

Editorial



Revised Pollen Calendar in Korea

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► See the article “Allergenic Pollen Calendar in Korea Based on Probability Distribution Models and Up-to-Date Observations” in volume 12 on page 259.

Pollens are one of the most important causes of respiratory allergy including allergic rhinoconjunctivitis, and can even cause food allergies.^{1,3} Recently, the prevalence of both pollinosis and pollen-food allergy syndrome has increased in Korea, which may reflect climate changes⁴ as well as increases in the growth of tree stocks in Korean forests. From 2005 to 2015, the growth of tree stocks doubled from 79.2 to 146 m²/ha,⁵ and the planting density of trees in the order Fagales (including oak, birch, and alder) increased steadily, in contrast to those of pines. The types of pollens responsible for allergic reactions differ geographically, as the major inhabitant trees, grasses, and weeds markedly differ from region to region. To be termed a “causative pollen,” several conditions must be met. In the 1930s, August Thommen⁶ suggested a list of postulates for causative pollens, which is still used today. First, the pollen must contain allergens to induce pollinosis, as it is not true that every type of pollen is allergenic. Secondly, the pollen should be windborne. Although pine tree pollen is windborne and abundantly distributed in Korea, its allergenicity is minimal and does not induce clinical symptoms. Thirdly, the pollen must be produced in sufficiently large quantities to cause symptoms. Fourthly, the pollen must be sufficiently buoyant to be carried considerable distances. Trees that distribute windborne pollen produce large amounts of pollen with buoyant shapes. For example, a single birch tree produces about 5.5 billion pollen grains annually, whereas an oak produces 0.6 billion pollen grains. Finally, the plant producing the pollen must be abundantly distributed. Species of trees that meet these criteria are limited in each country, and thus a pollen calendar should focus on tree species that meet Thommen's postulates.

In this issue of the *Allergy, Asthma & Immunology Research*, Shin *et al.*⁷ presents a current pollen calendar in South Korea based on pollen counts from 2007 to 2017. It should be noted that this group published the pollen calendar collected from 1997 to 2009.⁸ Based on this new calendar, we can compare the changes in allergy-causing pollen counts as a result of climate change and the growing stock of trees and weeds, especially Fagales, Japanese cedar (*Cryptomeria japonica*), and *Humulus japonicus*, throughout Korea. This study showed marked annual differences in pollen counts and length of pollen seasons in this country, which are already well-known findings in other countries.⁶ These differences help explain why the annual severity of pollinosis differs greatly, and support the need for long-term studies to evaluate the effects of climate and ecological changes, with or without human interference, on pollinosis. Short-term studies may not have a sufficient power to overcome the compounded effects of the annual differences in pollen counts.

Interestingly, regional differences in pollen counts are significant, even in a small country like Korea. Southern provinces have different patterns of pollen counts. Previously, Japanese cedar

pollen was found on Jeju Island exclusively, but this new calendar in this issue shows that a significant number of Japanese cedar pollen grains were also found in the southern provinces of Kwangju, Busan, and Jeonju, in addition to Jeju Island. Such differences may reflect the latitudinal elevation of plant hardiness zones for Japanese cedar. Another interesting feature is that the pollen count of alder, which belongs to the birch family (Betulaceae), is higher than that of birch in the southern cities such as Busan, Gwangju and Jeonju. The pollen calendar for the Gangneung area is also unique. Birch and hazelnut pollen counts are significantly higher in this area, as both belong to the Betulaceae family and favor northern temperate and boreal climates. Pollen counts for weeds and grasses do not differ from those described in previous studies. The weeds (*H. japonicus*, mugwort, and ragweed) are important causes of pollinosis in Korea, with *H. japonicus* responsible for the highest number of cases. Recent studies published in Korea demonstrated that the major causes of pollen-food allergy syndrome are due to group 1 major allergens of trees belonging to the order Fagales. However, mugwort-related pollen-food allergy syndrome, via lipid transfer protein allergen, has been reported in both China and Korea,^{9,10} suggesting an important role of mugwort pollen in this syndrome in East Asia.

In conclusion, Shin *et al.*⁷ study describes the pollens responsible for allergic reactions in Korea in detail, allowing better interpretations of skin prick test and specific immunoglobulin E results (considering actual levels of pollen exposure) and reasonable applications of allergen immunotherapy in affected individuals. Furthermore, this study describes the effects of climate and ecological changes on the significant differences in pollen counts, with or without human interference, in Korea.

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