
Allergy to *Ailanthus altissima* Pollen: A Local Allergen to Consider

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The diagnostic work-up for pollen allergy must include species with allergenic potential that are specific to an area. Although the most prevalent pollens are well-known and studied in our geographical area (Barcelona, Spain), in order to achieve an accurate diagnosis, we should also take into account recently introduced species.

We present the case of a 42-year-old woman who had experienced rhinoconjunctivitis (sneezing, rhinorrhea, nasal and ocular pruritus, and tearing) between May and June for the previous 3 years. She related her symptoms to the presence of certain trees near her home. The trees were identified as *Ailanthus altissima*.

A altissima, also known as the tree of heaven, is a dioecious plant that is native to China and was introduced as an ornamental species in Spain in the XIX century. It has become naturalized and invasive [1]. Some plants produce hermaphrodite flowers, and others only male flowers, which tend to be 4 times more abundant than plants that produce female flowers. The pollen grain is spheroidal and isopolar, medium-sized (26 µm, varying from 24.3-28.7 µm), tricolporate, and striato-reticulate. Pollination is from May to July [2]. The database of the Catalan Aerobiological Network (<http://lap.uab.cat/aerobiologia>) shows that for the Barcelona area and the period 1994-2019, the pollen grains from *Ailanthus* species are airborne from the second week of May until the end of June, with a sporadic presence during July.

In order to study *A altissima* sensitization in the present case, we collected pollen from male trees during the pollen season and obtained a protein extract. The protein content measured by the Bradford method was 0.14 mg/mL of extract. After obtaining the patient's consent, we performed skin prick tests with the most prevalent aeroallergens in our environment (*Cupressus*, *Platanus*, *Olea*, *Parietaria*,

Artemisia, Salsola, Acer, Alnus, Betula, Castanea, Celtis, Corylus, Eucalyptus, Fagus, Ligustrum, Morus, Phoenix, Pinus, Populus, Prunus, Quercus, Robinia, Salix, Ulmus, and grass pollen mix, as well as house dust mites, dog and cat dander, and molds [Laboratorios LETI, Spain]). We also performed skin testing with *A altissima* pollen extract. Histamine hydrochloride and glycerol saline were used as a positive and negative control, respectively. Two atopic patients served as controls.

The protein components of the pollen extract were separated by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) and subsequently underwent IgE immunoblotting to detect IgE-binding proteins.

The results of the skin tests were negative for all the aeroallergens except for *A altissima* pollen (wheal, 12×9 mm; histamine control, 7×6 mm). SDS-PAGE revealed multiple bands (between 10 and 80 kDa), whereas immunoblotting revealed 3 IgE-binding bands (14, 25, and 70 kDa) (Figure). The result of the skin prick test with *A altissima* extract was negative in the 2 controls.

Concentrations of airborne *A altissima* pollen in the general atmosphere may be low, unlike local concentrations in the area where the tree is located. In addition, the pollen period coincides with that of many other autochthonous and allergenic plants. Consequently, *A altissima* pollen is often not included

in the calendar of allergenic pollen concentrations or in routine diagnostic allergy tests.

Respiratory symptoms suggestive of allergy to *A altissima* pollen have been reported in a small number of patients [3,4], and, in some cases, an immunoallergological study was performed [5].

A positive skin test result with *A altissima* has generally been found in polysensitized patients, probably due to cross-reactivity with other pollens [4], since *A altissima* pollen contains cross-reactive calcium-binding proteins [6] and cross-reactive carbohydrate determinants (CCDs) [7], which have also been identified in the pollen of unrelated species.

It must be highlighted that in the present case, the patient was only sensitized to *Ailanthus* pollen; therefore, we can rule out the possibility that this sensitization was due to cross-reactivity with the other species tested. 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 2 IgE binding bands with a molecular weight of 42 and 52 kDa.

The same authors subsequently studied 6 sera that were positive to *A altissima* pollen and reported 4 different sensitization patterns based on the results of IgE-immunoblotting, as follows: one representing a patient with a wide range of proteins (25-100 kDa, possibly associated with CCDs), another pattern recognizing proteins of between 42 and 52 kDa, a third one with 36 kDa IgE-reactive band, and a fourth pattern with a 115-kDa band. The 5 allergenic proteins identified by the authors were 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 in the present case, since the bands observed in immunoblotting (14, 25, and 70 kDa) do not correspond to the molecular weight of the proteins described. However, our results are more comparable with those obtained by Dhyani et al [9], who compared the cross-reactivity of IgE-binding protein in the pollen of *Prosopis juliflora* with that 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 studies were performed in Middle Eastern countries, where the environmental and climatic conditions differ from those in our area; therefore, we might speculate that the allergenic characteristics of the pollen could be different. In this regard, variations in the allergenic protein composition of the *A altissima* pollen collected over 2 consecutive years have been observed [10].

Based on the results obtained, and to our knowledge, this is the first report of a patient monosensitized to *A altissima* pollen, with a sensitization pattern that differs from those described above. Unfortunately, we were unable to identify proteins at the molecular level despite trying to compare them with proteins described in molecular databases. The allergologic diagnosis should take local flora into account.

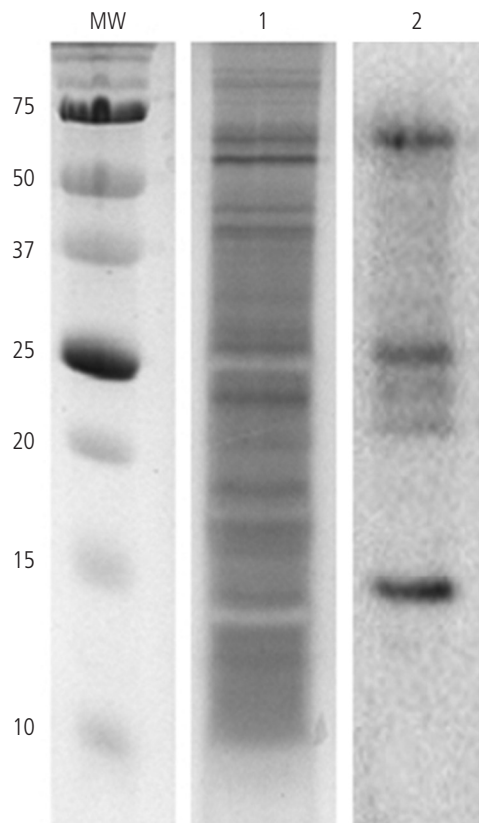


Figure. Sample extract of *Ailanthus altissima* pollen. Lane 1, electrophoretic profile (SDS-PAGE); Lane 2, IgE immunoblotting. MW indicates molecular weight markers (kDa).

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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