

A 10 YEAR SURVEY OF THE HAY FEVER PLANTS AND IMPORTANT ATMOSPHERIC ALLERGENS IN THE SAN ANTONIO, TEXAS, METROPOLITAN AREA

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THE FIRST pollen survey done in this area was by Kahn and Grathous in 1925.¹ They attempted to list in detail all the plants causing hay fever. Kahn² made numerous studies of pollens using the pollen-plate method of Scheppegegrell. He was able to correlate his clinical findings with the presence of pollinating plants in field observations. Kahn³ believed that it was impossible without the determination of the pollen content of the air to know what pollens to treat for. He felt that pollens in this area disappeared completely for only a few weeks a year or following a killing frost. He pointed out that the pollen counts were highest during the period of high wind velocity, referred to as "Northers." French⁴ published a summary of the pollens in south central Texas, but this was based on clinical studies, rather than daily pollen counts. Hay fever-producing plants which are of importance clinically were described by Black and Durham⁵⁻⁶ and Sellers.⁷ The last complete survey, which covered a one year period, was made by Bieberdorf and Hampton,⁸⁻⁹ at the Allergy Laboratory, AAF Regional Hospital, San Antonio Aviation Cadet Center, Lackland Air Force Base, Texas, now named the Allergy Department, USAF Hospital.

A botanical survey was conducted at the beginning of this study to determine which plants were capable of causing pollinosis. Pollen samples were collected from many different plant species and a permanent collection of photographs and microscopic slides were prepared by mounting pollen slides by the technique using glycerin jelly stained with basic fuchsin dye.

Three areas for collection of pollens were selected for the purpose of exposing the prepared slides to the atmosphere. One site was a three story building in the center of the city, another a six story building away from the center of the city, and one slide seven miles from the city at the U. S. Air Force Hospital, Lackland Air Force Base, Texas.

Collection of the pollen grains and fungus spores at the three stations were obtained by the gravity method of Durham,¹⁰ approved by the American Academy of Allergy.¹¹⁻¹² Slides were exposed for 24 hours from 8:00 A.M. each day. The slides were prepared for microscopic examination by placing a 4.84

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sq. cm. coverslip on the glycerin jelly that had been slightly heated. The slides were examined under low power magnification using a 10× objective and 15× ocular. The sweep method of counting was employed. The entire coverslip was counted in twelve horizontal sweeps. The pollen grains or fungus spores per square centimeter were converted to the number of grains per cubic yard of air. This was accomplished by using the formula recommended by Durham.¹⁰

$$\text{Conversion factor for local pollen grain} = \frac{(\text{Diameter of experimental grain})^2 \left(\frac{\text{Conversion factor of experimental grain}}{(\text{Diameter of similar local grain})^2} \right)}{(\text{Diameter of similar local grain})^2}$$

A complete table of the conversion factors is not given here as it has been done elsewhere.¹⁰⁻¹³

RESULTS

Botanical Survey.—The following is a list of the important plants found in the Metropolitan San Antonio area capable of causing pollinosis and the months in which they pollinate.

<i>Scientific Name</i>	<i>Common Name*</i>	<i>Time of Pollination</i>
MISCELLANEOUS TREES		
<i>Carya pecan</i>	Pecan	March-May
<i>Celtis occidentalis</i>	Hackberry	February-May
<i>Fraxinus toumeyi</i>	Arizona ash	February-April
<i>Juniper sabinoides</i>	Mountain cedar	December-March
<i>Ligustrum japonicum</i>	Ligustrum	May-June
<i>Ligustrum vulgare</i>	Common privet	March-May
<i>Morus rubra</i>	Mulberry	March-April
<i>Populus deltoides</i>	Cottonwood	February-April
<i>Prosopis glandulosa</i>	Mesquite	February-November
<i>Quercus virginiana</i>	Live oak	February-May
<i>Ulmus americana</i>	American elm	February-April
<i>Ulmus crassifolia</i>	Serub elm	September-October
GRAMINEAE		
<i>Cynodon dactylon</i>	Bermuda grass	March-October
<i>Sorghum halpense</i>	Johnson grass	March-October
AMBROSIEAE		
<i>Ambrosia trifida</i>	Giant ragweed	August-November
<i>Ambrosia aptera</i>	Western giant ragweed	August-November
<i>Ambrosia psilostachya</i>	Western ragweed	August-November
AMARANTHACEAE		
<i>Amaranthus gracilis</i>	Tumbleweed-amaranth	May-October
<i>Amaranthus palmeri</i>	Careless weed	May-October
<i>Amaranthus retroflexus</i>	Pigweed	May-October
<i>Amaranthus spinosus</i>	Spiny amaranth	May-October
COMPOSITAE		
<i>Franseria tenuifolia</i>	Slender false ragweed	May-August
<i>Franseria acanthicarpa</i>	False ragweed	May-August

*Common names from the Herbarium Committee of the American Academy of Allergy.

The following is a list of the more common fungi found in the San Antonio area and the months in which they sporulate.

<i>Scientific Name</i>	<i>Common Name</i>	<i>Time of Sporulation</i>
<i>Alternaria</i> species	None	January-December
<i>Aspergillus</i> species	None	January-December
<i>Fusarium</i> species	None	March-December
<i>Helminthosporium</i> species	None	June-October
<i>Hormodendrum</i> species	None	January-December
<i>Penicillium</i> species	None	January-December
<i>Phoma</i> species	None	March-December
<i>Puccinia</i> species	None	March-December
<i>Spondylocadium</i> species	None	February-October
<i>Uredinales</i>	Rusts	January-December
<i>Ustilago cynodontis</i>	Bermuda grass smut	February-November
<i>Shaefferia holci</i>	Johnson grass smut	February-November

Many plants which were not listed as causing pollinosis were either too sparse or are found only occasionally on exposed slides. Many of these plants have been known to cause pollinosis in susceptible persons. The following is a list of these plants.

<i>Scientific Name</i>	<i>Common Name</i>	<i>Time of Pollination</i>
<i>Artemisia gnaphalopes</i>	Prairie sage	August-September
<i>Artemisia tridentata</i>	Sagebrush	August-September
<i>Juniper pinchotii</i>	Red-berried cedar	December
<i>Leucophyllum texanum</i>	Senisa	May

Atmospheric Survey.—Table I gives the monthly and yearly totals of pollen grains counted. These years were selected for report to show the effect of the drought on the total pollen grains reported. Because of the difficulty in differentiating the species of pollen grains in certain genera they were reported under their respective genus.

CLIMATOLOGIC DATA*

The climate of the San Antonio metropolitan area, situated on the edge of the Gulf Coastal plains, is considered a modified subtropical climate. Normal mean temperature range from 50.6° F. in January to a high of 84.4° F. in August. The summer is hot, with daily maximum temperatures above 90° F. over 80 per cent of the time; extremely high temperatures are rare, the highest on record being 107° F. Mild weather prevails during the winter months, with below freezing temperatures occurring on the average of only 13 days each year.

San Antonio is situated at latitude 29 degrees, 30 minutes north, longitude 98 degrees, 30 minutes west, between a semi-arid area to the west and the coastal area of heavy precipitation to the southeast. There is a normal annual rainfall

*Climatologic data obtained from U. S. Department of Commerce, Weather Bureau, local summary, San Antonio, Texas, and Texas Almanac 1961-1962. Published by the *Dallas Morning News*.

TABLE I. POLLEN GRAINS PER CUBIC YARD OF AIR: MONTHLY AND YEARLY TOTALS, SAN ANTONIO, TEXAS

SCIENTIFIC NAME	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTALS
1951													
<i>Juniper sabinoides</i>	904	411									27	1,617	2,939
<i>Celtis occidentalis</i>		208	751	73	16	3							1,051
<i>Fraxinus tomentosa</i>		213	31	26	2	3							275
<i>Ulmus americana</i>		74	48	6	3								131
<i>Ulmus crassifolia</i>									340	3			343
<i>Populus deltoides</i>		79	53	26	16	4							178
<i>Morus rubra</i>		3	21	29	56	22	4						135
<i>Quercus virginiana</i>		96	302	291	291	3							721
<i>Carya pecan</i>		16	39	416	31	2							504
<i>Prosopis glandulosa</i>	2	8	6	46	22			2	2				80
<i>Ligustrum vulgare</i>					8	91	5						104
<i>Ligustrum japonicum</i>													
<i>Cynodon dactylon</i>	9	16	31	54	63	59	24	15	42	57	3	4	367
<i>Sorghum halpense</i>													
<i>Amaranthus</i> species	2	2	5	6	11	26	29	59	51	43	21	6	261
<i>Franseria</i> species				3	56	36	18						113
<i>Ambrosia</i> species								113	127	280	5		525
1952													
<i>Juniper sabinoides</i>	71	52										105	228
<i>Celtis occidentalis</i>		267	893	23	76	4	4	2					1,269
<i>Fraxinus tomentosa</i>		188	43	48	8								287
<i>Ulmus americana</i>		35	24	8	1	1							69
<i>Ulmus crassifolia</i>													
<i>Populus deltoides</i>		65	34	20	2	5	1	1	99	30			130
<i>Morus rubra</i>			3	6	20	3							127
<i>Quercus virginiana</i>		173	250	202	23	2							32
<i>Carya pecan</i>		16	12	256	18								630
<i>Prosopis glandulosa</i>	4	26	3	90	18	29	25	11	113	6	50	2	364
<i>Ligustrum vulgare</i>					21	119	10						377
<i>Ligustrum japonicum</i>													150
<i>Cynodon dactylon</i>	1	2	7	12	42	46	19	9	6	3	10	1	158
<i>Sorghum halpense</i>													
<i>Amaranthus</i> species	1	2	10	3	13	32	35	50	25	41	24		236
<i>Franseria</i> species					18	17	28	15					78
<i>Ambrosia</i> species							10	263	456	389			1,118
1953													
<i>Juniper sabinoides</i>	236	129									3	94	462
<i>Celtis occidentalis</i>		180	512		31	1		5					729
<i>Fraxinus tomentosa</i>		241	82	70	12								405
<i>Ulmus americana</i>		47	35	28	10	2							122
<i>Ulmus crassifolia</i>													
<i>Populus deltoides</i>		114	93	48		30	6	3	17	36			56
<i>Morus rubra</i>		7			15			1					23

<i>Quercus virginiana</i>	194	376	377	51	5	4						1,007
<i>Carya pecan</i>	8	71	200	96	4							397
<i>Prosopis glandulosa</i>	3	32	14	32	11	18					13	148
<i>Ligustrum vulgare</i>				47	134	13						194
<i>Ligustrum japonicum</i>												
<i>Cynodon dactylon</i>	2	6	13	23	35	19					5	148
<i>Sorghum halpense</i>												
<i>Amaranthus species</i>	4	4	9	16	14	28						259
<i>Franseria species</i>		2		66	20	35						142
<i>Ambrosia species</i>												962
1954												
<i>Juniperus sabinoideis</i>	242											527
<i>Celtis occidentalis</i>	176		96	237					6		226	839
<i>Fraxinus toumeyi</i>	330	140	20									612
<i>Ulmus americana</i>	125	3	10	5	2							145
<i>Ulmus crassifolia</i>												112
<i>Populus deltoides</i>	59	123	45	13	13							253
<i>Morus rubra</i>	10	20	15	60								105
<i>Quercus virginiana</i>	330	603	603	718	274	12						2,340
<i>Carya pecan</i>	7	73	315	533	92	4						1,024
<i>Prosopis glandulosa</i>	8		22	32	15	7						261
<i>Ligustrum vulgare</i>				75	42	20						137
<i>Ligustrum japonicum</i>												
<i>Cynodon dactylon</i>	8	16	4	38	21	28					3	157
<i>Sorghum halpense</i>	6	6	5	29	29	41						259
<i>Amaranthus species</i>		2		55	32	43						146
<i>Franseria species</i>					12	10						617
<i>Ambrosia species</i>												
1955												
<i>Juniperus sabinoideis</i>	175	262										1,130
<i>Celtis occidentalis</i>	70		132	2								204
<i>Fraxinus toumeyi</i>	189	724	189	27								1,129
<i>Ulmus americana</i>	62	276	76	9								423
<i>Ulmus crassifolia</i>												98
<i>Populus deltoides</i>	218	1,076	104									1,398
<i>Morus rubra</i>				38	58							329
<i>Quercus virginiana</i>	120	804	1,049	137	4							2,117
<i>Carya pecan</i>	132	1,104	6,537	5,187	225							13,185
<i>Prosopis glandulosa</i>	13		25	83	19	44						222
<i>Ligustrum vulgare</i>				65	10							88
<i>Ligustrum japonicum</i>												
<i>Cynodon dactylon</i>	5	8	7	123	182	90						921
<i>Sorghum halpense</i>												
<i>Amaranthus species</i>	19	6		28	93	116						1,021
<i>Franseria species</i>					217	7						224
<i>Ambrosia species</i>						2						1,620

(Continued on next pages.)

TABLE I—CONT'D

SCIENTIFIC NAME	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTALS
1956													
<i>Juniper sabinooides</i>	3,111	241	172	23	1	1					18	90	3,657
<i>Celtis occidentalis</i>		15	1,249	8									1,272
<i>Fraxinus toumeyi</i>		176	12	1									189
<i>Ulmus americana</i>	3	19	13	2									37
<i>Ulmus crassifolia</i>									77	7		1	85
<i>Populus deltoides</i>		10	121										131
<i>Morus rubra</i>		2	22	35	126	85	69						342
<i>Quercus virginiana</i>	2	32	837	1,028	3	22	1						1,925
<i>Carya pecan</i>			412	163	5	30							610
<i>Prosopis glandulosa</i>	6	29	71	108	29	21	5	14	1	3	1		288
<i>Ligustrum vulgare</i>		2	40	28	55	18							143
<i>Ligustrum japonicum</i>													
<i>Cynodon dactylon</i>	7	16	156	705	94	94	45	10	26	64	29	5	1,251
<i>Sorghum halpense</i>													
<i>Amaranthus</i> species	7	6		13	53	91	84	7	30	128	92	17	528
<i>Franseria</i> species	11	3		3	19	62	21						119
<i>Ambrosia</i> species								22	133	248	36	5	544
1957													
<i>Juniper sabinooides</i>	966	3,885	288	22	2					10	46	206	5,425
<i>Celtis occidentalis</i>		5	335	11	2								353
<i>Fraxinus toumeyi</i>	2	249	119	6			1						377
<i>Ulmus americana</i>	4	92	40	11	2	1	1				2		151
<i>Ulmus crassifolia</i>									78	8		3	91
<i>Populus deltoides</i>			13										13
<i>Morus rubra</i>			23										23
<i>Quercus virginiana</i>	7	2	116	347	311	27	65	398					914
<i>Carya pecan</i>		2	23	96	32	3	5						494
<i>Prosopis glandulosa</i>	12	12	62	57	23	20	43	6			14		154
<i>Ligustrum vulgare</i>		3	92	18	68	22	1		139	26		2	404
<i>Ligustrum japonicum</i>													204
<i>Cynodon dactylon</i>	2	41	361	369	367	412	173	181	22	90	160	29	2,207
<i>Sorghum halpense</i>													
<i>Amaranthus</i> species	5	24	32	58	131	348	229	503	47	16	60	26	1,479
<i>Franseria</i> species		7	3	28	167	143	145						493
<i>Ambrosia</i> species								448	680	448	108	72	1,756
1958													
<i>Juniper sabinooides</i>	2,528	6,569	451	3									9,895
<i>Celtis occidentalis</i>		10	683	27						13	52	279	720
<i>Fraxinus toumeyi</i>	2	570	206	86									864
<i>Ulmus americana</i>	14	251	82	6									453
<i>Ulmus crassifolia</i>									179	1			180
<i>Populus deltoides</i>			29										29
<i>Morus rubra</i>			291	249	15	260	44	68					927

<i>Quercus virginiana</i>	14	225	1,797	25	6	1	8	8	15	6	27	2,718	2,061
<i>Carya pecan</i>		94	796	33								923	923
<i>Prosopis glandulosa</i>		14	377	111							3	653	653
<i>Ligustrum vulgare</i>		21	125	497								699	699
<i>Ligustrum japonicum</i>			56										
<i>Cynodon dactylon</i>	2	82	720	442	244	294	87	134					
<i>Sorghum halpense</i>			665										
<i>Amaranthus</i> species	9	72	139	34	236	266	238	318	96	69	4	1,901	1,901
<i>Franseria</i> species		22	4	4	193	37						232	232
<i>Ambrosia</i> species							138	2,480	1,319	173	28	4,168	4,168
1959													
<i>Juniper sabinooides</i>	7,082	539	6	25					5	10	288	7,955	7,955
<i>Celtis occidentalis</i>			1,224	102								1,375	1,375
<i>Fraxinus toumeyii</i>		165	725	13								893	893
<i>Ulmus americana</i>	6	186	750									942	942
<i>Ulmus crassifolia</i>								210	42			252	252
<i>Populus deltoides</i>		30	35									65	65
<i>Morus rubra</i>		3	1,027	110								1,177	1,177
<i>Quercus virginiana</i>			2,154	8,938	2							11,320	11,320
<i>Carya pecan</i>			10	4,000	14							4,856	4,856
<i>Prosopis glandulosa</i>		8	4	3	6		4	4	1	1		31	31
<i>Ligustrum vulgare</i>					190							398	398
<i>Ligustrum japonicum</i>	1			208									
<i>Cynodon dactylon</i>			3	356	1,459	535						2,356	2,356
<i>Sorghum halpense</i>													
<i>Amaranthus</i> species				26	192	386	90	218	100	38	11	1,050	1,050
<i>Franseria</i> species			3	53	100	6						162	162
<i>Ambrosia</i> species					1	47	51	640	325	25	4	1,093	1,093
1960													
<i>Juniper sabinooides</i>	285	106	88	12					6	7	1	512	512
<i>Celtis occidentalis</i>		3	1,000	222								1,226	1,226
<i>Fraxinus toumeyii</i>		106	18	149								124	124
<i>Ulmus americana</i>		54	24									78	78
<i>Ulmus crassifolia</i>												35	35
<i>Populus deltoides</i>		3	11						13			14	14
<i>Morus rubra</i>			7	1								8	8
<i>Quercus virginiana</i>		3	123	5,277								5,499	5,499
<i>Carya pecan</i>		4	1	1,471	31							1,652	1,652
<i>Prosopis glandulosa</i>			3	1	6	1	5		8	1	1	31	31
<i>Ligustrum vulgare</i>				30	51	19						103	103
<i>Ligustrum japonicum</i>													
<i>Cynodon dactylon</i>				155	137	459	183	79	41	53	6	1,113	1,113
<i>Sorghum halpense</i>													
<i>Amaranthus</i> species		1	5	30	31	87	126	152	48	10	3	488	488
<i>Franseria</i> species				17	12	2						49	49
<i>Ambrosia</i> species						3	22	305	247	41	3	621	621

of 27.93 inches. Precipitation is fairly well distributed throughout the year, with the heaviest amounts occurring during April and May in the spring and September in the fall. Precipitation usually occurs with thunderstorms with fairly large amounts falling in short periods of time, whereas most of the winter precipitation occurs as light rain or drizzle. Measurable snow occurs once in 3 or 4 years. Northerly winds prevail during the winter and are called "Northers." Southerly winds from the Gulf of Mexico prevail during the summer time. San Antonio is popularly known as the place "where the sunshine spends the winter." San Antonio has about 50 per cent of the possible amount of sunshine during the winter months and more than 70 per cent during the summer months. The relative humidity averages about 80 per cent during the early morning hours throughout the year, dropping to near 50 per cent in the late afternoon. There is a general increase in the pollen grains with the decrease in the relative humidity and vice versa. In the past 10 years (Table II), the amount of rainfall has varied from 13.70 inches in the drought of 1954 to 48.83 inches at the end of the drought in 1957. The drought started in 1950 with 19.86 inches of rain. The yearly charts show the marked decrease in pollen grains during drought and the increase with heavy rainfall.

TABLE II. TOTAL PRECIPITATION: SAN ANTONIO, TEXAS, 1949 TO 1960, INCLUSIVE

YEAR	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTALS
1949	2.91	2.98	2.27	8.99	0.85	8.26	2.24	1.03	0.78	7.58	0.13	2.79	40.81
1950	0.32	1.43	0.24	3.42	2.41	1.03	1.60	6.15	3.02	0.08	0.13	0.03	19.86
1951	0.25	2.43	2.76	0.93	4.44	7.07	0.51	0.06	3.75	1.44	0.67	0.13	24.44
1952	0.81	2.01	2.34	3.40	1.91	1.86	2.75	0.00	3.02	0.00	4.47	3.67	26.24
1953	0.41	0.90	0.53	2.08	1.00	2.19	0.01	3.12	2.48	3.06	0.34	1.44	17.56
1954	0.51	0.03	0.03	1.94	1.46	2.71	1.25	1.05	0.52	1.98	2.02	0.20	13.70
1955	1.45	2.33	1.40	0.14	4.44	2.88	1.32	0.81	0.79	0.39	1.57	0.66	18.18
1956	0.81	0.85	0.27	0.49	3.07	0.27	0.53	3.94	0.62	1.23	1.13	1.10	14.31
1957	0.51	2.63	4.19	9.32	8.22	3.49	0.73	0.21	11.10	4.71	2.90	0.92	48.83
1958	4.57	3.88	1.08	1.32	1.98	3.39	7.39	0.45	8.36	5.43	0.77	1.07	39.69
1959	0.52	2.50	0.13	2.55	2.43	1.32	1.48	3.05	1.72	5.11	2.17	1.52	24.50
1960	0.76	1.22	1.65	2.08	1.21	2.70	1.31	5.96	0.76	7.84	1.30	2.97	29.76

DISCUSSION

The metropolitan San Antonio area lies at an altitude of 700 feet above sea level, classed as the seventeenth largest city in the United States and the third largest in Texas. The metropolitan area (Bexar County) is 1,247 square miles. "Northers" bring in the highest concentration of pollen grains and cause a flare-up of disease in most hay fever and asthma sufferers. Many persons will begin to have symptoms approximately 24 hours before the "Norther" arrives. This is usually accompanied by a drop in temperature of from 25° to 35° F.

The group of plants which contribute the majority of atmospheric allergens in the San Antonio area are the mesophytic species which are dependent on the presence of water. Most of the trees are in this group and are short-term anemophilous pollinators which have a definite seasonal periodicity in the production of pollen grains. During the spring, many of them pollinate during the same months. In the early spring, these are classified as "early trees" and in the late spring they are categorized as "late trees."

The first tree to pollinate is the *Juniper sabinoides*, the mountain cedar, which is very common in San Antonio. The pollination period may start during wet years, as early as November and reach its peak in January and February. The patients clinically correlate their symptoms with Christmas Day.

Fraxinus toumeyii, the Arizona ash, is the next to pollinate, beginning the first part of February and continuing through March. The Arizona ash pollen count has never been high, even during the heavy rainfall years.

Also in February and sometimes earlier, *Celtis occidentalis*, hackberry, appears. The pollen counts are high and it is the most important of the early tree group.

Appearing about this time is the *Ulmus americana*, the American elm, which reaches its highest pollination in February and at times during March. The *Populus deltoides*, the cottonwood, is important and may reach high pollen counts during the month of March. About the middle of March, *Morus rubra*, mulberry trees, begin to pollinate and give off large amounts of pollen throughout April and May. Mulberry pollens are found on the slides during other months and is thus not classified in the early or late tree group.

The most important spring trees occur in the late group with *Quercus virginiana* which pollinates somewhat earlier and in greater quantities than *Carya pecan*, the pecan tree. The live oak which is very prevalent in this area is a durable tree. It was the last victim of the prolonged drought during the summer of 1956. Nearly all the beautiful pecan trees in this area had died. The oak pollinates in greater abundance than any other tree and for a longer period of time than the other trees. The largest amount was during March, 1959, when 8,939 pollens were counted. The *Carya pecan* is the state tree of Texas and begins to pollinate during late March and reaches its peak in April and lasts throughout May. The pollen counts of all trees are highest during the period of high wind velocity. During the drought, tree pollens were very low in count and were clinically of no importance.

Prosopis glandulosa, the mesquite tree, was first found to be clinically important in hay fever by Sellers⁷ in 1929. This tree pollinates all year round, especially following rainfall. The pollen grains are never very great in quantity and are usually highest in late April and May.

Ligustrum vulgare, the privet, and *Ligustrum japonicum*, the ligustrum, are included here. The latter is not a tree but a hedge and a member of the olive family. In the metropolitan area, it is allowed to grow as a tree and pollen counts become very high during the months of May and June. These are heavy pollens and are not seen in great quantities on the slides. If these hedges are cut low so that the flowering tops are not present, they are no problem.

Grasses in this area pollinate most of the year. *Cynodon dactylon*, Bermuda grass, is used for many of the lawns. The quantity of pollen is found to be greatest during May, June, and July, but this depends upon the rainfall.

The only other important grass is *Sorghum halpense*, Johnson grass, which varies in the amount of pollen it produces. With the development of suburban areas, it becomes more important. The quantity of pollen grains also varies

with the amount of rainfall. St. Augustine grass used in this area for most lawns produces only small amounts of pollen, is seldom air borne, and rarely causes inhalant allergy.

The *Amaranthus* group becomes quite important around the same time of the year as the grasses. *Amaranthus palmeri*, careless weed, or Palmer's amaranth, is the most important. It appears as early as May and also as late as November. This group grew in abundance even through the drought years. *Amaranthus graecizans*, tumbleweed amaranth, is present in this area and is frequently mistaken by many as the tumbleweed of the western plains. *Salsola pestifer* or Russian thistle.

The tree *Ulmus crassifolia*, scrub elm, has become quite important because it pollinates during the fall, September and October, and will aggravate the ragweed hay fever sufferers.

A mild contributor to atmospheric pollens are two anemophilous plants of the genus *Franseria*. *Franseria tenuifolia*, slender false ragweed, pollinates from May through August. *Franseria acanthicarpa*, false ragweed, reaches greatest abundance in June. The pollens of the *Franseria* species are reported together.

The true ragweeds of the genus *Ambrosia* which pollinate in the fall are very important in the San Antonio area. The numerous streams and rivers give adequate growth and abundant pollination. In spite of this, the *Ambrosia* are not as important here as elsewhere. *Ambrosia trifida*, giant ragweed, which reaches the height of 9 to 12 feet, is the chief pollinator. It is found along the roadsides in this entire area. *Ambrosia aptera*, Western giant ragweed, is also seen. *Ambrosia psilostachya*, Western ragweed, adds to the abundance of pollens seen during the months of August, September, and October. This group is very conspicuous along the widespread areas of the expressways, giving difficulty to the many automobile travelers.

Several plants and trees, the pollens of which are found on the slides, seem to be of minor importance. They are found usually during high wind velocity out of the north.

Fungus spores were found in abundance. There is a high incidence of air-borne molds in the San Antonio area, the most important and abundant of which is the *Alternaria*. The molds include, *Alternaria*, *Hormodendrum*, *Helminthosporium*, *Sponylocladium*, *Fusarium*, *Penicillium*, *Aspergillus*, *Phoma*, and *Pullularia*. They are saprophytic forms, frequently found on decaying vegetation, in the upper layers of the soil and in street and house dust. The highest counts for *Alternaria* were in the late summer and fall. Of importance in recent years seems to be the concentration of smut spores found on Johnson grass, *Sphacelotheca holci*, and Bermuda grass, *Ustilago cynodontis*. There is some question about the clinical importance of smuts appearing on other grasses, particularly the *Stenothphrum secundatum*, St. Augustine grass.

As in previous observations by Kahn,² Bieberdorf and Hampton,⁵ and Swimmy,¹³ the local pollen counts are lower than in many other areas of Texas, but are always present because of the longer growing season. The pollen counts are below average for many parts of the United States and the pollen index for the San Antonio area has been reported as the lowest for the major city areas of Texas.

With the introduction of the newer methods of counting pollens,¹⁴⁻¹⁷ more detailed information will be obtained to aid the hay fever sufferers in this and other areas. It is still important to keep a watchful eye out for the appearance of a new weed or tree pollen, either naturally or artificially introduced, which may become important clinically. Correlation of pollen counts with allergic problems is essential in achieving optimal clinical results.

SUMMARY

1. A botanical survey of the hay fever plants in the metropolitan area of San Antonio, Texas, is presented.

2. Detailed data are given about the types, abundance, and seasonal occurrence of atmospheric pollens and fungus spores found during a 10 year period of study which was carried out from Jan. 1, 1951, through Dec. 31, 1960, in San Antonio, Texas.

3. Pollens are present in the air over the entire year with the *Quercus virginiana* (live oak) and the *Carya pecan* (pecan) being present in large quantities in the spring. The *Amaranthus* species (careless weed) and grasses, *Cynodon dactylon* (Bermuda grass) and *Sorghum halpense* (Johnson grass), appear during most of the year but in largest quantities during the early summer. The Ambrosiae appear in the late summer and fall months. The *Juniper sabinoidea* (mountain cedar) is a heavy pollen contributor during the winter, becoming most important particularly to those migrants who have never been exposed to this toxic pollen. Multiple fungus spores are found in the air during the entire year with spring and fall peaks, which add to the clinical symptoms caused by the pollens.

4. A perennial allergy problem exists in the metropolitan area of San Antonio and is evidenced by the presence of large amounts of allergens and molds in the air throughout the year. The abundance of pollen varies greatly with the prevailing winds and their direction, and the amount of rainfall.

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