POLLEN ALLERGY IN EUROPE

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INTRODUCTION

Pollen allergy is the most common form of seasonal respiratory allergic disease in Europe. More than a quarter of a million pollen producing plant species have been catalogued world wide. However, less than 100 of them seem to cause allergies in people. Pollens are part of a plant's reproductive mechanism (containing the plant's male sexual component). Pollens are carried from the anther of the male flower (*Figure 1*) to the female part (stigma) of another plant on the wind or by insects in a process known as pollination. As you can imagine, pollination is a bit hit and miss, so to increase the chances of sexual reproduction, some plants produce large quantities of pollen.

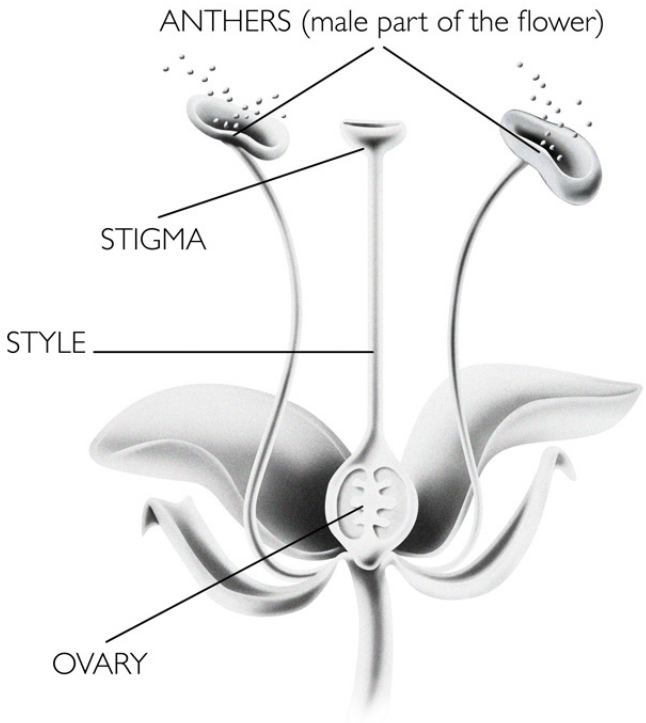

Figure 1
Diagram showing how pollination occurs in plants

What makes some types of pollen cause allergies?

- Firstly, they must actually contain allergens (the "active ingredient", if you like) that trigger an allergic response in sensitive people.
- The plants that produce the pollen must either produce it in large quantities and/or be very wide spread since there must be enough pollen in the air to cause a reaction - even in sensitive people.
- The pollen grains must be buoyant in air such that they can be carried long distances (otherwise they would only affect people living close to them).

Designed to be carried on the wind, large amounts of light pollen grains are produced by plants in order to increase the chances of fertilising the stigma of a given female flower. Wind-pollinated plants are the most important source of allergens for people suffering from pollen allergies. As you can imagine, plants that self-pollinate (e.g. cultivated cereals such as wheat) or plants endowed with brightly coloured petals and nectar (e.g. roses or orchids) designed to persuade insects to carry their pollen to other plants, are not very important in pollen allergy as most people don't tend to breathe in insects!

You may have noticed that your allergy symptoms seem to change with the weather. That's because the production, dispersal and quantity of pollen grains in the air are strongly related to weather patterns. Another reason why your allergy symptoms may vary over the course of the year is because pollens are seasonal. For example, birch trees (an important allergen) have a short pollen seasons; unfortunately, other important pollen allergens, for example some members of the nettle family, are present almost all year round in some regions. So if you suffer from allergies to one of these sources, you will be affected all year long.

Figure 2
Distribution of pollens derived from grasses, olive trees and members of the nettle family in Europe during the month of June.

The geographical distribution of plants has an important influence on their allergenic impact (Figure 2). Grasses, such as perennial rye and timothy and weeds, such as mugwort, can be found anywhere in Europe and, indeed, all over the world which is why they are very important in terms of pollen allergy. Some plants are only found in specific regions: birch occurs mainly in the northern hemisphere; ragweed grows predominantly in North America (but is beginning to colonize central Europe); Parietaria (a member of the nettle family) and olive trees are found mainly in the Mediterranean area; the Japanese cedar is restricted to Japan. Consequently, allergies to the pollen of certain plants may be restricted to specific regions whereas allergies to common pollens (such as grasses) will be encountered throughout the world.

It's worth mentioning that some ornamental plants (for example, Ficus benjamina and mimosa) can cause allergies in people who have them in their homes, or encounter them occupationally, such as gardeners.

Tip: Although not highly allergenic, mimosa has been known to cause proximity pollinosis; it's best to avoid smelling these flowers.

POLLEN SHEDDING AND DISTRIBUTION (POLLINATION)

Pollens are shed by the male part of flowers and their release is often triggered by changes in atmospheric humidity levels. Pollen may be released in a single burst or be released gradually. Usually, pollen release occurs early in the morning (*Figure 3*) so your symptoms may be worst early in the day.

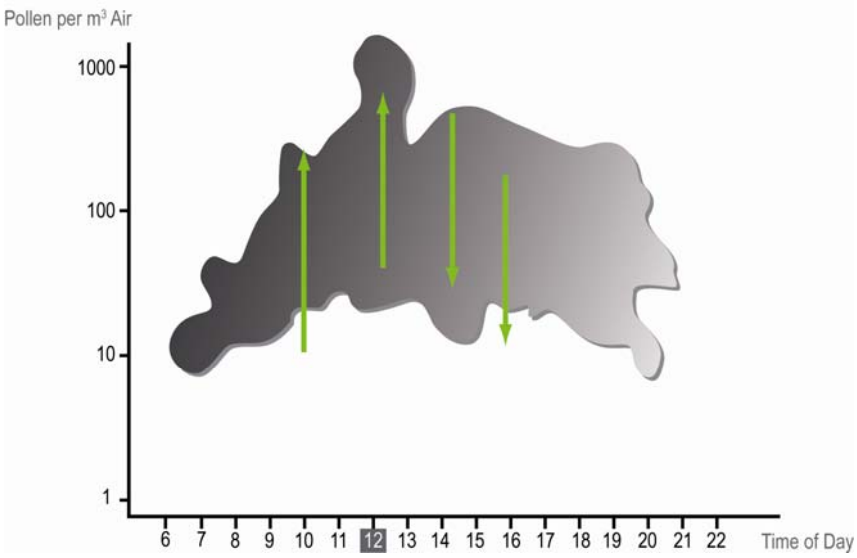

Figure 3: Pattern of Pollen level variations over the day.

The distance pollen grains travel from the plant depends on the nature of the carrying agent (wind, insects, etc.), environmental conditions and pollen grain size. For example, most grass pollen is deposited within 3 metres from the source; only 1% of grass pollen manages to travel a distance of 1 km from the source. However, depending on the characteristics of the wind, pollen grains from some plants can be found up to an astounding 20 km away from the plant that released them.

Grasses

Pollen produced by grass is the major cause of pollinosis (pollen allergy) in many parts of the world. The most prolific airborne grass pollen originates from tall meadow grasses such as timothy, orchard grass, meadow foxtail and perennial rye.

Grass pollinates about 2-3 weeks earlier at sea level than in mountainous regions.

Atmospheric concentrations of grass pollen usually peak 1-2 months after the start of the main flowering season. Most grass-pollen types exhibit extensive cross-reactivity (this means that if you are allergic to one type of grass pollen, you'll find that most types of grass pollen bring on your allergy symptoms, unfortunately). On the other hand, you will only

need to be tested against two or three species of grass pollen to establish if you have a grass pollen allergy or not.

Allergens (allergy's active ingredients) are rapidly released when pollen comes into contact with the mouth, nose or eyes. This is what causes you to experience the classic hay-fever symptoms.

Figure 4: Grasses (Gramineae).
1.Kentucky Bluegrass (*Poa pratensis*) 2. Orchard grass (*Dactylis glomerata*).
3 Perennial rye grass (*Lolium perenne*). 4. Barley (*Hordeum vulgare*). 5. Oats (*Avena Sativa*)

Members of this family are common throughout Europe**.**

Tip: To avoid exposure to pollen whilst inside your house, keep your windows and doors closed during risk periods.

ALLERGENIC PLANTS IN EUROPE

Allergy-inducing plants in Europe can be divided into five main areas:

Northern	Birch, grasses
Central	Deciduous forest trees, birch, grasses
Eastern	Grasses, mugwort, ragweed
Mountainous	Grasses, trees
Mediterranean	Grasses, Parietaria, olive, cypress

In northern, central and eastern Europe, the main grass flowering period starts at the beginning of May and finishes at the end of July. In Mediterranean areas, flowering usually starts and ends one month earlier. In northern Europe, pollen from the Betulaceae family (Birch tree) is a major cause of allergy. Hazel and alder are the first trees to shed pollen in Europe, followed by Birch. Hazel and alder can act as primers of allergic sensitization to birch because of their cross-reactivity.

The mild winters and dry summers typical of the Mediterranean region, mean that the vegetation of the area is totally different from that of central and northern Europe.

In the Mediterranean area there are three pollen seasons:

- A low winter pollen season (December - March) with pollens from trees such as Cypress and Juniper , Hazel , Mimosa and Birch.
- A high spring-summer pollen season (April - July), dominated by the pollination of Grasses, some members of the nettle family and olive trees. Between March and May, Platanus pollen (such as the American sycamore) may effect some people in Mediterranean areas
- A summer-autumn season (August - October) involves a second flowering of the nettle family and pollination of herbaceous plants, such as mugwort and plants such as beet, sugar beet, and chard, and wild spinach.

Pollen from the nettle family is responsible for many cases of severe pollinosis. Its pollen first appears in early spring and persists into the summer months. Unfortunately, the length of its pollination period in the Mediterranean area means that your allergy symptoms will be persistent if you live in this region and are allergic to its pollen.

Figure 5 Parietaria (A member of the nettle family):

Native to Mediterranean Areas.

In the olive tree family the most allergenic pollen is produced by Olea europaea. In the Mediterranean area, the olive pollen has been recognized as one of the most important causes of seasonal respiratory allergy. The olive pollination season lasts from April to late June and can causes severe symptoms in people allergic to its pollen. Frequently, sensitization to olive tree pollen is associated with other allergies such as grass pollen. Curiously, olive pollen allergy symptoms are frequently not limited to the pollination season, but are present all year round in sufferers although the underlying reason has yet to be established.

Figure 6 Olive:

Native to Mediterranean Areas.

Over the last twenty five years, respiratory allergy has had a remarkable clinical impact throughout Europe in terms of school days or working days lost. Evidence suggests that allergic reactions induced by pollen are increasing. Grass pollen is the most common culprit. Between 8 and 35% of young adults in EU countries exhibit IgE serum antibodies to grass pollen allergens (indicating that they are allergic to pollen).
Interestingly, in many European cities, such as London, Vienna and Naples, the number of people affected by allergic rhinitis and allergic asthma is increasing, but the concentration of grass pollen in the atmosphere is decreasing. The decrease has been attributed to the substantial reduction in grassland cover over large areas of the continent. In fact, the last 20 years has seen a decline of about 40% in European grasslands. The fact that more Europeans are suffering from allergic rhinitis and asthma induced by grass pollen suggests that other factors are involved, almost certainly including air pollution.

Tip: In order to enjoy your well-earned break, select holiday destinations that are not high risk for your type of allergy. The pollen count is usually low at the seaside and high in the mountains. An exception is *Parietaria* that flowers around the Mediterranean coast.

POLLEN-FOOD ALLERGY (ORAL ALLERGY SYNDROME)

Pollen-Food Allergy (also known as Oral Allergy Syndrome or OAS) results from a cross-reactivity reaction between allergy antibodies that your body raises against pollen proteins, with similar proteins found in other (edible) parts of plants. Common OAS symptoms include itchiness of the mouth and throat associated with mild swelling immediately after eating the fresh fruits or vegetables to which you have become sensitive. If you are allergic to ragweed pollen, you might experience these symptoms when consuming banana, cucumber, melon, zucchini/courgette, sunflower seeds, chamomile tea or Echinacea due to cross-reactivity.

OAS is common in people with birch tree pollen allergies. Foods that can trigger a reaction in people with this allergy are: peach, apple, pear, cherry, carrot, hazelnut, kiwi or almonds.

Figure 7 Birch,

Commonly found in Northern and Central Europe.

If you are allergic to this pollen you may also react to certain foods.

If you have grass pollen allergy, you may have reactions when eating wheat, tomato, kiwi fruits, melon, watermelon, peach, cherries or apricots. People who are allergic to nettle family pollen can react to basil, mulberry, cherries and melon.

In many cases, cooking the food will de-nature the proteins in the food and prevent any reaction. However, this is not always the case and symptoms in highly allergic individuals may include severe swelling of the throat or systemic reactions.

Tip: If you know you are allergic to ragweed, birch, grasses or Parietaria, remember that you may also react to certain foods.

INTERRELATIONSHIP BETWEEN OUTDOOR AIR-POLLUTION, CLIMATIC CHANGES AND POLLEN-RELATED RESPIRATORY ALLERGY

Researchers have established that air pollution can have an adverse effect on your respiratory health. Throughout the industrialised world, allergic respiratory diseases such as hay fever and hay asthma have become more common in the last two decades. Although there seems to be a link between the increasing frequency of respiratory allergy and the increasing levels of air pollution, the exact mechanism is still not fully understood. Various factors may be involved either singly or in concert including the roles of cigarette smoke, exposure to indoor pollutants and to aeroallergens (outdoors and indoors) in people who are sensitive to more than one allergen.

Your response to pollution exposure depends on the type of pollution, its concentration and climatic factors amongst other things. Climatic factors may cause accumulation of airborne pollutants at ground level causing episodes of asthma aggravation. Living near busy roads can be associated with impaired respiratory health. Governments and international organizations such as the World Health Organization and European Union are facing a growing problem of reconciling the respiratory effects of motor vehicle emissions with the requirements of sustainable economic development and personal mobility.

Figure 9
Pollution from motor vehicles can exacerbate allergic reactions

The most abundant airborne pollutants in urban areas with high levels of vehicle traffic are respirable particulate matter, nitrogen dioxide and ozone. It is estimated that more than

50% of the population of the USA live in areas that exceed the current National Ambient Air Quality Standards for ozone, nitrogen dioxide, sulphur dioxide and particulates, set by the US Environmental Protection Agency. Air pollution can cause damage to the nose and lung mucosae and may make it easier for inhaled allergens to enter deeply into the lung.

Tip: When travelling by car through risk areas, keep your car windows closed. Ensure that the air conditioning is equipped with a filter and remember to change the filter periodically.

Interaction between air pollution and allergenic vegetation

Many factors influence the interaction, between plants and air pollution including type of air pollutants, plant species, the plant's nutrient balance, soil conditions and climatic factors. By affecting plant growth, air pollutants can affect both the amount of pollen produced and the amount of allergenic proteins contained in pollen. Birch trees exposed to high levels of air pollutants are produce higher levels of pollen antigen than trees growing in areas with lower levels of air pollution.
Nitrogen dioxide (a pollutant gas) exposure adversely affected the pollen germination of various trees (birch, alder and hazel), changing their protein content, including allergens. Pollen grains collected from roadsides with heavy traffic density and from other areas with high levels of air pollution are covered with large numbers of airborne micro-particulates. Considerable interest has been focussed on diesel exhaust particulates (DEP), the pollution produced from diesel engines, because experiments have shown that it can modify the immune response in predisposed animals and humans. DEP seems to exert an adjuvant immunological effect on the synthesis of the antibodies responsible for allergic diseases in sensitive individuals, thereby influencing sensitization to airborne allergens. New diesel engine designs will need to reduce DEP emissions into the atmosphere.

Research in which allergic asthmatics volunteers are exposed to either ozone (a pollutant gas) containing or clean air prior to tests with allergens, showed an increased sensitivity to inhaled allergens in the volunteers who had been exposed to the pollution.

Measures which may reduce the impact of urban air pollution on allergy include:

- Reducing the pollution levels by:
  - Limiting the use of private cars in towns and even stricter control of vehicle emissions.

- Decreasing the use of fossil fuels and increasing the use of alternative energy sources.

- Reducing the levels of allergens in built up areas by:
  - Planting trees in urban settings which are non-allergenic.

- Reducing the impact of these factors on allergic individuals by:
  - Increasing dietary consumption of anti-oxidant foods.
  - Improving nasal function (for example via the use of antihistamines) which could then protect the lower airways.

Interaction between thunderstorms and asthmatic attacks in pollen sensitive individuals

Thunderstorms have been linked to asthma epidemics, especially during the pollen seasons. Such epidemics have been reported in various cities, mainly in western Europe (Birmingham and London in UK and Naples in Italy) and Australia (Melbourne and Wagga Wagga).
Pollen grains can be carried at ground level by the strong air currents often associated with thunderstorms; during these events, the likelihood of pollen grain bursting and releasing allergens is increased. The allergens can be released as fine dispersions in air/water mixtures called aerosols. Such aerosols can be readily inhaled and can penetrate deeply into the lower airways inducing asthma reactions in pollinosis patients.

Figure 10
Thunderstorms have been linked with asthma epidemics

The thunderstorm-asthma outbreaks are characterized, at the beginning of the storms, by a sudden increase in the number of patients visiting their general practitioner or hospital emergency departments with asthma symptoms. Indeed, subjects affected by seasonal rhinitis with no history of asthma may experience an asthma attack during thunderstorms.
No unusual air pollution levels were noted at the time of the epidemics reported in the cities mentioned above, but there was a strong association with high atmospheric concentrations of pollen grains such as grasses or other allergenic plant species. If you are affected by pollen allergy you should be aware about the possible (albeit low) risk of an asthmatic attack during thunderstorms occurring during the pollen season.

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