

A STUDY OF POLLEN

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Botanists know that pollen is an indispensable part of the life cycle of flowering plants. They recognize that plants have a very definite problem in providing for the distribution of their pollen; and they know some plants chiefly for their production of an abundance of light, wind-carried pollen which causes much hay fever. But unless one has made a special study of pollen, it is sometimes not realized that each pollen grain is due as much individual consideration as the plant from which it came.

Because of their size, pollen grains could not be studied as individuals until the microscope reached a fairly high stage of development. In fact, it was not until some time after the invention of the microscope that the function of pollen was discovered. Long before the birth of Christ, naturalists speculated upon the function of pollen, but the problem remained unsolved until Rudolph Camerarius made a special study and published his results in 1694.

Before Camerarius published his paper Nehemiah Grew, an Englishman, had studied pollen morphology extensively. He noticed that all pollen grains were not alike, but he pointed out that the pollen grains of one species were fairly uniform.

After Grew's time the study of botany was at a stand-still for about 150 years so that the next important work on pollen morphology was not done until 1790. It was Francis Bauer, another Englishman, who made this study. Since Bauer was an artist and not a botanist, the value of his work consist chiefly in the accuracy of his drawings. Most of his drawings were not published, but the originals may be found in the British Museum. Bauer wrote few descriptions of the grains which he drew, but his ability to pick out the outstanding features shows that he had an advanced understanding of pollen morphology.

Between 1830 and 1839 several men, including Purkinje, von Mohl, and Mirble, made studies of pollen. However, it was not until the publication of the doctor's degree thesis of Carl Albert Fischer, a German, that the science of pollen morphology took its modern form.

Some contemporaries who are making a study of pollen are: R. P. Wodehouse, who published "Pollen Grains" in 1935; O. C. Durham, who specializes in the study of wind-carried pollen; and in our own state Dr. Paul B. Sears and Dr. Ray B. Balyeat have done extensive work.

As for the pollen grains themselves, the forces which affect them are the same as those affecting any other organism, i. e., those of the internal and external environment.

The difference between a pollen grain of one species and that of another species lies chiefly in the characteristics of the exine. The exine has three functions: 1. protection from mechanical injury, 2. provision for the emergence of the pollen tube at the time of fertilization, and 3. the accommodation in volume change which different degrees of dryness and humidity make necessary. The exine is also modified for dissemination purposes.

Pollen grains were at first simple protoplasmic bodies resembling fern spores, but in the course of evolution they provide for the emergence of the pollen tube by developing a germ pore. In order to accommodate volume change, they developed furrows.

The furrows have an interesting evolutionary history in themselves. Their size and position depend largely upon the relation of the grain to the other three members of the tetrad. At first, the side of the grain away from the other three members of the tetrad was merely sucked in.

Next a wide open furrow developed and after that, evolution was largely protection, reduction, or elimination of this wide open furrow.

In modern pollen grains, sometimes only the pore is present and sometimes both pore and furrow are found. In the latter case the furrow always contains the pore.

Time does not permit a detailed description of possible furrow patterns. We may say that the gymnosperms, monocotyledons and lower dicotyledons have only one germinal furrow. The higher dicotyledons may have from three to thirty germinal furrows. Some grains have no furrows but many small germinal apertures instead.

Pollen grains are modified in various ways for dissemination. There are the wings of the pine, the spines and roughness of the composites and mallows, and the cobwebby threads of the Evening Primrose.

One of the more recent developments in the study of pollen is the examination of atmospheric pollen and the making of pollen graphs. Microscopic slides covered with a thin coat of either methyl-green glycerin jelly or plain vaseline are exposed. The pollen count is more accurate if these slides are exposed some distance from the ground, for then the pollen from the plants in the immediate vicinity does not appear in abnormally large quantities. Slides are exposed for twenty-four hours. If the methyl-green glycerin jelly slide is slightly heated and covered with a cover glass, the slide lasts for a period of from nine months to two years. In order to make a pollen count from such a slide the slide is placed on a microscope with a mechanical stage and an area of approximately 1.8 sq. millimeters is counted.

I found that recognition of pollen on the methyl-green glycerin jelly coated slides was not so easy, so I exposed two slides each twenty-four hours—one covered with the methyl-green jelly and one with plain vaseline. My slides were exposed inside of a weather box here at the college, since access to the top of a building was not possible. I exposed slides from March 18, 1936, to May 13, 1936, inclusive. This is a total of 57 days.

Pollen grain of the wind-pollinated plants are extremely simple as compared with the pollen of some of the insect-pollinated plants so that recognition of the pollen found on the exposed slides is no easy task unless one is familiar with many different grains. I am indebted to Mr. O. C. Durham, Chief Botanist for the Abbott Laboratories, Chicago, for the identification of the pollen on the slides which I exposed.

Because of the large amount of dust found on some of the slides, examination for pollen was impossible.

If more than fifteen grains of a certain kind of pollen are found on any one slide, it is a good indication that the air is pretty well filled with that sort of pollen. If there are as many as fifteen grains on a slide, the air contains enough to cause hayfever provided that grain is a cause of hayfever.

Cottonwood pollen was found on the slides in considerable amounts from March 18 to April 19. It was most abundant on the March 31 slide. Cottonwood pollen is known to cause some hayfever.

Oak pollen first appeared on the slides on March 27, and some oak was found on almost every other slide. The greatest amount was found on the slides exposed on April 13, April 19, and April 20. Oak pollen is a cause of hayfever.

On the May 5th slide there were 27 grains of walnut pollen and 15 grains of hickory. Neither is an important cause of hayfever.

There are no cottonwood, oak, hickory or walnut trees near the weather box, so the pollen must have been carried for a considerable distance.

The slides were exposed too early in the year for a very large amount of grass pollen to be expected. Grass pollen first appeared on the May 5th

slide. On May 13 there was one sedge grain.

The season was too far advanced to expect maple pollen, but there were four grains on the March 24th slide.

Besides pollen grains, there were a great many spores of rusts on the slides. These were most abundant in May.

Slides exposed for a complete flowering season furnish a valuable hayfever indicator for a community if the pollen on the slides is accurately counted and a pollen graph is made. These graphs are being made in some of the larger cities.

