

ATMOSPHERIC POLLEN COUNTS IN TORONTO, CANADA

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FROM the period, Dec. 7, 1953, to Dec. 6, 1954, daily atmospheric pollen counts were done at The Hospital for Sick Children, Toronto. No such study has been done in this area since the one conducted by LaRush¹ more than twenty years ago.

TECHNIQUE

The counts were done by means of the standard sampling device manufactured by the Wilkens-Anderson Company of Chicago,² using standard microscope slides covered with a thin coating of soft petrolatum jelly (75 per cent U.S.P. petrolatum, 25 per cent U.S.P. mineral oil). This apparatus was placed on the roof of the hospital, which is eleven stories high, in a relatively unobstructed position, although a superstructure about thirty feet away caused slight obstruction from a northerly direction. There are no surrounding tall buildings which cause any obstruction. The slide was replaced daily at 11:15 A.M. and examined under a binocular microscope, without stain. The area of the cover slip, 4.4 sq. cm., was counted, but results were reduced to the number of pollen granules per square centimeter for reporting.

RESULTS

The results of the counts are shown in Figs. 1, 2, and 3. From Fig. 1, it is seen that the tree season extends from the first week of April to the second week of July, the grass season from the fourth week of May to the end of July (although some grass pollen was found until the middle of September), and the weed season from the beginning of August to the end of September.

Fig. 2 demonstrates that the important tree pollens, numerically, are birch, elm, maple, oak, pine, and poplar. Elm and poplar pollens are predominant through April; birch through May; maple through April and May; oak through April, May, and the first half of June; and pine largely from the middle of May to the middle of July. Pine pollens gave the highest counts of all the tree pollens and accounted for practically all the tree pollen seen after the first of June.

Fig. 3 reveals that ragweed is the only weed pollen present to an appreciable extent. Very few granules of dandelion pollen (included in the compositae) were seen.

Correlation of Counts With Skin Tests to Pollens in the Toronto Area.—

Pollens are clinically very important in the Toronto area, where hay fever and asthma, during the pollen seasons, are very common. Skin reactions to extracts

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of tree pollens are very common, as would be expected from the high pollen counts, and are commonly obtained with alder, ash, and willow, in spite of their low counts obtained in this study. The very high counts obtained with pine pollen came as a distinct surprise. Since pine pollen is not generally considered to be allergenically active, we have never skin tested with this pollen and, therefore, cannot make any comment on skin testing with this agent.

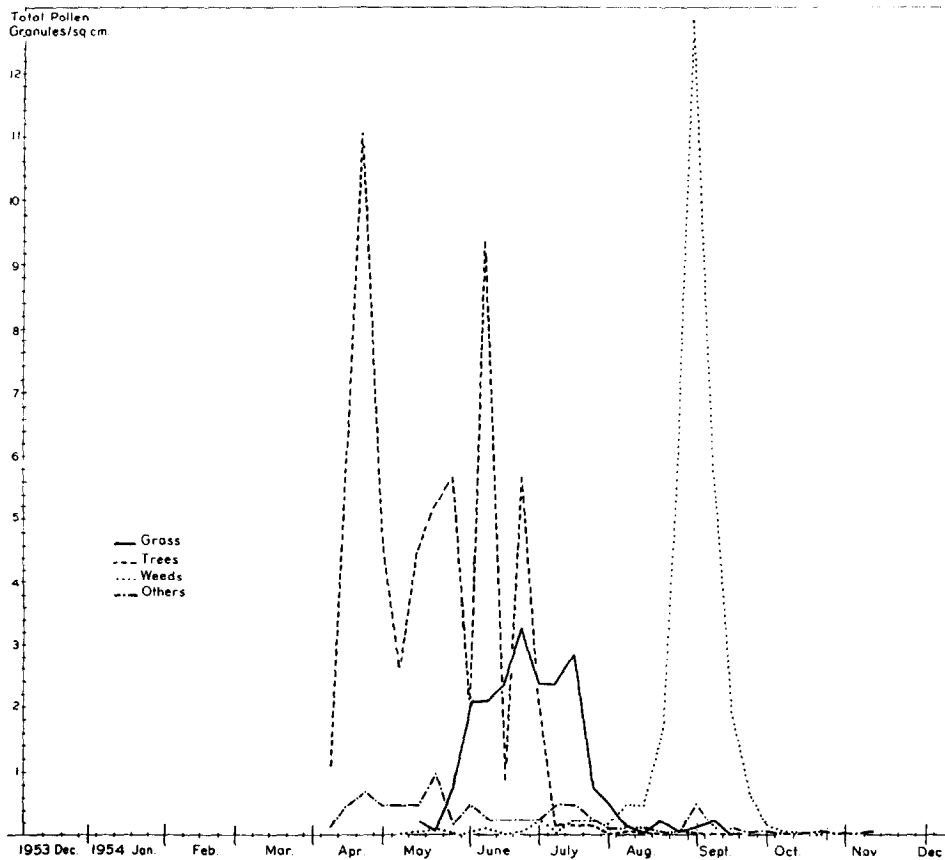


Fig. 1.—Total tree, grass, and weed pollen counts, expressed as number of pollen granules per square centimeter of exposed slide. The average daily count for each week is charted for purposes of simplification.

From Fig. 3, it is obvious that ragweed accounts for the major portion of weed pollens in this area. In spite of this, positive skin tests are extremely common with cocklebur, dandelion, goldenrod, goosefoot, mugwort, pigweed, plantain, and Russian thistle, and one of us (C. C. W.) feels very definitely that patients reacting to these weeds have better clinical results if treated with them than if treated with ragweed alone.

Correlation Between Pollen Counts and Observations on the Weather.—Certain observations on the weather are of interest. It was noted that if the mean daily temperature fell 10 degrees or more, the daily pollen count almost

of the pollen-producing plants in the area in which the counts are being done. Therefore, a knowledge of the distribution of these plants is important in order to generalize on the incidence of pollen granules in neighboring areas.

Trees: Southern Ontario (Fig. 4) has a wide variety of tree species. For the purposes of description, the map is divided into four areas, formed, in part, by the geological structure of the land. The southern boundaries of Area 4 are those of the granite Canadian Shield coming down to Lake Ontario around Kingston. Area 1 is approximately the northern limit of the so-called Carolinian zone of vegetation, extending up from the south into Ontario.

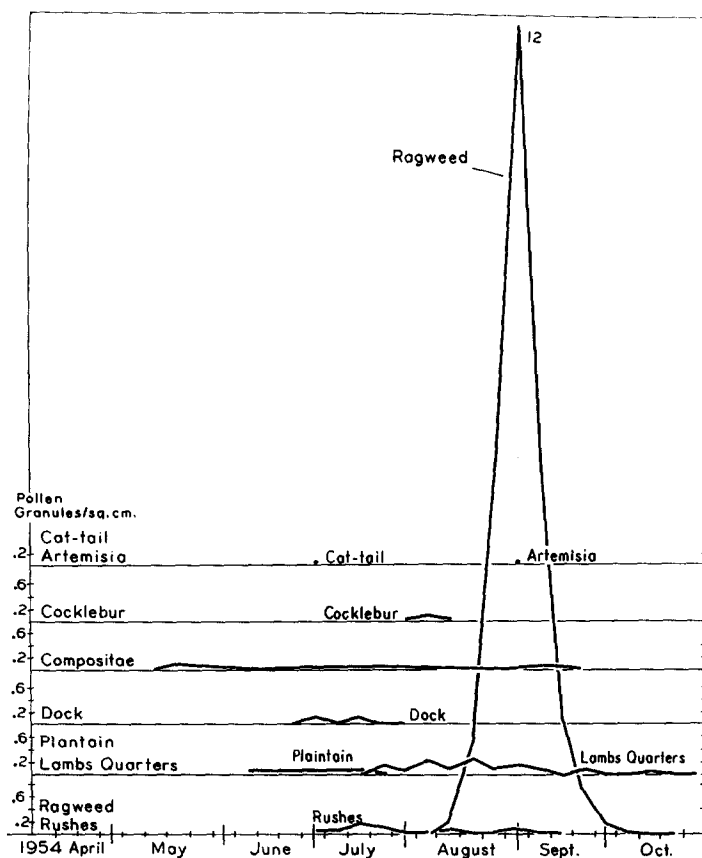


Fig. 3.—Pollen counts of all weeds whose pollens were identified, expressed as number of pollen granules per square centimeter of exposed slide. The average daily count for each week is charted for purposes of simplification.

The distribution of the different genera whose pollen was obtained on the slides will be discussed briefly.

The commonest alder (*Alnus rugosa*) occurs over the entire area, mainly in swamps and by streams. No other alders are present in quantity.

The white ash (*Fraxinus americana*) and the black ash (*F. nigra*) are the most common species of this genus. They occur over the entire map area, but are more prevalent in the southern parts.

The beech (*Fagus grandifolia*), while covering the whole map area, is most common in Areas 1 and 2.

The white birch (*Betula papyrifera*) and the yellow birch (*B. lutea*) extend over the entire map area. The former is found in quantity in the northern section (Area 4).

The eastern white cedar (*Thuja occidentalis*) is the most common cedar. It is found mainly in swampy or moist areas.

White elm (*Ulmus americana*) is the most common species of its genus in southern Ontario. It extends over the entire area, but is more plentiful in Area 2. Two less common species, slippery elm (*U. rubra*) and rock elm (*U. Thomasi*) are also found.

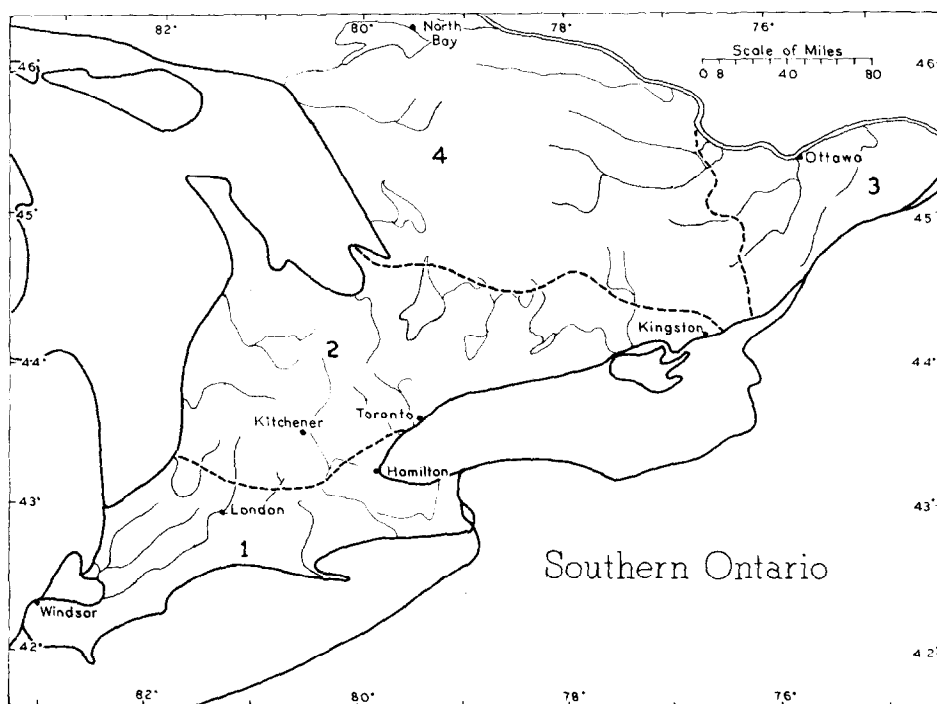


Fig. 4.—Map of southern Ontario, designating the four areas of vegetation referred to in the text.

The eastern hemlock (*Tsuga canadensis*) is found over the whole area.

The hickories are confined to the extreme southern parts of the province (Areas 1 and 2). The bitternut hickory (*Carya cordiformis*) and the shagbark hickory (*C. ovata*) are the most common. The former extends through Areas 1 and 2; the latter is confined to Area 1.

The only native linden or basswood (*Tilia americana*) is found chiefly in Areas 1 and 2, but is distributed over the whole map area.

Maples undoubtedly constitute a larger proportion of the trees over the whole southern Ontario area. The sugar maple (*Acer saccharum*), silver maple (*A. saccharinum*), and red maple (*A. rubrum*) are the most common. In the cities, the Norway maple (*A. platanoides*) is planted most extensively.

Among the oaks, there are several species found in southern Ontario, but the following are most frequent: white oak (*Quercus alba*), northern red oak (*Q. borealis*), and bur oak (*Q. macrocarpa*). While these cover the entire map area, they are much more common in the southern section (Area 1).

The two most common species of pine are the white pine (*Pinus strobus*) and the red pine (*P. resinosa*). Both are found in largest quantity in Area 4, but extend over the whole map area.

The most common poplars in southern Ontario are the aspen (*Populus tremuloides*), large-toothed aspen (*P. grandidentata*), and the balsam poplar (*P. balsamifera*). These species are spread over virtually the whole map area, but are much more common in the northern section, particularly Area 4.

The black walnut (*Juglans nigra*), the most common walnut, is not plentiful and is confined almost to Area 1. The butternut (*J. cinerea*) is not plentiful either. It is mostly in Area 1, but extends through Area 2.

Many willow species are found. They cover the entire map area, usually occurring, however, in scattered areas along river valleys and streams. Some varieties are also planted for ornamental use.

In this area, there are no trees in quantity from which pollen was not obtained in this study.

In summary, Area 1 is composed of a wide variety of broad-leaved trees, with beech, sugar and red maples, lindens, and oaks predominating. Lesser amounts of hickories, walnuts, ash, and other species occur.

Area 2 is quite similar. Sugar maples and beeches are still dominant. With them are lindens, white elms, yellow birches, and some ash, red maple, and oak trees. Some white and red pines also occur.

Area 3 is very similar to Area 2, but there is a larger proportion of pine.

Area 4 has sugar maples and pines in quantity. Here the poplars and white birches become more frequent, the oak and beech trees much rarer.

Grasses: It is impossible to reach any general conclusion about the grasses in southern Ontario, since so many species are spread over the entire area. However, they are more common in the southern parts, which are more agricultural, than in the rocky, wooded areas of the north. The most common are timothy (*Phleum pratense*), Kentucky bluegrass (*Poa pratensis*), and orchard grass (*dactylis glomerata*).

Weeds: The generalization about grasses applies also to the weeds. The commonest weeds are the ragweeds—short ragweed (*Ambrosia elatior*), and tall ragweed (*A. trifida*), the former being much more common.

The plantains (*Plantago major*, *P. rugelii* Dene, and *P. lanceolata*) and lamb's-quarters (*Chenopodium album* and *C. glaucum*) are also very common. Occurring to a lesser extent, but still frequent, are the artemisias (*Artemisia biennis* and *A. vulgaris*), the docks (*Rumex acetosella*, *R. crispus*, and *R. obtusifolius*), amaranthus (*Amaranthus retroflexus*), cocklebur (*Xanthium pennsylvanicum*), rushes (*Juncaceae*), and cattails (*Typha*).

SUMMARY

Daily pollen counts for the year 1954 in Toronto, Canada, are reported. The tree season is predominantly from the first of April into the second week of July, but after June 1 practically the only tree pollen seen is that of pine. The grass season is predominantly from the fourth week of May through July, but grass pollen is found until the middle of September. The weed season is through August and September, with the peak at the beginning of September.

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REFERENCES

1. LaRush, F.: Pollen Content of the Air in Toronto, Canada, 1932, *J. ALLERGY* 5: 306, 1934.
2. Durham, O. C.: The Volumetric Incidence of Atmospheric Allergens. IV. A Proposed Standard Method of Gravity Sampling, Counting and Volumetric Interpolation of Results, *J. ALLERGY* 17: 79, 1946.