Rendiconti Seminario Facoltà Scienze Università Cagliari Vol. 73 Fasc. 1 (2003)

Ailanthus altissima (Miller) Swingle as a cause of immunoallergic respiratory manifestations

ANDREA MAXIA(*), LUCIA MAXIA(*)

Abstract. *In questo lavoro gli autori mettono in correlazione le concentrazioni aeropolliniche di* Ailanthus altissima *(Miller) Swingle (*Simaroubaceae*) rilevate nell'atmosfera della città di Cagliari (Sardegna meridionale, Italia) e del suo hinterland, con le sindromi allergiche causate, in alcuni pazienti atopici, dai pollini di questa pianta. Dalle indagini aerobiologiche è stato possibile mettere in evidenza come le più alte concentrazioni aeropolliniche di ailanto sono state riscontrate nel periodo tra aprile e giugno. Su un campione significativo di 74 pazienti, di sesso ed età diversa, ben 21 soggetti sono risultati positivi ai test allergologici.*

Key words: *Ailanthus altissima*, airborne pollens, immunoallergic manifestations.

INTRODUCTION

Besides defining the real airborne pollen concentrations on land, the biological monitoring of the atmosphere is known to provide an important diagnostic tool in allergological practice, and consequently helps locate immunological mechanisms behind seasonal allergopathies.

In the past years, the introduction and massive diffusion of plants of exotic origin as decoration in city gardens, parks, and avenues has led to an increase in new pollen granules in the atmosphere that may potentially cause allergic manifestations in immunologically predisposed subjects.

Thanks to the continuous evolution of allergologic and aerobiological studies and innumerable botanical observations, it has been possible to obtain a large amount of specific information that can be useful both in the qualitative and quantitative determination of biological aerosols and in the introduction of new and more specific therapeutic and preventive intervention on allergopathic patients.

(*) Department of Botanical Sciences. University of Cagliari, viale S. Ignazio da Laconi 13, 09123 Cagliari, Italy
Presentato l'8/04/03

The aim of this work has been to determine the airborne pollen concentrations of *Ailanthus altissima* (Miller) Swingle in the atmosphere of the city of Cagliari (south Sardinia, Italy) and its hinterland, as well as to correlate possible relations that might exist between these concentrations and the immunological (IgE specific) and reactive characteristics of atopical subjects.

Ailanthus altissima (Miller) Swingle (= *A. glandulosa* Desf.) commonly known as ailantus, tree of paradise, tree of the sun, or Persian sumach, belongs to the *Simaroubaceae* family.

The tree, which originates in China and the Moluccas, and is common all over eastern Asia, was introduced in Europe in 1571 and in Italy in 1760. Its cultivation spread in the second half of the past century to promote rearing the ailanthus silk-worm (*Bombyx cynthia*) in substitution of the silk-moth (*Bombyx mori*). Since then the plant has been completely acclimatised.

It is a caducous plant that grows 15-20 metres tall and 70 centimetres in diameter, very leafy, and with an irregular oval shape; the trunk is slender, cylindrical, and without branches a good way up. Especially when rubbed, the leaves issue a characteristic, extremely unpleasant smell. The flowers are polygamous, white-yellowish or greenish, joined in dense racemose heads, and they too have an unpleasant smell. The fruits, brown-light reddish samaras, are produced copiously. It blooms from April to June; impollination is prevalently anemophilous.

The pollinic granule is tricolporate, isopolar, suboblate or spheroidal, of a diameter of 22-25 micrometers. The exina is thick and finely reticulated, the intina is thin and thickened under the openings to form onci.

A. altissima is a fast-growing tree that can easily adapt to all kinds of ground; it resists drought and the winter cold. *Ailanthus* plants were first widely used as ornamental plants, especially as trees. They have been used for their prerogative to cover rapidly subsidence-prone land and rocky slopes, thanks to their great ability to adapt, their superficial rooting system, and especially their ability to emit a large number of side shoots.

The progressive steady spread of *A. altissima* in the city parks, avenues, and uncultivated ruderal areas of Cagliari and its hinterland has led to such a significant presence of pollen granules in the airborne plankton, that we have felt the need to study its possible allergising action in view of the poor existing literature on the subject.

MATERIALS AND METHODS

Airborne pollen samplings were carried out with a Burkard-type volumetric weekly sampler, positioned in the centre of Cagliari at a height of about 25 metres from the ground and away from sources of pollination [1, 2].

The aerobiological sampling techniques, the reading of pollen granules, and the phenological survey follow the recommendations of the Italian Aerobiological Association [3, 4].

In order to determine the airborne pollen component, we used special guides and taxonomical atlases [5, 6, 7] as well as a reference pollen collection prepared by us.

Aerobiological monitoring was carried out in the 1997-2002 period, when phenological phases were also observed.

Seventy-four casually selected atopical subjects of an age range between 18 and 69 years, 44 males and 30 females, were examined. Before being submitted to specific allergological investigations, such as the radioallergosorbent test (RAST) and the prick test, all patients were examined with an accurate (family, physiological, remote and proximal pathological) case history and a general medical visit.

RESULTS AND DISCUSSION

Air surveys carried out over a number of years [8, 9, 10] have shown that in May-June, the pollen concentration values (mean monthly concentration per cubic metre of air) of *A. altissima* by far exceed the threshold value (value above which in general pollen granules may trigger an allergic reaction in immunologically predisposed subjects, quantifiable at 20-22 granules per cubic metre of air). Thus from the 12 granules per cubic metre of air found in the month of April, maximum peaks of 125 and 97 granules are reached in the months of May and June respectively, to drop back to 13 granules per cubic metre in September.

The values found by us tend to increase year after year (86 granules per cubic metre of air in 1997, 133 granules in 1998, 284 in 1999, 362 in 2000, 405 in 2001, and 494 in 2002), and the greater the amount of pollen granules in the air with which the atopic subject comes into contact, the more likely are sensitisation processes to develop [11]. In fact, once the threshold value of airborne pollens concentrations is exceeded, the so-called «priming effect» is reached [12]; this varies from subject to subject depending on the level of individual sensitisation with the appearance of the clinical symptomatology. This is generally more intense when high levels of pollen first impact the patient, followed by a period during which high enough levels of pollen produce less evident symptoms, as if the triggering phase is followed by a period of adaptation due to the production of antibodies that have a blocking activity.

Nevertheless, it has been difficult to diagnose with certainty the role of these emerging pollen granules in inducing the allergic manifestations that characterised a large number of patients. This was because of the possible cross reaction with other pollen particles that present common antigenic determinants as well as the same pollination period.

The clinical symptoms induced by inhalations of granules of *A. altissima* are manifestations of conjunctivites and/or rhinites, similar to those due to *Poaceae* and/or *Oleaceae*. A few patients in vaccine therapy for *Poaceae* and/or *Oleaceae* when sensitised to ailantus, did not show the sharp clinical improvement that was observed in the majority of patients; even *Parietaria diffusa* M. et K., *Chenopodiaceae* sp. pl. and *Plantaginaceae*, which pollinate at the same time and with a greater intensity than

ailanthus, could have caused the rhinites and/or conjunctivites attributed to *A. altissima*.

These doubts were dispelled by preparing a specific extract to be included in the intradermal routine skin test panel, which is capable of detecting the presence of possible specific antibodies. The test was used on a significant number (74) of randomly selected allergic subjects. Twenty-one of these were found positive to the skin tests, 11 of whom were concordant with the 1st class Rast (for specific IgE's) and 3 with the 2nd class Rast, while 7 subjects showed no concordance. The subjects positive to the skin tests were submitted to a follow-up.

Having identified the cause of the allergic manifestations, an adequate therapy was immediately prepared. Following international guidelines [13], the patient is submitted both to antihistaminic symptomatic pharmacological treatment and to specific immunotherapy (SIT). In this way optimal control of the clinical symptoms is guaranteed in both the short and the long term [14, 15].

In conclusion it can be stated that aerobiological monitoring is both important and indispensable in the study of pollen allergy symptomatology, both for preventive, diagnostic, and therapeutic purposes. Thanks to these samplings, it has been possible to show that in the past years the amount of granules in the pollen aerosol produced by non-autochthonous species has increased, and consequently also that of allergenic forms of doubtful and at times incomprehensible aetiology. Aerobiological monitoring therefore is valid as it can also identify unusual allergens in specific local realities. It should also be added that since many exotic species come from the southern hemisphere, they bloom in winter, when most of the autochthonous essences are completely silent, thus causing problems both to patients and allergologists.

REFERENCES

[1] J.M. Hirst, G. W. Hurst, Long-distance spore transport. *Airborne microbes*. Eds. Gregory P. H. & Monteith J. L. Symp. Soc. Gen. Microbiol., Cambridge University Press, 385 (1967).

[2] F.B. Michel, C.H. Seignalet, P. Cour, *Contribution palynologique, allergologique, metèorologique et climatologique de l'Etude des flut polliniques entre la Scandinavia et l'Afrique du Nord*. Premiers rèsultats. «Les Pollinoses», Ed. Fisons, 159 (1979).

[3] V. Feliziani, *Monitoraggio pollinico in allergologia*. Atti VII° Congresso Nazionale A.I.A., Firenze, 80-82 (1996).

[4] G. Puppi Branzi, *Fenologia e previsioni aerobiologiche*. Atti VII° Congresso Nazionale A.I.A., Firenze, 36 (1996).

[5] G. Erdtman, *Pollen morphology and plant taxonomy: Angiospermae*. Almquist & Winchell, Stockolm (1952).

[6] V. Feliziani, *I pollini di interesse allergologico. Guida al loro riconoscimento*. Masson Italia Ed., Milano (1986).

[7] W.H. Lewis, P. Vinay, V.E. Zenger, *Airborne and allergenic pollen of North America*. J. Hopkins University Press., Baltimore, MD (1983).

[8] M. Ballero, Airborne pollens analysis in Cagliari (south Sardinia): observations on *Ailanthus altissima* (Miller) Swingle, *Casuarina equisetifolia* J. R. & G. Foster and *Schinus molle* L.

Centro, **1** (4) 22-27 (1989).

[9] M. Ballero, G. Piu, *Considerazioni sulla diffusione nell' atmosfera di Cagliari ed Oristano dell' aerosol pollinico e sulle implicazioni patologiche provocate da specie allergofitiche*. Rendiconti Seminario Facoltà Scienze Università Cagliari, 64 (2) 197-205 (1994).

[10] M. Ballero, A. Ariu, *Relazioni tra flora nitrofila e ruderale e concentrazioni aeropolliniche nell' area urbana di Cagliari*. Rendiconti Seminario Facoltà Scienze Università Cagliari, **67** (1), 39-46 (1997).

[11] R. R. Davies, *Aerobiology and clinical allergy*. «Allergy 74» Eds. Ganderton M. A., Frankland A. W. Pitman Medical 277 (1974).

[12] J.T. Connel, *Quantitative intranasal pollen challenges. The priming effect in allergic rhinitis*. J. Allergy, **43**, 33-39 (1969).

[13] P. van Cauwenberge, C. Bachert, G. Passalacqua, J. Bousquet, G. W. Canonica, S. R. Durham, W. J. Fokkens, P. H. Howarth, V. Lund, H. J. Malling, N. Mygind, D. Passali, G. K. Scadding, D. Y., Wang, *Consensus statement on the treatment of allergic rhinitis. European Academy of Allergology and Clinical Immunology*. «Allergy 2000», **55**, 116-134 (2000).

[14] S.R. Durham, S.M. Walker, E.M. Varga, M.R. Jacobson, F. O'Brien, W. Noble, S.J. Till, Q.A. Hamid, K.T. Nouri-Aria, *Long-Term clinical afficacy of grass-pollen immunotherapy*. New England J. of Medicine, **341** (7), 468-475 (1999).

[15] Y. Ohashi, Y. Nakai, A. Tanaka, Y. Kakinoki, Y. Washio, Y. Yamada, H. Sakamoto, Y. Nasako, M. Hayashi, *A comparative study of the clinical efficacy of immunotherapy and conventional pharmacological treatment for patients with perennial allergic rhinitis*. Acta Otolaryngologica (Suppl.), **538**, 102-112 (1998).

Pagina bianca