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First annual register of allergenic pollen in Talca, Chile

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Abstract
Background: There are no data on atmospheric pollen in Talca. In the present work, our aim is to describe the amount of pollen grain in the atmosphere of the city of Talca likely to cause pollinosis of its inhabitants.
Methods: A volumetric Hirst sampler (Burkard seven-day recording device) was used to study pollen levels. It was placed in the centre of Talca from May 2007 to April 2008.
Results: The highest airborne presence of pollen, as measured in weekly averages, was *Platanus acerifolia* with a maximum weekly daily average of 203 grains/m^3 registered during September and October. The second highest was *Acer pseudoplatanus* with a maximum weekly daily average of 116 grains/m^3. *Populus* spp. had a maximum weekly daily average 103 grains/m^3. *Olea europaea* reached 19 grains/m^3 in November. Grasses presented high levels of pollen counts with a maximum weekly daily average of 27 grains/m^3 from the end of August until the end of January. Pollens of *Plantago* spp. *Rumex acetosella* and *Chenopodium* spp. had a similar distribution and were present from October to April with maximum weekly daily average of 7 grains/m^3, 7 grains/m^3 and 3 grains/m^3 respectively. Significant concentrations of *Ambrosia artemisiifolia* were detected from February until April.
Conclusion: The population of Talca was exposed to high concentrations of allergenic pollen, such as *P. acerifolia*, *A. pseudoplatanus*, and grasses in the months of August through November. The detection of *O. europaea* and *A. artemisiifolia* is important as these are emergent pollens in the city of Talca. Aerobiological monitoring will provide the community with reliable information about the level of allergenic pollens, improving treatment and quality of life of patients with respiratory allergy.

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Introduction

The aerial dispersion of copious amounts of pollen, as part of a complex reproductive strategy in wind pollinated plants, results in adverse health-related consequences.[1] Pollens are one of the most important causal agents of allergic diseases, and considered, by many, to be the principal allergen eliciting rhino-conjunctivitis and responsible for more than 50% of the cases of asthma.[2–5] International guidelines for management of allergic asthma and rhinitis, such as GINA[6] and ARIA[7] respectively, aeroallergens described as factors associated with the development of allergic clinical manifestations.

The technological advances applied in the area of aerobiology and other advances made in palynology have accumulated in an exhaustive knowledge of this discipline, which has as its main purpose the improvement in diagnosis and treatment of pollinic patients. The sensitisation to certain pollen in a population depends on the levels of exposure, genetic predisposition, and allergenic characteristics of the plants that inhabit the region.[8] Local aeroallergen surveys identify and establish patterns of prevalence for allergenic tree, grass, and weed species that enable the clinician to more effectively select allergens for skin prick test and therapy. Increasing the public's knowledge of major area aeroallergens will facilitate the practice of more effective avoidance measures for the sensitised patient.[1]

In the southern hemisphere the works aimed to describe atmospheric pollen loads have been few. The first attempt to investigate and measure the atmospheric pollen in Chile was performed by Hoffman et al.[9] This work was carried out with a gravity sensor, which limited its findings to define qualitatively the pollen present and seasonality. Twenty years later, Rojas et al. determined by volumetric methods, the pollen rain of Santiago city.[10] Both studies established the rational basis for the implementation of skin prick test of allergens for the diagnosis of respiratory allergy in this city. The city of Talca, Chile, has a variety of trees, shrubs, grasses and weeds of foreign origin[11] with known allergenic characteristics.[12,13] The pollen of these plants causes well described diseases. However, some species planted at a considerable distance from the city are becoming new forms of non-traditional or rural pollen that pollute the air of Talca. In the present work, our aim is to describe the amount of pollen grain in the atmosphere of the city of Talca likely to cause pollinosis of its inhabitants.

Materials and methods

Study area

The city of Talca is located in the central valley of the south-central zone of Chile (35°26′S, 71°40′W). It is located at an altitude of 97 m above sea level. The climate is Mediterranean pluviestational oceanic, with an average annual temperature of 14.7 °C and an average annual precipitation of 737 mm.[14] The area studied is characterised by a great poplar grove, squares and avenues with predominantly introduced ornamental trees of different taxa such as: Cupressaceae, Pinaceae, Taxodiaceae between the Gymnosperms and *Platanus acerifolia*, *Acer negundo*, *Acer pseudoplatanus*, *Populus alba*, *Ulmus procera*, among others.[11] Furthermore, numerous introduced herbs appear in streets, abandoned sites and gardens, abandoned fields, with a prodigious presence of Gramineae, Asteraceae as *Ambrosia artemisiifolia*, Chenopodiaceae among others.[15] The majority of these plants are anemophilous with an allergenic background.[1,16] The natural vegetation in the surrounding area of the city of Talca consists of sclerophyllous forest and the spiny arborescent scrub. On the banks of the rivers, different tress species grow. There, the genus of *Salix* and *Populus* and scrubs such as *Tessaria absinthioides* and *Baccharis pingraea* are found.[14] It is also not uncommon to find short ragweed in the city surroundings.[15]

Air sampling

A volumetric Hirst sampler was used to study pollen counts (Burkard Seven Day Spores-Trap®). It was placed on the roof of the Talca Municipality building in compliance with the regulations established by the World Allergy Organization (WAO) guidelines.[17] Samples were analysed once a day for a week with an E200 Nikon Microscope and a visual field of 400× between May 2007 and April 2008. Daily pollen counts and weekly average counts for each of the species were taken. The principal species according to allergenic background[10,18,19] and atmospheric presence were selected to represent, with the information described above, the annual curve of each of this pollen. Pollen capturer, conversion and interpretation of the samples were carried out according to the recommendations given by the WAO.[20]

Analysis of the information

Data were compiled using Microsoft office Excel 07. The variables were analysed by using measures of position, central tendency and dispersion. The Kolmogorov–Smirnov test was employed to analyse the normality of quantitative variables. SPSS statistical software, version 14.0 (SPSS Inc., Chicago, IL, USA), was used for all statistical analyses.

Results

Eleven different pollinic types were present in the first register of annual pollen counts of the city of Talca. Furthermore, these eleven pollinic types have a high probability of causing pollinosis. Six of them are trees and five are herbs (Table 1).

Among the tree pollinic types, *P. acerifolia* was found to contribute the highest quantity of pollen (3248 grains/year), with a weekly daily average peak of 203 grains/m^3 during the last days of September and the beginning of October. Next was *Populus* spp. registering high concentrations (1470 grains/year with a weekly average peak of 103 grains/m^3 in the first week of September). *A. pseudoplatanus* was also found to contribute to the pollinic lead (1456 grains/year) with a weekly average peak of 116 grains/m^3 registered during the first week of October as

Table 1 Pollen types chosen, total annual pollen, % of total pollen, maximum pollination peak and period and maximum pollination period.

Pollen types	Total annual pollen	% of total pollen	Maximum pollination peak (grains/m^3)	Maximum pollination period
Trees				
Platanus acerifolia	3248	29.99	203	September-04
Acer pseudoplatanus	1470	13.57	116	October-01
Populus spp.	1470	13.57	103	September-01
Cupressus spp.	644	5.95	47	August-05
Olea europaea	259	2.39	19	November-03
Ulmus spp.	133	1.23	9	August-02
Grass				
Gramineae	2520	23.27	26/27	August-05/November-04
Herbs				
Ambrosia artemisiifolia	189	1.75	10	February-04
Plantago lanceolata	441	4.07	7	November-02
Rumex acetosella	343	3.17	7	February-02
Chenopodium-Amaranthaceae	105	0.97	3	March-02

well as *Cupressus* spp. (644 grains/year) with a weekly average peak of 47 grains/m^3 during the fifth week of August and *Ulmus* spp. with less concentrations (133 grains/year) and a weekly daily average peak of 9 grains/m^3 and a maximum pollination period registered during the second week of August (Fig. 1).

It is important to point out the presence and emergence of the pollen of *Olea europaea* (259 grains/year) which had a weekly daily average peak of 19 grains/m^3 and a maximum pollination period registered during the third week of November (Fig. 1). This species has been recently cultivated in the Quepú and Pencahue valleys located 15 km north-west of Talca, with about 1000 ha.

In relation to pollinic types of herbs, the grasses (Gramineae) presented the highest total counts (2520 grains/year) with two maximum peaks in the year, one in the fifth week of August and the other in the fourth week of November. *Plantago lanceolata* reached 441 grains/year. More important than the previous species was *Ambrosia artimisiifolia* (189 grains/year) beginning in the fourth week of February and continuing throughout the summer until the beginning of autumn. The pollinic types *Rumex acetosella* reached 343 grains/year and *Chenopodium*-Amaranthaceae, reached similar concentrations with approximately 105 grains/year each year during the summer and beginning of autumn (Fig. 1).

The majority of the pollinic types have an established period of pollination. Thus, the pollinic types of the tree species, *P. acerifolia*, *A. pseudoplatanus* and *Ulmus* spp. were detected in the atmosphere during a very short time period of about two months.

Nevertheless, the herbs such as Gramineae had a wide period of pollination during the entire year, but with two peaks of pollination, one in September and the other in November. This can be explained by the fact that many plant species contain this pollinic type and each one has a different time of flowering.[21]

The more relevant pollinic types in order of quantitative importance are: *P. acerifolia* (30.06%), Gramineae (23.27%), *A. pseudoplatanus* (13.57%), *Cupressus* spp. (5.95%), *R. acetosella* (3.17%) and *O. europaea* (2.93%) as the rest of the taxa account for less than 2% of the total spectrum (Table 1).

Grasses presented high levels of pollen and a long season. They registered two maximum weekly daily averages of 26/27 grains/m^3 at the end of August and at the end of November (Fig. 1).

A. artemisiifolia (ragweed) was present from February until April with a maximum weekly daily average of 10 grains/m^3. *P. lanceolata* (plantain), *R. acetosella* (sorrel) and *Chenopodium* spp (lamb quarters) had a similar distribution and were present from October until April with maximum weekly daily average of 7 grains/m^3, 7 grains/m^3 and 3 grains/m^3 respectively (Fig. 1).

Discussion

Pollinic types of tree species (66.77%) dominate the pollinic spectrum in Talca just as has been demonstrated in studies done in other Mediterranean regions.[13,22,23] The pollen from the herbaceous species represents 33.13% of the total pollen emitted annually, mainly by Gramineae.

The months of greater concentration of pollen in the air occurred during the spring months (i.e. the four weeks of September and October) and coincided with the flowering period of the principal anemophilous tree species: *P. acerifolia* and *A. pseudoplatanus*, both pollinic types that present an allergenic background[16,24–26] and *Populus* spp. The pollinic type Cupressaceae (*Cupressus* spp.) pollinates from July until the end of August, which is until the end of the winter season, mentioned as the cause of winter pollinosis in the sensitised patients.[26] The pollinic type *Populus* spp. and *A. pseudoplatanus* (13.57% of total pollen count) are considered in foreign literature to have a low allergenic count,[24,26,27] but not necessarily in local reports.

O. europaea (olive) appeared as a type of emergent pollen in the pollinic spectrum and was important at the end of spring with 19 grains pollen/m^3 as a maximum. In the

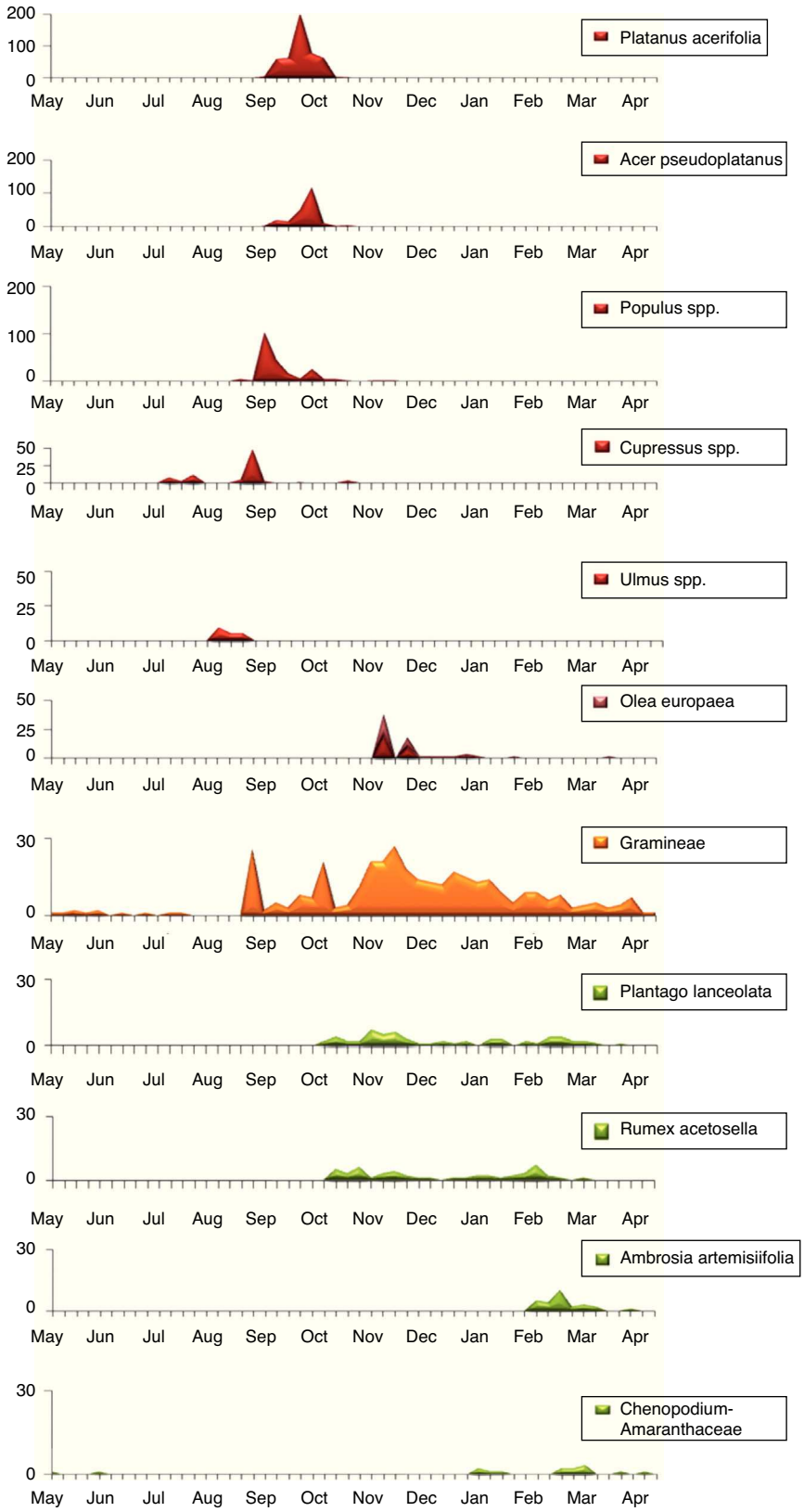

Figure 1 Pollen count [daily average per week (pollen grains/m^3)]. Talca 2007–2008.

Spanish Mediterranean region, it is considered to be the principal cause of pollinosis.[27,28] In the city of Jaén, Spain, 84% of the population is sensitised to olive pollen.[29]

One of the most relevant pollinic types are Gramineae (grasses) which contribute to the annual pollinic spectrum at 23.27%, reaching maximum levels at the end of winter and peaking again at the end of spring. In this way, grasses contribute to winter, spring and summer pollinosis, and their allergenic capacity has been well documented.[24,27,30]

The remaining pollinic types contribute less than 4% of the total pollen load. Pollinic types, such as *P. lanceolata* and *R. acetosella* cause spring pollinosis.[24,31] In contrast, *A. artemisiifolia*, *Chenopodium*-Amaranthaceae and *R. acetosella* produce summer and late summer allergies[32]

The pollinic type *A. artemisiifolia* (common or short ragweed) seems to be characteristic of Talca. According to Matthei,[15,33] this is a very aggressive weed that inhabits the Maule region (Talca and Linares provinces). This weed abounds in all type of crops and produces great quantities of pollen capable of provoking allergies.

The contribution of the principal allergenic tree pollen load in Talca is less significant than that observed in the same species in Santiago city.[16] This indicates that, at the moment, the air of Talca contains a much lesser charge of pollen than Santiago (Table 1). On the other hand, the percentage of the pollen of grasses and weeds in Talca is very low compared to those of the city of Temuco.[34]

Nevertheless, we found similarities in the species that pollinate in Talca compared with those in Temuco or Santiago. Their concentration varies significantly, causing an expected difference in the impact on the sensitisation of the allergic population. The pollen of the herbaceous species *A. artemisiifolia*, which has a notable allergenic power,[35] could be an important factor determining the phenotype of allergic patients, who could expect to show symptoms in late summer in those allergic to this weed. Although levels are not very high in the urban environment, it has a high allergenic potency, high presence in rural surroundings and it is present exclusively in this area of Chile. These facts emphasise the importance of having an aerobiological and clinical surveillance of these species.[15]

Limitations of the study are as follows. First, although missing two seasons to establish the behaviour of the pollen rain type, the reference of a year is significant and sets a pattern of behaviour types and levels of pollens. Second, although there is no information about allergic sensitisation of the inhabitants of the city of Talca, there are literature reports where these pollens have been associated with episodes of respiratory allergy. In conclusion, the population of Talca is exposed to high concentrations of allergenic tree pollen species from August to November. The clinical relevance should be established in future studies using skin prick tests in patients with symptoms of seasonal allergic rhinoconjunctivitis and/or asthma in the city of Talca. The clinical application of this information may save resources, in addition to rationalising and optimising health costs in relation to the use of allergenic extracts for diagnosis and immunotherapy. Moreover, aerobiological monitoring will provide the community with reliable information about the level of allergenic pollens, improving the treatment and quality of life of patients with respiratory allergy.

Ethical disclosures

Patients' data protection. Confidentiality of data. The authors declare that they have followed the protocols of their work centre on the publication of patient data and that all the patients included in the study have received sufficient information and have given their informed consent in writing to participate in that study.

Right to privacy and informed consent. Right to privacy and informed consent. The authors have obtained the informed consent of the patients and/or subjects mentioned in the article. The author for correspondence is in possession of this document.

Protection of human subjects and animals in research. Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the responsible Clinical Research Ethics Committee and in accordance with those of the World Medical Association and the Helsinki Declaration.

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Conflict of interest

The authors declare economical contribution in the realisation of this work of Laboratorio Merck Sharp Dome.

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