Allergy to *Ailanthus altissima* pollen: A local allergen to consider

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The diagnostic study of pollen allergy must include those species with allergenic potential that are specific to a certain zone. Although the most prevalent pollens are known and studied in our geographical area (Barcelona, Spain), in order to achieve an accurate diagnosis one should also take into account those species that have recently been introduced.

We present the case of a 42-year-old woman who suffered rhinoconjunctivitis (sneezing, rhinorrhea, nasal and ocular pruritus, and tearing) from May to June during the last three years. She related her symptoms to the presence of certain trees near her home that were identified as *Ailanthus altissima* (from now on *A. altissima*).

A. altissima tree, also known as the tree of heaven, is a dioecious plant native of China and it was introduced as an ornamental species in Spain in the XIX century, which has become naturalized and invasive [1]. Some plants produce hermaphrodite flowers and other only male flowers, which tend to be four times more abundant than plants that produce female flowers. Pollen grain is spheroidal and isopolar, medium sized (26 µm, varying from 24.3-28.7), tricolporate and striato-reticulate; and the pollination occurs from May to July [2]. The database of the Catalan Aerobiological Network

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(http://lap.uab.cat/aerobiologia) shows, for the Barcelona area and the period 1994-2019, that the pollen grains from *Ailanthus* are airborne from the second week of May till end of June, maintaining sporadic presence during July.

To study *A. altissima* sensitization in our patient, pollen was collected from male trees during pollination season, and a protein extract was obtained. Protein content measured by the Bradford method showed 0.14 mg of protein / ml of extract. After obtaining patient consent, skin prick tests were performed with the most prevalent aeroallergens in our environment (*Cupressus, Platanus, Olea, Parietaria, Artemisia, Salsola, Acer, Alnus, Betula, Castanea, Celtis, Corylus, Eucaliptus, Grafus, Ligustrum, Morus, Phoenix, Pinus, Populus, Prunus, Quercus, Robinia, Salix, Ulmus* and grass pollen mix; and house dust mites, dog and cat dander and molds. (Lab LETI, Spain), and with *A. altissima* pollen extract. Histamine hydrochloride and glycerosaline were used as a positive and negative control, respectively. Two atopic patients were used as control.

The protein components from pollen extract were separated by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) and subsequently an IgE immunoblotting was carried out to detect IgE-binding proteins.

Skin tests showed a negative result for all the aeroallergens except for the pollen of *A. altissima* (Wheal: 12x9mm; Histamine control: 7x6mm). SDS-PAGE showed multiple bands (between 10 and 80 kDa), whereas Immunoblotting revealed three IgE binding bands, of 14, 25 and 70 kDa (Fig.). Skin prick test with *A. altissima* extract was negative in the two control subjects.

A. altissima airborne pollen concentrations in the general atmosphere may be low, unlike local concentrations in the area where the tree is located. In addition, the pollination period takes place at the same time that a lot of other autochthonous and

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allergenic plants. As a result of all this, pollen of *A. altissima* is often neither included in the calendar of allergenic pollen concentrations nor in routine diagnostic allergy tests.

A small number of patients had been reported with respiratory symptoms suggestive of allergy to *A. altissima* pollen [3,4]. In some cases, an immunoallergological study was performed [5].

Positivity skin test to *A. altissima* has generally been found in polysensitized patients probably due to a cross-reactivity with other pollen [4], since it has been shown that *A. altissima* pollen contains cross-reactive calcium binding proteins [6] and cross-reactive carbohydrates determinants (CCDs) [7] identified also in the pollen of unrelated species.

It must be highlighted that in our case, the patient only showed sensitivity to the *Ailanthus* pollen, so it can be ruled out that this sensitization was due to cross-reactivity with other tested species. In addition, no IgE-binding bands corresponding to CCDs or calcium-binding proteins were detected in immunoblotting performed with the patient's serum.

Mousavi et al. [5] performed SDS-Page with pollen extract and obtained several protein bands ranging from 10 to 110 kDa, while immunoblotting carried out with the patient's serum detected two IgE binding bands with a molecular weight (MW) of 42 and 52 kDa.

Later, the same authors studied 6 positive sera to *A. altissima* pollen and described four different sensitization patterns based on the results of IgE-immunoblotting: one representing a patient with a wide range proteins between 25 and 100 kDa (which could be associated to CCDs), another pattern recognizing 42 and 52 kDa proteins, a third one with 36 kDa IgE-reactive band, and a last pattern with 115 kDa band. They identified 5

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allergenic proteins: “enolase, calreticulin, probable pectate lyase 6, conserved hypothetical protein and ras-related protein RHN1-like [8].

These results differ from those obtained with the serum of our patient, since the bands observed in immunoblotting (14, 25, 70 kDa) do not correspond to the MW of these described proteins. However, our results are more comparable with those obtained by Dhyani et al. [9] who studied cross-reactivity of IgE binding protein in the pollen of *Prosopis juliflora (P. juliflora)* with those of *Ailanthus excelsa* and showed that both present shared allergens that correspond to bands of 14, 41, 52 and 66 kDa, while bands of 26 and 29 kDa are specific for *P. juliflora.*

It should be noted that most of the studies are made in Middle Eastern countries, where the environmental and climatic conditions are not the same as in our area, so it could be speculated that the allergenic characteristics of the pollen could be different. In this regard, variations in the allergenic protein composition in the pollen of *A. altissima* collected over two consecutive years was observed [10].

Based on the results obtained, and to our knowledge, this is the first patient monosensitized to *A. altissima* pollen with a sensitization pattern that differs from those described above. Unfortunately, we have not been able to identify proteins at the molecular level despite trying to compare them with proteins described in molecular databases. On the other hand, it should be noted that it is important to consider the local flora, in order to achieve an allergologic diagnosis.

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Conflict of interest declaration

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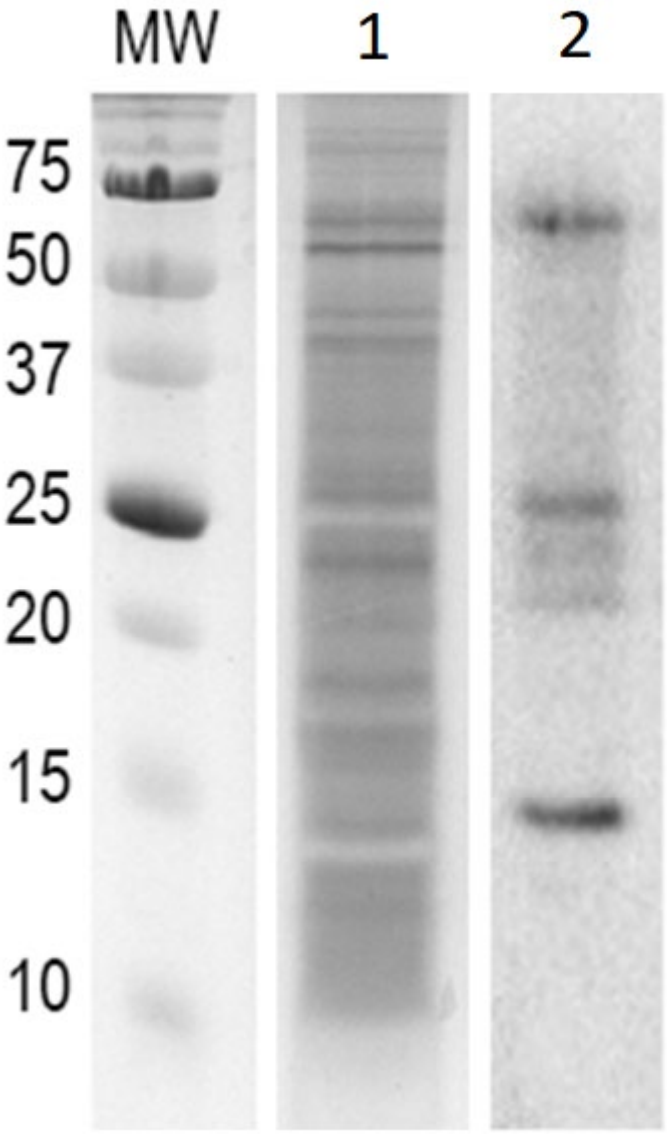
Figure. Sample extract of *Ailanthus altissima* pollen. MW: Molecular Weight markers (kDa). Lane 1, electrophoretic profile (SDS-PAGE). Lane 2, IgE immunoblotting.



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