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Airborne Pollen of Native Prairie

Clyde A. Willman

AIRBORNE POLLEN
OF NATIVE PRAIRIE

by

Clyde A. Willman

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This Thesis submitted by Clyde A. Willman in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota is hereby approved by the Faculty Advisory Committee under whom the work has been done.

(Chairman)

Marjorie Behringer

John R. Reid

Dean of the Graduate School

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Department Biology

Degree Master of Science

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ABSTRACT

The study consisted of a qualitative survey of airborne pollen on the native prairie. The study site is located T. 151 N., R. 52 W., Sec. 16, Oakville Township, Grand Forks County, North Dakota. Airborne pollen was obtained using the gravity slide method with a Durham Air Sampling Device from June 15 to August 15, 1967. Gramineae and Chenopodiaceae pollen predominated with Urticaceae, Polygonaceae, Compositae, Pinaceae, and other pollen in lesser amounts.

INTRODUCTION

Although considerable published information is available on the prairie flora of North Dakota, including studies on the phenology of vascular plants, none is available on pollen, especially those which are airborne. The present study was undertaken to determine the types of airborne pollen present in the air over a native prairie site fourteen miles west of Grand Forks, North Dakota. A study of this type should be a useful reference in related disciplines: phenology, paleoecology, and allergy.

LOCATION AND DESCRIPTION OF STUDY AREA

The study area is located in Section 16, T. 151 N., R. 52 W., Oakville Township, Grand Forks County, North Dakota. The area is approximately fourteen miles west of the University of North Dakota campus, Grand Forks. The site is relatively flat with elevations ranging from 860 feet to 890 feet above sea level (Figs. 1,2). The study area is classified in the Tall Grass Prairie Association of Carpenter (1940) and the True Prairie Association of Clements and Shelford (1939). It lies in the Agassiz Lake Plain District of the Western Young Drift Section of the Central Lowlands Physiographic Province (Fenneman, 1938).

The study area is considered to be native prairie. There is no evidence that the soil has been disturbed except to a lesser degree by native animals and by the installation of the Portal Pipeline which transects the section in an east to west direction. It is a land grant school section by the Enabling Act of 1889. If the sod was turned this was before 1889 and the soil has reverted to native prairie since that time. Portions of the area have been mowed as recently as 1960. The areas on which mowing was discontinued at an earlier date reveal a greater abundance of forbs.

Figure 1. Photographs of Study Area

Section 16, T. 151 N., R. 52 W., Grand Forks County, North Dakota

Photographs taken August 15, 1967

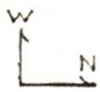
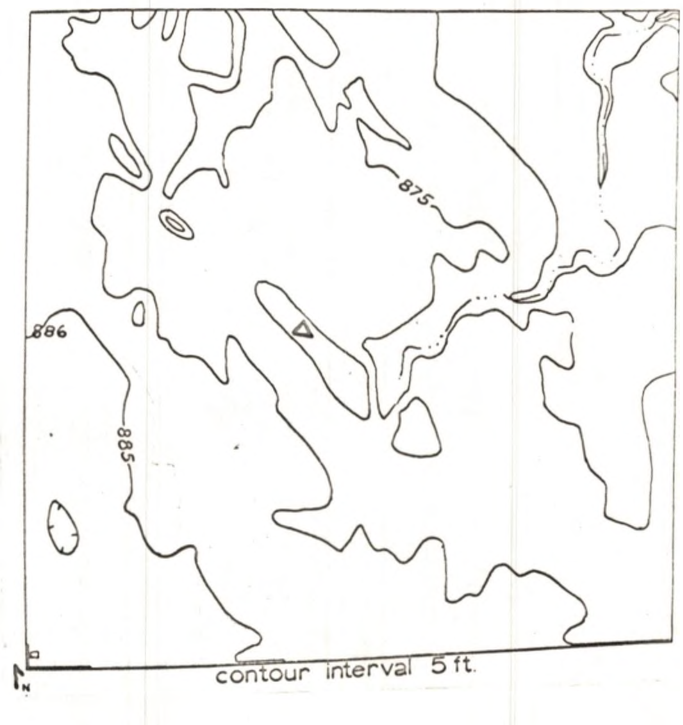


Figure 2. Topographic Map of Study Area

Prepared from USGS Quadrangle Maps, Emerado Quadrangle, 1963



Sampler Location △

0 440 880 yards

Scale

GEOLOGY, SOILS AND CLIMATE

The study area is covered almost completely with a mantle of lake sediments overlying glacial drift (Laird, 1944). Several large boulders are exposed where the lake sediments have been eroded. The underlying bedrock is nearly horizontal and the strata range in age from Precambrian to Cretaceous. The Cretaceous age Dakota Sandstone forms an aquifer that supplies the area with saline artesian water. The drift, approximately 200 feet thick, was deposited as ground moraine by the Wisconsin Glacier during the Pleistocene Epoch. Lacustrine sediments were deposited in Glacial Lake Agassiz as the Wisconsin Glacier retreated. About one-half mile southwest of the area is the Emerado Beach which was one of the shorelines of Lake Agassiz. This northwesterly trending beach has a general elevation of nine hundred feet. Possible remnants of a lower level beach of Lake Agassiz are in the area also. These are at the same level as the Ojata Beach to the northwest which, if continued southeast, would connect with these remnants.

The present drainage is poorly developed, consisting of road-side ditches draining north and a small ephemeral stream which originates near the center of the section and flows northeasterly. Several undrained depressions are located in the western half of the section.

Freeman (1962) conducted soil tests in the area and found that according to the United States Bureau of Soil Classification the soil is a sandy loam. He also found that the grain size of the soil varies from larger than 2.0 mm down to 0.001 mm. The pH of the soil varies from seven to nine with an average of eight from five samples. The soils of the lower areas can also be classified as a solonchak, a type of soil with relatively high concentrations of soluble salts, which develops under halophytic plants and occurs primarily in a subhumid or semiarid climate. These soils usually contain sufficient soluble salts to impair their productivity. It seems that the arid conditions prevalent in this area since the time of deposition were initially responsible for the present halophytic plants (Weddle, 1963). The saline artesian waters percolating to the surface from the Dakota Sandstone are a prime source of the salts in the soil.

The United States Weather Station at the University of North Dakota, 12 miles east of Section 16, is the nearest weather station and was used for climate data. Records have been maintained for the past 73 years.

The climate is subhumid, typified by cold and snowy winters, warm summer days with cool summer nights, and a variety of weather systems both in summer and winter. The mean annual precipitation at Grand Forks is 19.80 inches. Of this amount, more than three-fourths falls during the growing season of April through September. A single average monthly maximum of 3.85 inches occurs in June, with 2.50 inches in May, and slightly more than 2.80 inches in July and August. The average temperature for the three summer months of June, July, and August is 66.3 degrees Fahrenheit with a variation of just a few degrees between the averages for these months. The average wind movements for the year is less than 10 miles per hour, with a range of monthly averages from 8 to 11 miles per hour. The prevailing wind direction is from the northwest, except for the three summer months when the direction changes to southeast. The average date of the last killing frost in the spring is May 15th; the average date of the first killing frost in the fall is September 24th, giving an average freeze-free season of 131 days each year (USWB, 1961).

METHODS AND MATERIALS

Glass slides prepared with a thin film of glycerine jelly were exposed in the Durham air-sampling device located approximately in the center of the study area. Each slide was exposed for a period of twenty-four hours, and the pollen in an area of 1.8 square centimeters was identified and tabulated according to the technique outlined by the Pollen and Mold Survey Committee of the American Academy of Allergy (Durham, 1946b).

The Durham sampling apparatus, built according to Durham's specifications in the University of North Dakota Industrial Arts Department, has been approved and recommended as a standard device by the American Academy of Allergy. Essentially, it consists of two nine inch, heavy, polished, steel discs set horizontally three inches apart and held with three struts (Fig. 3). One inch above the center of the lower plane is a slide holder into which the slide fits snugly. The supporting rod of the apparatus, thirty inches long, rises from a base designed for stability (Durham, 1946a).

Techniques followed were modified from those of Wodehouse (1936). Slides were prepared by placing a small drop of dye in glycerin jelly on a slide, spreading it to cover an area approximately equal to the cover glass used. After exposure for twenty-four hours the slide was brought into the laboratory where extraneous material was removed under a hand lens. The slide was then heated until excess moisture

Figure 3. Durham Air Sampler

was driven off. It was then covered with a No. 0 cover glass and sealed with paraffin. The number of pollen grains of each taxon were counted on 1.8 square centimeter of slide area.

Reference slides were prepared of pollen dissected from the anthers of identified plants collected in the study area during the study period. The same procedure was followed in the preparation of all reference material. Voucher specimens of the collected plants are in the University of North Dakota Herbarium at the Biology Department. Nomenclature follows that of Fernald (1950).

In addition to the above reference slides, the books: Hyde and Adams (1958), Faegri and Iverson (1964), Erdtman (1952), and Erdtman (1954) were used as references to identify unknown pollen.

RESULTS

Reference plants were collected in anthesis in the study area from June 15 to August 15, 1967. The appendix lists these in phylogenetic order according to Fernald (1950). From this qualitative study of the flora in the area it is apparent that Gramineae and Compositae predominate. Other families, although present, are represented by fewer species.

Species from the following families were represented by airborne pollen grains (Table 1; Fig. 4, 5, 6): Pinaceae, Typhaceae, Gramineae, Cyperaceae, Betulaceae, Urticaceae, Polygonaceae, Chenopodiaceae, Ranunculaceae, Tiliaceae, and Compositae (*Ambrosia*, *Artemisia*, and others). Of the preceding, Pinaceae, Betulaceae, and Tiliaceae do not occur on the study area (Appendix). Pinaceae pollen was observable in small numbers on the slides set out on the Durham Air Sampler from June 15 to August 15 (Table 2). Pinaceae genera were apparently *Pinus* and *Picea*; species were impossible to determine from the material available. Betulaceae pollen appeared on slides dated June 21, 22, and 30 only. No determination was made of genera of Betulaceae present due to lack of reference material. Tiliaceae pollen collected only on August 4, appears to be *Tilia americana* which although not present on the prairie is present along rivers in the vicinity.

Gramineae pollen was collected nearly every day during the

TABLE 1. Frequency of Airborne Pollen on the Prairie

Date	Pollen Grains per 1.8 sq. cm Slide Area													
	Family													
	Pinaceae	Typhaceae	Gramineae	Cyperaceae	Betulaceae	Urticaceae	Polygonaceae	Chenopodiaceae	Ranunculaceae	Tiliaceae	Compositae Ambrosia	Compositae Artemisia	Compositae Other	Unknown
June														
15	6			1										3
16			2											2
17			2											
18														
19	1		4											
20	3		6	1										
21	9		22		2									3
22	10		8		7									1
23			6											
24			18											
25	1		38											1
26			16						1					
27	1		3						1					
28			23											2
29	1		14											2
30	1		14		2									
July														
1	4		10				1							4
2														
3	1		1											1
4	1		2				8							1
5							4							2
6	1	1	3				1		2					2
7														1
8	1	1	9				8		2					3
9	1		1											
10	1		2											
11			7				1		2					1
12			13				1							2
13	1	1	1				4							1
14			7											
15			5											
16			3				3		3					1
17			2						7					1
18			2				8		2					
19							16		1					
20							1							8

TABLE 1--Continued

Date	Pollen Grains per 1.8 sq. cm Slide Area													
	Family													
	Pinaceae	Typhaceae	Gramineae	Cyperaceae	Betulaceae	Urticaceae	Polygonaceae	Chenopodiaceae	Ranunculaceae	Tiliaceae	Compositae Ambrosia	Compositae Artemisia	Compositae Other	Unknown
July														
21			2				2							
22														
23	6		6			1	1	1	1					18
24			1			10								
25	2					1		1						
26			4			18		1						4
27	1		3			15								
28			1			6							1	
29			1			2					1			2
30	6		2			7		3			1			
31	2					4		4				2		
August														
1	1					30					2	2		3
2			8			6		7			1		1	2
3			5			5		2						
4			1			69				5	1	1		1
5						6		10				1	1	
6			1			3						1		1
7						8		1						1
8			2			5		113				3		5
9			6			3		1			1	1	3	1
10						2		16						1
11						3		82			5	1	1	
12			2					105			1	1		1
13			11					161			7			1
14			5					543			7	3	6	
15			9			8		3			1		1	
Totals	62	3	314	2	11	200	59	1054	22	5	28	16	14	82
Percent of Total	3.3	0.2	16.7	0.2	0.5	11.0	3.2	56.3	1.2	0.3	1.5	0.8	0.8	4.4

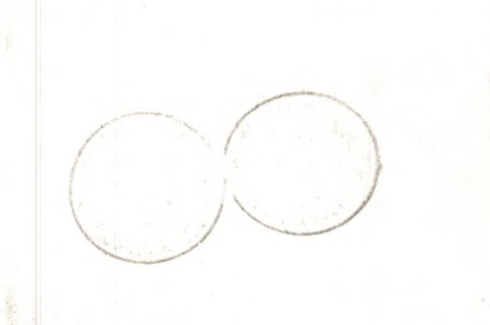
Total Pollen Counted 1872 grains

Figure 4. Common Pollen Grains of Native Prairie-I

Pinaceae *Pinus*

Pinaceae *Picea*

Typhaceae *Typha*



Gramineae

Cyperaceae *Carex*

Magnification X600

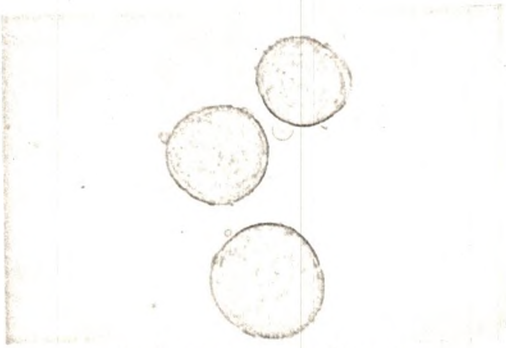
0 20 40 microns

Scale

Figure 5. Common Pollen Grains of Native Prairie-II

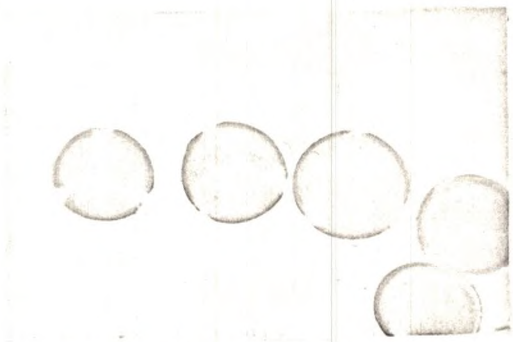
Betulaceae

Urticaceae <u>Urtica</u>



Polygonaceae <u>Rumex</u>

Chenopodiaceae



Ranunculaceae <u>Anemone</u>

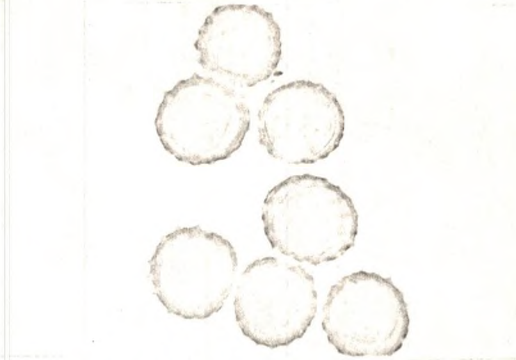
Magnification X600

0 20 40 microns

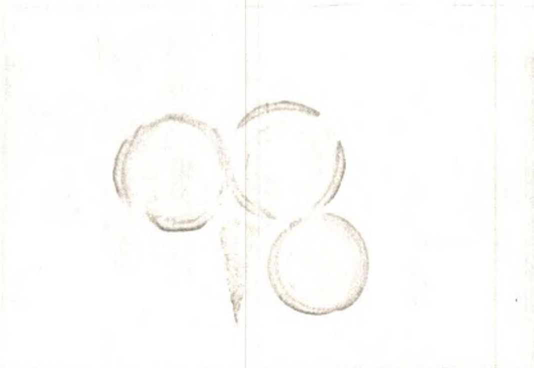
Scale

Figure 6. Common Pollen Grains of Native Prairie-III.

Tiliaceae Tilia

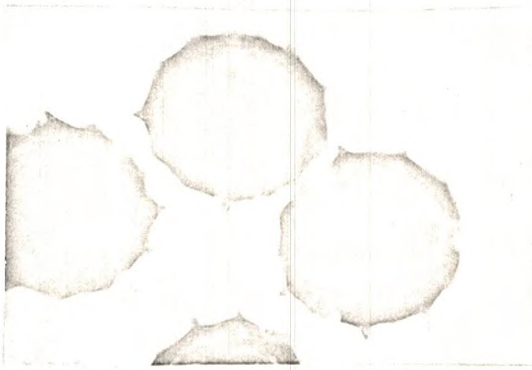


Compositae Ambrosia



Compositae Artemisia

Compositae Helianthus



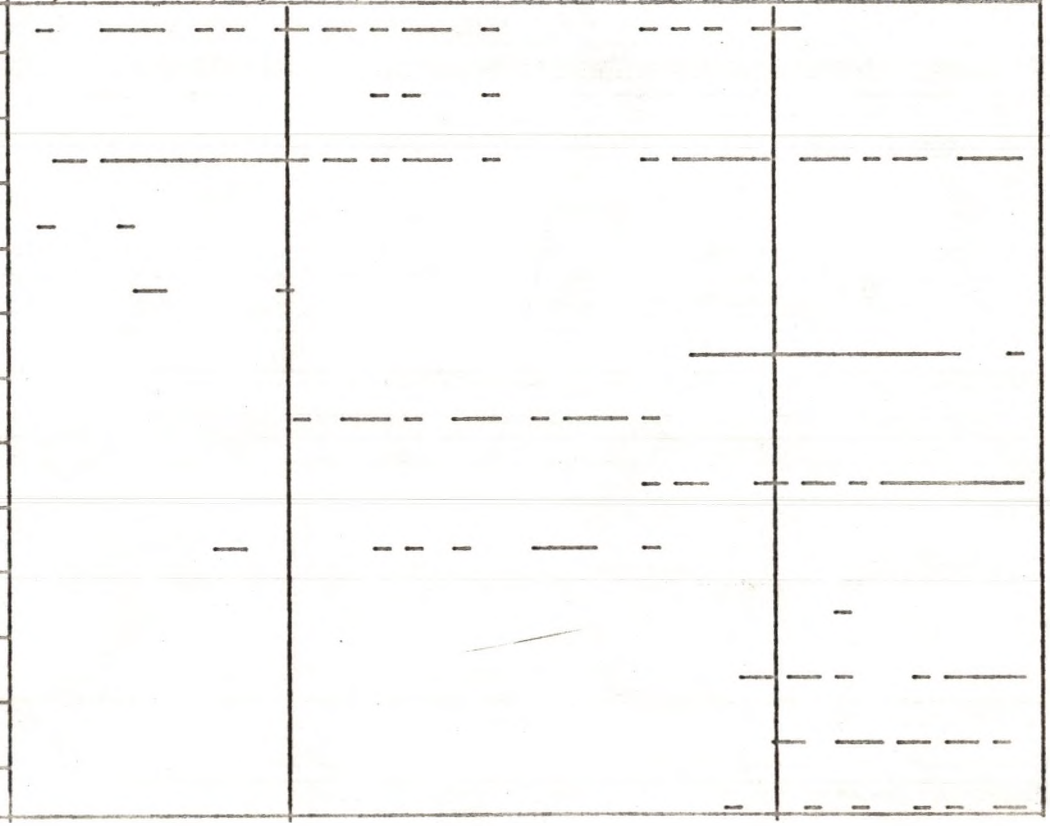
Compositae Cirsium

Magnification X600

0 20 40 microns
Scale

TABLE 2. Time Periods of Atmospheric Pollen Occurrence

FAMILY NAME	TOTAL POLLEN / FAMILY	DATES OF POLLEN OCCURRENCE June 15...20...25..30....5....10...15...20...25...30....5....10..15 (July, August)
PINACEAE	62	
TYPHACEAE	3	
GRAMINEAE	314	
CYPERACEAE	2	
BETULACEAE	11	
URTICACEAE	200	
POLYGONACEAE	62	
CHENOPODIACEAE	1054	
RANUNCULACEAE	22	
TILIACEAE	5	
COMPOSITAE (AMBROSIA)	28	
(ARTEMISIA)	16	
(OTHER)	14	



study except during or after a rain or when the wind was from a direction in which there were no blooming species. The greatest quantity of Gramineae was collected from June 20 to July 1 with a secondary peak around July 12. No attempt was made to separate Gramineae pollen since it cannot be differentiated, as they are all very similar except for variations in size (Brown, 1949). Compositae, although not anemophilous were represented by the genera: Ambrosia, Artemisia, Helianthus, Solidago, and Cirsium. The latter three are included under "Compositae Other" in Table 1. The Compositae pollen first appeared July 28, specifically Solidago; Ambrosia, on July 29; Artemisia July 31 followed by Helianthus and Cirsium on August 5 and 9, respectively.

The most numerous airborne pollen collected was that from the anemophilous Chenopodiaceae. Included in this classification is the closely related Amaranthaceae. The pollen of the Chenopodiaceae and Amaranthaceae were impossible to separate taxonomically due to their many similarities and few differences. The only genus, under Chenopodiaceae in Table 1 identified with certainty was Kochia. However, the additional genera Chenopodium, Atriplex, and Amaranthus are known from surrounding areas although none were found in the study area. Urticaceae pollen was collected from July 22 to the end of the study period. Comparison with known Urtica procera pollen led to a positive identification of pollen collected. The genera of Polygonaceae collected in the study area were Rumex and Polygonum.. Pollen from Rumex appeared on the slides from July 1 to July 21. Ranunculaceae pollen, present on the slides from June 26 to July 24, corresponds to the flowering period and reference pollen of the genus Anemone. The Typhaceae pollen, found in quartets, indicates a positive identification for Typha latifolia. The Typha pollen was found from July 6 to July 13. The Cyperaceae was found only on two days, June 15 and June 20. There were only two spores for the two dates and both of these match the reference slides for Carex sp.

DISCUSSION

Native prairie may be characterized by its anemophilous plants, these include: (i) grasses, rushes, sedges and their allies; (ii) aquatic monocotyledonous herbs such as *Triglochin* and *Sparganium*; (iii) nettles and their allies; (iv) herbs with elevated inflorescences such as *Plantago*, *Rumex*, *Thalictrum*, and some Compositae particularly *Ambrosia* and *Artemisia*; and (v) deciduous trees (Gregory, 1960).

Several methods can be used for obtaining airborne pollen. Of these, the gravity slide method has been utilized the most. This method was standardized by the American Academy of Allergy (Durham, 1946b). Several attempts have been made to correlate the amount of pollen deposited on a given slide area during a given time period to a distinct volume of air. To this date, none has been successful; but for standardized data the Durham Air Sampler has been employed with its horizontal adhesive slide. The data are given in terms of a specific area on the slide usually 1.0, 1.8, or 3.6 square centimeters.

The efficiency of the horizontal and coated slide is in part dependent upon wind velocity. The study of Gregory and Stedman (1953) with spores of *Lycopodium* indicate that the number of spores deposited on a horizontal slide is dependent upon wind velocity. The deposit of spores is reduced as the wind velocity increases due to edge shadow caused by the buffeting of air against the edge of the slide and the slide holder. Spores, and presumably other particles of similar shape and speed of fall, are carried over the slide for a distance which is directly proportional to the wind velocity. There is a critical wind velocity which is again dependent upon the size and shape of the particle and its speed of fall beyond which, it is interesting to note, that the turbulence increases the deposit on the sampling area (Rowley, 1955).

The direction of the wind is also an important factor. The study area is in a saline region that extends both north and south of the area. Immediately to the west and a short distance to the east the land is cultivated intensively. Thus, if the wind were from the east or west, it would be possible for crop pollen to influence the results. It is possible that some of the grass pollen on the slides is a direct result of small grain agriculture in the area. To the north are several low areas. If the wind were from that direction, one would expect to obtain grass, cattail, rush, and reed pollen. To the south are pastures and sand ridges. If the wind were from this direction, one would expect a variety of grasses and weedy species. Also, far to the northeast lies the coniferous forest. A wind from that direction would possibly bring pine pollen into the area. In general, the data conform to these premises.

During several days of the study, thunderstorms moved across the area. They were characterized by high winds and heavy rainfall of short duration. Although the sampler is designed to eliminate the washing effects of storms, this type of precipitation resulted in a washing effect on the microscope slide in the Durham Air Sampler. Thus the data on these days were altered to an unknown extent.

The anemophilous plants shed their pollen at different times during the growing season. Hayfever analysts have divided the growing season into three separate periods: the first is the Early Spring Season and involves mainly trees; the second is the Early Summer Season when grasses and a few herbs such as *Rumex* and *Thalictrum* shed pollen; the third is the Late Summer Season when ragweeds, sage brush, chenopods and amaranths shed their pollen (Wodehouse, 1935).

Two of the three seasons recognized by the hayfever analysts were covered during the course of the study. Due to the time of the study, June 15 to August 15, the Early Spring Season was missed. At the beginning of the study the author did get some Cyperaceae, Betulaceae, and some early grasses from the first season but missed nearly all the early trees, and most of the rushes and sedges that are commonly associated with that season.

The entire Early Summer Season which consists mainly of grass pollen was covered. Also during this season quantities of Polygonaceae and Ranunculaceae pollen were encountered. The Polygonaceae pollen was probably *Rumex* pollen which is found in abundance in the area and corresponds to reference pollen from plants collected in the area. The Ranunculaceae pollen was probably that of the genus *Anemone* due to the large numbers of that genus in the vicinity of the air sampling apparatus. *Thalictrum* is a common anemophilous member of the Ranunculaceae but only one small stand of the plant consisting of pistulate members was found. The airborne pollen of the grass

(Gramineae) cannot be differentiated, as they are all very similar except for variations in size (Brown, 1949).

The Late Summer Season arrives on the native prairie towards the end of July. It consists mainly of Chenopodiaceae, Urticaceae, and Compositae pollen. The Compositae include abundant numbers of Ambrosia, Artemisia, and other genera such as Helianthus and Solidago in smaller amounts. The Urticaceae pollen matches reference slides of Urtica procera Muhl. which is found on the hummocks in the area. The pollen designated Chenopodiaceae includes Chenopodium, Amaranthus, and Kochia. All are common and their pollen cannot be separated with certainty (Wodehouse, 1935). There are a deceptively high number of Chenopodiaceae pollen grains on the gravity slides. The plants are very common in the area, and one would expect large quantities of the pollen. In this case, the extremely high count is probably due to the proximity of Kochia scoparia L. to the Durham Air Sampler. Grass continued to be caught during this season but in smaller relative amounts. Pinaceae pollen was found on the slides throughout the study period. Most of the pollen was Pinus although a small number of Picea was also noted. Pine pollen on the prairie would at first glance appear unusual. However, many farmers in the area have pine trees in their shelter belts and around their homes. Also, the coniferous forest to the north and northeast is a possible source of these pollen grains.

Rowley (1955) did a recent pollen study at the Lake Itasca Biological Station in Minnesota, approximately 150 miles southeast of Grand Forks, North Dakota. The floral composition of his study area, a mixed forest of hardwoods and evergreens, was quite different from the prairie location. Also his study, from June 15 to July 17, was of shorter duration, but there are similarities. Throughout the period of his study, he found grass pollen and pine pollen. He also had a short period of Betulaceae pollen about June 17 and Typhaceae pollen beginning July 5. He recorded Polygonaceae Rumex pollen around June 29.

On the prairie, grass and pine pollen were recorded throughout the same period. Betulaceae pollen was encountered June 21, 22, and 29 which corresponds, roughly, with Rowley's. The records of Typhaceae pollen run from July 6 to July 13, also corresponding to Rowley's dates. Polygonaceae pollen was found from July 1 to July 23. The first of the Polygonaceae pollen grains begin to appear about the same time as is shown in his records but lasts for a much longer period of time. The difference is probably due to the differences in vegetation in the two areas.

On the east coast, the Late Summer Pollen Season is associated with the advent of the ragweed blooming. The arbitrary date for this beginning is August 15. In the study area, Ambrosia started blooming around the first of August. Probably this difference is due to climatic differences and the shorter growing season in this area.

This study may have several applications. First, it would be an aid to the phenologist for determination of approximate flowering times of anemophilous plants present on the prairie. Second, it would be useful in paleoecological studies for correlation of peat and bog studies with the present pollen composition of the atmosphere. Finally, the airborne pollen would have a direct relation to people suffering from hayfever. The grasses, chenopods, and ragweeds are all known to cause hayfever. During their peak periods, one would expect hayfever symptoms to occur.

Also present on the gravity slides but not taken into consideration for this study were large numbers of fungi and lower plant spores. This would be a fertile area for further research.

Another possibility for further study would be a year long study of airborne spores of all types. To the authors knowledge, this has not been done in the Grand Forks or northern plains area and it would be an important contribution to scientific knowledge.

APPENDIX

The following is a taxonomic listing of plants found in anthesis on the research area during the study.

TYPHACEAE

Typha latifolia L.

SPARGANIACEAE

Sparganium eurycarpum Engelm.

JUNCAGINACEAE

Triglochin maritima L.

ALISMACEAE

Alisma subcordatum Raf.

GRAMINEAE

Bromus inermis Leyss
Distichlis stricta (Torr.) Rydb.
Agropyron repens (L.) Beauv.
Hordeum jubatum L.
Koeleria cristata (L.) Pers.
Calamogrostis inexpansa A. Gray
Phleum pratense L.
Stipa spartea Trin.
Spartina pectinata Link
Beckmannia syzigachne (Fern.) Steud.
Hierochloe odorata (L.) Beauv.
Andropogon scoparius Michx.

JUNCACEAE

Juncus balticus Willd.

LILIACEAE

Zigadenus elegans Pursh.
Allium stellatum Fraser
Allium textile Nels. & Macbr.
Lilium philadelphicum L.
Smilacina racemosa (L.) Desf.

IRIDACEAE

Sisyrinchium montanum Greene(O. Lakela, personal communication to Dr. V. Facey)

URTICACEAE

Urtica procera Muhl.

POLYGONACEAE

Rumex occidentalis Greene
Polygonum coccineum Muhl.

CHENOPODIACEAE

Kochia scoparia (L.) Roth

CARYOPHYLLIACEAE

Stellaria longipes Goldie
Cerastium arvense L.

RANUNCULACEAE

Ranunculus sceleratus L.
Thalictrum venulosum Trel.
Delphinium virescens Nutt.
Anemone cylindrica Gray
Anemone patens L. var. *wolfgangiana* (Bess.) Koch

ROSACEAE

Spiraea alba DuRoi
Fragaria virginiana Duchesne
Rosa arkansana Porter

LEGUMINOSAE

Melilotus officionalis (L.) Lam.
Melilotus alba Desr.
Psoralea argophylla Pursh
Petalostemum candidum (Willd.) Michx.
Petalostemum purpureum (Vent.) Rydb.
Astragalus goniatus Nutt.
Glycyrrhiza lepidota (Nutt.) Pursh
Vicia americana Muhl.

EUPHORBIACEAE

Euphorbia esula L.

VIOLACEAE

Viola papilionacea Pursh
Viola pedatifida G. Don

ONAGRACEAE

Oenothera biennis L.

UMBELLIFERAE

Zizia aptera (Gray) Fern.
Sium suave Walt.

APOCYNACEAE

Apocynum sibiricum Jacq.

ASCLEPIADACEAE

Asclepeas syriaca L.

CONVOLVULACEAE

Convolvulus sepium L.

BORAGINACEAE

Lithospermum canescens (Michx.) Lehm.

LABIATAE

Monarda fistulosa L.
Mentha arvensis L.

RUBIACEAE

Galium boreale L.

CAPRIFOLIACEAE

Symphoricarpos occidentalis Hook.

LOBELIACEAE

Lobelia spicata Lam.

COMPOSITAE

Liatris punctata Hook.
Grindelia squarrosa (Pursh) Dunal.
Aster laevis L.
Aster ericoides L.
Aster brachyactis Blake
Ambrosia trifida L.
Rudbeckia serotina Nutt.
Ratibida columnifera (Nutt.)
Helianthus maximiliana Schrad.
Helianthus rigidus (Cass.)Desf.
Achillea lanulosa Nutt.
Artemisia ludoviciana Nutt.
Senecio plattensis Nutt.
Cirsium vulgare (Savi) Tenore
Cirsium undulatum (Nutt.) Spreng.
Cirsium arvense (L.) Scop.
Tragopogon pratensis L.
Sonchus arvensis L.
Sonchus asper (L.) Hill
Lactuca pulchella (Pursh) DC
Agoseris glauca (Pursh) Raf.
Taraxacum officionale Weber

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