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Letter

High Chinese elm pollen counts in the fall in Atlanta, Georgia, 2009–2015

Allergic rhinoconjunctivitis symptoms and disease prevalence directly correlate with increasing concentration of atmospheric pollen.[1] Climatic and environmental factors have the ability to influence local botany and aerobiology. Knowledge regarding annual and seasonal fluctuations in pollen counts is important in the treatment of patients with allergic rhinoconjunctivitis to provide appropriate treatment regimens.

The distribution and abundance of individual plant species are dependent on many environmental and climatic factors, including soil pH, soil mineral content, annual rainfall, and average temperatures. The North American continent is divided into 10 discrete floristic zones based on a variety of "geographic, geochemical, and meteorological factors" as a means to map which plant species inhabit specific regions.[2] Key factors dividing these zones are annual minimal temperature, rainfall, and annual maximum temperature.[2] Plants within these zones are known to have consistent annual pollen seasons.[2] However, pollen season duration and peak can vary with local weather events, including thunderstorms, wind, and humidity fluctuation.[2]

Pollen counts are reported by local pollen collection stations as grains of pollen per cubic meter of air collected during 24 hours.[3] Individuals certified through the American Academy of Asthma, Allergy, and Immunology Aerobiology Committee work at National Allergy Bureau (NAB) pollen-counting stations throughout the country. Pollen counts are reported as low (less than the median or 50%), moderate (50%–75%), high (75%–99%) and very high (>99%). On the basis of these percentage definitions, each plant type has a corresponding range to classify the pollen grains detected as low, moderate, high, or very high.[3]

Atmospheric sampling for aeroallergens in Atlanta, Georgia, was performed during an 11-year interval according to NAB standards using a Rotorod sampler. The sampler is situated on the clinic roof, approximately 30 ft above the ground. Samples were collected each morning by trained observers. Rods were examined at ×400 magnification, and various pollens are counted. The pollen-counting station was moved a distance of 2.2 miles in 2010 when the allergy clinic was relocated.

Atmospheric concentrations of pollen grains per cubic meter of air were determined by calculation from the raw counts for each 24-hour sampling period. Per similar reports and NAB guidelines, the pollen season was determined by 1% and 99% criteria. According to these criteria, the onset and commencement of the pollen season are defined as the day on which the cumulative total reaches 1% and 99% of the total annual pollen sum, respectively.[3]

The Southeast has an intense spring pollen season characterized by high tree pollen counts, often within the very high zone. In past years, the fall pollen season was less intense with a predominance of ragweed pollen. However, in 2009 to 2015, there were high levels of *Ulmus parvifolia* (Chinese elm) tree pollen during August and September. The pollen counts were consistently within the moderate range for trees as determined by NAB criteria as greater than 15 grains per cubic meter (Table 1). Peak counts ranged from 39.1 to 475.2 grains per cubic meter, and the 4-day mean ranged from 23.5 to 206.2 grains per cubic meter. Notable was the greater number of days within the moderate pollen range and longer duration of the season.

The distribution of a plant species is limited by its ability to adapt to evolving habitats, climate change, and environmental factors.[2] According to the floristic zones, there are no native elms located west of the Rocky Mountains.[2] In previous years, Chinese elm has not been a dominant local aeroallergen in Atlanta, Georgia. In fact, as its name implies, Chinese elm is native to China, Korea, and Japan.[4] Because of a variety of climatic, environmental, and societal factors throughout the years, the prevalence of Chinese elm pollen in metropolitan Atlanta has increased. Chinese elms were originally introduced to America in 1905 in the National Arboretum (Bodie Pennisi, PhD, University of Georgi, personal oral communication, April 2015). These trees were initially cultivated and breed by horticulture experts. However, over time, they have escaped cultivation through their production of seedlings and can now be found across many Gulf States and the Southeast.[4]

Similar biannual presentation of Chinese elm pollen was reported by Kosisky et al[5] in Washington, DC, from 1998 to 2007, with pollen detected from February to April and again in August to the middle of October. However, these findings differ from those observed in Atlanta because peak elm pollen counts occurred during the spring rather than the fall. Through contact with local tree nurseries, landscape architects, and an expert in horticulture (Bodie Pennisi, PhD, University of Georgia, personal oral communication, April 2015), we learned that Chinese elm has been increasingly used throughout metropolitan Atlanta landscaping. Chinese elm is a favored by landscapers and gardeners for its shade, low maintenance, and beauty (Bodie Pennisi, PhD, University of Georgia, personal oral communication, April 2015). Chinese elms have an ornamental "lacy" bark with extensive blooms and leaves.[1] In addition, these nonnative elms are resistant to Dutch elm disease, caused by the fungus ascomycete, *Ophiostoma umi* transmitted via the elm bark beetle *Hyglurgopinus rufipes*, which destroyed much of the American elm supply.[4] Chinese elms have adapted to the climate typical of the Southeast and thrived in the urban, suburban niche of metropolitan Atlanta (Bodie Pennisi, PhD, University of Georgia, personal oral communication, April 2015).

For any plant, the pollen season is predictable from year to year.[6] However, many conditions can influence local pollen production,

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Table 1
Fall Pollen Counts in Atlanta, Georgia

Year	Peak atmospheric concentration, grains/m^3	4-Day mean, grains/m^3	Moderate per NAB, d	Length of season, 2d
2005	1.8	0.6	0	8
2006	2.4	1.4	0	17
2007	5.3	2.4	0	10
2008	4.1	2.7	0	24
2009	34.3	12.4	1	29
2010	39.1	23.5	6	19
2011	475.2	205.3	4	16
2012	408.3	121.0	16	33
2013	288.8	206.2	5	31
2014	217.16	114.68	12	39
2015	369.82	185.36	7	25

including the introduction of nonnative species and evolving landscape practices. Indigenous plants are often not best suited for the urban environment because of the harsh conditions of sparse nutrient-rich soil, increased root pressure, and exposure to insects, fungi, and high humidity. In home gardening, families desire plants that offer shade, with bountiful blooms and leaves and low-maintenance care. Australian pine and Russian olive are 2 examples of nonnative plans with increased use in landscaping. These trees are also known to produce significant amounts airborne pollen (Bodie Pennisi, PhD, University of Georgia, personal oral communication, April 2015).[6] Australian pine is a medium tall evergreen tree that was introduced to the United States in the early 1900s from Australia and the Philippines. Australian pine is able to colonize nutrient poor soils, such as sandbars, sand dunes, and rocky coastline, and therefore planted in South Florida, coastal California, and Hawaii.[6] Russian olive, a Eurasia native, was introduced in the early 1900s. Russian olive is a fast-growing, drought-tolerant tree that often serves as a windbreak.[6] It is planted extensively along the American midland in Nebraska, Kansas, Oklahoma, and Texas (Bodie Pennisi, PhD, University of Georgia, personal oral communication, April 2015).[6] Introduced nonnative plants may become dominant because of their ability to adapt to environmental factors, driving out indigenous species.[2]

Given that pollen aerobiology is influenced by many factors, such as weather, disease, and landscaping practices, it is imperative that allergists remain aware of their local environment. Allergists should focus on pollen counts of indigenous and nonnative species in the region and remain aware of changing environmental factors and landscaping practices. This observation is necessary to ensure that testing practices and treatment regimens identify the symptoms caused by any new and clinically relevant aeroallergens. In metropolitan Atlanta, Chinese elm is now an important autumn aeroallergen and should be considered in patients having predominant late summer-fall symptoms, especially if they fail to respond to ragweed testing or immunotherapy.

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