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# Systematic Diversity of the Family Poaceae (Gramineae) in Chile

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## 1. Introduction

The role of Systematics in studies of biodiversity is essential to a variety of studies, including species conservation, extinction, biodiversity hotspots, bio-prospecting and ecosystem function (Alroy, 2002; Scotland & Wortley, 2003; Smith & Wolfson, 2004; Wilson, 2000). The analysis of the biodiversity as well as the analysis of the distribution of species richness at different levels (national, regional), the distribution of the endemic species, the detection of areas whose preservation is necessary and many other topics related to the conservation of the biodiversity requires an important collection effort, so that the organized databases constructed by the herbaria become as comprehensive as possible. Herbarium specimens represent a rich source of information for botanists and ecologists, even though data based on herbaria collections have many limitations, since they are geographically and seasonally biased, and taxonomically incomplete (Crawford & Hoagland, 2009; Delisle et al., 2003; Fuentes et al., 2008; Funk & Richardson, 2002; Ponder et al., 2001). Moreover, it has been established that there is a tendency to a decline in the number of specimens of vascular plants collected in the last years (Prather et al., 2004), although taxonomists are aware that there are still many undescribed species (Smith & Wolfson, 2004). In order to know how many species of grasses exist in Chile, as well as their identity and taxonomic distribution, this chapter provides a checklist of the family Poaceae in Chile, taking into account the nomenclatural changes recently proposed. Moreover, we analyze the completeness of the inventory of the family represented in two of the most important national herbaria.

Grasses (Poaceae or Gramineae) are the fifth most diverse family among the flowering plants or Angiosperms and the second most diverse family among the Monocotyledons. Poaceae comprises about 10,000 species in approximately 700 genera (Clayton & Renvoize, 1986; Tzvelev, 1989; Watson & Dallwitz, 1992). Recent evidence suggests that grasses had already diversified during the Cretaceous. The evidence came from phytolith analysis (Prasad et al., 2005), tiny crystals of silica formed in the epidermal cells of leaves or floral bracts of grasses and other plants. The discovery of grass phytoliths in coprolites of titanosaurid sauropods that lived in India 65 to 71 million years ago (Prasad et al., 2005), suggested that grasses and dinosaurs coevolved (Piperno & Sues, 2005). Phylogenetic approach to reveal the evolutionary history of grasses in a biogeographical context suggests that Poaceae originated in the African or South American regions of Gondwana during the late Cretaceous (Bouchenak-Khelladi et al., 2010).

The economic significance of the grass family is undeniable. Grasses are found on all continents, including Antarctica (e.g. *Deschampsia antarctica*) and are ecologically dominant in some ecosystems such as the African savannas (Kellogg, 2000). Grasslands, in which grasses are the most important floristic component, cover about 40% of the earth surface (Peterson et al., 2010). Most people on Earth depend on grasses, such as wheat, corn, oats, rice, sugarcane, and rye, for a large part of their diet. In addition, domestic animals are fed on diets based largely on forage grasses. Moreover, many of the most serious weeds growing on agricultural land are also members of the grass family.

## 2. Diversity, phylogeny and classification of the grass family

Grasses are unique from a morphological point of view. The grass flower contains a bicarpellary gynoecium surrounded by an androecium composed of three or more stamens in one or two whorls. The perianth is reduced to two or three lodicules situated outside the stamens; the lodicules open the florets during the pollination process. Outside the lodicules, in adaxial position, there is the palea. Subtending the flower there is another bract, the lemma (Kellogg, 2000). The elemental inflorescence is the spikelet, with one to many florets inserted along an axis, the rachilla. Each spikelet has two empty bracts called glumes which protect the immature spikelet. The lemma and the palea enclosing the flower or caryopsis constitute the floret. Lemmas often bear awns or mucros born at the apex or on the back of the body of the lemma. Awns are very common in the family, nearly the half of the genera of Poaceae have awns (GPWG, 2001). The inflorescence (in fact a synflorescence) is a panicle, a raceme or a spike (for a detailed descriptive terminology on grass inflorescence see Allred, 1982). The fruit is a caryopsis or grain; a caryopsis is defined as a one-seeded indehiscent fruit with the seed coat fused with the pericarp (the ovary wall). The embryo is lateral and highly differentiated, with shoot (plumule) and root meristems, leaves and vascular system. The embryo has a scutellum considered to be a modified cotyledon; in many species there is the epiblast, opposite to the scutellum, considered to be a rudiment of a second cotyledon or an outgrowth of the coleorrhiza (Tzvelev, 1983). The epiblast is absent in the subfamilies Arundinoideae and Panicoideae (Clayton & Renvoize, 1986). In the lower part of the embryo the root meristem is covered by the coleorrhiza. In the upper part, the plumule is covered by the coleoptile. The embryos of Arundinoideae, Chloridoideae, Centothecoideae and Panicoideae have a mesocotyl (first internode), between the insertion of the scutellum and the coleoptile. The embryos of Arundinoideae, Bambusoideae, Centothecoideae, Chloridoideae, Ehrhartoideae and Panicoideae have a cleft between the coleorrhiza and the scutellum. The plants are annual or perennial, herbaceous or woody. The stems, called culms, are simple or branched and often with rhizomes or stolons. Culms are hollow or more rarely, solid. Roots are fibrous and adventitious (homorrhiza).

Leaves are distichous; the leaves have the basal portion forming the sheath and the upper portion forming the blade. At the adaxial junction of the sheath and blade there is a membranous ligule, sometimes transformed in a fringe of hairs. Most grasses lack an abaxial ligule; an abaxial ligule is present in Bambuseae, some members of the PACMAD clade and a few Pooideae. The sheath is sometimes auriculate. In bamboos, the leaves have a pseudopetiole, a constriction at the base of the leaf blade

Two main photosynthetic pathways, C<sub>3</sub> and C<sub>4</sub>, are found in Poaceae but C<sub>3</sub>/C<sub>4</sub> intermediates also occur. In C<sub>3</sub> photosynthesis CO<sub>2</sub> combines with ribulose 1,5-biphosphate in the Calvin-Benson cycle. The first detectable metabolic product of this process is

phosphoglycerate, a compound with three carbon atoms. C3 photosynthesis takes place in the leaf mesophyll. C3 grasses are well adapted to temperate climates. In C4 photosynthesis or Hatch-Slack cycle the first detectable metabolic product is oxalacetate, a compound with four carbon atoms. In C4 grasses, C4 activity is confined to the mesophyll and C3 photosynthesis is displaced to the bundle sheath surrounding the vascular tissue (Kranz syndrome). It is presumed that C4 photosynthesis is an adaptation to low CO<sub>2</sub> levels and high O<sub>2</sub> levels. C4 plants minimize photorespiration sequestering Rubisco in the cells of the bundle sheath making C4 photosynthesis more efficient than C3, especially at high temperatures and arid environments. C4 photosynthesis evolved in four of the 13 subfamilies of Poaceae (Panicoideae, Aristidoideae, Chloridoideae and Micrairoideae). The earliest fossil grass leaves with C4 anatomy is dated 12.5 Ma but Chloridoideae phytoliths have been dated 19 Ma. It has been suggested that C3 photosynthesis is ancestral to the origin of C4 photosynthesis and occurs about 32 Ma during the Oligocene, and that the origin of the C4 pathway is polyphyletic (Vincentini et al., 2008).

The family Poaceae is monophyletic. Characters that unambiguously support the monophyly of the family are the grass-type embryo lateral, peripheral to the endosperm and highly differentiated in the caryopsis, and a *trnT* inversion in the chloroplast genome (GPWG, 2001).

The grass family has been divided in a number of subfamilies ranging from two to 13 (for a review see GPWG, 2001). Traditionally, the family was divided in two major groups: Festucoideae (= Pooideae) and Panicoideae (Hitchcock, 1950). The system of grasses (Tzvelev, 1989) also recognized only two subfamilies: Bambusoideae with 14 tribes, and Pooideae, with 27 tribes. In Tzvelev's system, Panicoideae are embedded in Pooideae. One of the most widely used systems is that of Clayton & Renvoize, which divided the family in six subfamilies: Bambusoideae, Pooideae, Centothecoideae, Arundinoideae, Chloridoideae and Panicoideae (Clayton & Renvoize, 1986). The phenetic system of Watson & Dallwitz recognizes seven subfamilies (the same as Clayton & Renvoize + Stipoideae) (Watson & Dallwitz, 1992). The largest proposed number of subfamilies is 13 (Caro, 1982): Bambusoideae, Streptochaetoideae, Anomochloideae, Olyroideae, Centostecoideae, Oryzoideae, Ehrhartoideae, Phragmitoideae, Festucoideae (= Pooideae), Eragrostoideae (= Chloridoideae), Aristidoideae, Panicoideae and Micrairoideae.

The evolutionary history of Poaceae has been deciphered using different molecular markers, such as restriction site maps of the chloroplastidial DNA (Soreng & Davis, 1998), sequences of various chloroplast genes such as *ndhF* (Clark et al., 1995; Sánchez-Ken & Clark, 2010), *rpoC2* (Barker et al., 1999), *rbcL* (Barker et al., 1995; Sánchez-Ken & Clark, 2010), *matK* (Hilu et al., 1999), *rps4* (Nadot et al., 1994), and sequences of several nuclear genes such as phytochrome B (Mathews et al., 2000), GBSSI (Mason-Gamer et al., 1998), ITS (Hsiao et al., 1999), and 18S rDNA (Hamby and Zimmer, 1988). The Grass Phylogeny Working Group (GPWG, 2001) combined the data from these sources to produce a phylogeny of the family (Kellogg, 2001). They recognized 12 subfamilies: Anomochloideae, Pharoideae, Puelioideae, Bambusoideae<sup>\*1</sup>, Ehrhartoideae\*, Pooideae\*, Aristidoideae\*, Arundinoideae\*, Danthonioideae\*, Centothecoideae, Panicoideae\*, and Chloridoideae\*. Three early diverging lineages (Anomochloideae, Pharoideae and Puelioideae) and two major lineages were recognized: a clade comprising the subfamilies Bambusoideae, Ehrhartoideae and Pooideae, called the BEP clade, and the PACCAD clade, containing the subfamilies Panicoideae,

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<sup>1</sup> An asterisk indicates the subfamilies present in Chile.

Arundinoideae, Chloridoideae, Centothecoideae, Aristidoideae and Danthonioideae. Later, the resurrection of the subfamily Micrairoideae and the synonymization of Centothecoideae with Panicoideae changed the acronym of the PACCAD clade to PACMAD (Sánchez-Ken et al., 2007; Sánchez-Ken & Clark, 2010). The PACMAD clade comprises ca. 5000 species or about half of the diversity of the family.

Subfamily **Anomochloideae** is the earliest diverging lineage of Poaceae followed by Pharoideae and Puelioideae (GPWG, 2001). Anomochloideae and Pharoideae were embedded in Bambusoideae as tribe Anomochloae and tribe Phareae respectively, but later resurrected as subfamilies (Clark & Judziewicz, 1996). Anomochloideae includes two genera (*Anomochloa* and *Streptochaeta*) from tropical America characterized by “spikelet equivalent” instead of true grass spikelets. Puelioideae includes two genera (*Gaduellia*, *Puelia*), native to tropical Africa of perennial rhizomatous grasses of shaded forest understory (Clark et al., 2000). Anomochloideae, Pharoideae and Puelioideae are absent in the Chilean grass flora.

Subfamily **Bambusoideae** includes approximately 115 genera (GPWG, 2001) of herbaceous (Tribe Olyreae, ca. 110 spp.) and woody bamboos (Bambuseae, ca. 1300 spp.). The world most diverse genus of bamboos is *Chusquea*, with 134 described species. Bambusoideae are perennial (rarely annual) usually woody grasses, with pseudopetiolated leaves. Culms are erect or scandent. Anatomically, they are characterized by the presence of fusoid cells, aligned perpendicular to the long axis of the leaf blade. Fusoid cells are large, thin walled and lack chloroplasts and other cell contents; they probably represent internal gas spaces. C3 photosynthesis takes place in the arm cells; these are thin walled cells with well developed invaginations or arm like lobes (Judziewicz et al., 1999; for a detailed leaf anatomical description of Chilean bamboos species see also Matthei, 1997).

Subfamily **Ehrhartoideae** includes three tribes (Oryzae, Ehrharteae and Phyllorachidae) and approximately 120 species (Barkworth et al., 2007), characterized by spikelets with one fertile floret often with one or two proximal sterile florets, two lodicules, three or six stamens, C3 photosynthesis, with a double bundle sheath around the veins, the outer sheath parenchymatous and the inner with thick walls (Kellogg, 2009).

Subfamily **Pooideae** is the largest of the 13 subfamilies of Poaceae (GPWG, 2001), comprising about 3560 species (Soreng et al., 2007). It includes some of the most economically important species, such as wheat (*Triticum aestivum*), oats (*Avena sativa*), barley (*Hordeum vulgare*) and rye (*Secale cereale*) and many forage and weed species. Plants herbaceous, with hollow culms (rarely solid); leaves distichous with an adaxial membranous ligule, rarely a fringe of hairs; leaf blades narrow; sheaths with or without auricles. Spikelets usually disarticulating above the glumes, laterally compressed. Glumes 2, lemmas 1 to many. Caryopsis with a linear or punctiform hilum. Endosperm solid, soft or liquid, with compounds starch grains (except in Bromaeae, Triticeae, and Brachyelytreae). Embryo small, epiblast present, scutellar cleft absent, mesocotyl internode absent, embryonic leaf margins not overlapping. Photosynthetic pathway: C3. Basic chromosome number  $x = 7$ . Microhairs absent. Stomata with parallel-sided subsidiary cells. Pooideae includes some 3300 species distributed in temperate climates and in the tropics in the mountains. Most of the Chilean grasses belong to this subfamily.

Subfamily **Aristidoideae** includes three genera (*Aristida* L., *Stipagrostis* Nees and *Sartidia* de Winter) and more than 350 species in tropical, subtropical and temperate zones, most belonging to *Aristida*. Aristidoideae are members of the PACMAD clade, with C4 or C3 photosynthesis (Cerros-Tlatilpa & Columbus, 2009). Plants are annuals or perennial. The



abaxial ligule is absent or present; the adaxial ligule membranous or a fringe of hairs. The leaf sheath is non-auriculate. The inflorescence is a panicle. Spikelets with two glumes; lemmas three-awned; lodicules 2, rarely absent. Caryopsis with short or long-linear hilum. Endosperm hard, containing compound starch grains. Embryo small or sometimes large; epiblast absent; scutellar cleft present or absent; mesocotyl internode elongated; embryonic leaf margins not overlapping. Members of Aristidoideae have C4 photosynthesis (except *Sartidia* with non-Kranz anatomy and C3 photosynthesis). Basic chromosome number  $x = 11, 12$ . Bicellular microhairs present. Stomata with dome-shaped or triangular subsidiary cells. With only one genus (*Aristida*) and three species, this subfamily is underrepresented among Chilean grasses.

Subfamily **Arundinoideae** includes 33-38 species of temperate and tropical zones (GPWG, 2001). Arundinoideae are perennial (rarely annual), herbaceous or sometimes woody plants, of temperate and tropical zones. Culms usually hollow; leaves distichous usually with adaxial ligule only; ligule membranous or a fringe of hairs; sheath non-auriculate. Inflorescence usually a panicle. Spikelets disarticulating above the glumes; glumes 2; lemma sterile sometimes present; 1 or more female-fertile florets. Lodicules 2. Caryopsis with hilum short or long-linear; endosperm solid, with compound starch grains. Embryo large or small; epiblast absent; scutellar cleft present; mesocotyl internode elongated; embryonic leaf margins meeting or overlapping. Basic chromosome number  $x = 6, 9, 12$ . Photosynthetic pathway: C3. Stomata with dome or triangular subsidiary cells. Bicellular microhairs present (sometimes absent).

Subfamily **Danthonioideae** comprises some 250 species (GPWG, 2001). Plants usually perennial, rarely annual, usually herbaceous with rhizomes, stolons or caespitoses and culms most often solid. Leaves with adaxial ligule; ligule membranous or a fringe of hairs. Inflorescence a panicle. Spikelets laterally compressed, with two glumes and one to several fertile florets; rachilla disarticulating above the glumes and between the florets; lodicules two. Caryopsis with short or long-linear hilum; endosperm hard with compound starch grains; embryo large or small, with epiblast, with scutellar cleft, mesocotyl internode elongated and embryonic leaf margins meeting, rarely overlapping. Basic chromosome numbers  $x = 6, 7, 9$ . Photosynthetic pathway: C3. Stomata with dome shaped or parallel-sided subsidiary cells. Bicellular microhairs present.

Subfamily **Chloridoideae** comprises approximately 140 genera and more than 1420 species of arid environments (Hilu & Alice, 2001; Peterson et al., 2010). Plants annual or perennial with hollow or solid culms. Leaves distichous, with adaxial membranous ligule. Inflorescences paniculate. Spikelets with two glumes, laterally compressed or sometimes dorsally compressed; rachilla disarticulating above the glumes. Lemmas 1 to many; lodicules 2 (or absent), non-membranous (fleshy). Caryopsis with the pericarp often free or loose; endosperm solid, with simple or compound starch grains; embryo large, with epiblast, with scutellar cleft, mesocotyl internode elongated and embryonic leaf margins meeting, rarely overlapping. Stomata with dome-shaped or triangular subsidiary cells; bicellular microhairs or chloridoid type (inflated, spherical microhairs). Photosynthesis C4 of two main types: NAD-ME (nicotinamide adenine dinucleotide co-factor malic enzyme) and PCK (phosphoenolpyruvate carboxykinase). Basic chromosome numbers  $x = 9, 10$ , rarely 7 or 8 (GPWG, 2001). Stomata with dome-shaped or triangular subsidiary cells. Bicellular microhairs present.

Subfamily **Panicoideae** comprises approximately 206 genera and 3300 species, mainly from tropical and warm temperate climates (Giussani et al. 2001; GPWG, 2001). Plants annual or

perennial usually with solid culms. Leaves distichous with adaxial membranous ligule, sometimes a fringe of hairs or absent. Inflorescences panicle, racemes or compound inflorescences. Spikelets 2-flowered, with the lower floret staminate or barren, single or paired, dorsally compressed, with two glumes, disarticulating below the glumes (rarely above the glumes). Lodicules 2, fleshy. Caryopsis with short hilum, hard endosperm containing simple (rarely compound) starch grains; embryo large, epiblast absent, scutellar cleft present, mesocotyl internode elongated, embryonic leaf margins overlapping. Stomata with triangular or dome-shaped subsidiary cells; bicellular microhairs of the panicoid type present. Photosynthetic pathway C3, C4 and C3/C4 intermediates (GPWG, 2001). The presence of bifloral spikelets with the lower flower staminate or neuter, simple starch grains and molecular data, both from chloroplast and nuclear DNA, are synapomorphies that support the monophyly of the Panicoideae (Aliscioni et al., 2003).

### 3. Some geographical features of the Chilean territory

Details of the geographical and evolutionary characteristics of the Chilean flora have been published elsewhere (Arroyo et al., 1993; Grau, 1995; Squeo et al., 2008; Stuessy & Taylor, 1995). Chile stretches from north to south for nearly 4270 km (ca. 39 degrees) along the western coast of South America, between 17°30'S (10 km North of Visviri) and 56°30'S (Diego Ramírez islands) and extends to the Antarctica at the South Pole (Chilean Antarctic Territory). Also belong to Chile the oceanic islands San Félix and San Ambrosio (Desventuradas islands), the archipelago of Juan Fernández and the Polynesian islands Easter Island and Sala and Gómez. Including the Chilean Antarctic Territory, the country's length spans for about 73 degrees. The maximum width occurs in southern Chile (52°21'S), where there is over 400 km between the Pacific Ocean and the Andes, but the overall width of the country usually does not exceed 200 km. Chile borders with Peru on the North, on the East with Argentina and Bolivia, on the West with the Pacific Ocean and on the South with the South Pole. In the north, Chile shares with Bolivia, Peru and Argentina the Altiplano, a plateau which does not descend from 4000 m of altitude. The Andes runs end-to-end the territory, establishing the border with Argentina. The Andes reaches heights of almost 7000 m in the northern zone, while to the south it falls below 2500 m. The Atacama Desert, considered to be one of the driest places in the world, dominates the climate on the north (Pankhurst & Hervé, 2007), with rainfall below 10 mm per year. From the Aconcagua valley to the region of Bío-Bío (approx. 32-38°S), the Mediterranean climate is dominant, with the exception of the high peaks of the Andes with cold weather due to the altitude. The Mediterranean region of Chile is included in the Chilean hotspot of biodiversity (Winter Rainfall Area of Central-Northern Chile Hotspot or Chilean Winter Rainfall and Valdivian Forests). The Chilean hotspot is located between 25 and 40°S (Arroyo et al., 1999), including the regions of Coquimbo and Atacama and extending to the region of Los Lagos in southern Chile. This hotspot contains 3892 vascular plant species, of which 1957 (more than 50%), are endemic to Chile. The Chilean hotspot covers almost 400.000 km<sup>2</sup> including the islands San Félix, San Ambrosio and the archipelago of Juan Fernández (Conservation International, 2011). South of 38°S the mixed deciduous-evergreen temperate forests occur.

The biogeographic sketch of the Chilean vegetation (Cabrera & Willink, 1973) divided the territory into two phytogeographical regions (*Región Neotropical* and *Región Antártica*) and domains (*Dominio Patagónico* and *Dominio Subantártico*). A detailed account of the Chilean

vegetation can be found in (Gajardo, 1994). To the Patagonian domain belong the Provinces *Provincia Altoandina*, *Provincia Puneña*, *Provincia del Desierto*, *Provincia Chilena Central* and *Provincia Patagónica* (Cabrera & Willink, 1973). *Provincia Altoandina* extends from Venezuela to Tierra del Fuego, in the high Andes. In the Andes of Mendoza (Argentina) and adjacent regions of Chile of *Provincia Altoandina* dominate communities of *Festuca*, *Poa*, *Deyeuxia* and *Nasella*. *Provincia Puneña* extends from 15-27°S, in the high Andes between 3200 and 4000 m of altitude. Communities of *Pappostipa chrysophylla* (coirón amargo) are common in this area. *Provincia del Desierto* is located on the Pacific coast between 5 and 30°S. This province has a warm, dry weather because of the Humboldt Current. The coastal fogs known as "camanchacas" allow the growth of vegetation mainly with species of the family Nolanaceae (*Alona*, *Nolana*). This province (also known as *Subregión del desierto costero*) is very interesting from a floristic point of view due to the high number of endemic species that live there (Gajardo, 1994). South of La Serena (Region of Coquimbo), the coastal fogs provide sufficient moisture to sustain the forest of Fray Jorge, a relict forest of *Aextoxicon punctatum* (olivillo, Aextoxicaceae), which only reappears only in southern Chile (Valdivia). *Provincia Chilena Central* extends between 32°S and 38°S (except in the high mountains), including the regions of Valparaíso, Metropolitana, O'Higgins, Maule and Bío-Bío. This province is dominated by sclerophyllous forests with *Bielschmiedia miersii* (belloto, Lauraceae), *Peumus boldus* (boldo, Monimiaceae), *Cryptocarya alba* (peumo, Lauraceae), *Kageneckia oblonga* (huayu, Rosaceae), *Lithrea caustica* (litre, Anacardiaceae), *Quillaja saponaria* (quillay, Rosaceae), *Colliguaya dombeyana* (colliguay, Euphorbiaceae), etc. In the central valley known as Depresión Intermedia, the espinal of *Acacia caven* (espino, Mimosaceae) is the dominant vegetation community. The espinal has a very high diversity of Poaceae. Species commonly found in the prairie of the espinal are *Agrostis capillaris*, *Aira caryophyllea*, *Aristida pallens*, *Avena barbata*, *Briza maxima*, *B. minor*, *Bromus hordeaceus*, *B. rigidus*, *B. stamineus*, *Chascolytrum subaristatum*, *Chusquea quila*, *Cynosurus echinatus*, *Dactylis glomerata*, *Danthonia chilensis* var. *aureofulva*, *Hordeum chilense*, *H. murinum*, *Lolium multiflorum*, *L. perenne*, *Melica violacea*, *Nasella gibba*, *N. neesiana*, *N. pfisteri*, *Paspalum dasypleurum*, *Phalaris amethystina*, *Poa annua*, *Piptochaetium montevidense*, and *Vulpia bromoides*. In southern Chile, *Provincia Patagónica* comprises the regions of Aysén and Magallanes. This region is characterized by dry and cold climate with vegetation consisting mainly of grassland steppe (Fig. 1), where communities of *Festuca palleescens* and *F. gracillima* are important in Aysén and Magallanes, respectively (Luebert & Pliscoff, 2006). Other species frequently found are *Festuca argentina*, *Jarava neaei*, *Deschampsia antarctica*, *D. elongata* (Pisano, 1985).

*Región Antártica* and *Dominio Subantártico* include two provinces: *Provincia Subantártica* and *Provincia de Juan Fernández*. The archipelago of Juan Fernández, situated 670 km west of continental Chile in the Pacific Ocean, comprises three islands of volcanic origin: Masafuera or Alejandro Selkirk (33°37'S, 80°46'W), Masatierra or Robinson Crusoe (33°37'S, 78°50'W), and Santa Clara. Masafuera is located 180 km west of Masatierra whereas the small island Santa Clara is located 1 km SW of Masatierra (Errázuriz et al., 1998; Swenson et al. 1997). The archipelago of Juan Fernández is characterized by a high level of endemism; 31% of the vascular plants are endemic (Baeza et al., 2007; Swenson et al. 1997). The vascular flora of the islands comprises 42 families of flowering plants, including the monotypic and endemic Lactoridaceae. According to Skottsberg, the largest families are Asteraceae, Cyperaceae and Poaceae (Skottsberg, 1956). On the other hand, the high number of alien plants is a serious threat to the native flora of Juan Fernández (Matthei et al., 1993; Swenson et al., 1997).



#### 4. Analysis of the Chilean grass diversity

To analyze the diversity of the family Poaceae in Chile, a database was prepared based on the collections of the herbaria of University of Concepción (CONC), National Museum of Natural History (SGO) and specimens cited in Tropicos database (tropicos.org), and taxonomic literature [Acevedo de Vargas (1959, *Cortaderia* Stapf); Baeza (1996, *Danthonia* DC., *Rytidosperma* Steud.); Cialdella & Arriaga (1998, *Piptochaetium* J. Presl); Cialdella & Giussani (2002, *Piptochaetium*); De Paula (1975, *Anthoxanthum* L. under *Hierochlœe* R.Br.); Finot et al. (2005, *Trisetum* Pers.); Matthei (1965, *Nassella* (Trin.) E. Desv. under *Stipa* L.; 1975, *Briza* L.; 1982, *Festuca*; 1986, *Bromus* L.; 1987<sup>a</sup>, *Aristida* L., 1987b; *Panicum* L.); Muñoz-Schick (1985, *Melica* L.; 1990, *Nassella*); Nicora (1998, *Eragrostis* Wolf); Rúgolo de Agrasar (1978, 2006, *Deyeuxia* Kunth; 1982, *Bromidium* Nees et Meyen; 1999, *Corynephorus* P. Beauv.); Rúgolo de Agrasar & Molina (1997, *Agrostis* L.)]; Rúgolo de Agrasar et al. (2009, *Danthonia*); Soreng & Gillespie (2007, *Nicoraepoa*); Soreng & Peterson (2008, *Poa*)]. A total of 13.924 records were included in the database, including the name of the species, subfamily, tribe, subtribe, geographical origin (native, introduced, endemic), collector, latitude, longitude, altitude, locality, date of collection, herbarium, and herbarium number. A checklist of the species based in the database, the Catalogue of the New World Grasses (Judziewicz et al., 2000; Peterson et al., 2001; Soreng et al., 2003; Zuloaga et al., 2003, available online at <http://www.Tropicos.org>) and the Catálogo de las plantas vasculares del Cono Sur (Zuloaga et al., 2008, available online at <http://www2.darwin.edu.ar>) was prepared. Recent taxonomic treatments of Chloridoideae (Peterson et al., 2007; Peterson et al., 2010), Danthonioideae (Linder et al., 2010), Panicoideae (Sánchez-Ken & Clark, 2010), *Avenella*, *Deschampsia*, *Vahlodea* (Chiapella & Zuloaga, 2010), *Bromus* (Planchuelo, 2010), *Cenchrus* (Chemisquy et al., 2010), *Deyeuxia* (Rúgolo de Agrasar, 2006), *Digitaria* (Vega et al., 2009) and *Trisetum* (Finot, 2010), were followed to update the nomenclature and the classification of the species. Lists of the species of the family Poaceae growing in Chile have been published for different regions (Arroyo et al., 1989, 1990, 1992, 1998; Baeza et al., 1999, 2002, 2007; Finot et al., 2009; Kunkel, 1968; Matthei et al., 1993; Reiche, 1903; Rodríguez et al., 2008a, 2008b; Rundel et al., 1996) or for all the country (Muñoz, 1941; Marticorena & Quezada, 1985; Zuloaga et al., 2008).

Many species of Chilean grasses were collected and described early in the nineteenth century. The collection of grass specimens began at a fairly early stage of the knowledge of the diversity of the Chilean flora, in the early nineteenth century, with the collections made by Eduard Poeppig, Carlo Bertero, Rodolfo Amando and Federico Philippi, and Claudio Gay. In this period, Emile Desvaux published one of the first complete treatments of the Chilean grasses in Gay's "*Historia Física y Política de Chile*" (Desvaux, 1854), including 22 beautiful illustrations of native and endemic Chilean grasses, in Gay's Atlas. In the early twentieth century, new collections were made by Karl Reiche, Félix Jaffuel, Víctor Baeza, Franz Neger, Ernesto Barros, Atanasio Hollermayer, Hugo Gunckel, Erich Werdermann, Karl Junge, and Gilberto Montero, among others. Nonetheless, the number of specimens and, as a result, the number of species collected in the first 10 decades (1828-1917) is quite small (Fig. 2). In the early twentieth century only about 20% of the currently known grass flora had been collected. Since 1918 the collection effort was significantly increased; among 544 and 2063 specimens per decade were collected. These new collections allowed recording more than 430 new species. In order to compare the collection effort in the fifteen political

regions in which the country is divided (Table 1), we calculated the collection index (Squeo et al., 1998):

$$CI = \text{Number of species} / \text{Number of collections} \quad (1)$$

<i>Lat °S</i>	<i>Region</i>	<i>Number of observed taxa</i>	<i>Mean number of estimated taxa*</i>	<i>Represented percentage</i>	<i>Estimated number of unknown taxa</i>	<i>NCO</i>	<i>CI</i>
17°30'-19°06'	AP	109.0	150.5	72.4	41.5	429	0,23
18°56'-21°39'	TA	73.0	120.0	60.9	47.0	250	0,34
20°56'-26°05'	AN	125.0	181.0	69.1	56.0	853	0,11
25°17'-29°11'	AT	106.0	173.8	61.0	67.8	385	0,20
29°02'-32°16'	CO	167.0	237.8	70.2	70.8	888	0,16
32°02'-33°57'	VA	186.0	253.6	73.3	67.6	1055	0,16
32°55'-34°19'	ME	198.0	260.6	76.0	62.6	1375	0,13
33°51'-35°01'	OH	89.0	161.7	55.0	72.7	172	0,49
34°41'-36°33'	MA	172.0	261.6	65.8	89.6	648	0,25
36°00'-38°30'	BB	263.0	337.0	78.0	74.0	3118	0,07
37°35'-39°37'	AR	188.0	244.2	77.0	56.2	1254	0,14
39°16'-40°07'	LR	143.0	185.5	77.1	42.5	742	0,18
40°07'-44°04'	LL	131.0	202.3	64.8	71.3	634	0,19
43°38'-49°16'	AY	112.0	179.6	62.4	67.6	373	0,26
48°39'-62°22'	MG	158.0	195.3	80.9	37.3	1829	0,07

Table 1. Poaceae diversity of Chile at national and regional level. NCO = number of collected specimens, CI = collection index, Regions: AP = Arica and Parinacota, TA = Tarapacá, AN = Antofagasta, AT = Atacama, CO = Coquimbo, VA = Valparaíso, ME = Metropolitan, OH = O'Higgins, MA = Maule, BB = Bío-Bío, AR = Araucanía, LR = Los Ríos, LL = Los Lagos, AY = Aysén, MG = Magallanes and Antarctica Chilena. \*Mean value of ICE, Chao2, Jackknife1, Jackknife2, Bootstrap and Michaelis-Menten estimators.

The collection index takes values ranging from 1 to near zero. Value 1 indicates poor collection effort while values near to 0 indicate that the region is over-collected (Squeo et al., 1998). Collections are not uniformly distributed along the country; on the contrary, some regions have been collected more or less intensely (e.g. Bío-Bío, Metropolitan, Magallanes, Araucanía, Valparaíso), while others regions (e.g. O'Higgins, Tarapacá and Aysén) have been weakly collected (Table 1, Fig. 5). The species accumulation curves allow the estimation of species richness from a sample and to compare the species richness of different areas. The accumulation curve for the country together with the curves of the five species richness estimators are shown in Fig. 3. The accumulation curve for the all country tends to be asymptotic (Fig. 3) and the mean number of estimated taxa (Table 1) indicated that our database included about 85.5% of the taxa expected to be found in Chile. There are about 70 taxa not yet collected, nevertheless, these indicators show that the overall knowledge of



Fig. 1. Grassland communities in Aysén, Chile (R. Wilckens & F. Silva).

Chilean grasses is good enough. On the other hand, the species accumulation curves at regional level (Fig. 4) show the number of taxa collected as a function of sampling effort (time) for each political region. Figure 4 show that the regions with lower richness are Tarapacá (TA), O'Higgins (OH), Atacama (AT) and Aysén (AY), while those with higher species richness are Bío-Bío (BB), Metropolitan (ME), Araucanía (AR) and Valparaíso (VA). According to Table 1, only 55% of the expected taxa for the region of O'Higgins are represented in the botanical collections.

The species richness of Poaceae along the country is shown in Fig. 5. The regions located in northern Chile, Arica and Parinacota (AP), Tarapacá (TA), and Antofagasta (AN), known collectively as "Norte Grande" (Far North), and the regions of Atacama and Coquimbo, known as "Norte Chico" (Near North), are characterized by its desert climate because of the presence of the Atacama Desert. In the Far North, the diversity of grasses reaches relatively low values when compared with the regions of central and southern Chile.

In Arica and Parinacota, there are 109 taxa (68% non-endemic native, 5.94% endemic, and 15.84% introduced), belonging to six subfamilies (Bambusoideae and Ehrhartoideae are absent in northern Chile), and 42 genera. The taxonomic biodiversity is higher than in the other regions of the Far North. Six endemic species were detected in Arica and Parinacota: *Anatherostipa venusta*, *Bromus gunckelii*, *Cynodon nitidus*, *Festuca panda*, *Nassella pungens*, and *Trisetum johnstonii* subsp. *mattheii*, the latter species is an endemic at regional level.

In Tarapacá there were 73 taxa in six subfamilies and 36 genera; however, the collection effort is lower than in the adjacent regions; four species endemic to Chile were present in this region: *Anatherostipa venusta*, *Bromus gunckelii*, *Cynodon nitidus*, and *Polypogon linearis* Trin.



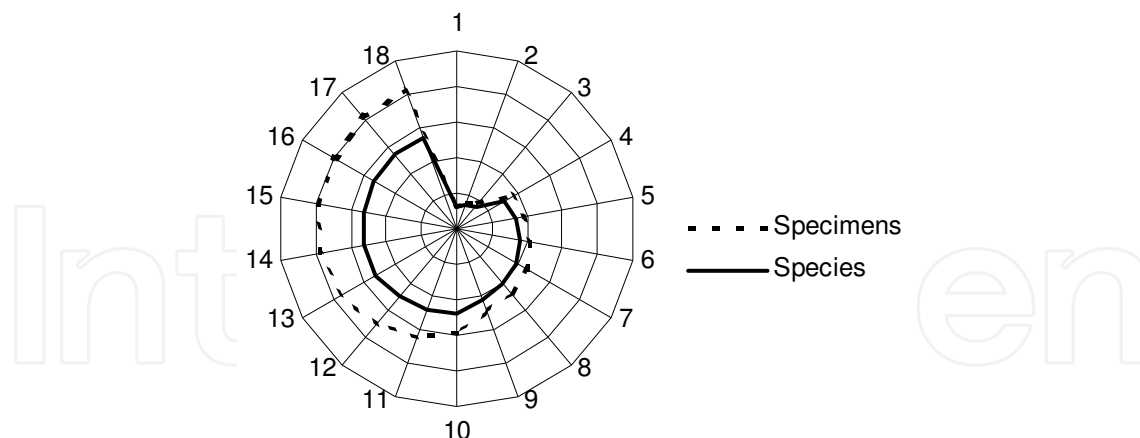


Fig. 2. Accumulated number of specimens and accumulated number of species collected in Chile in the 18 decades between 1828 and 2007.

In Antofagasta there were 125 taxa, and a greater collection effort (Table 1); in comparison with the other two regions of "Norte Grande", in Antofagasta reside a greater number of endemic species: *Anatherostipa venusta*, *Festuca morenensis*, *F. tunicata*, *F. werdermannii*, *Jarava matthei*, *J. tortuosa*, *Nassella pungens*, *Poa paposana*, and *Polypogon linearis*.

In the near north, we found two regions: Atacama (AT) and Coquimbo (CO), located between the hyper-arid region of Antofagasta and the more fertile region of Central Chile, between the rivers Copiapó and Aconcagua. In Atacama, only 106 taxa were recognized, of which 58 are native or endemic, while other six species were included in the Catalogue of the vascular flora of Atacama (Squeo et al. 2008). Nevertheless, the collection index shows a relatively small collection effort for grasses in Atacama (Table 1). Endemic species in Atacama are *Festuca werdermannii*, *Jarava tortuosa*, *Nassella duriuscula*, *N. pungens*, and *Poa paposana*.

In Coquimbo there is an increase of the taxonomic biodiversity, coupled with an increased collection effort. The number of taxa reaches 167, which corresponds to the highest for Poaceae in northern Chile. According to the Catalogue of the vascular flora of Coquimbo (Marticorena et al., 2001), the flora of this region (native and naturalized) includes 1727 species of which nearly 9% belong to Poaceae. An analysis of the biodiversity of Coquimbo (Squeo et al., 2001) mentions 104 species of Poaceae, the second most diverse family after Asteraceae in Coquimbo. An increase in the number of endemic grasses also takes place (Table 1). There are 26 endemic grasses belonging to 12 genera. The high degree of endemic species of Poaceae coincides with the high degree of endemism present in this region (53.5% of the vascular flora is endemic to Chile) (Squeo et al., 2001). The subfamily Bambusoideae has its septentrional limit of distribution in the region of Coquimbo. In Fray Jorge, there are 11 species of Poaceae, including *Chusquea cumingii* (Arancio et al., 2004), which represents the northernmost record of subfamily Bambusoideae in Chile.

Central Chile includes the regions of Valparaíso, Metropolitana, O'Higgins, Maule and Bío-Bío, approximately between 32° and 36°S. The high degree of anthropic pressure in central Chile is reflected in the greatest number of introduced species (approx. 10-16% of grasses are adventives). Due to the high percentage of endemic species, the high percentage of introduced species is disquieting as most of them are invasive weeds (Matthei, 1995). As has



been pointed out, invasive species play a major role in displacing native plants and are the second leading threat to biodiversity following habitat destruction (Holcombe et al., 2010). It has been suggested that approximately 690 species of alien plants have been introduced and became naturalized in Chile, 507 of which reside in the Mediterranean area of central Chile; Poaceae is the most important family, with 151 species (Arroyo et al., 2000).

Easter Island (Isla de Pascua, Rapa Nui) belongs to the Region of Valparaíso in central Chile (27°9'S, 109°27'W) and lies 3700 km off the Chilean coast. The island has a small amount of vegetation. Currently, there are 22 genera and about 200 species of seed plants, most of them introduced (Mann et al., 2003). Introduced grasses (Poaceae) dominate the vegetation while native species number about forty-six. Only eight endemic species remain. All trees are introduced species. The endemic tree *Sophora toromiro* Skotts. (Fabaceae) disappeared in the 1950's, probably due to animal grazing and anthropogenic impact. A major effort to reintroduce this species on the island has been done by CONAF (Corporación Nacional Forestal) and Jardín Botánico Nacional of Chile. Among grass species *Rytidosperma paschalis* is endemic. Introduced grasses in Easter Island are *Agrostis stolonifera*, *Austrostipa scabra* (sometimes cited as *Stipa horridula* Pilg.), *Avena fatua*, *Briza minor*, *Cenchrus clandestinus*, *C. echinatus*, *Chloris gayana*, *Cynodon dactylon*, *Dichelachne micrantha*, *Digitaria ciliaris*, *D. setigera*, *D. violascens*, *Eleusine indica*, *Eragrostis atrovirens*, *Gastridium phleoides*, *Hordeum murinum*, *Lachnagrostis filiformis*, *Lolium perenne*, *Melinis repens*, *Poa annua*, *Setaria parviflora*, *Sorghum halepense*, *Sporobolus indicus*, *S. africanus* (cultivated for grazing purpose), and *Vulpia myuros*. Native grasses: *Axonopus compressus* (sometimes cited under the name *A. paschalis*) *Bromus catharticus*, *Paspalum dasyleurum*, *P. dilatatum*, *P. forsterianum*, and *P. scrobiculatum* var. *orbiculare* (Giraldo-Cañas, 2008; Mann et al., 2003; Markgraf, 2003; Matthei, 1995; Skottsberg, 1956; Steadman, 1995).

In the archipelago of Juan Fernández (Region of Valparaíso), Poaceae is represented by approximately 35 genera and 61 species. Most of the species belong to the subfamily Pooideae (44 spp., 72%) and Panicoideae (9 spp., 14%). Only two Bambusoideae are found, *Chusquea fernandeziana*, endemic to Masatierra, and *C. culeou* (Baeza et al., 2007), one cultivated species of the subfamily Arundinoideae (*Arundo donax*), two species of Danthonioideae (*Danthonia chilensis* and *D. malacantha*), and two species of Chloridoideae (*Cynodon dactylon* and *Eleusine tristachya*). Five species are endemic: *Agrostis masafuerana* Pilg. (Masafuera), *Chusquea fernandeziana* (Masatierra), *Megalachne berteriana* and *M. masafuerana* (Masatierra and Masafuera), and *Podophorus bromoides* possibly extinct (Baeza et al., 2002; Baeza et al., 2007). *Polypogon imberbis* is considered endemic to Juan Fernández, but occasionally found in continental Chile (Müller, 1985). *Megalachne* and *Podophorus* are endemic genera.

The regions with greater diversity of Poaceae in Central Chile were Bío-Bío, Metropolitan, and Valparaíso, with 263, 198, and 186 taxa, respectively. According to our data, 57 species of grasses from 21 genera of grasses endemic to Chile are found in the area of the Chilean hotspot. On the other hand, O'Higgins is the most weakly collected region in Central Chile. Our data show that only 55% of the estimated grass flora in this region is represented in the Herbarium collections.

Southern Chile includes the regions of Araucanía, Los Ríos and Los Lagos, from approx. 37°S to 43°S. The Region of Araucanía is the best collected. There are 188 known taxa of Poaceae, of which 57 are introduced and 14 are endemic: *Anthoxanthum altissimum*, *A. spicatum*, *Bromidium trisetoides*, *Chusquea quila*, *Danthonia araucana*, *D. chilensis* var. *aureofulva*, *Deschampsia monandra*, *Gymnachne koelerioides*, *Melica violacea*, *Nassella duriuscula*, *N. juncea*

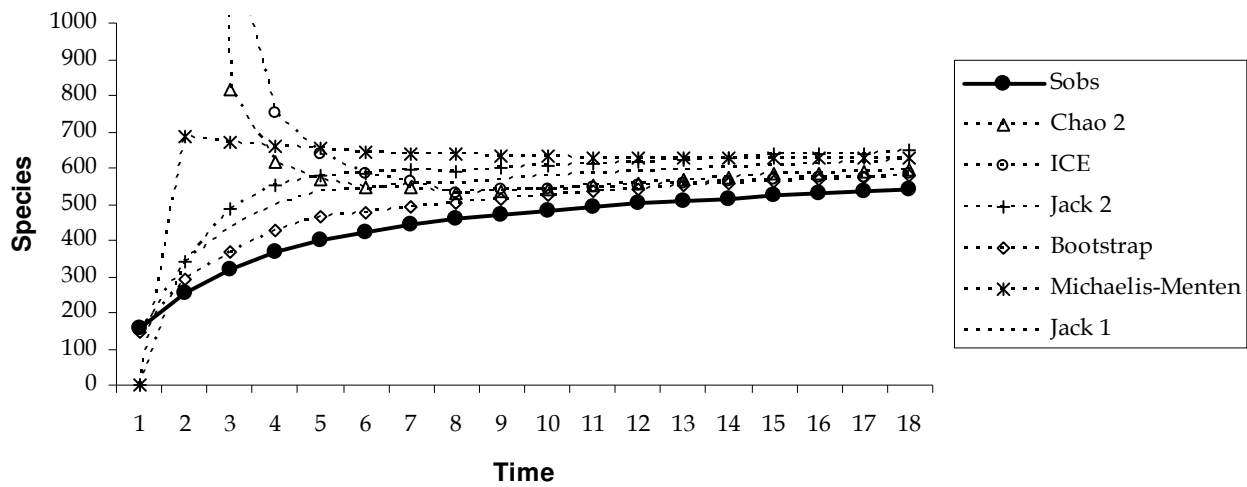


Fig. 3. Species accumulation curve of observed species (Sobs) in Chile and curves of estimated number of species calculated using the indices Chao 2, ICE, Jackknife 1, Jackknife 2, Bootstrap y Michaelis-Menten.

and *N. macrathera*, *Phalaris amethystina*, and *Poa cumingii*. In the region of Los Ríos 143 taxa were collected, 46 of which are introduced and 13 are endemic to Chile. Endemic species are the following: *Alopecurus lechleri*, *Anthoxanthum altissimum*, *Chusquea macrostachya*, *C. montana*, *C. quila*, *C. uliginosa*, *Danthonia araucana*, *D. chilensis* var. *aureofulva*, *Melica violacea*, *Nassella duriuscula*, *N. juncea* and *N. macrathera*, and *Poa cumingii*. In Los Lagos, 131 taxa were recorded, 38 introduced species, and eight endemic species (*Agrostis insularis*, *Anthoxanthum altissimum*, *Chusquea macrostachya*, *C. montana*, *C. quila*, *C. uliginosa*, *Poa cumingii*, and *Polypogon linearis*).

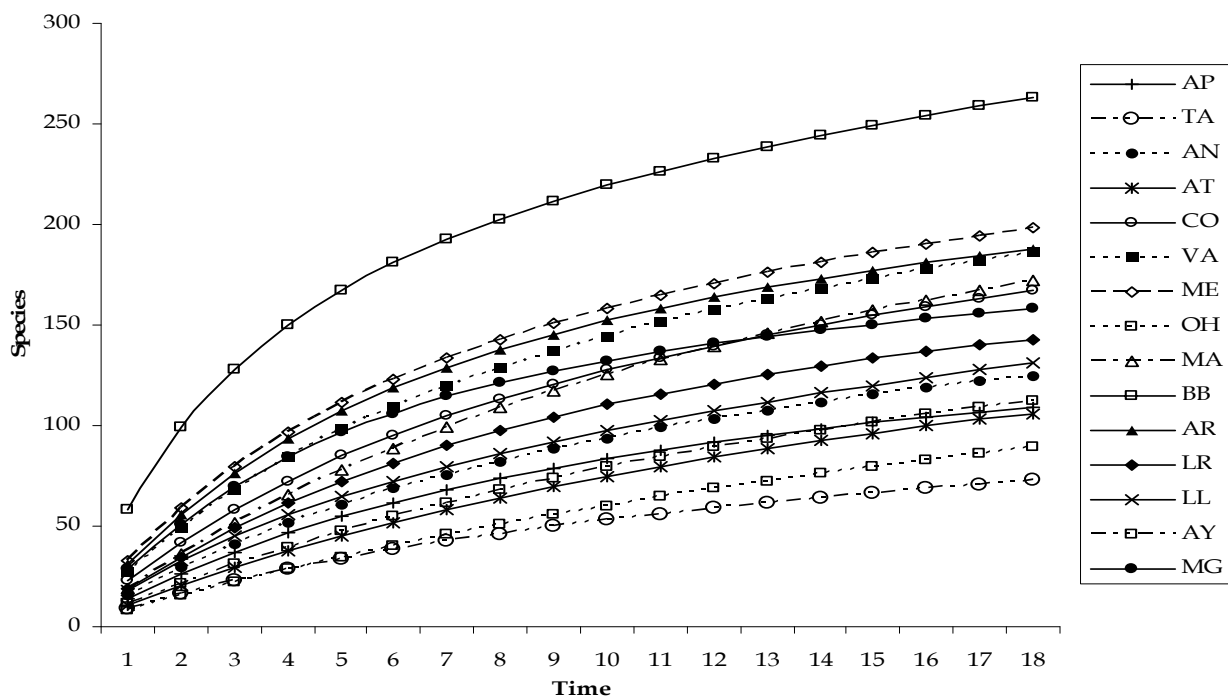


Fig. 4. Species accumulation curves of observed species (Sobs) in the fifteen political regions of Chile. See Table 1 for abbreviations of the regional names.

Austral Chile, also known as Chilean Patagonia, includes the regions of Aysén and Magallanes and extends from about 43°S to the south. While Aysén has been weekly collected, Magallanes is one of the best known from a floristic point of view (Fig. 5). In Aysén 112 grass species have been collected (Table 1), including 77 native species, 19 introduced species and 4 endemic species (*Anthoxanthum altissimum*, *Chusquea montana*, *C. quila*, and *C. uliginosa*). In Magallanes 158 species have been collected (Table 1). Endemic species in this region are *Alopecurus helechloides*, *Festuca magensiana*, *Hordeum brachyatherum*. Introduced species number 38 and native species number 117.

## 5. Taxonomic diversity of Chilean grasses

In Chile, Poaceae number approximately 523 species and 57 infraspecific taxa, distributed in 122 genera (Table 2), representing about 10.1% of the Chilean flora. Poaceae is the second most diverse family of angiosperms in Chile after Asteraceae with about 863 species (Moreira-Muñoz & Muñoz-Schick, 2007). Of the 13 subfamilies of Poaceae, eight are present in Chile. As expected, most of the Chilean grasses (388 spp., 75%) belong to the subfamily Pooideae, followed by a few Panicoideae (59 spp., 10%), and Chloridoideae (43 spp., 7.9%). Species are distributed in 17 tribes and 43 subtribes. Three-hundred and fifty six species (68%) are native, 58 species (11%) are endemic and 109 species and 12 varieties (21%) are introduced. Percentages of native, introduced and endemic species in each political region are shown in Fig. 6. Endemic species belong to 23 genera in four subfamilies: Bambusoideae (7 spp.), Chloridoideae (1 sp.), Danthonioideae (3 spp.), and Pooideae (47 spp.).

Subfamily	Tribes	Subtribes	Genera	Species	Infraspecific taxa	Total taxa	Total %
Aristidoideae	1	1	1	3	0	3	0.52
Arundinoideae	1	1	2	2	0	2	0.35
Bambusoideae	1	1	1	10	1	11	1.89
Chloridoideae	3	9	16	43	3	46	7.93
Danthonioideae	1	1	4	20	4	24	4.13
Ehrhartoideae	2	2	2	2	0	2	0.35
Panicoideae	2	10	19	55	4	59	10.17
Pooideae	6	18	77	388	45	433	74.65
Total	17	43	122	523	57	580	100.00

Table 2. Number of tribes, subtribes, genera, species, and infraspecific taxa in the eight subfamilies of Poaceae present in Chile.

The arrangement of the genera of Poaceae according to the classification of (Soreng et al., 2009) is shown in Table 3. Under each subfamily each species is mentioned. Introduced species are indicated with and asterisk (\*), and endemic species are bold faced.

### 5.1 BEP clade

The three subfamilies of the BEP clade grow in Chile (Bambusoideae, Ehrhartoideae, Pooideae) but only two (Bambusoideae and Pooideae) include native species. The BEP clade comprises the majority of the Chilean grasses (ca. 450 spp, ca. 80%).

### 5.1.1 Bambusoideae

Bambusoideae are represented in Chile only by the genus *Chusquea* (Bambuseae, Chusqueinae). This diverse genus comprises some 134 described species; notwithstanding, some 70 species remain undescribed (Judziewicz et al. 1999). The genus *Chusquea* is exclusively American, growing from Mexico to Chile and Argentina, from approximately 24°N to 47°S and from sea level to approximately 4000 m of altitude. Ten species and one variety grow in Chile, seven species are endemic (Tables 2 and 3). In Chile, the species of *Chusquea* are usually associated to forest margins, from approx. 30°S (Coquimbo) to 46°40'S (Aysén), and from the sea level to 2300 m in the Andes. The most widely distributed species in Chile is *C. culeou* (coligüe), living from Choapa (31 ° S) to Aysén (45 °S) between the sea level to ca. 2000 m of altitude; this species lives also in Argentina. Common to Chile and Argentina are also *C. andina*, *C. montana* f. *montana* (tihuén) and *C. valdiviensis* (quila del sur). Although *C. quila* (quila) is considered endemic to Chile, some botanists considered it a synonym of *C. valdiviensis* (Nicora, 1978; Parodi, 1945). Even though *C. quila* has been collected between Valparaíso (33°S) and Aysén (44°S) it has its main distribution between Valparaíso and Ñuble (approx. 36°S), while *C. valdiviensis* is distributed mainly from the Araucanía Region (38°S) to the south (Chiloé, 43°S). *Chusquea andina* lives in the central-southern regions of Bío-Bío and Araucanía, above the tree line in the Andes. *Chusquea montana* f. *montana* grows between Ñuble (36°S) and Chiloé (46°S), as well as *C. valdiviensis*. Endemic to Chile are *C. ciliata*, *C. cumingii*, *C. fernandeziana*, *C. macrostachya* (quila), *C. montana* f. *nigricans* (quila enana), *C. quila* and *C. uliginosa*. *Chusquea ciliata* is endemic to the Region of Valparaíso. *Chusquea fernandeziana* is endemic to the Robinson Crusoe or Juan Fernández archipelago, where is found in Masatierra on outcrops between rocks, ravines or forest, usually isolated and sparse (Baeza et al., 2002). When Munro describes *C. ligulata* from Cundinamarca (Colombia), he includes under this name a sterile specimen collected by Bertero in Juan Fernández that possibly corresponds to *C. fernandeziana* (Parodi, 1945). This is, probably, the reason why *C. ligulata* is included sometimes as a synonym of *C. fernandeziana*. However, *C. ligulata* is closer to or conespecific with *C. sneidernii* Asplund of section Longiprophyllae, not to *C. fernandeziana* (Clark, 1990). *Chusquea cumingii* grows between Limarí (Region of Coquimbo, 30 °S) and Ñuble (36 °S), usually below 1500 m of altitude. *Chusquea macrostachya* has been collected between Santiago and Chiloé (33-43°S) but it is found more frequently in the southern regions of the country into the forest under the canopy or in canopy gaps as well as in roadsides. *Chusquea uliginosa* (quila de los ñadis), is found from Valdivia to Aysén (39-44°S), below 1500 m of altitude, in the central valley. The species of *Chusquea* are known in Chile by the vernacular names “coligües” or “quilas”. Indigenous people (“mapuches”) used the culms of *C. culeou* (coligüe) to build partitions inside their houses (“rucas”), musical instruments (“trutucas”) or fences, and used quilas (*C. quila*, *C. cumingii*), as forage for livestock. Currently, craftsmen use coligües to build furniture. Although coligües are not widely used in the industry, some properties like specific gravity, fiber length and chemical constitution suggest that this plant could be used as raw material for paper and for particle or fiber board production (Poblete et al., 2009).

### 5.1.2 Ehrhartoideae link

In Chile, Ehrhartoideae are absent from the native grass flora, but both the cultivated (rice) and wild rice (red rice, *Oryza sativa*) are found. Approximately 25,000 ha of rice are grown in a small south-central area of the country, located between O'Higgins (34°S) and Bío-Bío



(36°S), which is the southernmost region of the rice crop in the world. In the same area, wild red rice is found, one of the most problematic weed of rice production in temperate countries (Gealy et al., 2003). *Ehrharta calycina* is native to southern Africa (Barkworth et al., 2007); it has been collected in pastures in Elqui and cultivated in Rinconada de Maipú Experimental Station of University of Chile, Metropolitan Region.

### 5.1.3 Pooideae benth

In Chile, Pooideae encompasses six tribes and 18 subtribes with nearly 396 species in 76 genera (Table 1). Pooideae are distributed from the north end of Chilean territory (17°30'S) to the Region of Magallanes and Antartica Chilena (62°S), and from sea level to 5250 m of altitude. Species of *Anthochloa* (*A. lepidula*), *Catabrosa* (*C. werdermannii*), *Dielsiochloa* (*D. floribunda*), *Deyeuxia* (*D. breviaristata*, *D. cabreræ* var. *trichopoda*, *D. crispa*, *D. deserticola*), *Festuca* (*F. orthophylla*), *Nassella* (*N. nardoides*), *Pappostipa* (*P. frigida*), *Poa* (*P. humillima*, *P. gymnantha*) are found at high altitude (approx. 4000-5250 m), in northern Chile [Region of Arica and Parinacota (17-18°S) and Region of Antofagasta (21-22°S)]. Some genera, like *Anthochloa*, *Dielsiochloa*, and *Dissanthelium*, are restricted to northern Chile (18-21°S). Some taxa are restricted to central Chile, like the endemic and monotypic *Gymnachne* (*G. koelerioides*) (32°S, Quillota, Region of Valparaíso to 38°S, Cautín, Region of Araucanía), *Helictotrichon bulbosum* (restricted to Ñuble and Concepción, Region of Bío-Bío), *Apera interrupta* (33-38°S, Santiago to Malleco), *Calotheca brizoides* (34-38°S). Genera whose distribution is restricted mainly to southern Chile are *Vahlodea* (Santiago but mainly from Valdivia to Puerto Williams), *Alopecurus* (Choapa but mainly from Santiago to Magallanes), *Anthoxanthum* (mainly from Ñuble to Tierra del Fuego). The largest genera are *Poa* (48 spp.), *Nassella* (ca. 30 spp.), *Agrostis* (28 spp.), *Festuca* (26 spp.), *Bromus* (23 spp.), *Deschampsia* (15 spp), *Jarava* (13 spp.) and *Trisetum* (11 spp.). Several genera are monotypic (*Dielsiochloa*, *Dichelachne*, *Leptophyllochloa*, *Gymnachne*, *Hainardia*, *Podagrostis*).

Tribe **Brachypodieae** is represented only by one genus and one species, *Brachypodium distachyon* introduced from southern Europe, this species grows in roadsides in central Chile, from the Region of Valparaíso to the Region of Bío-Bío (32-37°S), as well as in Juan Fernández archipelago. Tribe **Meliceae** comprises the genera *Glyceria* with two species and *Melica* represented by eight species (Table 3). *Glyceria* is represented only by the Eurasiatic *G. fluitans* (L.) R. Br., and a native species *G. multiflora* Steud., inhabiting from Chacabuco (33°S) to Última Esperanza (50°S). *Melica* comprises eight species (including *M. cepacea* sometimes classified in the genus *Bromelica*), seven endemic. Genus *Melica* is distributed mainly in central-southern Chile, between 27°50'S and 40°15'S, and from sea level to 2000 m of altitude (Muñoz-Schick, 1985). Three species are considered vulnerable: *M. longiflora*, *M. paulsenii*, and *M. poecilantha* (Squeo et al., 2001). Tribe **Stipeae** includes 21 genera and more than 500 species of which 279 live in the New World in temperate regions in both hemispheres, growing mainly in dry open grasslands and steppe communities. Most species of the New World Stipeae (approx. 80%) are South American (Romaschenko et al., 2008). Tribe Stipeae includes nine genera in Chile. *Amelichloa* Arriaga & Barkworth was described recently on the basis of five species segregated from genus *Stipa*, three of which grow in central-southern Chile (Arriaga & Barkworth, 2006). *Anatherostipa* (Hack. ex Kuntze) Peñailillo, was segregated from *Stipa* (Peñailillo, 1996), to include 11 species, four of which grow in Chile, restricted to the Andes of the northern regions (17-25°S) from 3400 to 4600 m of altitude. The South American genus *Jarava* Ruiz & Pav., includes 13 species widely distributed in Chile, mainly from the Andes and Patagonia, between 18°S and 50°S. *Nassella*,

being the largest genus of the tribe Stipeae in Chile, encompasses about 30 species, 10 of which are endemic. The genus *Nassella* ranges, approximately, between 17°S and 43°S. Two species of genus *Ortachne*, *O. breviseta* and *O. rariflora* inhabit the subantarctic forests. *Ortachne breviseta* grows between Valdivia and Llanquihue (39-41°S) and *O. rariflora* between Chiloé and Tierra del Fuego (42-55°S), and from sea level to 1700 m of altitude. The genus *Pappostipa* includes six species in Chile distributed between Arica (18°S) and Magallanes (53°S). *Pappostipa chrysophylla*, *P. ibari* and *P. humilis* are restricted to or have its main distribution in southern Chile. On the contrary, *P. atacamensis* and *P. frigida* are distributed primarily in northern Chile. *Pappostipa speciosa* is widely distributed in Chile and it is found also in the northern hemisphere. The genus *Piptatherum* is introduced. *Piptochaetium* includes seven species distributed from Limarí (Coquimbo) to Osorno (Los Lagos). Tribe **Poeae** is by far the largest in species number, with 58 genera and more than 290 species or 72%. The largest genera are *Poa* (48 spp.), *Agrostis* (28 spp.), *Festuca* (27 spp.), *Deyeuxia* (26 spp.), *Deschampsia* (15 spp), *Trisetum* (11 spp.), and *Anthoxanthum* (8 spp.). A large number of genera in this tribe are represented by only one or two species, such as *Bromidium*, *Calotheca*, *Chascolytrum*, *Dielsiochloa*, *Helictotrichon*, *Gymnachne*, *Leptophyllochloa*, *Megalachne*, *Podophorus*, *Relchela*, *Rhombolytrum*, etc. Twenty-five taxa of Poeae are endemic to Chile: *Agrostis umbellata*, *A. masafuerana*, *A. arvensis*, *A. insularis*, *Alopecurus heleochloides*, *A. lechleri*, *Anthoxanthum altissimum*, *A. spicatum*, *Bromidium trisetoides*, *Deschampsia setacea*, *D. looseriana*, *D. monandra*, *Festuca magensiana*, *F. morenensis*, *F. panda*, *F. tunicata*, *F. werdermannii*, *Gymnachne koelerioides*, *Phalaris amethystina*, *Poa cumingii*, *P. paposana*, *P. pfisteri*, *Polypogon linearis*, *Trisetum johnstonii* subsp. *mattheii*, and *T. nancaguense*. Tribe **Triticeae** includes some economically important species, such as wheat, rye, triticale, and barley, grown in the temperate regions of the world. In Chile, Triticeae comprises seven genera: *Agropyron*, represented only by *A. cristatum* an introduced species growing only in Magallanes, *Elymus*, *Hordeum*, *Leymus*, *Secale*, *Taeniatherum* and *Triticum*. Only *Hordeum* and *Elymus* contain native species and only one endemic species is found in this tribe, *Hordeum brachyaterum*. Tribe **Bromeae** includes only the genus *Bromus*, with 24 species. *Bromus gunckelii* is an endemic species of northern Chile. *Bromus mango* was used by indigenous people (mapuches) as a cereal grain. This species is probably extinct (Mösbach, 1999).

## 5.2 PACMAD clade

Five subfamilies of Chilean Poaceae belong to the PACMAD clade: Aristidoideae, Arundinoideae, Danthonioideae, Panicoideae and Chloridoideae.

### 5.2.1 Aristidoideae Caro

In Chile, only the genus *Aristida* is present, with three native species. Genus *Aristida* is distributed from Arica and Parinacota (ca. 18°S) to Araucanía (Malleco, 37°50'S). *Aristida adscensionis* is found in northern-central Chile (approx. 18°S-33°S), and *A. pallens* and *A. spegazzinii* in central-southern Chile (approx. 35-37°S). It has been established (Matthei, 1987) that *A. longiseta* previously cited for Chile (Marticorena & Quezada, 1985) is absent in Chile.

### 5.2.2 Arundinoideae Burmeister

Arundinoideae comprises two species, *Arundo donax* and *Phragmites australis*; both species are tall reeds of wet places. *Phragmites australis* is a weed of rice fields (Matthei, 1995); *A. donax* is sometimes cultivated as ornamental.

### 5.2.3 Danthonioideae P.H. Linder & N.P. Baker

Subfamily Danthonioideae is represented in Chile by four genera (*Cortaderia*, *Danthonia*, *Rytidosperma* and *Schismus*), and 19 species. Some species of *Cortaderia*, known as “cola de zorro” or “Ngerü-quëlen” (Mösbach, 1999) are used as ornamental plants. Species of *Schismus* (*S. arabicus* and *S. barbatus*) are ruderal and agricultural weeds in Central Chile (Matthei, 1995). *Danthonia* comprises four species and two varieties distributed from the region of Coquimbo (32°S) to the region of Los Lagos (Chiloé, 42°50'S). *Rytidosperma* includes five species in Chile, from the region of Coquimbo (Limarí, 30°40'S) to Magallanes (Tierra del Fuego, 52°50'S). *Cortaderia* includes six species distributed from Arica and Parinacota (18°S) to Magallanes (Wollaston island, 55°44'S). *Danthonia araucana*, *D. chilensis* var. *aureofulva*, and *R. quirihuense* are endemic species.

### 5.3 Panicoideae Link

Panicoideae consists of two tribes, 10 subtribes, 18 genera and about 50 species in Chile (Table 2). Tribe **Andropogoneae** is represented by the genera *Cymbopogon* (*C. citratus*) in northern Chile, *Schizachyrium* (*S. sanguineum*, *S. spicatum*) in Central Chile, *Imperata* (*I. condensata*) from Copiapó to Valdivia, *Miscanthus* (*M. sinensis*), cultivated in Central Chile, *Bothriochloa* (*B. laguroides* and *B. saccharoides* in Central Chile, *B. ischaemum* in Easter Island), *Sorghum* (*S. bicolor*, *S. halepense*), widely distributed in northern and central Chile (*S. halepense* is a serious agricultural weed from Arica and Parinacota to the region of Araucanía and Easter Island) (Matthei, 1995). *Zea mays* is cultivated (corn), but also commonly found in roadsides. Tribe **Panicaceae** is represented by some 39 species in 11 genera, most of them have been mentioned as summer weed of agricultural fields in Chile. Genus *Cenchrus* contains seven species, from northern and central Chile, some of them reported as common weeds (*C. incertus*, *C. clandestinus*, *C. myosuroides*, *C. chilensis*, *C. longisetus*). In addition, all species of genus *Digitaria* in Chile have been reported as weeds in agricultural fields, however, the most important because of its geographical distribution is *D. sanguinalis*, living from Huasco (Atacama) to Valdivia (Los Rios) and Juan Fernández. *Digitaria setigera* and *D. violascens* are introduced weeds in Easter Island (Matthei, 1995). *Eriochloa montevidensis* has been reported only from Valle de Azapa (Arica) as a weed in agricultural and ruderal fields. *Melinis repens* was also reported as a weed species introduced in Easter Island (Matthei, 1995). *Dichanthelium sabulorum* occurs in central-southern Chile (Maule, Bío-Bío). *Echinochloa* includes three species (*E. colona*, *E. crus-galli*, and *E. crus-pavonis*), all of them important weeds of rice fields. Genus *Panicum* includes four or five species, two of them weeds of ruderal and agricultural places, *P. capillare* and *P. dichotomiflorum*.

Ten species of *Paspalum* have been reported, most of them as summer weeds in corn, sugar beets, rice, and other crops (Matthei, 1995). Genus *Setaria* also includes several important weed species in Chile, growing in vineyards, sugar beet, orchards, etc: *S. parviflora*, *S. pumila*, *S. verticillata*, *S. viridis*.

### 5.4 Chloridoideae Kunth ex Beilschm

Subfamily Chloridoideae comprises 16 genera and 41 species. Most of the genera are represented in Chile by only 1, 2 or 3 species. The largest genus is *Eragrostis*, comprising 12 species and two varieties (Escobar et al., 2011). Chloridoideae are present in northern, central and Southern Chile but they are rare in Austral Chile. *Bouteloua* comprises only one Arica and Parinacota, in semi-desert slopes of the Andean foothills of Arica, above 2000 m of

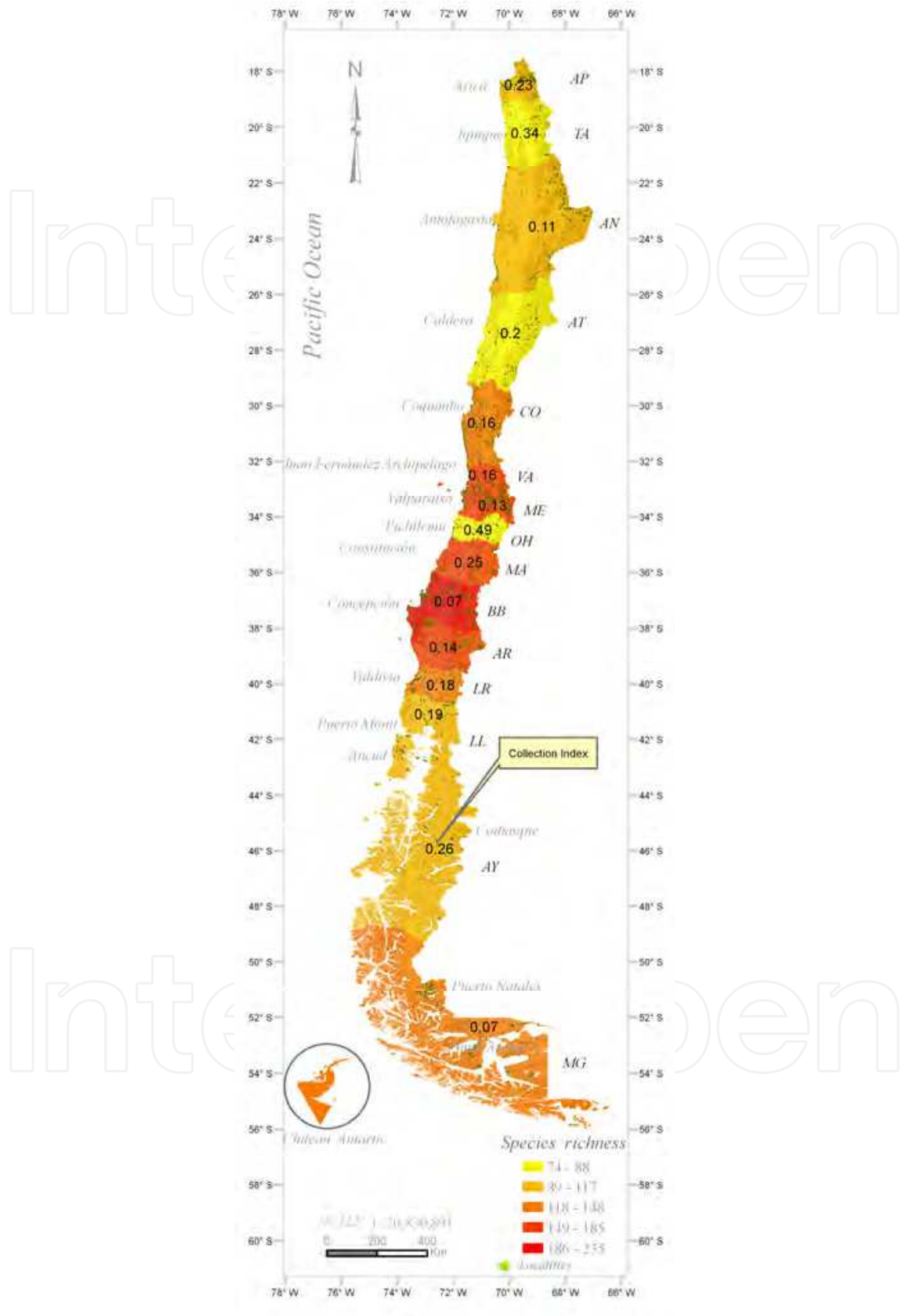


Fig. 5. Collection effort and species richness of Poaceae in the fifteen Chilean political regions. Each point represents at least one specimen.



altitude (Matthei, 1973). *Chloris* comprises three species; all introduced (*C. gayana*, *C. radiata* and *C. virgata*). *Chloris gayana* is native from Africa (Senegal); in Chile it is found only in Easter Island (Anderson, 1974; Matthei, 1995). The other two species grow in Northern Chile. *Cynodon nitidus* is endemic to Chile. *Cynodon dactylon* is a common weed in ruderal places, both in continental Chile and Easter Island. *Eleusine indica* is found only in Easter Island. *Eleusine tristachya* is a common weed of gardens as well as orchards and meadows in Central Chile. Genus *Eragrostis* comprises 12 species, eight of them native and four introduced.

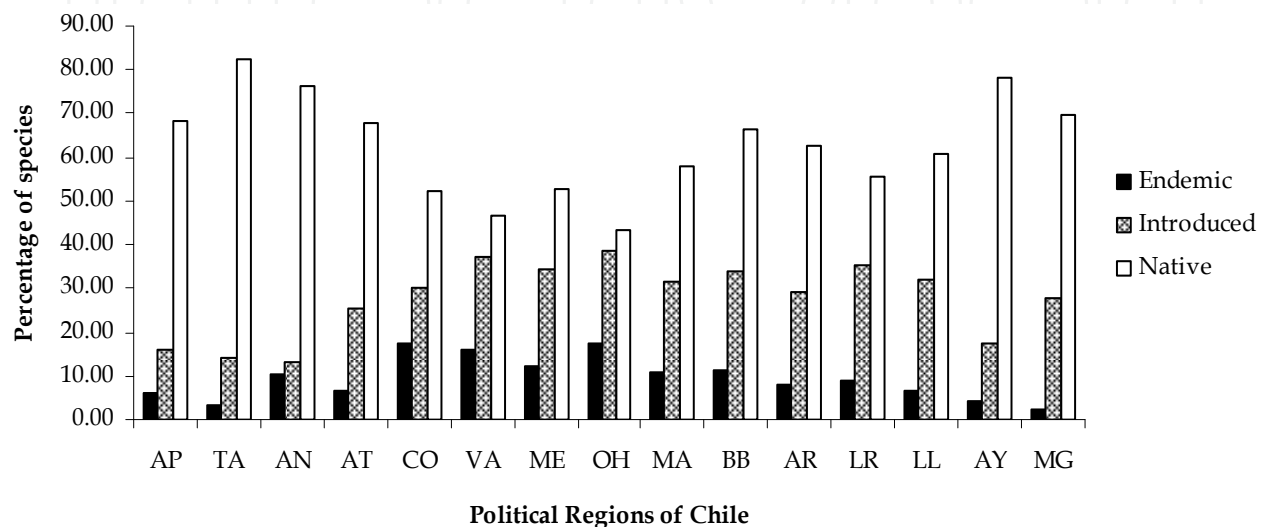


Fig. 6. Number of Endemic, introduced, and native non-endemic species in the fifteen political regions of Chile.



Fig. 7. *Chusquea culeou* in Aysén, Chile (A. Solís).

*Eragrostis pycnantha*, *E. peruviana*, *E. weberbaueri*, *E. nigricans*, and *E. kuschelii* are restricted to Northern Chile. *Eragrostis peruviana* and *E. kuschelii* grow in Islas Desventuradas (approx. 26°S). *Eragrostis atrovirens* and *E. tenuifolia*, introduced from Eurasia, grow in Easter Island. *Eragrostis polytricha* grows in Central Chile. *Spartina densiflora* (austral cordgrass), a species probably native from the east coast of South-America (Bortolus, 2006), has been reported as an invasive species in North America, Europe and Africa (Ayres et al., 2004); it grows in

Chile in salt marshes, from Concepción (Bío-Bío) to Chiloé (Los Lagos) as the dominant species of the association Sarcocornio-Spartinetum densiflorae (San Martín et al., 2006). In the same habitats are usually found species of genus *Distichlis*; *D. spicata*, can also grow as a weed of orchards and ruderal places (Matthei, 1995).

## 6. Conclusions

The family Poaceae is represented in Chile by 523 species in 122 genera and eight subfamilies. Fifty eight species from 23 genera are endemic. *Megalachne* and *Gymnachne* are endemic to Chile. Endemic species represent about 11% of the Chilean grass flora. More than 20% are introduced species. Our data, based mostly on the collections of the two most important Chilean herbaria (CONC, SGO), indicate that the present knowledge of the Chilean Poaceae is good enough. The observed species richness reaches over 88% of the estimated species richness. However, the collection index calculated for the different political regions indicates a weak collection effort in some regions (e.g. O'Higgins, Tarapacá and Aysén). New expeditions to these regions are necessary to complete the inventory, because the knowledge of the species richness depends directly on its representation in the herbaria collections.

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### SUBFAMILY BAMBUSOIDEAE LUERSS.

**Tribe Bambuseae** Dumort.

**Subtribe Chusqueinae** Soderstr. & R.P. Ellis

1. *Chusquea* Kunth: *C. andina* Phil., *C. ciliata* Phil., *C. culeou* E. Desv., *C. cumingii* Nees, *C. fernandeziana* Phil., *C. macrostachya* Phil., *C. montana* Phil. fma. *montana*, *C. montana* fma. *nigricans*, *C. quila* Kunth, *C. uliginosa* Phil. and *C. valdiviensis* E. Desv.

### SUBFAMILY EHRHARTOIDEAE LINK

**Tribe Ehrharteae** Nevski

2. *Ehrharta* Thunb.: \**E. calycina* Sm.

**Tribe Oryzeae** Dumort.

3. *Oryza* L.: \**O. sativa* L.

### SUBFAMILY POOIDEAE BENTH.

**Tribe Brachypodieae** Harz

4. *Brachypodium* P. Beauv.: \**B. distachyon* (L.) P. Beauv.

**Tribe Meliceae** Link ex Endl.

5. *Glyceria* R. Br.: \**G. fluitans* R. Br., *G. multiflora* Steud.
6. *Melica* L.: *M. argentata* E. Desv., *M. cepacea* (Phil.) Scribn., *M. commersonii* Nees ex Steud., *M. longiflora* Steud., *M. mollis* Phil., *M. paulsenii* Phil., *M. poecilantha* E. Desv., *M. violacea* Cav.

**Tribe Stipeae** Dumort.

7. *Amelichloa* Arriaga & Barkworth: *A. brachychaeta* (Godr.) Arriaga & Barkworth, *A. brevipes* (E. Desv.) Arriaga & Barkworth, *A. caudata* (Trin.) Arriaga & Barkworth
  8. *Anatherostipa* (Hack. ex Kunze) Peñailillo: *A. bomanii* (Hauman) Peñailillo, *A. mucronata* (Griseb.) F. Rojas, *A. rigidiseta* (Pilg.) Peñailillo, *A. venusta* (Phil.)
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## Peñailillo

9. *Autrostipa* S.W.L. Jacobs & Everett: \**A. scabra* (Lindl.) S.W.L. Jacobs & J. Everett
10. *Jarava* Ruiz & Pav.: *J. annua* (Mez) Peñailillo, *J. ichu* Ruiz & Pav., *J. ichu* var. *pungens* (Nees & Meyen) Ciald., *J. leptostachya* (Griseb.) F. Rojas, *J. mattheii* F. Rojas, *J. neaei* (Nees ex Steud.) Peñailillo, *J. plumosa* (Spreng.) S.W.L. Jacobs & J. Everett, *J. plumosula* (Nees ex Steud.) F. Rojas, *J. pogonathera* (E. Desv.) Peñailillo, *J. psilantha* (Speg.) Peñailillo, *J. pungionata* (Caro & E.A. Sánchez) Matthei, *J. subaristata* (Matthei) Matthei, *J. tortuosa* (E. Desv.) Peñailillo
11. *Nassella* (Trin.) E. Desv.: *N. arcuata* (R.E. Fr.) Torres, *N. asplundii* Hitchc., *N. chilensis* (Trin.) E. Desv., *N. coquimbensis* (Matthei) Peñailillo, *N. depauperata* (Pilg.) Barkworth, *N. duriuscula* (Phil.) Brakworth, *N. elata* (Speg.) Torres, *N. filiculmis* (Delile) Barkworth, *N. gibba* (Phil.) Muñoz-Schick, *N. gigantea* (Steud.) Muñoz-Schick, *N. hirtifolia* (Hitchc.) Barkworth, *N. juncea* Phil., *N. lachnophylla* (Trin.) Barkworth, *N. laevissima* (Phil.) Barkworth, *N. linearifolia* (E. Fourn.) R.W. Pohl, *N. longiglumis* (Phil.) Brakworth, *N. macrathera* (Phil.) Barkworth, *N. manicata* (E. Desv.) Barkworth, *N. nardoides* (Phil.) Barkworth, *N. neesiana* (Trin. & Rupr.) Barkworth, *N. parodii* (Matthei) Barkworth, *N. pfisteri* (Matthei) Barkworth, *N. phillippii* (Steud.) Barkworth, *N. poeppigiana* (Trin. & Rupr.) Barkworth, *N. pubiflora* (Trin. & Rupr.) E. Desv., *N. pungens* E. Desv., *N. rupestris* (Phil.) Torres, *N. tenuis* (Phil.) Barkworth, *N. tenuissima* (Trin.) Barkworth
12. *Ortachne* Nees ex Steud.: *O. breviseta* Hitchc., *O. rariflora* (Hook. f.) Hughes
13. *Pappostipa* (Speg.) Romasch., P.M. Peterson & Soreng: *P. atacamensis* (Parodi) Romasch., *P. chrysophylla* (E. Desv.) Romasch. var. *chrysophylla*, *P. chrysophylla* var. *cordilleranum* (Parodi) Romasch., *P. frigida* (Phil.) Romasch., *P. humilis* (Cav.) Romasch., *P. ibarii* (Phil.) Romasch., *P. speciosa* (Trin. & Rupr.) Romasch., *P. vaginata* (Phil.) Romasch.
14. *Piptatherum* P. Beauv.: \**P. miliaceum* (L.) Coss.
15. *Piptochaetium* J. Presl: *P. angolense* Phil., *P. bicolor* (Vahl) E. Desv., *P. hirtum* Phil., *P. montevidense* (Spreng.) Parodi, *P. panicoides* (Lam.) E. Desv., *P. setosum* (Trin.) Arechav., *P. stipoides* (Trin. & Rupr.) Hack. ex Arechav. var. *stipoides*, *P. stipoides* var. *equinulatum* Parodi

## Supertribe Poodae L. Liou

## Tribe Poeae R. Br.

## Subtribe Agrostidinae Fr.

17. *xAgropogon* P. Fourn.: \**xA. lutosus* (Poir.) P. Fourn.
18. *Agrostis* L.: *A. arvensis* Phil., *A. brachyathera* Steud., *A. breviculmis* Hitchc., \**A. capillaris* L., \**A. castellana* Boiss. & Reut., \**A. gigantea* Roth, *A. glabra* (J. Presl) var. *glabra*, *A. glabra* var. *melanthes* (Phil.) Rúgolo et De Paula, *A. idahoensis* Nash, *A. imberbis* Phil., *A. inconspicua* Kunze ex E. Desv., *A. insularis* Rúgolo & A.M. Molina, *A. kuntzei* Mez, *A. leptotricha* E. Desv., *A. magellanica* Lam., *A. masafuerana* Pilg., *A. mertensii* Trin., *A. meyeri* Trin., \**A. nebulosa* Boiss. & Reuter, *A. montevidensis* Spreng., *A. perennans* (Walter) Tuck., *A. philippiana* Rúgolo & De Paula, *A. scabra* Willd., *A. serranoi* Phil., \**A. stolonifera* L. var. *stolonifera*, \**A. stolonifera* var. *palustris*, *A. toluensis* Kunth, *A. uliginosa* Phil., *A. umbellata* Colla, *A. vidalii* Phil., *A. vinealis* Schreb.
19. *Ammophila* Host: \**A. arenaria* (L.) Link



20. *Bromidium* Nees & Meyen: *B. anomalum* (Trin.) Döll, *B. trisetoides* (Steud.) Rúgolo
21. *Calamagrostis* Adans.: \**C. epigeios* (L.) Roth
22. *Deyeuxia* Clarion ex P. Beauv.: *D. breviaristata* Wedd., *D. brevifolia* J. Presl. var. *brevifolia*, *D. brevifolia* var. *expansa* Rúgolo & Villav., *D. cabreræ* (Parodi) Parodi var. *cabreræ*, *D. cabreræ* var. *aristulata* Rúgolo & Villav., *D. cabreræ* var. *trichopoda* Parodi ex Rúgolo, *D. chrysantha* J. Presl var. *chrysantha*, *D. chrysantha* var. *phalaroides* (Wedd.) Villav., *D. chrysophylla* Phil., *D. chrysostachya* E. Desv., *D. crispa* Rúgolo & Villav., *D. curoula* Wedd., *D. deserticola* Phil. var. *breviaristata* Rúgolo & Villav., *D. deserticola* Phil. var. *deserticola*, *D. diemii* Rúgolo, *D. eminens* J. Presl var. *eminens*, *D. eminens* var. *fulva* (Griseb.) Rúgolo, *D. eminens* var. *discreta* Rúgolo & Villav., *D. erythrostachya* E. Desv. var. *erythrostachya*, *D. erythrostachya* var. *neuquenensis* Rúgolo, *D. filifolia* Wedd., *D. hackelii* (Lillo) Parodi, *D. heterophylla* Wedd., *D. patagonica* Speg., *D. poaeoides* (Steud.) Rúgolo, *D. rigescens* (J. Presl) Türpe, *D. rigida* Kunth, *D. spicigera* var. *cephalotes* (Wedd.) Rúgolo & Villav., *D. spicigera* J. Presl var. *spicigera*, *D. suka* (Speg.) Parodi, *D. velutina* Nees & Meyen var. *velutina*, *D. velutina* var. *nardifolia* (Griseb.) Rúgolo, *D. vicunarum* Wedd., *D. viridiflavescens* (Poir.) Kunth var. *viridiflavescens*, *D. viridiflavescens* var. *montevidensis* (Nees) Cabrera & Rúgolo, *D. viridis* Phil.
23. *Dichelachne* Endl.: *D. micrantha* (Cav.) Domin
24. *Gastridium* P. Beauv.: \**G. phleoides* (Nees & Meyen) C.E. Hubb.
25. *Lachnagrostis* Trin.: *L. filiformis* (G. Forst.) Trin.
26. *Lagurus* L.: \**L. ovatus* L.
27. *Podagrostis* (Griseb.) Scribn. & Merr.: *P. sesquiflora* (E. Desv.) Parodi ex Nicora
28. *Polypogon* Desf.: *P. australis* Brongn., *P. chilensis* (Kunth) Pilger, *P. elongatus* Kunth, *P. exasperatus* (Trin.) Renvoize, *P. imberbis* (Phil.) Johow, *P. interruptus* Kunth, *P. linearis* Trin., *P. maritimus* Willd., \**P. monspeliensis* (L.) Desf., \**P. viridis* (Gouan) Breistr.

#### Subtribe Airinae Fr.

29. *Aira* L.: \**A. caryophyllea* L., \**A. elegantissima* Schur, \**A. praecox* L.
30. *Avenella* (Bluff & Fingerh.) Drejer: *A. flexuosa* (L.) Drejer
31. *Corynephorus* P. Beauv.: \**C. divaricatus* (Pourr.) Breistr.
32. *Deschampsia* P. Beauv.: *D. airiformis* (Steud.) Benth. & Hook., *D. antarctica* E. Desv., *D. berteriana* (Kunth) Trin., *D. cespitosa* (L.) P. Beauv. var. *cespitosa*, *D. cespitosa* var. *pulchra* (Nees & Meyen) Nicora, *D. cordillerarum* Hauman, *D. danthonioides* (Trin.) Munro, *D. elongata* (Hook.) Munro, *D. kingii* (Hook. f.) E. Desv., *D. laxa* Phil., *D. looseriana* Parodi, *D. monandra* Parodi, *D. parvula* (Hook. f.) E. Desv., *D. patula* (Pilg.) Pilg. ex Skotts., *D. setacea* (Huds.) Hack., *D. venustula* Parodi
33. *Vahlodea* Fr.: *V. atropurpurea* (Wahlenb.) Fr. ex Hartm.

#### Subtribe Alopecurinae Dumort.

34. *Alopecurus* L.: *A. geniculatus* L. var. *geniculatus*, *A. geniculatus* var. *patagonicus* Parodi, *A. heleochloides* Hack., *A. lechleri* Steud., *A. magellanicus* Lam. var. *magellanicus*, *A. magellanicus* var. *bracteatus* (Phil.) Mariano, *A. myosuroides* Huds., \**A. pratensis* L.

#### Subtribe Aveninae J. Presl

35. *Arrhenatherum* P. Beauv.: \**A. elatius* (L.) P. Beauv. Ex J. Presl & C. Presl subsp. *elatius*, \**Arrhenatherum elatius* subsp. *bulbosum* (Willd.) Schübl. & G. Martens



36. *Avena* L.: \**A. barbata* Pott ex Link, \**A. fatua* L., \**A. sativa* L., \**A. sterilis* L., \**A. strigosa* Schreb.

37. *Helictotrichon* Besser: *H. bulbosum* (Hitchc.) Parodi

38. *Koeleria* Pers.: *K. fueguina* C.E. Calderón ex Nicora, *K. kurtzii* Hack.

39. *Leptophyllochloa* C.E. Calderón: *L. micrathera* (E. Desv.) C.E. Calderón

40. *Relchela* Steud.: *R. panicoides* Steud.

41. *Rostraria* Trin.: \**R. cristata* (L.) Tzvel., *R. trachyantha* (Phil.) Tzvel.

42. *Trisetum* Pers.: *T. ambiguum* Rúgolo & Nicora, *T. barbinode* Trin., *T. caudulatum* Trin., *T. cernuum* Trin., *T. flavescens* (L.) P. Beauv., *T. johnstonii* (Louis-Marie) Finot subsp. *johnstonii*, *T. johnstonii* subsp. *mattheii* (Finot) Finot, *T. longiglume* Hack. var. *longiglume*, *T. nancaguense* Finot, *T. preslei* (Kunth) E. Desv., *T. pyramidatum* Louis-Marie ex Finot, *T. spicatum* (L.) K. Richt. subsp. *spicatum*, *T. spicatum* subsp. *cumingii* (Nees ex Steud.) Finot, *T. spicatum* subsp. *dianthemum* (Louis-Marie) Finot, *T. spicatum* subsp. *phleoides* (d'Urv.) Macloskie

#### Subtribe Brizinae Tzvelev

43. *Briza* L.: \**B. maxima* L., \**B. minor* L.

44. *Calotheca* Desv.: *C. brizoides* (Lam.) Desv.

45. *Chascolytrum* Desv.: *C. subaristatum* (Lam.) Desv.

46. *Gymnachne* Parodi: *G. koelerioides* (Trin.) Parodi

47. *Rhombolytrum* Link: *R. rhomboideum* Link

#### Subtribe Coleanthinae Rchb.

48. *Catabrosa* P. Beauv.: *C. aquatica* (L.) P. Beauv., *C. werdermannii* (Pilg.) Nicora & Rúgolo

49. *Puccinellia* Parl.: *P. argentinensis* (Hack.) Parodi, *P. biflora* (Steud.) Parodi, *P. frigida* (Phil.) I.M. Johnst., *P. glaucescens* (Phil.) Parodi, *P. magellanica* (Hook. f.) Parodi, *P. preslii* (Hack.) Ponert, *P. pusilla* (Hack.) Parodi, *P. skottsbergii* (Pilg.) Parodi

#### Subtribe Cynosurinae Fr.

50. *Cynosurus* L.: \**C. cristatus* L., \**C. echinatus* L.

#### Subtribe Dactylidinae Stapf

51. *Dactylis* L.: \**D. glomerata* L.

52. *Lamarckia* Moench: \**L. aurea* (L.) Moench

#### Subtribe Holcinae Dumort.

53. *Holcus* L.: \**H. lanatus* L.

#### Subtribe Loliinae Dumort.

54. *Dielsiochloa* Pilg.: *D. floribunda* (Pilg.) Pilg.

55. *Festuca* L.: *F. acanthophylla* E. Desv., *F. argentina* (Speg.) Parodi, *F. chrysophylla* Phil., *F. cirrosa* (Speg.) Parodi, *F. contracta* Kirk, *F. deserticola* Phil., *F. filiformis* Pourr., *F. gracillima* Hook. f., *F. hypsophila* Phil., *F. kurtziana* St.-Yves, *F. magellanica* Lam., *F. magensiana* Potztal, *F. monticola* Phil., *F. morenensis* Matthei, *F. nardifolia* Griseb., *F. orthophylla* Pilg., *F. pallescens* (St.-Yves) Parodi, *F. panda* Swallen, *F. purpurascens* Banks & Soland. ex Hook., *F. pyrogea* Speg., *F. rigescens* (J. Presl) Kunth, *F. rubra* L., *F. scabriuscula* Phil., *F. tectoria* St.-Yves, *F. thermarum* Phil., *F. tunicata* E. Desv., *F. weberbaueri* Pilg., *F. werdermannii* St.-Yves.

56. *Lolium* L.: \**L. multiflorum* Lam., \**L. perenne* L., *L. rigidum* Gaudin subsp. *rigidum*, \**L. rigidum* subsp. *lepturoides* (Boiss.) Sennen & Mauricio, \**L. temulentum* L.

57. *Megalachne* Steud.: *M. berteroniana* Steud., *M. masafuerana* (Skotts. & Pilg.) Matthei

58. *Podophorus* Phil.: *P. bromoides* Phil.

59. *Schenodorus* P. Beauv.: \**S. arundinaceus* (Schreb.) Dumort.

60. *Vulpia* C.C. Gmel.: *V. antucensis* Trin., \**V. bromoides* (L.) Gray, \**V. muralis* (Kunth) Nees, \**V. myuros* (L.) C.C. Gmel. var. *myuros*, \**V. myuros* var. *hirsuta* Hack., \**V. myuros* var. *megalura* (Nutt.) Auquier, *V. octoflora* (Walter) Rydb.

#### Subtribe Parapholiinae Caro

61. *Catapodium* Link: \**C. rigidum* (L.) Dony

62. *Hainardia* Greuter: \**H. cylindrica* (Willd.) Greuter

63. *Parapholis* C.E. Hubb.: \**P. incurva* (L.) C.E. Hubb., \**P. strigosa* (Dumort.) C.E. Hubb.

#### Subtribe Phalaridinae Fr.

64. *Anthoxanthum* L.: *A. altissimum* (Steud.) Veldkamp, *A. gunckelii* (Parodi) Veldkamp, *A. juncifolium* (Hack.) Veldkamp, \**A. odoratum* L., *A. pusillum* (Hack. ex Dusén) Veldkamp, *A. redolens* (Vahl) P. Royen, *A. spicatum* (Parodi) Veldkamp, *A. utriculatum* (Ruiz & Pav.) Y. Schouten & Veldkamp.

65. *Phalaris* L.: *P. amethystina* Trin., *P. angusta* Nees ex Trin., \**P. aquatica* L., \**P. arundinacea* L., \**P. canariensis* L., \**P. caroliniana* Walter, \**P. minor* Retz.

#### Subtribe Phleinae Benth.

66. *Phleum* L.: \**P. alpinum* L., \**P. pratense* L.

#### Subtribe Poinae Dumort.

67. *Anthochloa* Nees & Meyen: *A. lepidula* Nees & Meyen.

68. *Apera* Adans.: \**A. interrupta* (L.) P. Beauv.

69. *Dissanthelium* Trin.: *D. peruvianum* (Nees & Meyen) Pilg.

70. *Nicoraepoa* Soreng & L.J.: Gillespie: *N. andina* (Trin.) Soreng & L.J. Gillespie, *N. chonotica* (Phil.) Soreng & L.J. Gillespie, *N. pugionifolia* (Speg.) Soreng & L.J. Gillespie, *N. robusta* (Steud.) Soreng & L.J. Gillespie, *Nicoraepoa subenervis* (Hack.) Soreng & L.J. Gillespie subsp. *subenervis*, *Nicoraepoa subenervis* subsp. *spgaziana* (Nicora) Soreng & L.J. Gillespie

71. *Poa* Barnhart: *P. acinaciphylla* E. Desv., *P. alopecurus* (Gaudich. ex Mirb.) Kunth subsp. *alopecurus*, *P. alopecurus* ssp. *fuegiana* (Hook. f.) D.M. Moore & Dogg., *P. alopecurus* ssp. *prichardii* (Rendle) Giussani & Soreng, *P. alopecurus* subsp. *fuegiana* (Hook. f.) D.M. Moore & Dogg., *P. androgyna* Hack., \**P. annua* L., *P. atropidiformis* Hack. var. *atropidiformis*, *P. aysenensis* Hack., *P. bonariensis* (Lam.) Kunth, *P. bulbosa* L. subsp. *vivipara* (Koeler) Arcang., *P. compressa* L., *P. cumingii* Trin., *P. darwiniana* Parodi, *P. denudata* Steud., *P. flabellata* (Lam.) Raspail, *P. gayana* E. Desv., *P. glauca* Vahl subsp. *glauca*, *P. gymnantha* Pilg., *P. hachadoensis* Nicora var. *hachadoensis*, *P. hachadoensis* var. *pilosa* Nicora, *P. holciformis* J. Presl, *P. humillima* Pilg., \**P. infirma* Kunth, *P. kurtzii* R.E. Fr., *P. laetevirens* R.E. Fr., *P. lanigera* Nees, *P. lanuginosa* Poir., *P. ligularis* Nees ex Steud. var. *ligularis*, *P. lilloi* Hack., *P. mendocina* Nicora & F.A. Roig, \**P. nemoralis* L., *P. obvallata* Steud., *P. palustris* L., *P. paposana* Phil., *P. parviceps* Hack., *P. pearsonii* Reeder, *P. perligulata* Pilg., *P. pfisteri* Soreng, *P. planifolia* Kuntze, \**P. pratensis* L. subsp. *pratensis*, \**P. pratensis* subsp. *alpigena* (Lindm.) Hiitonen, *P. scaberula* Hook. f., *P. schoenoides* Phil., *P. secunda* J. Presl subsp. *secunda*, *P. secunda* subsp. *juncifolia* (Scribn.) Soreng, *P. spiciformis* subsp. *prichardii* (Rendle) Giussani & Soreng, *P. spiciformis* var. *ibari* (Phil.) Giussani, *P. spiciformis* var. *spiciformis*, *P. stenantha* Trin. var. *stenantha*, *P. stepparia* Nicora, *P. superata* Hack., *P. trachyantha* Hack., *P. tricolor* Nees ex Steud., \**P. trivialis* L. subsp. *trivialis*, *P. yaganica* Speg.

**Subtribe Torretochloinae** Soreng

72. *Amphibromus* Nees: *A. scabrivalvois* (Trin.) Swallen.

**Supertribe Triticodae** T.D. Macfarl. & L. Watson**Tribe Triticeae** Dumort.**Subtribe Hordeinae** Dumort.

73. *Agropyron* Gaertn.: \**A. cristatum* (L.) Gaertn.  
 74. *Elymus* L.: *E. angulatus* J. Presl, *E. magellanicus* (E. Desv.) A. Löve, *E. patagonicus* Speg., \**E. repens* (L.) Gould, *E. scabriglumis* (Hack.) A. Löve.  
 75. *Hordeum* L.: *H. brachyatherum* Phil., *H. chilense* Roem. & Schult., *H. comosum* J. Presl, *H. fuegianum* Bothmer N. Jacobsen & R.B. Jorg., *H. jubatum* L., *H. lechleri* (Steud.) Schenck, \**H. marinum* Huds. subsp. *gussoneanum* (Parl.) Thell., \**H. marinum* Huds. subsp. *marinum*, \**H. murinum* L. subsp. *murinum*, \**H. murinum* subsp. *glaucum* (Steud.) Tzvelev, \**H. murinum* subsp. *leporinum* (Link) Arcang., *H. muticum* J. Presl, *H. patagonicum* subsp. *magellanicum* (Parodi ex Nicora) Bothmer, Giles & N. Jacobsen, *H. patagonicum* subsp. *santacrucense* (Parodi ex Nicora) Bothmer, Giles & N. Jacobsen, *H. pubiflorum* Hook.f. subsp. *pubiflorum*, *H. pubiflorum* subsp. *halophilum* (Griseb.) Baden & Bothmer, *H. tetraploideum* Covas, \**H. vulgare* L.  
 76. *Leymus* Hochst.: \**L. arenarius* (L.) Hochst., *L. erianthus* (Phil.) Dubcovs.  
 77. *Secale* L.: \**S. cereale* L.

**Subtribe Triticinae** Fr.

78. *Taeniatherum* Nevski: \**T. caput-medusae* (L.) Nevski  
 79. *Triticum* L.: \**T. aestivum* L., \**T. durum* Desf.

**Tribe Bromeae** Dumort.

80. *Bromus* L.: *Bromus araucanus* Phil., *B. berterioanus* Colla, *B. catharticus* Vahl var. *catharticus*, *B. catharticus* var. *elata* (E. Desv.) Planchuelo, *B. coloratus* Steud., *B. erectus* Huds., *B. gunckelii* Matthei, \**B. hordeaceus* L., *B. japonicus* Thunb., *B. lanatus* Kunth, *B. lanceolatus* Roth, *B. lithobius* Trin., \**B. madritensis* L., *B. mango* E. Desv., *B. pellitus* Hack., *B. racemosus* L., \**B. rigidus* Roth, *B. scoparius* L. var. *scoparius*, \**B. scoparius* var. *villiglumis* Maire & Weiller, *B. secalinus* L., *B. setifolius* J. Presl, *B. setifolius* var. *brevifolius* Nees, *B. setifolius* var. *pictus* (Hook. f.) Skotts., \**B. squarrosus* L., \**B. sterilis* L., \**B. tectorum* L., *B. tunicatus* Phil.

**SUBFAMILY ARISTIDOIDEAE** CARO**Tribu Aristidae** C.E. Hubb.

81. *Aristida* L.: *A. adscensionis* L., *A. pallens* Cav., *A. spegazzinii* Arechav.

**SUBFAMILY ARUNDINOIDEAE** BURMEIST.**Tribe Arundinae** Dumort.

82. *Arundo* L.: \**A. donax* L.  
 83. *Phragmites* Adans.: *P. australis* (Cav.) Trin. ex Steud.

**SUBFAMILY DANTHONIOIDEAE** P.H. LINDER & N.P. BAKER**Tribe Danthoniae** Zotov.

84. *Cortaderia* Stapf: *C. araucana* Stapf, *C. atacamensis* (Phil.) Pilg., *C. pilosa* (D'Urv.)

- Hack. var. *pilosa*, *C. pilosa* var. *minima* (Conert) Nicora, *C. rudiuscula* Stapf, *C. selloana* (Schult. & Schult.) Asch. & Graebn., *C. speciosa* (Nees & Meyen) Stapf
85. *Danthonia* DC.: *D. araucana* Phil., *D. boliviensis* Renvoize, *D. californica* Bol. var. *americana* (Scribn.) Hitchc., *D. chilensis* E. Desv. var. *chilensis*, *D. chilensis* var. *aureofulva* (E. Desv.) C. Baeza, *D. chilensis* var. *glabrifolia* Nicora, *D. decumbens* (L.) DC., *D. malacantha* (Steud.) Pilg.
86. *Rytidosperma* Steud.: *R. lechleri* Steud., *R. paschalis* (Pilg.) Baeza, *R. pictum* (Nees & Meyen) Nicora var. *pictum*, *R. pictum* var. *bimucronatum* Nicora, *R. quirihuense* C. Baeza, *R. violaceum* (E. Desv.) Nicora, *R. virescens* (E. Desv.) Nicora
87. *Schismus* P. Beauv.: \**S. arabicus* Nees, \**S. barbatus* (L.) Thell.

#### SUBFAMILY PANICOIDEAE LINK

##### Tribe Andropogoneae Dumort.

##### Subtribe Andropogoninae J. Presl

88. *Cymbopogon* Spreng.: \**C. citratus* (DC.) Stapf  
 89. *Schizachyrium* Nees: \**S. sanguineum* (Retz.) Alston, *S. spicatum* (Spreng.) Herter

##### Subtribe Saccharinae Griseb.

90. *Imperata* Cirillo: *I. condensata* Steud.  
 91. *Miscanthus* Andersson: \**M. sinensis* Andersson

##### Subtribe Sorghinae Clayton & Renvoize

92. *Bothriochloa* Kuntze: *B. ischaemum* (L.) Keng, *B. laguroides* (DC.) Herter, *B. saccaroides* (Sw.) Rydb. var. *saccharoides*  
 93. *Sorghum* Moench: \**S. bicolor* (L.) Moench, *S. x drumondii* (Nees ex Steud.) Millsp. & Chase, \**S. halepense* (L.) Pers.

##### Subtribe Tripsacinae Dumort.

94. *Zea* L.: \**Z. mays* L.

##### Tribe Paniceae R.Br.

##### Subtribe Cenchrinae Dumort.

95. *Cenchrus* L.: \**C. americanus* (L.) Morrone, *C. chilensis* (E. Desv.) Morrone, \**C. clandestinus* (Hochst. ex Chiov.) Morrone, \**C. echinatus* L., \**C. incertus* M.A. Curtis, \**C. longisetus* M.C. Johnst., \**C. myosuroides* Kunth, \**C. purpureus* (Schumach.) Morrone

##### Subtribe Digitariinae Butzin

96. *Digitaria* Haller: *D. aequiglumis* (Hack. & Arechav.) Parodi, *D. ciliaris* (Retz.) Koeler, \**D. ischaemum* (Schreb.) Schreb. ex Muhl. var. *ischaemum*, \**D. sanguinalis* (L.) Scop., *D. setigera* Roth ex Roem. & Schult., *D. violascens* Link

##### Subtribe Melinidinae Pilg.

97. *Eriochloa* Kunth: *E. montevidensis* Griseb.  
 98. *Melinis* P. Beauv.: \**M. minutiflora* P. Beauv., \**M. repens* (Willd.) Zizka

##### Subtribe Panicinae Fr.

99. *Dichanthelium* (Hitchc. & Chase) Gould: *D. sabulorum* (Lam.) Gould & Clark var. *sabulorum*, *D. sabulorum* var. *polycladum* (Ekman) Zuloaga  
 100. *Echinochloa* P. Beauv.: \**E. colona* (L.) Link, \**E. crus-galli* (L.) P. Beauv. var. *crus-galli*, \**E. crus-galli* var. *mitis* (Pursh) Peterm., \**E. crus-galli* var. *zelayensis* (Kunth) Hitchc., \**E. crus-pavonis* (Kunth) Schult.  
 101. *Panicum* L.: \**P. capillare* L., *P. dichotomiflorum* Michx., *P. racemosum* (P. Beauv.) Spreng., *P. urvilleanum* Kunth



**Subtribe Paspalinae** Griseb.

102. *Axonopus* P. Beauv.: *A. compressus* (Sw.) P. Beauv.  
 103. *Paspalum* L.: *P. candidum* (Humb. & Bonpl. Ex Flügge) Kunth, *P. dasypleurum* Kunze ex E. Desv., *P. dilatatum* Poir., \**P. distichum* L., *P. ekmanianum* Henrard, *P. flavum* J. Presl, *P. forsterianum* Flügge, *P. minus* E. Fourn., *P. scrobiculatum* L. var. *orbiculare* (G. Forst.) Hack., *P. urvillei* Steud., *P. vaginatum* Sw.

**Subtribe Setariinae** Dumort.

104. *Paspalidium* Stapf: \**P. geminatum* (Forssk.) Stapf  
 105. *Setaria* P. Beauv.: \**S. parviflora* (Poir) Kerguelen var. *parviflora*, *S. parviflora* var. *brachytricha* Pensiero, \**S. pumila* (Poir.) Roem. & Schult., \**S. verticillata* (L.) P. Beauv., \**S. viridis* (L.) P. Beauv.  
 106. *Stenotaphrum* Trin.: \**S. secundatum* (Walter) Kuntze

**SUBFAMILY CHLORIDOIDEAE KUNTH EX BEILSCHM.****Incertae sedis**

107. *Trichoneura* Andersson: *T. weberbaueri* Pilg.

**Tribe Cynodonteae** Dumort.**Subtribe Boutelouinae** Stapf

108. *Bouteloua* Lag.: *Bouteloua simplex* Lag.

**Subtribe Eleusininae** Dumort.

109. *Chloris* Sw.: \**Chloris gayana* Kunth, *C. radiata* (L.) Sw., *C. virgata* Sw.  
 110. *Cynodon* Rich.: *Cynodon affinis* Caro & E.A. Sánchez, \**C. dactylon* (L.) Pers., *C. nitidus* Caro & E.A. Sánchez  
 111. *Eleusine* Gaertn.: \**Eleusine indica* (L.) Gaertn., \**E. tristachya* (Lam.) Lam.  
 112. *Eustachys* Desv.: \**Eustachys distichophylla* (Lag.) Nees  
 113. *Leptochloa* P. Beauv.: *L. fusca* subsp. *uninervia* (J. Presl) N. Snow  
 114. *Microchloa* R. Br.: *M. indica* (L. f.) P. Beauv., *M. kunthii* Desv.

**Subtribe Monanthochloinae** Pilg. ex Potztl

115. *Distichlis* Raf.: *D. humilis* Phil., *D. scoparia* (Nees ex Kunth) Arechav., *D. spicata* (L.) Greene var. *spicata*, *D. spicata* var. *mendocina* (Phil.) Hack., *D. spicata* var. *stricta* (Torr.) Thorne

**Subtribe Muhlenbergiinae** Pilg.

116. *Muhlenbergia* Schreb.: *M. asperifolia* (Nees & Meyen ex Trin.) Parodi, *M. fastigiata* (J. Presl) Henrard, *M. peruviana* (P. Beauv.) Steud.

**Subtribe Scleropogoninae** Pilg.

117. *Munroa* Torr.: *M. andina* Phil., *M. argentina* Griseb., *M. decumbens* Phil.

**Subtribe Tripogoninae** Stapf

118. *Tripogon* Roem. & Schult.: *T. nicorae* Rúgolo & A.S. Vega, *T. spicatus* (Nees) Ekman

**Tribe Eragrostidae** Stapf**Subtribe Cotteinae** Reeder

119. *Enneapogon* Desv. ex P. Beauv.: *E. devauxii* P. Beauv.

**Subtribe Eragrostidinae** J. Presl

120. *Eragrostis* Wolf: \**E. atrovirens* (Desf.) Trin. ex Steud., *E. attenuata* Hitchc., \**E. curvula* (Schrud.) Nees, *E. kuschelii* Skotts., *E. mexicana* (Hornem.) Link subsp. *virescens* (C. Presl) S.D. Koch & Sánchez-Vega, *E. nigricans* (Kunth) Steud. var. *nigricans*, *E. nigricans* var. *punensis* Nicora, *E. peruviana* (Jacq.) Trin., \**E. pilosa* (L.)

P. Beauv., *E. polytricha* Nees, *E. pycnantha* (Phil.) Nicora, \**E. tenuifolia* (A. Rich.) Hochst. ex Steud., *E. weberbaueri* Pilg.

**Tribe Zoysiae Benth.**

**Subtribe Sporobolinae Benth.**

121. *Spartina* Schreb.: *S. densiflora* Brongn.

122. *Sporobolus* R. Br.: *S. africanus* (Poir) Robyns & Tournay, \**S. indicus* (L.) R. Br., *S. rigens* (Trin.) E. Desv., \**S. virginicus* (L.) Kunth

Table 3. List of the species of Poaceae registered in Chile, ordered according to (Soreng et al., 2009). \* = introduced; bold = endemic.

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## 8. References

- Acevedo de Vargas, R. (1959). Las especies de Gramineae del género *Cortaderia* en Chile. *Boletín del Museo Nacional de Historia Natural*, Vol. 27, pp. 205-246, ISSN-0027-3910.
- Aliscioni, S.S., Giussani, L.M., Zuloaga, F.O. & Kellogg, E.A. (2003). A molecular phylogeny of *Panicum* (Poaceae: Paniceae): Tests of monophyly and phylogenetic placement within the Panicoideae. *American Journal of Botany*, Vol. 90, No. 5 (May 2005), pp. 796-821, ISSN 1537-2197.
- Allred, K.W. (1982). Describing the grass inflorescence. *Journal of Range Management*, Vol. 35, No. 5 (Sep. 1982), pp 672-675, ISSN 0022-409X.
- Alroy, J. (2002). How many named species are valid? *Proceedings of the National Academy of Science*, Vol. 99, No. 6 (Mar. 2002), pp. 3706-3711, ISSN 1094-6490.
- Anderson, D.E. (1974). Taxonomy of the genus *Chloris* (Gramineae). *Brigham Young University Science Bulletin* Vol. 19, No. 2 (Mar. 1974), pp. 1-133, ISSN 0068-1024.
- Arancio, G., Jara, P., Squeo, F.A. & Marticorena, C. (2004). Riqueza de especies de plantas vasculares en los Altos de Talinay, Parque Nacional Bosque Fray Jorge. In, *Historia Natural del Parque Nacional Bosque Fray Jorge*, pp. 189-204. F.A. Squeo, J.R. Gutiérrez & I.R. Hernández (Eds.). Ediciones Universidad de La Serena, La Serena.
- Arriaga, M.O. & Barkworth, M.E. (2006). *Amelichloa*: a new genus in the Stipeae (Poaceae). *Sida Contributions to Botany*, Vol. 22, No. 1, pp. 145-149, ISSN 1934-5259.
- Arroyo, M.T.K., Armesto, J.J., Squeo, F. & Villagrán, C. (1993). Global change: Flora and vegetation of Chile. In: *Earth system responses to global change: contrasts between North and South America*, H.A. Mooney, E.R. Fuentes & B.I. Kronberg (Eds.), pp. 239-263, Academic Press, San Diego.
- Arroyo, M.T.K., Castor, C., Marticorena, C., Muñoz, M. Cavieres, L. & Matthei, O. (1998). La flora del parque nacional Llullaillaco ubicado en la zona de transición de las lluvias de invierno-verano en los Andes del norte de Chile. *Gayana Botánica* Vol. 55, No. 2 (May 1999), ISSN 0016-5301.

- Arroyo, M.T.K., Marticorena, C., Matthei, O. & Cavieres, L. (2000). Plant invasions in Chile: present patterns and future predictions. In, *Invasive species in a changing world*, H.A. Mooney & R.J. Hobbs (Eds.), pp. 385-421. Island Press, USA.
- Arroyo, M.T.K., Marticorena, C., Miranda, P., Matthei, O. (1989). Contribution to the high elevation flora of the Chilean Patagonia: A checklist of species on mountains on an East-West transect in the Sierra de los Baguales, Latitude 50°S. *Gayana Botánica* Vol. 46, No. 1-2 (Jul. 1989), pp. 121-151, ISSN 0016-5301.
- Arroyo, M.T.K., Marticorena, C., Muñoz-Schick, M. (1990). A checklist of the native annual flora of continental Chile. *Gayana Botánica* Vol. 47, No. 3-4 (Apr. 1991), pp. 119-135, ISSN 0016-5301.
- Arroyo, M.T.K., Rozzi, R., Simonetti, J.A., Marquet, P. & Salaberry, M. (1999). Central Chile. In *Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecorregions*, R.A. Mittermeier, N. Myers, P. Robles Gil & C. Goettsch Mittermeier (Eds.), pp. 161-171. CEMEX, México.
- Arroyo, M.T.K., von Bohlen, Ch., Cavieres, L. & Marticorena, C. (1992). Survey of the alpine flora of Torres del Paine National Park, Chile. *Gayana Botánica* Vol. 49, No. 1-4 (Dec. 1992), pp. 47-70, ISSN 0016-5301.
- Ayres, D.R., Smith, D.L., Zaremba, K., Klohr, S. & Strong, D.R. (2004). Spread of exotic cordgrasses and hybrids (*Spartina* sp.) in the tidal marshes of San Francisco Bay, California, U.S.A. *Biological Invasions*, Vol. 6, No. 2 (Jun. 2004), pp 221-231, ISSN 1573-1464.
- Baeza, C.M. 1996. Los géneros *Danthonia* DC. y *Rytidosperma* Steud. (Poaceae) en América-Una revisión. *Sendtnera* Vol. 3, pp. 11-93, ISSN 0944-0178.
- Baeza, C.M., Marticorena, C. & Rodríguez, R. (1999). Catálogo de la flora del monumento natural Contulmo, Chile. *Gayana Botánica* Vol. 56, No. 2 (Dec. 1999), pp. 125-135, ISSN 0016-5301.
- Baeza, C.M., Marticorena, C., Stuessy, T., Ruiz, E. & Negritto, M. (2007). Poaceae en el archipiélago de Juan Fernández (Robinson Crusoe). *Gayana Botánica* Vol. 64, No. 2 (Dec. 2007), pp. 125-174, ISSN 0016-5301.
- Baeza, C.M., Stuessy, T. & Marticorena, C. (2002). Notes on the Poaceae of Robinson Crusoe (Juan Fernández) islands, Chile. *Brittonia* Vol. 54, No. 3 (Jul. 2002), pp. 154-163, ISSN 0007-196X.
- Barker, N.P., Linder, H.P. & Harley, E. (1995). Polyphyly of Arundinoideae (Poaceae): Evidence from *rbcL* sequence data. *Systematic Botany* Vol. 20, No. 4, pp. 423-435, ISSN 0363-6445.
- Barker, N.P., Linder, H.P. & Harley, E.H. (1999). Sequences of the grass-specific insert in the chloroplast *rpoC2* gene elucidate generic relationships of the Arundinoideae (Poaceae). *Systematic Botany* Vol. 23, No. 3, pp. 327-350, ISSN 0363-6445.
- Barkworth, M.E., Capels, K.M., Long, S., Anderton, L.K. & Piep, M.B. 2007. *Flora of North America north of Mexico*, Vol. 24. Poaceae, part 1. Oxford University Press, New York.
- Bortolus, A. (2006). The austral cordgrass *Spartina densiflora* Brongn.: its taxonomy, biogeography and natural history. *Journal of Biogeography*, Vol. 33, No. 1 (Jan. 2006), pp. 158-168, ISSN 1365-2699.
- Bouchenak-Khelladi, Y., Verboom, G.A., Savolainen, V. & Hodkinson, T.R. (2010). Biogeography of the grasses (Poaceae): a phylogenetic approach to reveal

- evolutionary history in geographical space and geological time. *Botanical Journal of the Linnean Society*, Vol. 162, No. 4 (Apr. 2010), pp. 543-557, ISSN 1095-8339.
- Cabrera, A.L. & A. Willink. (1973). *Biogeografía de América Latina*. The General Secretariat of the Organization of American States, Washington D.C., U.S.A.
- Caro, J.A. (1982). Sinopsis taxonómica de las gramíneas Argentinas. *Dominguezia*, Vol. 4, No. 1 (Feb. 1982), pp. 1-51, ISSN 1669-6859.
- Cerros-Tlatilpa, R. & Columbus, J.T. (2009). C3 photosynthesis in *Aristida longifolia*: Implication for photosynthetic diversification in Aristidoideae (Poaceae). *American Journal of Botany*, Vol. 96, No. 8 (Jul. 2009), pp. 1379-1387, ISSN 1537-2197.
- Chemisquy, A., Giussani, L.M., Scataglini, M.A., Kellogg, E.A. & Morrone, O. (2010). Phylogenetic studies favour the unification of *Pennisetum*, *Cenchrus* and *Odontelytrum* (Poaceae): a combined nuclear, plastid and morphological analysis, and nomenclatural combinations in *Cenchrus*. *Annals of Botany*, Vol. 106, N°.1 (Jul. 2010), pp. 107-130, ISSN 1095-8290.
- Chiappella, J. & Zuloaga, F. (2010). A revision of the genera *Deschampsia*, *Avenella*, and *Vahlodea* (Pooideae, Poaceae, Airinae) in South America. *Annals of the Missouri Botanical Garden*, Vol. 97, No. 2, (Jul. 2010), pp. 141-162, ISBN 0026-6493.
- Cialdella, A.M. & Arriaga, M. (1998). Revisión de las especies sudamericanas del género *Piptochaetium* (Poaceae, Pooideae, Stipeae). *Darwiniana* Vol. 36, No. 1-4, pp. 107-157, ISSN 0011-6793.
- Cialdella, A.M. & Giussani, L.M. (2002). Phylogenetic relations of the genus *Piptochaetium* (Poaceae: Pooideae: Stipeae): Evidence from morphological data. *Annals of the Missouri Botanical Garden* Vol. 89, No. 3 (Summer 2002), pp. 305-336, ISSN 0026-6493.
- Clayton, W.D & Renvoize, S.A. (1986). *Genera graminum. Grasses of the world*. Kew Bull. Additional Series XIII, Royal Botanic Gardens, Kew.
- Clark, L.G. (1990). *Chusquea* sect. *Longiprophyllae* (Poaceae: Bambusoideae): A new Andean section and new species. *Systematic Botany* Vol. 15, No. 4 (Oct.-Dec. 1990), pp. 617-634, ISSN 0363-6445.
- Clark, L.G. & Judziewicz, E.J. (1996). The grass subfamilies Anomochlooideae and Pharoideae (Poaceae). *Taxon* Vol. 45, No. 4 (November, 1996), pp. 641-645, ISSN 0040-0262.
- Clark, L.G., Kobayashi, M., Mathews, S., Spangler, R.E & Kellogg, E. (2000). The Puelioideae, a new subfamily of Poaceae. *Systematic Botany*, Vol. 25, No 2, pp. 181-187, ISSN 0363-6445.
- Clark, L.G., Zhang, W. & Wendel, J.F. (1995) A phylogeny of the grass family (Poaceae) based on *ndhF* sequence data. *Systematic Botany*, Vol. 20, No 4 (October-December 1995), pp. 436-460. ISSN 0363-6445.
- Conservation International. (2011). Biodiversity hotspots. 20.01.2011. Available from [http://www.biodiversityhotspots.org/xp/Hotspots/hotspotsScience/pages/hotspots\\_defined.aspx](http://www.biodiversityhotspots.org/xp/Hotspots/hotspotsScience/pages/hotspots_defined.aspx).
- Crawford, P.H.C. & Hoagland, B.W. (2009). Can herbarium records be used to map alien species invasion and native species expansion over the past 100 years? *Journal of Biogeography*, Vol. 36, No. 4 (April 2009), pp. 651-661, ISSN 1365-2699.



- Delisle, F., Lavoie, C., Jean, M. & Lachance, D. (2003). Reconstructing the spread of invasive plants: taking into account biases associated with herbarium specimens. *Journal of Biogeography*, Vol. 30, No. 7 (July 2003), pp. 1033-1042, ISSN 1365-2699.
- De Paula, M.E. (1975). Las especies del género *Hierochloë* (Gramineae) de Argentina y Chile. *Darwiniana*, Vol. 19, No. 2-4, pp. 422-457, ISSN 1850-1702.
- Desvaux, E. (1854). Gramíneas. In, Gay, C. *Historia Física y Política de Chile* Vol. 6, pp. 233-469, lám. 74-83 in Atlas.
- Escobar, I., Ruiz, E., Finot, V.L., Negritto, M.A. & Baeza, C.M. (2011). Revisión taxonómica del género *Eragrostis* Wolf en Chile, basado en análisis estadísticos multivariados. *Gayana Botánica* Vol. 68, No. 1, pp. 47-81, ISSN 0016-5301.
- Finot, V.L. (2010). Analysis of species boundaries in *Trisetum* Pers. sect. *Trisetara* Asch. & Graebn. (Poaceae) in America using statistical multivariate methods. *Current Topics in Plant Biology*, Vol. 11 (December 2010), pp. 39-74, ISSN 0972-4575.
- Finot, V.L., Marticorena, C., Barrera, J.A., Muñoz-Schick, M. & Negritto, M.A. (2009). Diversidad de la familia Poaceae (Gramineae) en la región del Bío-Bío, Chile, basada en colecciones de herbario. *Gayana Botánica*, Vol. 66, No.2 (December 2009), pp. 134-157. ISSN 0016-5301.
- Finot, V.L., Peterson, P.M., Zuloaga, F.O., Soreng, R.J. & Matthei, O. (2005). A revision of *Trisetum* (Poaceae: Pooideae: Aveninae) in South America. *Annals of the Missouri Botanical Garden* 92: 533-568.
- Fuentes, N., Ugarte, E., Kühn, I. & Klotz, S. (2008). Alien plants in Chile: inferring invasion periods from herbarium records. *Biological Invasions* 10: 649-657.
- Funk, V.A. & Richardson, K.S. (2002). Systematic data in biodiversity studies: Use it or lose it. *Systematic Biology* 51(2): 303-316.
- Gajardo, R. (1994). *La vegetación natural de Chile. Clasificación y distribución geográfica*. Editorial Universitaria, Santiago de Chile.
- Gealy, D.R., Mitten, D.H. & Rutger, J.N. (2003). Gene flow between red rice (*Oryza sativa*) and herbicide-resistant rice (*O. sativa*): implications for weed management. *Weed Technology* Vol. 17, No. 3 (Jule-September 2003), pp. 627-645.
- Giraldo-Cañas, D. (2008). Revisión del género *Axonopus* (Poaceae: Paniceae): primer registro del género en Europa y novedades taxonómicas. *Caldasia* Vol. 30, No. 2 (July-December), pp. 301-314, ISSN 0366-5232.
- Giussani, L.M., Cota-Sánchez, J.H., Zuloaga, F.O. & Kellogg, E.A. (2001). A molecular phylogeny of the grass subfamily Panicoideae (Poaceae) shows multiple origins of C4 photosynthesis. *American Journal of Botany*, Vol. 88, No. 11 (Nov. 2001), pp. 1993-2012, ISSN 1537-2197.
- Giussani, L.M., Zuloaga, F.O., Quarín, C.L., Cota-Sánchez, J.H., Ubayasena, K. & Morrone, O. (2009). Phylogenetic relationships in the genus *Paspalum* (Poaceae: Panicoideae: Paniceae): an assessment of the *Quadrifaria* and *Virgata* informal groups. *Systematic Botany*, Vol. 34, No. 1 (Jan.-Mar. 2009), pp. 32-43, ISSN 1548-2324.
- GPWG (Grass Phylogeny Working Group). (2001). Phylogeny and subfamilial classification of the grasses (Poaceae). *Annals of the Missouri Botanical Garden*, Vol. 88, No. 3 (September 2001), pp. 373-457, ISBN 0026-6493.
- Grau, J. (1995). Aspectos geográficos de la flora de Chile. In, *Flora de Chile, Vol. I. Pteridophyta-Gymnospermae*, pp. 63-83, C. Marticorena & R. Rodríguez (Eds.). Ed. Universidad de Concepción, Concepción, Chile.

- Hamby, R.K. & Zimmer, E.A. (1988). Ribosomal RNA sequences for inferring phylogeny within the grass family (Poaceae). *Plant Systematics and Evolution* 160: 29-37.
- Hilu, K.W. & Alice, L.A. (2001). A phylogeny of Chloridoideae (Poaceae) based on *matK* sequences. *Systematic Botany* Vol. 26, No. 2, pp. 386-405.
- Hilu, K.W., Alice, L.A. & Liang, H. (1999). Phylogeny of Poaceae inferred from *matK* sequences. *Annals of the Missouri Botanical Garden* 86: 835-851
- Hitchcock, A.S. (1950). *Manual of the grasses of the United States*. U.S.D.A. Miscellaneous Publication No. 200, Washington.
- Holcombe, T., Stohlgren, T.J. & Jarnevich, C.S. (2010). From points to forecasts: Predicting invasive species habitat suitability in the near term. *Diversity*, Vol. 2, No. 5 (May 2010), pp. 732-767.
- Hsiao, C., Jacobs, S.W.L., Chatterton, N.J. & Asay, K.H. (1999). A molecular phylogeny of the grass family (Poaceae) based on the sequences of nuclear ribosomal DNA (ITS). *Australian Systematic Botany* 11: 667-688.
- Judziewicz, E.J., Clark, L.G., Londoño, X. & Stern, M.J. (1999). *American bamboos*. Smithsonian Institution, Washington DC.
- Judziewicz, E.J., Soreng, R.J., Davidse, G., Peterson, P.M., Filgueiras, T.S. & Zuloaga, F.O. (2000). Catalogue of New World Grasses (Poaceae): I. Subfamilies Anomochloideae, Bambusoideae, Ehrhartoideae and Pharoideae, *Contributions from the United States National Herbarium* Vol. 39, pp. 1-128, ISSN 0097-1618.
- Kellogg, E.A. (2000). Grasses: A case study in macroevolution. *Annual Review of Ecology and Systematics*, Vol. 31, (November 2000), pp. 217-238, ISSN 0066-4162.
- Kellogg, E.A. (2001). Evolutionary history of the grasses. *Plant Physiology*, Vol. 125, No. 3 (Mar. 2001), pp. 1198-1205, ISSN 1532-2548.
- Kellogg, E.A. (2009). The evolutionary history of Ehrhartoideae, Oryzeae, and *Oryza*. *Rice* Vol. 2, (Jan. 2009), pp 1-14, ISSN 1939-8425.
- Kunkel, G. (1968). Die Phanerogamen der Insel La Mocha (Chile). *Willdenowia* Vol. 4, No. 3, pp. 329-400, ISSN 0374-8960.
- Linder, P., Baeza, M., Barker, N.P., Galley, Ch., Humphreys, A.M., Lloyd, K.M., Orlovich, D.A., Pirie, M.D., Simon, B.K., Walsh, N. & Verboom, G.A. (2010). A generic classification of the Danthonioideae (Poaceae). *Annals of the Missouri Botanical Garden* Vol. 97, No.3 (Oct. 2010), pp. 306-364, ISBN 0026-6493.
- Luebert, F. & Pliscoff, P. (2006). *Sinopsis bioclimática y vegetal de Chile*. Editorial Universitaria, Santiago de Chile.
- Mann, D., Chase, J., Edwards, J., Beck, W., Reanier, R., and Mass, M. (2003). Prehistoric destruction of the primeval soils and vegetation of Rapa Nui (Isla de Pascua, Easter Island). In, *Easter Island*. Loret, J. & Tanacredi, J.T. (eds.), pp. 133-154, Kluwer Academic/Plenum Publishers, ISBN 0-306-47494-8, New York, USA.
- Markgraf, W. (2003). Anthropogen beeinflusste Landschaftsentwicklung im Osten der Osterinsel. Diplomarbeit zur Diplomprüfung im Fach Geographie Universität zu Kiel.
- Martcorena, C. & Quezada, M. (1985). Catálogo de la flora vascular de Chile. *Gayana Botánica* Vol. 42, No. 1-2 (Dec. 1985), pp. 5-157, ISSN 0016-5301.
- Martcorena, C., Squeo, F.A., Arancio, G. & Muñoz, M. (2001). Catálogo de la flora de la IV Región. In, *Libro rojo de la flora nativa y de los sitios prioritarios para su conservación:*

- Región de Coquimbo* (Squeo, F.A., Arancio, G. & Gutiérrez, J.R., Eds.), pp. 105-142. Ed. Universidad de La Serena, La Serena, Chile.
- Mason-Gamer, R.J., Weil, C.F. & Kellogg, E.A. (1998). Granule-bound starch synthase: structure, function, and phylogenetic utility. *Molecular Biology and Evolution*, Vol. 15, No. 12 (Dec. 1998), pp. 1658-1673, ISSN 1537-1719.
- Mathews, S., Tsai, R.C. & Kellogg, E. (2000). Phylogenetic structure in the grass family (Poaceae): evidence from the nuclear gene phytochrome B. *American Journal of Botany*, Vol. 87, No. 1 (Jan. 2000), pp. 96-107, ISSN 1537-2197.
- Matthei, O. (1965). Estudio crítico de las gramíneas del género *Stipa* en Chile. *Gayana Botánica*, Vol. 13 (Jun. 1965), 1-137, ISSN 0016-5301.
- Matthei, O. (1973). *Trichoneura* Andersson (Gramineae), nuevo género para la flora de Chile. *Boletín de la Sociedad de Biología de Concepción* Vol. 46, pp. 37-39, ISSN 0037-850X.
- Matthei, O. (1975). Der *Briza*-Kimplex in Südamerika: *Briza*, *Calotheca*, *Chascolytrum*, *Poidium* (Gramineae). Eine Revision. *Wildenowia* Vol. 8, pp. 1-168, ISSN 0374-8960.
- Matthei, O. (1982). El género *Festuca* (Poaceae) en Chile. *Gayana Botánica* Vol. 37 (Jun. 1982), pp. 1-64, ISSN 0016-5301.
- Matthei, O. (1986). El género *Bromus* L. (Poaceae) en Chile. *Gayana Botánica*, Vol. 43, No. 1-4 (Dec. 1986), pp. 47-110, ISSN 0016-5301.
- Matthei, O. (1987a). Las especies del género *Aristida* L. (Poaceae) en Chile. *Gayana Botánica* Vol. 44, No. 1-4 (Sep. 1987), pp. 17-23, ISSN 0016-5301.
- Matthei, O. (1987b). Las especies del género *Panicum* (Poaceae) en Chile. *Gayana Botánica* Vol. 44, No. 1-4 (Sep. 1988), pp. 25-32, ISSN 0016-5301.
- Matthei, O. (1995). *Manual de las malezas que crecen en Chile*. Alfabeta Imp., Santiago de Chile.
- Matthei, O. (1997). Las especies del género *Chusquea* Kunth (Poaceae: Bambusoideae), que crecen en la X Región, Chile. *Gayana Botánica*, Vol. 54, No. 2, (April 1998), pp. 199-220, ISSN 0016-5301.
- Matthei, O., Marticorena, C. & Stuessy, T.F. (1993). La flora adventicia del Archipiélago de Juan Fernández. *Gayana Botánica* Vol. 50, No. 2 (Dec. 1993), pp. 69-102, ISSN 0016-5301.
- Mösbach, E.W. (1999). *Botánica indígena de Chile*. Editorial Andrés Bello, Santiago de Chile.
- Moreira-Muñoz, A. & Muñoz-Schick, M. (2007). Classification, diversity, and distribution of Chilean Asteraceae: implications for biogeography and conservation. *Diversity and Distributions*, Vol. 13, No. 6 (Nov. 2007), pp. 818-828, ISSN 1472-4642.
- Müller, C. 1985. Zur verbreitung und taxonomie der gattung *Polypogon* (Poaceae) in Südamerika. *Wiss. Z. Karl-Marx-Univ. Leipzig, Math.-Naturwiss. R.*, Vol. 34, No. 4, pp. 437-449.
- Muñoz, C. (1941). *Indice bibliográfico de las gramíneas chilenas*. Boletín Técnico No. 2, Ministerio de Agricultura, Santiago de Chile.
- Muñoz-Schick, M. (1985). Revisión de las especies del género *Melica* L. (Gramineae) en Chile. *Boletín del Museo Nacional de Historia Natural*, Vol. 40, pp. 41-89, ISSN-0027-3910.
- Muñoz-Schick, M. (1990). Revisión del género *Nassella* (Trin.) E. Desv. en Chile. *Gayana Botánica* Vol. 47, No. 1-2 (Oct. 1990), pp. 9-35, ISSN 0016-5301.
- Nadot, S., Bajan, R. & Lejeune, B. (1994). The chloroplast gene *rps4* as a tool for the study of Poaceae phylogeny. *Plant Systematic & Evolution*, Vol. 191, No. 1-2 (Mar. 1994), pp. 27-38, ISSN 1615-6110.

- Nicora, E.G. (1978). Gramineae. In, Flora Patagónica, M.N. Correa (Ed.), pp. 1-563. Colecciones Científicas INTA, Buenos Aires, Argentina.
- Nicora, E.G. (1998). Revisión del género *Eragrostis* Wolf. (Gramineae: Eragrostideae) para Argentina y países limítrofes. *Boissera* Vol. 54 (May 1998), pp. 1-109, ISSN 0373-2975.
- Pankhurst, R.J. & Hervé, F. (2007). Introduction and overview. In, *The geology of Chile*, T. Moreno & E. Gibbons (Eds), pp. 1-4. The Geological Society of London. Version: 21 January 2011. [http://www.amazon.com/Geology-Chile-Teresa-Moreno/dp/186239220X#reader\\_186239220X](http://www.amazon.com/Geology-Chile-Teresa-Moreno/dp/186239220X#reader_186239220X)
- Parodi, L.R. (1945). Sinopsis de las gramíneas chilenas del género *Chusquea*. *Revista Universitaria (Santiago)*, Vol. 30, No. 1, pp. 331-345.
- Peñailillo, P. (1996). *Anatherostipa*, un nuevo género de Poaceae (Stipeae). *Gayana Botánica*, Vol. 53, No. 2, pp. 277-284, ISSN 0016-5301.
- Peterson, P.M., Columbus, J.T. & Pennington, S.J. (2007). Classification and biogeography of New World Grasses: Chloridoideae. *Aliso* Vol. 23, pp. 580-594, ISSN 0065-6275.
- Peterson, P.M., Romaschenko, K. & Johnson, G. (2010). A classification of the Chloridoideae (Poaceae) based on multi-gene phylogenetic trees. *Molecular Phylogenetics and Evolution* Vol 55 (June 2010), pp. 580-598, ISSN 1095-9513.
- Peterson, P.M., Soreng, R.J., Davidse, G., Filgueiras, T.S., Zuloaga, F.O. & Judziewicz, E.J., (2001). Catalogue of New World Grasses (Poaceae): II. Subfamily Chloridoideae, *Contributions from the United States National Herbarium* Vol. 41, pp. 1-255, ISSN 0097-1618.
- Piperno, D. & Sues, H.D. (2005). Dinosaurs dined on grass. *Science*, Vol. 310, No. 5751 (Nov. 2005), pp. 1126-1128, ISSN 1095-9203.
- Pisano, E. (1985). La estepa patagónica como recurso pastoral en Aysén y Magallanes. *Ambiente y Desarrollo*, Vol. 1, No. 2 (Jun. 1985), pp. 45-59, ISSN 0716-1476.
- Planchuelo, A.M. (2010). Nuevas citas y distribución de especies de *Bromus* L. (Poaceae: Bromeae) para Bolivia. *Kempffiana*, Vol. 6, N°1, (Jun. 2010), pp. 3-15, ISSN 1991-4652.
- Poblete, H., Cuevas, H. & Díaz-Vaz, J.E. (2009). Property characterization of *Chusquea culeou*, a bamboo growing in Chile. *Maderas. Ciencia y Tecnología*, Vol. 11, No. 2, pp. 129-138, ISSN 0718-211X.
- Ponder, W.F., Carter, G.A., Flemons, P. & Chapman, R.R. (2001). Evaluation of museum collections data for use in biodiversity assessment. *Conservation Biology*, Vol. 15, No. 3 (Jun. 2001), pp. 648-657, ISSN 1523-1739.
- Prasad, V., Strömberg, C.A.E., Alimohammadian, H. & Sahní, A. (2005). Dinosaurs coprolites and the early evolution of grasses and grazers. *Science*, Vol. 310, No. 5751 (Nov. 2005), pp. 1177-1180, ISSN 1095-9203.
- Prather, L.A., Alvarez-Fuentes, O., Mayfield, M.H. & Ferguson, C.J. (2004). The decline of plant collecting in the United States: A threat to the infrastructure of biodiversity studies. *Systematic Botany*, Vol. 29, No. 1 (Jan. 2004), pp. 15-28, ISSN 1548-2324.
- Reiche, K. (1903). La isla de la Mocha. *Anales del Museo Nacional de Chile* Vol. 16, pp. 1-104.
- Rodríguez, R., Grau, J., Baeza, C. & Davies, A. 2008a. Lista comentada de las plantas vasculares de los Nevados de Chillán, Chile. *Gayana Botánica*, Vol. 65, No. 2 (Dec. 2008), ISSN 0016-5301.



- Rodríguez, R., Marticorena, A. & Teneb, E. (2008b). Plantas vasculares de los ríos Baker y Pascua, región de Aisén, Chile. *Gayana Botánica*, Vol. 65, No. 1 (Jun. 2008), pp. 39-70, ISSN 0016-5301.
- Rúgolo de Agrasar, Z.E. (1978). Las especies australes del género *Deyeuxia* Clar. (Gramineae) de la Argentina y Chile. *Darwiniana*, Vol. 21, No. 2-4, pp. 417-453, ISSN 1850-1702.
- Rúgolo de Agrasar, Z.E. (1982). Revalidación del género *Bromidium* Nees et Meyen emend. Pilger (Gramineae). *Darwiniana*, Vol. 24, No. 1-4 (Jul. 1982), pp. 187-216, ISSN 1850-1702.
- Rúgolo de Agrasar, Z.E. (1999). *Corynephorus* (Gramineae), género adventicio para la flora de Chile. *Hickenia*, Vol. 2, No. 64 (Jan. 1999), pp. 299-302, ISSN 0325-3732.
- Rúgolo de Agrasar, Z.E. (2006). Las especies del género *Deyeuxia* (Poaceae, Pooideae) de la Argentina y notas nomenclaturales. *Darwiniana*, Vol. 44, N°.1, (Jul. 2006), pp. 131-293, ISSN 1850-1702.
- Rúgolo de Agrasar, Z.E., García, N. & Mieres, G. (2009). *Danthonia decumbens* (Danthoniae, Poaceae), nueva especie adventicia para Chile continental. *Gayana Botánica*, Vol. 66, No. 1 (jun. 2009), pp. 92-94, ISSN 0016-5301.
- Rúgolo de Agrasar, Z.E. & Molina, A.M. (1997). Las especies del género *Agrostis* L. (Gramineae, Agrostideae) de Chile. *Gayana Botánica*, Vol. 54, No. 2, (Apr. 1997), pp. 91-156.
- Rundel, P.W., Dillon, M.O. & Palma, B. (1996). Flora and vegetation of Pan de Azúcar National Park in the Atacama desert of northern Chile. *Gayana Botánica*, Vol. 53, No. 2 (Dec. 1996), pp. 295-315.
- Sánchez-Ken, J.G. & Clark, L.G. (2010). Phylogeny and a new tribal classification of the Panicoideae s.l. (Poaceae) based on plastid and nuclear sequence data and structural data. *American Journal of Botany* Vol. 97, No. 10 (Sep. 2010), pp. 1732-1748, ISSN 1537-2197.
- Sánchez-Ken, J.C., Clark, L.G., Kellogg, E.A. & Kay, E.E. (2007). Reinstatement and emendation of the subfamily Micrairoideae (Poaceae). *Systematic Botany*, Vol. 32, No. 1 (Jan.-Mar. 2007), pp. 71-80. ISSN 1548-2324.
- San Martín, C., Subiabre, M. & Ramírez, C. (2006). A floristic and vegetational study of a latitudinal gradient of salt-marshes in South-Central Chile. *Ciencia e Investigación Agraria*, Vol. 33, No. 1 (Jun.-Apr. 2006), pp. 33-40, ISSN 0718-1620.
- Scotland, R.W. & A.H. Wortley. (2003). How many species of seed plants are there? *Taxon* Vol. 52, No. 1 (Feb. 2003), pp. 101-104, ISSN 0040-0262.
- Skottsberg, C. (1956). *The natural history of Juan Fernandez and Easter Island*. Vol. I. Geography, Geology origin of island life. Almquist & Wiksells Boktryckeri Ab, Uppsala.
- Smith, G.F. & M.M. Wolfson. (2004). Mainstreaming biodiversity: the role of taxonomy in bioregional planning activities in South Africa. *Taxon*, Vol. 53, No. 2 (May 2004), pp. 467-468. ISSN 0040-0262.
- Steadman, D.W. (1995). Prehistoric extinctions of Pacific Island birds: Biodiversity meets zooarchaeology. *Science*, Vol. 267, No. 5201 (Feb. 1995), pp. 1123-1131, ISSN 0036-8075.
- Soreng, R.J. & Davis, J.I. (1998). Phylogenetics and character evolution in the grass family (Poaceae): Simultaneous analysis of morphological and chloroplast DNA restriction site character sets. *The Botanical Review*, Vol. 64, No. 1 (Jan. 1998), pp. 1-85, ISSN 0006-8101.

- Soreng, R.J., Davidse, G., Peterson, P.M., Zuloaga, F.O., Judziewicz, E.J., Filgueiras, T.S. & Morrone, O. (2009). Catalogue of New World Grasses (Poaceae). In, *Tropicos*, 27.12.2010, <http://www.tropicos.org>.
- Soreng, R.J., Davis, J.I. & Voionmaa, M.A. (2007). A phylogenetic analysis of Poaceae tribe Poeae sensu lato based on morphological characters and sequence data from three plastid-encoded genes: evidence for reticulation, and a new classification for the tribe. *Kew Bulletin*, Vol. 62, pp. 425-454, ISSN 1874-933X.
- Soreng, R.J. & Gillespie, L.J. (2007). Nicoraepoa (Poaceae: Poeae), a new South American genus based on Poa subg. Andinae, and emmendment of Poa sect. Parodiochloa of the Sub-Antarctic islands. *Annals of the Missouri Botanical Garden*, Vol. 94, No. 4 (Dec. 2007), pp. 821-849, ISSN 0026-6493.
- Soreng, R.J. & Peterson, P.M. (2008). New records of Poa (Poaceae) and Poa pfisteri: a new species endemic to Chile. *Journal of the Botanical Research Institute of Texas* Vol. 2, No. 2, pp. 847-859, ISSN 1934-5259.
- Soreng, R.J., Peterson, P.M., Davidse, G., Judziewicz, E.J., Zuloaga, F.O., Filgueiras, T.S. & Morrone, O. (2003). Catalogue of New World Grasses (Poaceae): IV. Subfamily Pooideae, *Contributions from the United States National Herbarium* Vol. 48, pp. 1-730, ISSN 0097-1618.
- Squeo, F.A., Arancio, G., Marticorena, C., Muñoz-Schick, M., & Gutiérrez, J.R. (2001). Diversidad vegetal de la IV región de Coquimbo, Chile. In, *Libro rojo de la flora nativa y de los sitios prioritarios para su conservación: Región de Coquimbo*, F.A. Squeo, G. Arancio. & J.R. Gutiérrez (Eds.), pp. 149-158. Ed. Universidad de La Serena, La Serena, Chile.
- Squeo, F.A., Arroyo, M.T.K., Marticorena, A., Arancio, G., Muñoz-Schick, M., Negritto, M., Rojas, G., Rosas, M. Rodríguez, R., Humaña, A.M., Barrera, E. & Marticorena, C. (2008). Catálogo de la flora vascular de la región de Atacama. In, *Libro rojo de la flora nativa y de los sitios prioritarios para su conservación: Región de Atacama*, F.A. Squeo, G. Arancio & J.R. Gutiérrez (Eds.), pp. 97-120. Ed. Universidad de La Serena, Concepción, Chile.
- Squeo, F.A., Cavieres, L., Arancio, G., Novoa, J., Matthei, O., Marticorena, C., Rodríguez, R., Arroyo, M.T.K. & Muñoz, M. (1998). Biodiversidad de la flora vascular en la región de Antofagasta, Chile. *Revista Chilena de Historia Natural*, Vol. 71, No. 4 (Dec. 1998), pp. 571-591, ISSN 0717- 6317.
- Stuessy, T.F. & Taylor, C. (1995). Evolución de la flora chilena. In, *Flora de Chile, Vol. I. Pteridophyta-Gymnospermae*, pp. 85-118, C. Marticorena & R. Rodríguez (Eds.). Ed. Universidad de Concepción, Concepción, Chile.
- Swenson, U., Stuessy, T.F., Baeza, M. & Crawford, D. (1997). New and historical plant introductions and potential pests in the Juan Fernández islands, Chile. ISSN 0016-5301, Vol. 52, No. 3, pp. 233-252. E-ISSN: 1534-6188.
- Tzvelev, N.N. (1983). *Grasses of the Soviet Union*, Oxonian Press, New Dehli.
- Tzvelev, N.N. (1989). The system of grasses (Poaceae) and their evolution. *The Botanical Review*, Vol. 55, No. 3 (Jul.-Sep. 1989), pp. 141-203, ISSN 0006-8101.
- Vega, A.S., Rua, G.H., Fabbri, L.T. & Rúgolo, Z.E. (2009). A morphology-based cladistic analysis of *Digitaria* (Poaceae, Panicoideae, Paniceae). *Systematic Botany*, Vol. 34, No. 2 (Apr.-Jun. 2009), pp. 312-323, ISSN 1548-2324.

- Vincentini, A., Barber, J.C., Aliscioni, S.S., Gissani, L.M. & Kellogg, E. (2008). The age of grasses and clusters of origins of C4 photosynthesis. *Global Change Biology*, Vol. 14, No. 6 (Jun. 2008), pp. 2963-2977, ISSN 1365-2486.
- Watson, L., & Dallwitz, M.J. (1992 onwards). *The grass genera of the world: descriptions, illustrations, identification, and information retrieval; including synonyms, morphology, anatomy, physiology, phytochemistry, cytology, classification, pathogens, world and local distribution, and references*. Version: 23rd Apr. 2010. <http://delta-intkey.com>'.
- Wilson, E.O. (2000). On the future of conservation biology. *Conservation Biology*, Vol. 14, No. 1 (Feb. 2000), pp. 1-3, ISSN 1523-1739.
- Zuloaga, F.O., Morrone, O. & Belgrano, M. (2008). *Catálogo de las plantas vasculares del Cono Sur. Vol. 1: Pteridophyta, Gymnospermae, Monocotyledoneae*. Monographs in Systematic Botany 107, Missouri Botanical Garden Press, St. Louis, Missouri, U.S.A.
- Zuloaga, F.O., Morrone, O., Davidse, G., Filgueiras, T.S., Peterson, P.M., Soreng, R.J. & Judziewicz, E.J., (2003). Catalogue of New World Grasses (Poaceae): III. Subfamilies Panicoideae, Aristidoideae, Arundinoideae, and Danthonioideae, *Contributions from the United States National Herbarium* Vol. 46, pp. 1-662, ISSN 0097-1618.

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