*Sedum annuum* L.	Exo.	Exo.	2
Cupressaceae	*Calocedrus decurrens* (Torr.) Florin	Exo.	Exo.	1
Cupressaceae	*Cupressus sempervirens* L.	Exo.	Exo.	22
Cupressaceae	*Thuja occidentalis* L.	Exo.	Exo.	1
Cyperaceae	*Cyperus alternifolius* L.	Exo.	Exo.	8
Didiereaceae	*Portulacaria afra* Jacq.	Exo.	Exo.	6
Elaeagnaceae	*Elaeagnus pungens* Thunb.	Exo.	Exo.	2
Euphorbiaceae	*Euphorbia peplus* L.	Exo.	Exo.	1
Euphorbiaceae	*Manihot esculenta* Crantz	Exo.	Exo.	2
Euphorbiaceae	*Ricinus communis* L.	Exo.	Exo.	1
Fabaceae	*Acacia baileyana* F. Muell.	Exo.	Exo.	2
Fabaceae	*Acacia dealbata* Link	Exo.	Exo.	2
Fabaceae	*Acacia melanoxylon* R. Br.	Exo.	Exo.	2
Fabaceae	*Acacia retinodes* Schltdl.	Exo.	Exo.	3
Fabaceae	*Albizia julibrissin* Durazz.	Exo.	Exo.	3
Fabaceae	*Erythrostemon gilliesii* (Wall. ex Hook.) Klotzsch	Nat.	Nat.	9
Fabaceae	*Erythrina crista-galli* L.	Nat.	Exo.	9
Fabaceae	*Lathyrus latifolius* L.	Exo.	Exo.	3
Fabaceae	*Lathyrus oleraceous* Lam.	Exo.	Exo.	3
Fabaceae	*Neltuma alba* (Griseb.) C.E. Hughes & G.P. Lewis	Nat.	Nat.	1
Fabaceae	*Phaseolus vulgaris* L.	Exo.	Exo.	1
Fabaceae	*Parasenegalia visco* (Lorentz ex Griseb.) Seigler & Ebinger	Nat.	Exo.	7
Fabaceae	*Robinia pseudoacacia* L.	Exo.	Exo.	14
Fabaceae	*Robinia pseudoacacia* L. cv. *casque rouge*	Exo.	Exo.	1
Fabaceae	*Spartium junceum* L.	Exo.	Exo.	3
Fabaceae	*Styphnolobium japonicum* (L.) Schott	Exo.	Exo.	3
Fabaceae	*Trifolium pratense* L.	Exo.	Exo.	3

Family	Species	SA	SBB	NEP
Fabaceae	*Wisteria sinensis* (Sims) DC.	Exo.	Exo.	1
Fagaceae	*Quercus robur* L.	Exo.	Exo.	1
Geraniaceae	*Geranium molle* L.	Exo.	Exo.	1
Geraniaceae	*Pelargonium hortorum* L.H. Bailey	Exo.	Exo.	36
Hydrangeaceae	*Hydrangea macrophylla* (Thunb.) Ser.	Exo.	Exo.	5
Hydrangeaceae	*Philadelphus coronarius* L.	Exo.	Exo.	2
Iridaceae	*Iris* x *germanica* L.	Exo.	Exo.	21
Juglandaceae	*Juglans regia* L.	Exo.	Exo.	1
Lamiaceae	*Lavandula angustifolia* Mill.	Exo.	Exo.	13
Lamiaceae	*Leonotis leonurus* (L.) R. Br.	Exo.	Exo.	1
Lamiaceae	*Plectranthus ciliatus* E. Mey.	Exo.	Exo.	1
Lamiaceae	*Plectranthus glabratus* (Benth.) Alston	Exo.	Exo.	1
Lamiaceae	*Plectranthus parviflorus* Willd.	Exo.	Exo.	1
Lamiaceae	*Plectranthus scutellarioides* R. Br.	Exo.	Exo.	1
Lamiaceae	*Rosmarinus officinalis* L.	Exo.	Exo.	6
Lamiaceae	*Salvia officinalis* L.	Exo.	Exo.	2
Lamiaceae	*Salvia splendens* Sellow ex Schult.	Exo.	Exo.	2
Lamiaceae	*Teucrium fruticans L.*	Exo.	Exo.	1
Lauraceae	*Laurus nobilis* L.	Exo.	Exo.	8
Lauraceae	*Persea americana* Mill.	Exo.	Exo.	2
Linaceae	*Linum grandiflorum* Desf.	Exo.	Exo.	1
Lythraceae	*Cuphea hyssopifolia* Kunth	Exo.	Exo.	2
Lythraceae	*Lagerstroemia indica* L.	Exo.	Exo.	4
Lythraceae	*Punica granatum* L.	Exo.	Exo.	4
Magnoliaceae	*Magnolia grandiflora* L.	Exo.	Exo.	1
Malvaceae	*Callianthe picta* (Gillies ex Hook. & Arn.) Donnell *	Nat.	Exo.	2
Malvaceae	*Ceiba chodatii* (Hassl.) Ravenna	Nat.	Exo.	1
Malvaceae	*Ceiba speciosa* (A.St.-Hil., A.Juss. & Cambess.) Ravenna	Nat.	Exo.	1
Malvaceae	*Hibiscus rosa-sinensis* L.	Exo.	Exo.	2
Malvaceae	*Hibiscus syriacus* L.	Exo.	Exo.	10
Malvaceae	*Malva arborea* (L.) Webb & Berthel.	Exo.	Exo.	1
Marantaceae	*Maranta leuconeura* É.Morren	Exo.	Exo.	1
Meliaceae	*Melia azedarach* L.	Exo.	Exo.	6
Moraceae	*Ficus benjamina* L.	Exo.	Exo.	13
Moraceae	*Ficus carica* L.	Exo.	Exo.	2
Moraceae	*Ficus elastica* Roxb. ex Hornem.	Exo.	Exo.	1
Moraceae	*Morus alba* L.	Exo.	Exo.	4
Myrtaceae	*Melaleuca linearis* Schrad. & J.C.Wendl.	Exo.	Exo.	2
Nephrolepidaceae	*Nephrolepis cordifolia* (L.) C.Presl	Nat.	Exo.	17
Nyctaginaceae	*Bougainvillea spectabilis* Willd.	Exo.	Exo.	3
Nyctaginaceae	*Mirabilis jalapa* L.	Exo.	Exo.	5

Family	Species	SA	SBB	NEP
Oleaceae	*Fraxinus pennsylvanica* Marshall	Exo.	Exo.	30
Oleaceae	*Jasminum mesnyi* Hance	Exo.	Exo.	13
Oleaceae	*Jasminum polyanthum* Franch.	Exo.	Exo.	6
Oleaceae	*Ligustrum lucidum* W.T. Aiton	Exo.	Exo.	14
Oleaceae	*Ligustrum sinense* Lour.	Exo.	Exo.	9
Oleaceae	*Olea europaea* L.	Exo.	Exo.	5
Oleaceae	*Syringa vulgaris* L.	Exo.	Exo.	3
Onagraceae	*Fuchsia hybrida* Voss	Exo.	Exo.	1
Onagraceae	*Clarkia amoena* (Lehm.) A. Nelson & J. F. Macbr.	Exo.	Exo.	1
Oxalidaceae	*Oxalis articulata* Savigny *	Nat.	Nat.	6
Passifloraceae	*Passiflora caerulea* L.	Nat.	Nat.	3
Phytolaccaceae	*Phytolacca dioica* L.	Nat.	Exo.	2
Pinaceae	*Pinus halepensis* Mill.	Exo.	Exo.	15
Pittosporaceae	*Pittosporum tenuifolium* Gaertn.	Exo.	Exo.	1
Pittosporaceae	*Pittosporum tobira* W.T. Aiton	Exo.	Exo.	11
Plantaginaceae	*Antirrhinum majus* L.	Exo.	Exo.	10
Plantaginaceae	*Nuttallanthus canadensis* (L.) D.A. Sutton	Exo.	Exo.	1
Platanaceae	*Platanus acerifolia* (Aiton) Willd.	Exo.	Exo.	1
Plumbaginaceae	*Plumbago auriculata* Lam.	Exo.	Exo.	7
Portulacaceae	*Portulaca grandiflora* Hook.	End.	Exo.	5
Primulaceae	*Cyclamen persicum* Mill.	Exo.	Exo.	1
Primulaceae	*Primula malacoides* Franch.	Exo.	Exo.	3
Primulaceae	*Primula obconica* Hance	Exo.	Exo.	3
Primulaceae	*Primula veris* L.	Exo.	Exo.	4
Ranunculaceae	*Ranunculus asiaticus* L.	Exo.	Exo.	2
Rosaceae	*Chaenomeles japonica* (Thunb.) Lindl. ex Spach	Exo.	Exo.	1
Rosaceae	*Cotoneaster franchetii* Bois	Exo.	Exo.	1
Rosaceae	*Cotoneaster glaucophyllus* Franch.	Exo.	Exo.	1
Rosaceae	*Cydonia oblonga* Mill.	Exo.	Exo.	1
Rosaceae	*Eriobotrya japonica* (Thunb.) Lindl.	Exo.	Exo.	7
Rosaceae	*Photinia* x *fraseri* Dress	Exo.	Exo.	3
Rosaceae	*Prunus amygdalus* Batsch	Exo.	Exo.	3
Rosaceae	*Prunus armeniaca* L.	Exo.	Exo.	10
Rosaceae	*Prunus avium* (L.) L.	Exo.	Exo.	2
Rosaceae	*Prunus cerasifera* Ehrh.	Exo.	Exo.	5
Rosaceae	*Prunus domestica* L.	Exo.	Exo.	8
Rosaceae	*Prunus simonii* Carrière	Exo.	Exo.	1
Rosaceae	*Prunus persica* (L.) Batsch	Exo.	Exo.	4
Rosaceae	*Pyracantha coccinea* M. Roem.	Exo.	Exo.	8
Rosaceae	*Pyrus communis* L.	Exo.	Exo.	1
Rosaceae	*Rosa* L. sp.	Exo.	Exo.	19

Family	Species	SA	SBB	NEP
Rosaceae	*Spiraea cantoniensis* Lour.	Exo.	Exo.	8
Rubiaceae	*Gardenia jasminoides* J. Ellis	Exo.	Exo.	2
Rutaceae	*Citrus aurantium* L.	Exo.	Exo.	5
Rutaceae	*Citrus limon* (L.) Osbeck	Exo.	Exo.	8
Rutaceae	*Citrus maxima* (Burm.) Merr.	Exo.	Exo.	4
Rutaceae	*Ruta graveolens* L.	Exo.	Exo.	7
Salicaceae	*Populus alba* L.	Exo.	Exo.	3
Salicaceae	*Populus nigra* L.	Exo.	Exo.	4
Salicaceae	*Salix babylonica* L.	Exo.	Exo.	7
Scrophulariaceae	*Buddleja davidii* Franch.	Exo.	Exo.	2
Scrophulariaceae	*Myoporum laetum* G. Forst.	Exo.	Exo.	6
Simaroubaceae	*Ailanthus altissima* (Mill.) Swingle	Exo.	Exo.	8
Solanaceae	*Brunfelsia australis* Benth.	Nat.	Exo.	1
Solanaceae	*Nicotiana glauca* Graham	Nat.	Nat.	1
Solanaceae	*Solanum crispum* Ruiz & Pav. *	End.	Exo.	1
Solanaceae	*Solanum lycopersicum* L.	Exo.	Exo.	2
Solanaceae	*Solanum tuberosum* L.	Exo.	Exo.	1
Talinaceae	*Talinum paniculatum* (Jacq.) Gaertn.	Exo.	Exo.	3
Tamaricaceae	*Tamarix ramosissima* Ledeb.	Exo.	Exo.	2
Theaceae	*Camellia japonica* L.	Exo.	Exo.	3
Tropaeolaceae	*Tropaeolum majus* L.	Exo.	Exo.	2
Ulmaceae	*Ulmus minor* Mill.	Exo.	Exo.	10
Urticaceae	*Parietaria judaica* L.	Exo.	Exo.	1
Urticaceae	*Pilea cadierei* Gagnep. & Guillaumin	Exo.	Exo.	1
Urticaceae	*Pilea nummulariifolia* (Sw.) Wedd.	Exo.	Exo.	6
Urticaceae	*Soleirolia soleirolii* (Req.) Dandy	Exo.	Exo.	1
Verbenaceae	*Aloysia citrodora* Paláu	Nat.	Exo.	1
Verbenaceae	*Duranta erecta* L.	Exo.	Exo.	1
Verbenaceae	*Lantana camara* L.	Nat.	Exo.	6
Viburnaceae	*Viburnum tinus* L.	Exo.	Exo.	12
Violaceae	*Viola odorata* L.	Exo.	Exo.	9
Violaceae	*Viola tricolor* L.	Exo.	Exo.	3
Vitaceae	*Parthenocissus quinquefolia* (L.) Planch.	Exo.	Exo.	4
Vitaceae	*Parthenocissus tricuspidata* (Siebold & Zucc.) Planch.	Exo.	Exo.	1
Vitaceae	*Vitis vinifera* L.	Exo.	Exo.	9

Some of the species found are horticultural, fruit trees, or even weeds, and although they are not ornamental, they are maintained in the establishments. They are easy to grow because they were previously on the property or because *"they are the only thing that grows, giving us something green"*.

The predominant habit recorded was herbaceous (51%). Among the woody species, shrubs (27%) and trees (22%) prevailed, and in smaller numbers, palms and vines (less than 10%).

Surveys/interviews to directors/teachers in charge of Initial Educational Institutions

The results show that most % of the institutions (83%) were not built initially as kindergartens. Most of them previously were private houses, different types of organizations or primary schools, all refurbished and adapted for their actual function.

A large percentage (70%) of the current plant species were already present when the institutions were inaugurated, although others were added later, having been donated or chosen by the personnel.

Most educational institutions (90%) had yet to plan for landscaping the grounds, but landscape architects had advised a few with an initial plan, which had been modified without any control. In this sense, most of the plants were chosen to improve the looks of the different areas, provide shade, or be on account of their rustic nature or adaptability to the region's climate. Many of the plants are gifts from parents or institutions and represent the species that can be purchased in nurseries in the area. The majority, brought by teachers cleaning staff from plants in their homes to "*make the spaces more beautiful and give it a green touch*". Occasionally, children prepare new flower beds by planting seedlings or cuttings.

The teachers commented that although they acquired basic knowledge of botany during their academic training, it still needs to be updated because it is not a specific part of the curricular topics they must teach. Some directors and teachers (20%) commented that they honestly lack knowledge of the flora in general. The majority (80%) say they know some of the plants found in kindergarten spaces, but they need to know if the name they use is correct (they do not know scientific names, only common ones).

Teachers said they do not use the presence of plant species in the establishments to generate didactic resources for student's learning, and they do not teach about native and exotic species and their implications.

90% of the directors and teachers commented that so many complex and diverse problems must be resolved, so the landscaping of the green spaces and the incorporation of new teaching resources (such as plants) are much less critical. However, they showed interest in learning about the topic and even thinking about plants as teaching resources to address different topics in the school curriculum.

Discussion

Census of plant species in Initial Education Institutions

Worldwide studies have shown that ornamental flora grown in cities on different continents increasingly resemble each other, even under different climatic and geographical conditions, a phenomenon called 'biotic homogenization' (McKinney, 2006). Urban vegetation is unique because it consists of new sets of native and exotic species influenced by the biophysical conditions of the site, such as climatic factors, and human factors, such as management or planting preferences (Aronson *et al.,* 2015). This is due in part to the cultural roots of immigrants, who cultivate plants native to their places of origin or similar to them (Fraser & Kenney, 2000). Besides, the popularization of certain species supported by publicity campaigns and social networks, as well as the influence of landscapers and nursery owners, tend to severely affect the tendencies in planning species to be used in green spaces.

Even when climate is a limiting factor for the cultivation of certain species, in big cities, plants that naturally would not grow manage to establish themselves due to the modification of the environment, therefore to urbanism (Kendal *et al*., 2012), which encourages the introduction of this type of species.

In this study, the number of ornamental species found in the different kindergartens is very different (from zero to more than 30 species), and in general, it is related to the personal interest of the people who work there since their care depends on them. This situation is entirely different from cultivating ornamental plants in public spaces or in areas

where specific personnel are involved in their care. In the 83 Initial Education Establishments of the Bahía Blanca District where plants were present, 272 species belonging to 86 botanical families were found, a diversity that could be considered comparable to that found in a study carried out in the city of Harare (Zimbabwe) where they were found, in 30 schools, 209 species belonging to 84 botanical families (Muvengwi *et al*., 2019). On the other hand, in studies developed in schools in England, a smaller number of species were found (76), with 30 being trees and the remaining 46 being shrubs and herbaceous plants. In this last study, no reference is made to botanical families' specific diversity or representativeness (Howlett & Turner, 2023).

In the kindergartens studied here, Asteraceae and Fabaceae family are the most represented, a point in common with the study carried out by Soulé *et al*. (2022) in two cities of the Niger Republic where Fabaceae also turned out to be the most abundant. This may be because the Fabaceae family has a cosmopolitan distribution with many species of trees, shrubs, annual or perennial herbs and lianas, even being dominant species in some ecosystems (Simpson, 2019). Also, the Rosaceae family was frequently represented, as was found by Rovere (2022) in the urban beds of Bariloche City (Río Negro province, Argentina). In Trabzon City (Turkey), the most frequent species are *Hydrangea macrophylla* (Thunb.) Ser.*, Nerium oleander* and *Rosa* L. sp. (Acar *et al.,* 2007), also commonly found in this study. The selection and cultivation of specific plant species influenced by the reasons already stated results in the loss of biodiversity of each region, leading the natural environment to a monotonous and repeated plant landscape in different places worldwide. In this sense, it is recommended that children from an early age be in contact with the native flora of their region; a path towards the protection of existing species will begin gradually and naturally (Moro *et al.,* 2014; Moro & Castro, 2015). There is a great variety of native species in each region of Argentina with beautiful foliage and showy flowers that, while unknown by a large part of the population, could be used as possible ornamental plants in urban environments (Mascó *et al.,* 1998; Torres et al., 2008). That is why government institutions must become aware of the critical role of indigenous flora as a didactic resource in educational establishments adequately plan how to incorporate this type of species into the urban green spaces and recommend the appropriate species to educational institutions. Until now, at least in Argentina, this work has not been carried out on a big scale; only scarce isolated projects developed by interested teachers are found principally in primary and secondary education, as can be noticed in online educational portals, digital newspapers or publications of diverse organizations.

In this study, 240 exotic species (88%) and 32 native species (12%) to Argentina were found. At this point, there is a very notable difference with the studies developed by Soulé *et al.* (2022) in Niger, where they found 53% exotic and 33% native to the country in the school census. As mentioned earlier, the percentage of native species of Argentina registered in the kindergartens surveyed is low. In contrast, that of species native to the Bahía Blanca region is even lower (only fourteen species). This low representativeness may be because it is not a characteristic usually considered in the planning of green spaces or even in the formation of unplanned ones, the unfamiliarity with them, and that are mostly not appreciated as ornamentals.

On the other hand, the greater preference for exotic species may be linked to the fact that they are the most popular and easily obtained in all nurseries. The value given to exotic plants as environmental goods of cultural importance reveals the processes of constructing an anthropized landscape that has prioritized the showy species of Eurasia (Betancourt *et al.,* 2017). It is also interesting to relate these proportions to the fact that the species in these recreational spaces are generally obtained as gifts from civil or private organizations or teachers or parents, which do not favour a correct "*a priori*" planning of the landscaping of the place. Chosen many times for their aesthetic beauty, price, or rusticity without considering other essential characteristics such as adaptation to the local climate or even what morphological structures that species present that, in many cases, do not make it safe for children's recreation spaces (thorns, stingers, allergy production, etc.). In many cases, these factors generate extra care work for establishment staff that could be avoided, for example, if the grown ornamental species make efficient use of the water (be native to the region) (Goedhart & Pataki, 2012).

It is essential to highlight that the presence of native or endemic species used as ornamentals can be considered fortuitous because there was no intention to cultivate them or knowledge to support their choice. It is also important to highlight that the most significant number of species found are herbaceous, related to the ease of cultivation in small spaces, such as pots or small beds, indoors and outdoors. This type of species also requires less cultural management care, such as pruning and adapting better to the reality of the institutions.

Regarding the habit of the species surveyed, herbaceous plants predominate, followed by trees and shrubs, unlike in recreational spaces of schools in England, where the number of herbaceous and tree species is practically equal (Howlett & Turner, 2023).

It is essential to clarify that these studies with which comparisons are made are schools and not kindergartens, which are the educational institutions surveyed in this study; in this sense, similar work has yet to be found in other cities worldwide. The analysis of these comparisons is also limited because the environmental, socio-economic, and cultural characteristics are entirely dissimilar.

Surveys/interviews to directors/teachers in charge of Initial Educational Institutions

Most educational establishments were not created for this purpose but were modified in terms of building issues to fulfil that purpose. Plant species were not considered in such renovations, similar to what happened in Khartoum (Sudan) (Onsa & Yagi, 2016). Even more, new plants have been introduced, although people need to consider pedagogical or conservation purposes.

This lack of general knowledge about plants and the importance of their planned selection for different spaces does that many of the species found in kindergartens have some degree of toxicity, leading to the possibility of involuntary poisoning due to consumption or development of contact allergies (phytodermatitis). In a previous work, carried out by this same work group (Pérez Cuadra *et al*., 2012), where the presence of toxic plants in Initial Educational Institutions was evaluated, it was found that 31% of the plants present can cause some type of toxicity. Of them, 70% cause moderate or mild conditions, generally related to dermatitis (*Ficus elastica* Roxb. ex Hornem., *Hedera helix* L., *Platanus acerifolia* (Aiton) Willd., etc.) while the remaining 30% can cause more serious conditions (*Catharanthus roseus* (L.) G. Don, *Nerium oleander*, *Ricinus communis* L., etc.). These percentages of toxic plants have remained at similar values in the surveys carried out in the present study, with no new toxic species being found. In no case it was it recommended to remove this type of plants, if not educate with them, since knowledge allows to make better decisions and gives security. Removing the danger from a place generates a momentary protection, since it could appear in another space. Plants can be very beneficial (food, medicine, shelter and construction materials, etc.) or very harmful (due to physical or chemical damage) so that only knowledge generates permanent security.

The results evidence a lack of knowledge of the flora in general, and although the directors/teachers showed interest in incorporating native plants in the spaces, the informant mentioned that training would be necessary to address the topic from an educational point of view. An issue that ends up being relegated in the face of the multiple problems presented by Argentine educational institutions. More importance should be given to integrating the plants with our lives so that teachers can generate educational projects to protect and appreciate regional native species. On the other hand, the native plant species and the different symbologists they represent by historical and cultural aspects (related to popular legends, specific historical facts, medicinal uses, superstitions, etc.) of each region of our country could also be taught. However, innumerable tasks can be done to promote the importance of cultivation and care of vegetation in educational establishments and that can also help improve the quality of learning.

In addition to the positive effects of plants on human health and well-being (Kendal *et al.,* 2012), they can be thought of as teaching tools to work on topics related to the assessment of flora in general and native and the conservation of environments at different educational levels (Steger *et al.*, 1973). The added value of the presence of plants in educational institutions is why the planned incorporation of species into recreational spaces and the thematic training of teachers will allow the construction of students committed to the environmental cause.

Conclusions

The plant census in the 85 kindergartens of the Bahía Blanca district showed that of the 272 species of plants belonging to 86 botanical families found, the vast majority are exotic for Argentina; the percentage of native species of the Bahía Blanca region was meagre. In general, the buildings where these institutions are located were not built for their final function, and there was no plan for the plant ornamentation of their spaces. Teachers do not use plants as a teaching resource due to the lack of knowledge, although they show interest in training on the subject and triggering different curricular aspects.

Author Contributions

All authors have carried out jointly and equally the data collection, its interpretation and writing of the manuscript.

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