

Clinical Communications

A volumetric survey of aeroallergens in San Antonio

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Clinical Implications

- An aeroallergen survey of San Antonio trees, weeds, and grasses does not exist. Our institution produced the first volumetric survey of the unique pollinating patterns in San Antonio. Surveillance of local aeroallergen patterns allows for tailored interventions for atopic patients.

TO THE EDITOR:

Aeroallergen sampling identifies pollens and is used to tailor interventions.¹ This survey represents the first volumetric analysis of aeroallergens in San Antonio, Texas. We sought to identify prodigious pollinators as well as prominent pollinating periods. Finally, we evaluated relationships between select weather parameters and pollen production.

San Antonio transects 5 of 10 ecosystems present in Texas.² Variation in these ecosystems results in a range of climate zones from subtropical to semi-arid.³ The average temperature is 68.7°F with an average high of >80°F for 7 months.⁴ Precipitation averages approximately 32.91 in. of rainfall per year.⁴ It follows that with this range of climate zones comes a variety of pollination patterns and by extension, allergen production.

A volumetric aeroallergen sampling was conducted from 2012 to 2017 in accordance with the National Allergy Bureau (NAB) of the American Academy of Allergy, Asthma, and Immunology. Sampling was performed at Wilford Hall Ambulatory Surgical Center (WHASC), an NAB-certified pollen counting center, using the Burkhard 7 Day Recording Volumetric Spore Sampler according to the manufacturer's recommendations.⁵ The device is located on the rooftop of WHASC at an elevation of 5.5 m. Raw pollen grains were counted by a single, NAB-certified station head, as pollen grains per cubic meter of air sampled daily. Average counts were then calculated weekly and combined across years. The pollen season was defined using the 5%/95% criteria.¹ The start of an individual pollen season was determined to be on the first day when cumulative pollen totals reached 5% of the total annual pollen sum.¹ The end of a season was defined as the day when pollen totals reached 95% of the total annual pollen sum.¹

Climate data was obtained from the National Weather Service of the National Oceanic and Atmospheric Administration.⁶ The data was collected at the San Antonio International Airport, 30.7 km northeast of the WHASC NAB pollen counting center.⁶ Descriptive statistics and Spearman rank-order correlation coefficient were used to analyze the data and determine a relationship between pollen seasons and climate parameters.

The most prevalent pollinators noted in 2012 to 2017 among trees include *Juniperus* (mountain cedar), *Quercus* (oak), *Celtis*

(hackberry), *Carya* (pecan), and *Ulmus* (cedar/American elm) (Table 1). The most prevalent weeds include *Ambrosia* (ragweed) and *Urtica* (nettle/pellitory). In 2017, trees comprised approximately 86.78% of the total annual pollen produced, weeds produced 8.45%, and grasses comprised 2.89%.

Juniperus, the highest volume tree pollinator, produced 191,331 pollen grains per cubic meter, or 37.31% of the total pollen generated, over 6 years. It flowered approximately 3 to 4 months per year at a moderate to very high level. By comparison, *Celtis*, which had the longest season among trees, produced 24,637 pollen grains per cubic meter from 2012 to 2017 and pollinated for over 6 months. For all study years, *Ambrosia*, the highest volume weed pollinator, produced 4.65% of the total pollen produced and pollinated for approximately 1.9 months in the fall. By contrast, *Urtica*, which had the longest season among weeds, pollinated for 5 months on average and comprised 4.26% of the total pollen production.

Figure 1 illustrates general seasons noted in this survey. The top pollinators when evaluated for length of season using the 5%/95% scale include *Juniperus*, *Quercus*, *Celtis*, *Ulmus*, *Ambrosia*, *Urtica*, and grass. Month by month evaluation is significant in that there are no months that are free from pollination. Although classical teaching would predict that tree pollination only occurs in the spring, in San Antonio, January is notable for high pollen produced by *Juniperus* and when coupled with *Fraxinus* (ash) and *Ulmus* (American elm) makes up the pollen that is seen in February. March through April is notable for multiple tree pollens to include *Quercus*, *Acer* (maple), *Carya*, *Morus*, and *Fraxinus*. *Celtis* starts pollinating in March and continues to do so throughout the summer and into early fall in all years studied. By late August/early September, *Ulmus* (cedar elm) starts pollinating and then November heralds the start of *Juniperus* pollinating season that lasts through the end of winter.

Weeds are characterized by a biphasic pattern with typical pollination in the fall due to *Ambrosia*, *Artemisia*, and *Chenopodium/Amaranthus* and atypically in the spring due to *Urtica*.⁷ *Urtica* pollinates in February and again in the fall. Grasses, generally thought of as having a predilection for summer pollination, are noted to pollinate at a steady rate in nearly all months of the year with the exception of January (Figure 1).⁸

South Texas' most prevalent pollinator, *Juniperus*, dominates pollen production in San Antonio.⁹ Correlation analyses between meteorological influences and pollen counts revealed a statistically significant negative correlation between elevated temperatures and total pollen counts. This highlights the winter pollinating pattern of *Juniperus* necessitating unique management of this tree allergen (Table E1, available in this article's Online Repository at www.jaci-inpractice.org).

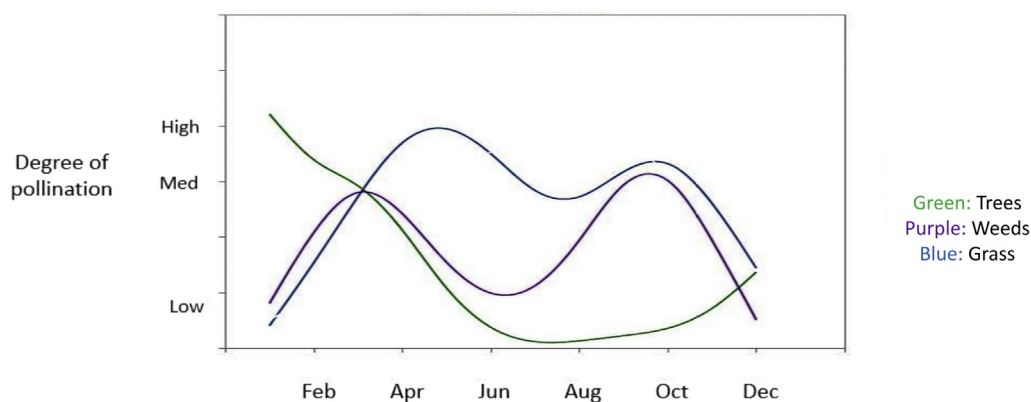
As mentioned earlier, *Celtis* was found to pollinate from early spring through mid-fall. Correlation analysis revealed that total pollen counts were negatively correlated with total precipitation allowing for the ability to pollinate during the dry summer months of South Texas. We found that the length of *Celtis* season and persistent elevated temperatures >80°F were positively correlated allowing for an average of >200 days of flowering per year (Table E1, available in this article's Online Repository at www.jaci-inpractice.org).

TABLE I. Most prevalent pollinators in San Antonio from 2012 to 2017, trees and weeds*

Family	Genus	Common name	Average season [†]
Trees			
1. Cupressaceae	<i>Juniperus</i>	Mountain cedar	October to April
2. Fagaceae	<i>Quercus</i>	Burr oak	February to April
		Post oak	
		Live oak	
		Shumard's oak	
3. Cannabaceae	<i>Celtis</i>	Hackberry	February to October
4. Juglandaceae	<i>Carya</i>	Pecan	March to April
5. Ulmaceae	<i>Ulmus</i>	Cedar elm	August to October
		American elm	
6. Moraceae	<i>Morus</i>	Mulberry	March to April
7. Oleaceae	<i>Fraxinus</i>	Ash	February to March
8. Pinaceae	<i>Pinus</i>	Pine	March to April
9. Sapindaceae	<i>Acer</i>	Maple	March to April
10. Fabaceae	<i>Prosopis</i>	Mesquite	March to April
11. Salicaceae	<i>Poplar</i>	Cottonwood	March to April
Weeds			
1. Asteraceae	<i>Ambrosia</i>	Common ragweed	August to November
		Western ragweed	
		Mugwort	
2. Amaranthaceae	<i>Chenopodia</i>	Lamb's quarters	August to November
	<i>Amaranthus</i>	Pigweed	
3. Urticaceae	<i>Urtica</i>	Stinging/common Nettle/Pellitory	February to June

*Botanical family and genus listed in descending order with most common/voluminous pollen producer listed at the top.

[†]Average season utilized from 2017 data.

**FIGURE 1.** General pollination seasons in San Antonio.

San Antonio sees its heaviest rains in May, September, and October.⁶ Correlation analyses between precipitation and total pollen count of *Urtica* demonstrated a positive correlation that lends itself to the precipitation pattern mentioned and unique period of fall pollination (Table E1, available in this article's Online Repository at www.jaci-inpractice.org).

Meteorological data was limited to temperature and precipitation. Studies are needed to decipher the sophisticated relationship between pollination and climate as well as whether the distance between the pollen counter and the point of weather data collection had an impact. Future studies are also needed to elucidate the clinical significance of the pollination seasons noted as this was beyond the scope of this examination.

This aeroallergen sampling survey represents the first evaluation of the most prevalent pollinators in San Antonio. The results demonstrate that San Antonio pollen is present in all 12 months with overlapping seasons between trees, grasses, and weeds. Continued surveillance of local aeroallergen patterns allows for tailored care of atopic patients.²

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TABLE E1. Significant meteorological influences on San Antonio pollen

	Total rain	<i>P</i> value	Temperature (80°F)	<i>P</i> value	Maximum temperature	<i>P</i> value
<i>Correlation coefficient between total pollen count and weather</i>						
Juniperus (mountain cedar)	−0.329	NS	−0.082	NS	−0.813	<.05
Celtis (hackberry)	−0.868	<.05	0.629	NS	0.514	NS
Urtica (nettle/pellitory)	0.833	<.05	−0.399	NS	−0.214	NS
<i>Correlation coefficient between length of season and weather</i>						
Celtis (hackberry)	−0.712	NS	0.921	<.05	0.273	NS
Ulmus (cedar elm)	0.865	<.05	−0.795	NS	−0.496	NS

NS, Nonsignificant.