

ALBERTA POLLEN SURVEY

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POLLEN surveys have been carried out in many parts of the United States but relatively few places in Canada have been thoroughly studied. With a few exceptions such as the outstanding work of Walton and Dudley,^{17, 18} most of the work done in Canada has been with ragweed pollens. No pollen survey had been done for the Province of Alberta and, except for Jamieson's article,¹¹ no information was available on the hay fever pollens. Therefore a pollen survey was undertaken to supply information on the air-borne pollens of this area. The main part of the survey covered the growing seasons (May 1 to September 30) of 1950 and 1951. Supplementary work was carried out during the summer of 1952 to provide more knowledge of the distribution of ragweeds in Alberta. The purposes of this paper are to present the results of the Alberta Pollen Survey and to describe our experience with two pollen sampling instruments.

PROCEDURE

Ten stations were set up at carefully selected points in Alberta chosen with reference to variation in vegetation and population density. The locations of the sampling stations are shown in Fig. 1. At each station two pieces of equipment were used: (1) The Standard Gravity Sampler recommended by the American Academy of Allergy. This device is shown in position on the left in Fig. 2. (2) A Rotating Stand, developed by the Dominion Rust Laboratory in Winnipeg, Canada. This instrument is designed to hold the slide so that it is always facing the wind, but is protected from rain, unless wind-driven. The Rotating Stand is shown on the right in Fig. 2. The two instruments were placed close together for comparison of pollen records and so that they might supplement one another's records of a district.

It has been stated often that the ideal site for a pollen-sampling device is the flat roof of a building free of all obstructions. Although aware of this fact, we had of necessity to locate our stations where a reliable person could carry out daily exposure and collection of slides. However, we endeavored to set up the instruments in locations that were as free of obstructions as possible. Where the instruments had to be placed on the ground we chose a piece of elevated open ground without buildings or vegetation sheltering the samplers. After studying the results in the light of the vegetation surrounding each station, it was concluded that ground sites produced as good a pollen record as the building sites.

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Two slides coated with white petroleum jelly were exposed for twenty-four hours each day. The entire area under the cover slip was counted and the count reported as the number of pollen grains of each kind per square centimeter of slide area. All results are reported on this basis.

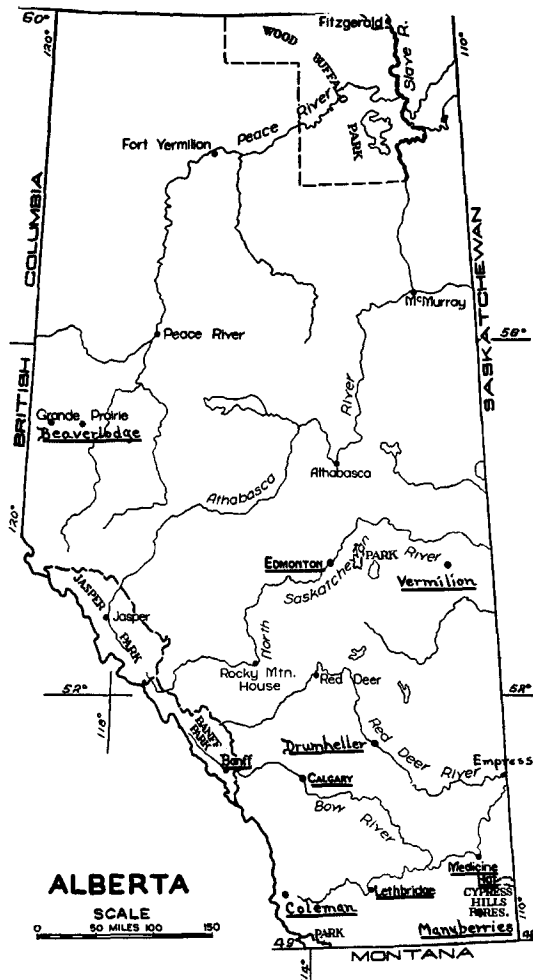


Fig. 1.—Location of stations.

There appears to be no agreement among workers in this field as to the number of pollen grains per square centimeter of slide area that will cause hay fever in susceptible individuals. However, when data from a pollen survey are to be summarized for medical use some decision on this point has to be made. It has been suggested that ragweed counts of 7 or more grains per square centimeter will cause hay fever in moderately susceptible persons.^{1, 4} This figure has been used for all the hay fever pollens discussed in this survey. The writer suggests that experiments designed to correlate pollen records with clinical findings might help elucidate this point.

Clinical work has shown that not all air-borne pollens produce hay fever in susceptible individuals. As references in the question of toxicity Vaughan,¹⁶ Wodehouse,¹⁹ and Feinberg⁶ have been followed.

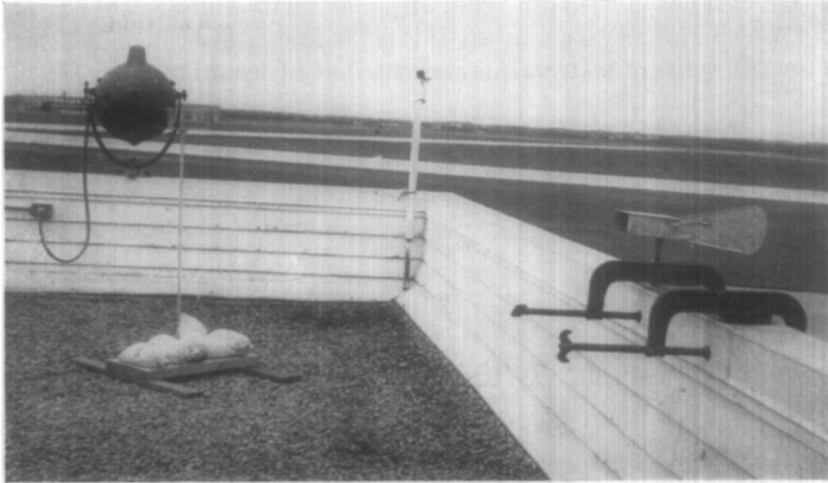


Fig. 2.—Pollen samplers used in survey.

COMPARISON OF TWO POLLEN SAMPLERS

Before giving the results of the survey it is advisable to discuss our conclusions as to the relative merits of the two instruments employed. An examination of the available literature before beginning this project revealed that two kinds of pollen samplers had been used in pollen investigations. The majority of studies had been carried out with the Standard Gravity Sampler or an instrument similar in construction. In this type of device the microscopic slide is held in a horizontal position and spoken of as a gravity slide. Some workers, however, such as Howell and McNeil,⁷ used a weather vane type of instrument which held the slide facing the wind.

With regard to the Gravity Sampler, Durham⁵ states that gravity slides “must be regarded henceforth as being much more inaccurate than many workers have assumed.” This was in connection with volumetric air analysis work.

Penfound and Efron¹³ found that counts on horizontal slides are not good indices of the amount of pollen in the air. They believe that counts on vertical slides are essential to obtain a good index of pollen abundance in the air.

Hyde and Williams^{9, 10} exposed slides in the horizontal position (Gravity slide) and slides in the vertical position (impact slide) at the same time. They found that the impact slide caught much more pollen than the gravity slide. In their studies of Ribwort plantain pollen production they report that “the pollen catch on the impact slide is a much better index of the rate of pollen liberation than the gravity slide.”

Walton and Dudley,¹⁷ whose pollen survey covered an area most closely resembling Alberta, remark that their pollen counts were low and suggest

that the Standard Sampler may not be an accurate method of studying pollen in the air.

It appears that although the Gravity Sampler is the standard device, much can be said in favor of the weather vane or impact slide type of instrument. We decided to use both types of pollen sampler at each of our stations (see Fig. 2). So far as we are aware this is the first large-scale pollen survey in which the two types of instruments were used at each station.

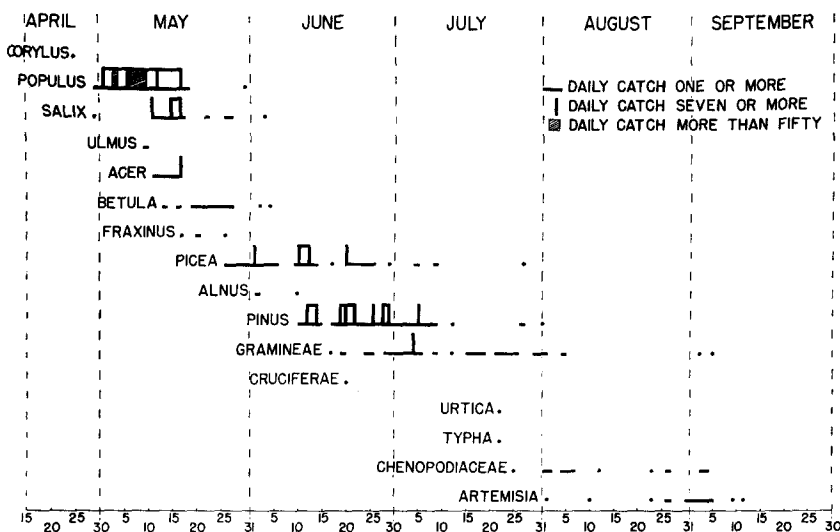


Fig. 3.—An Edmonton calendar based on Gravity Sampler records.

A comparison of the records from the two samplers for the two seasons showed that:

1. In general, the quantity of pollen recorded on the Rotating Stand slide was greater than the quantity recorded by the gravity slide. To determine this point the total seasonal catch of each of the main pollens and the maximum daily count of each of these pollens were compared. With one exception the Rotating Stand showed higher total seasonal catches and higher maximum daily counts than did the Gravity Sampler. The exception was found at Medicine Hat where the total seasonal catch and the maximum daily count for sagewort pollen were higher on the gravity device.

2. For the main pollens the Rotating Stand showed a longer period of time during which counts of 7 or more grains per square centimeter were recorded. This was important with hay fever pollens.

3. The Rotating Stand usually recorded more different kinds of pollen than did the Gravity Sampler. However, the difference between the two samplers is not so marked in this respect as is the case with the first two points.

Fig. 3 shows a pollen calendar for Edmonton based on records from the Gravity Sampler; Fig. 4 shows one based on records from the Rotating Stand

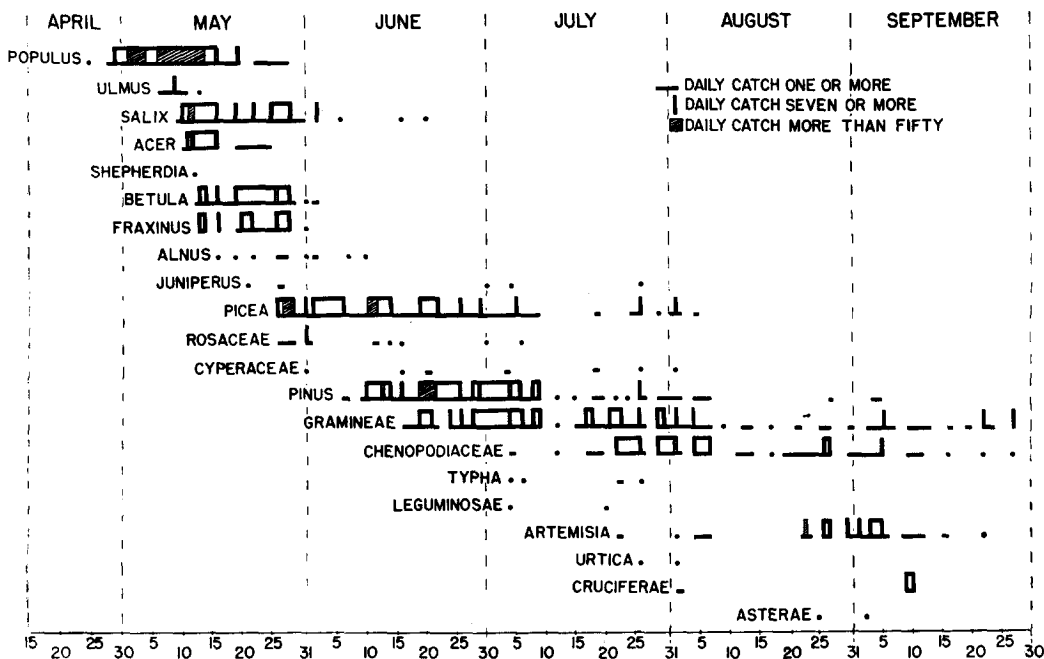


Fig. 4.—An Edmonton calendar based on Rotating Stand records.

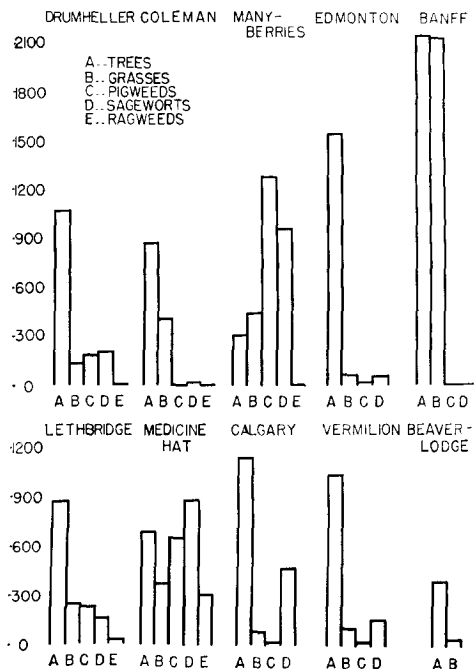


Fig. 5.—Total pollen counts by groups at each station for one season.

obtained at the same time. These calendars illustrate the difference between records obtained from the two instruments. Similar differences would be evident if such calendars were prepared for the other stations.

4. After studying the vegetation around the stations, we consider that the Rotating Stand records reflect more accurately the distribution of the main plants contributing to the air-borne pollen than does the Gravity Sampler.

DISCUSSION

Our experience with the two instruments indicated that the Rotating Stand slide counts gave a more accurate picture of the daily air-borne pollen of this region than did the counts obtained from the Gravity Sampler. It should be remembered, however, that a weakness of the Rotating Stand is its susceptibility to high dust concentrations in the air and to wind-driven rain. The dust obscures some of the pollen grains while a driving rain may wash some of them off the slide. On such days the Gravity Sampler may show a better pollen record. Nevertheless, in regions such as ours, where very high atmospheric pollen frequencies are not common, it seems that the Gravity Sampler is not as efficient an instrument as the Rotating Stand.

The main argument in favor of the Gravity Sampler is that the results can be compared with those obtained in other parts of Canada and in the United States, since this is the instrument most often employed. Such comparisons are of interest but they are not very helpful in the solving of regional hay fever problems.

To sum up, we consider that in aerobiological survey work carried out in regions with a vegetation and climate such as is found in Alberta, one should use both kinds of samplers to obtain the most nearly accurate picture of the air-borne pollen of the area. If only one piece of equipment is to be used at each station then we would give preference to the Rotating Stand.

In the discussion of the results of the Alberta survey which follows, the records from the Rotating Stand are included in all summarizing statements made concerning the air-borne pollens of this region.

RESULTS OF SURVEY

In the comprehensive report of this survey the results of each of the ten stations are presented and discussed independently. This procedure was followed since each station exhibited a distinctive pollen picture. The pollen records from each station for the two years were set out in 40 tables at the end of the report. This report has been deposited in the Medical Library at the University of Alberta. It is obviously impractical in an article of this kind to attempt to describe the records of all the stations in detail; therefore only the general conclusions about the air-borne pollens of Alberta will be given.

From the data obtained at the ten stations for two years certain conclusions can be drawn:

1. In our region there are two definite hay fever periods: the spring hay fever season and the summer-fall hay fever season. Many surveys speak of

three hay fever seasons; spring, summer, and fall, but results of this area show no definite summer and fall periods. Instead the pollens of the grasses and some weeds are found throughout the summer and fall months. The spring hay fever season begins sometime between the middle of April and the first of May, depending on the season and the part of the province. It lasts about five weeks. The hay fever pollens in the air at this time belong to trees such as poplar, birch, green ash, Manitoba maple, and elm and shrubs such as willow, alder, and juniper. No one station recorded significant quantities of all these pollens, but, in general, the most important trees and shrubs are poplar, birch, willow, Manitoba maple, and juniper in that order.

The summer-fall season begins between June 15 and July 1. It is due chiefly to pollens of the grasses, the pigweeds and the sageworts (*Artemisia* spp.). Grass pollen begins this season and is in the air throughout the balance of the growing season, that is, from about mid-June to early September. We have many species of grasses shedding their pollen at different times so that the air is never free of grass pollen once the first grains of the season are released. Grass pollen was recorded at all the stations in important quantities and is a primary suspect in our summer hay fever cases. The common grasses in Alberta are bluegrass (*Poa* spp.), spear grass (*Stipa* spp.), brome grass (*Bromus* spp.), wheat grass (*Agropyron* spp.), and June grass (*Koeleria* spp.).

The pigweeds begin to release pollen around July 1 and shed the bulk of their pollen from the middle of July to the first of September. These plants grow everywhere in Alberta and are an important component of the "weedy" vegetation. The common pigweeds of Alberta are goosefoot (*Chenopodium* spp.), Russian thistle (*Salsola pestifer*) and Russian pigweed (*Axyris amaranthoides*).

The sageworts are late summer plants and shed their pollen from the middle of August to the end of September. These plants are also common in the province, being especially abundant in the southern regions (south of Calgary).

2. In Alberta important amounts of ragweed (*Ambrosiaceae*) pollen were caught at Medicine Hat only. This was the only station at which records during both years placed ragweed pollen among the main hay fever pollens. Both marsh elder (*Iva xanthifolia*) and poverty weed (*Iva axillaris*) are common in the area and likely these two species contributed to the ragweed pollen counts. However, extensive field work in this region has revealed a considerable quantity of true ragweed (*Ambrosia artemisiifolia*) in the vicinity of Medicine Hat and Empress. This is the only part of the province in which true ragweed has been found in quantity worth mentioning. Since ragweed counts here were higher than at Lethbridge where marsh elder and poverty weed are common, we conclude that a large part of the ragweed pollen on the Medicine Hat slides was *Ambrosia* pollen.

Although Medicine Hat is the danger spot in the province with regard to ragweed, small amounts were caught at Lethbridge, Drumheller, and Manyberries. These records would be due to the pollens of marsh elder and

poverty weed which are common at Lethbridge and occur locally at Drumheller and Manyberries. These are not true ragweeds but their pollen is said to be fully as toxic. Concerning the question of the allergenic qualities of *Iva* pollen, Prince and Sucrest¹⁴ found that direct testing with marsh elder (*Iva*) and ragweed (*Ambrosia*) pollens did not show any differences in the allergenic contents of the extracts. It would seem that we should be on the alert for ragweed hay fever in southern Alberta and particularly in that area lying south of Lethbridge to Manyberries and east to Medicine Hat.

3. A study of the relation between the pollen records at each station shows that the pollen catch at all our stations was predominantly of local origin. Whenever we recorded high counts of a given pollen the plant producing this pollen was found to be common in the region. If some pollen did travel into the district from a distance that part of the pollen catch was relatively unimportant in the hay fever picture.

4. Since the survey extended over several seasons it was possible to compare the records of different years. The times and amounts of the different pollens varied somewhat from year to year. However, in general, the procession of the chief hay fever pollens throughout the growing season is the same each year.

5. A large proportion of the pollen caught on the slides could be called hay fever pollen; that is, toxic pollen discharged in quantity into the air. However, a number of kinds of pollen that do not qualify as hay fever pollens were recorded. Outstanding among these were the pollens of pine and spruce. Pine and spruce were caught in large quantities over a considerable period of time (June and July) at all our stations. Most authorities state that pine and spruce pollen lack the principle necessary to cause hay fever. However, Rowe¹⁵ found that some of his patients gave positive skin reactions to pine pollen. He was able to control their hay fever by sensitization with pine pollen extract. It seems difficult to believe that pollen shed in such large quantities would not produce hay fever in some individuals. Among other nontoxic pollens that might be mentioned are those of the mustards, the clovers, cat-tail, and nettle.

6. It is interesting to compare the various stations throughout the province with regard to the chief pollen groups recorded. Fig. 5 shows the total pollen counts by groups at each station for a growing season. Only the main groups are summarized although many kinds of pollen were caught.

SUMMARY

1. In the province of Alberta a more complete picture of the air-borne pollen was obtained by using both the Standard Gravity Sampler and the Rotating Stand Sampler.

2. A comparison of the two samplers showed that the Rotating Stand gave better records for this region.

3. There are only two hay fever seasons in this area: the spring hay fever season due to trees and shrubs and the summer-fall season due to grasses and weeds.

4. The chief hay fever pollens of Alberta are those of poplar, birch, green ash, Manitoba maple, elm, willow, alder, juniper, the grasses, the pigweeds, and the sageworts (*Artemisia* spp.).

5. Important amounts of ragweed (*Ambrosiaceae*) pollen were recorded at Medicine Hat only.

6. Pine and spruce pollen were caught in large quantities over a considerable period of time at all the stations.

7. The pollen recorded at all the stations was predominantly of local origin.

Common names of pollens in calendars are:

Acer—Manitoba maple	Juniperus—Juniper
Alnus—Alder	Leguminosae—Legumes
Artemisia—Sagewort	Picea—Spruce
Asterace—Aster tribe	Pinus—Pine
Betula—Birch	Populus—Poplar
Chenopodiaceae—Pigweeds	Rosaceae—Rose family
Corylus—Hazelnut	Salix—Willow
Cruciferae—Mustards	Shepherdia—Buffalo berry
Cyperaceae—Sedges	Typha—Cattail
Fraxinus—Green ash	Ulmus—Elm
Gramineae—Grasses	Urtica—Nettle

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