A Review of Pollenosis And the Role of Weeds

By W. C. Spain, M.D.

THE TERM "WEED" and the term "allergy" not only are difficult to define but are vague, indefinite, elastic, and subject to wide variations in interpretation. An agreement upon the concept of these two expressions is essential to any remarks that may be made upon them.

When does a plant become a weed? What is a weed? One's point of view would have something to do with reaching a decision. The overgrown vegetations of the tropics, rank and commonplace, become rare and pleasing exotic plants elsewhere; the goldenrod, an annoyance to the farmer, may appear as a colorful attractive flower to the urban dweller. It would seem that a plant becomes a weed when its nuisance value outweighs its esthetic or economic worth to man; when its lustiness and vigor, despite its beauty of form or flower, permit it to crowd out more delicate and more desirable plants; or when its noxious qualities make it a threat to the well-being of man and animal. On the basis of their being specific hazards to his own health, the allergic individual is inclined to group as weeds many additional plants which actually are of value in the general economy and are attractive and harmless to the majority of the population, but to him are decidedly disturbing.

The person suffering from an allergic malady is a peculiar individual, due largely to the fact that his symptoms are caused usually by a maladjustment to his physical environment rather than by any bacterial invasion of his body by infection. His ailments result from exposure to commonplace substances with which all persons are equally in contact. Although exposed to these substances to a degree no greater than are other members of the general population, his symptoms are prompt, severe, incapacitating, and place in the role of a major offender with great etiologic importance such an ordinary and usually harmless agent as the ever-present weed.

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Heredity a Factor

This tendency to react with marked discomfort to his surroundings is hereditary. It is a family trait transmissible from a member of one generation to that of another, apparently governed according to the laws of dominance that Gregor Mendel found operative in his study of the transmission of traits of the sweet pea. It is important to remember that the feature which is inherited is the capacity of the allergic individual's tissue cells to become extremely irritated or sensitized in a specific manner. The well-developed clinical allergic complaint itself is not inherited, its form being influenced greatly by the exposures and contacts in the individual's environment. Hay fever, rhinitis, bronchial asthma, bronchitis, and dermatitis (urticaria and eczema) are examples of allergic maladies caused by this cell sensitization. The tendency to an allergic condition may be manifested in a parent as hay fever, in the child as an entirely different ailment such as bronchial asthma.

The Role of Phagocytosis

Nature has provided a clearing mechanism for protecting man from the irritation of foreign substances passing into his system by absorption through the respiratory and gastrointestinal tracts and the skin. These foreign substances, naturally and normally present, are in the air we breathe as are pollens, dusts, animal danders; in the food we eat; in plant resins with which the intact skin comes into contact. Upon being absorbed into the body, such sub-

stances are attacked by tissue cells especially equipped for the purpose of neutralizing and disposing of any invading foreign material.

This process is completed without harm to the normal individual or his tissue cells, and without apparent detrimental after-effects such as the development of allergic symptoms. In 10 percent of the population, however, this special protective mechanism or phagocytosis does not end with this normal activity of disposing of foreign matter. The mechanism, often through hereditary influences, extends beyond this, becoming exaggerated and overcompensating. Enormous increases in the number of the defensive tissue cells or a great enhancement of their protective activities, or both, are stimulated by their contacts with the foreign substances. Such cells are equipped to produce a prompt and vigorous attack upon the reinvading foreign substance. This activity is responsible for the release of toxic materials which cause the severe, often incapacitating allergic symptoms.

Individuals whose tissue cells are thus sensitized to intense activity upon exposure and reexposure to foreign substances are termed allergic, and their symptoms may assume a variety of forms such as those of hay fever, bronchial asthma, or of allergy of the gastrointestinal tract or skin, depending upon the body area in which occurs the greatest degree of sensitized cell activity. Urban dwellers and rural workers, child and adult of all races are affected. The foreign materials, the causative agents, are many and varied, but are usually airborne as pollens, dusts, or ingestible substances such as foods and drugs.

Airborne Pollen

Of major importance are airborne plant pollens drawn into the respiratory tract in the inhaled air. The heavy, sticky type of pollen which tends to be immobile unless transported by the bodies and wings of visiting insects and bees is rarely the cause of hay fever. The colorful, attractive, often scented blossoms such as of the rose, the daisy, or goldenrod, designed to lure these carrying agents, are harmless unless cut and brought indoors where they dry, allowing their pollens to permeate the closely confined atmosphere of the house. The airborne pollens of the plants with inconspicuous, less noticeable blossoms are the usual cause of hay fever. Produced in tremendous excess, buoyant and widespread, these pollens are responsible for the distress of thousands of persons with hay fever and with bronchial asthma.

Not all types of airborne pollen are hay fever and asthma producers. Over the past four decades it has been the goal, seemingly impossible, of allergist and of botanist to discover in all the wealth of vegetation the particular offenders, and to identify the plants whose pollens produce allergic symptoms. In this the investigators were aided by two tremendously important facts; the first, that the skin cells of the allergic patient share the sensitization found in other types of tissue cells; and the second, well known to you, that there has been established by nature a reliable, dependable schedule of pollination characteristic of each plant, a schedule influenced but slightly by climatic or weather variations.

The Skin Test and Pollen Count

The skin test is the great diagnostic aid which enables identification of the patient with hay fever and also determines the specific, exact pollen causes important in his case. Upon exposing the cells of the skin by puncture or scarification procedures to minute carefully estimated amounts of extracts of the various suspected pollens, characteristic changes will occur, but only at those sites tested with the pollens to which the patient's cells are sensitive. Within a few minutes itching, flushing, and swelling of the skin will occur, with the development at the test site of a wheal or small hive, which persists for 15 to 20 minutes, then disappears. This test is very specific and delicate. It enables the investigator not only to identify the particular offending pollens, but also to determine the degree of sensitiveness present in the individual to each specifically offending pollen, a matter of great variability from patient to patient, and from pollen to pollen.

Well known to the patient suffering from a pollen allergy is the period within which his symptoms occur. The seasonal limits of onset

and offset of his discomforts are relatively constant from year to year, provided he continues to be in the same environment. By comparing the period of suffering with the pollination period of various plants producing airborne pollen, the investigator is enabled to narrow the list of possible causes in each patient's problem. The individual with hay fever occurring from mid-August to October is immediately suspected of being a victim of ragweed pollen, since its pollination period coincides with the patient's time of discomfort.

Additional useful information regarding pollen allergy may be obtained by comparing the patient's daily fluctuations in the degree of severity of his symptoms with the daily census of his specifically disturbing pollen as influenced by variations in weather conditions. A daily count of the pollen trapped upon an adhesive coated slide, exposed for constant periods, will provide the information upon the rate of pollen production. Thanks to their characteristic appearance microscopically, a classification can be made of those pollens most prevalent. Ragweed pollen has been made the object of special study. The New York State Department of Health has thus been able to determine areas in the Adirondack Mountains relatively free of this weed, and has prepared a valuable list of these for ragweed sufferers (*1*). New Jersey (*2*) and the city of Detroit (*3*) sponsor active pollen surveys, and according to information supplied by the division of laboratories and research, New York State Department of Health, New Hampshire and Maine also conduct these surveys.

The lists of weeds and plants which cause hay fever are known through the highly successful efforts and zealous cooperation of the botanist. Field studies and pollen surveys, the collection of pollen from suspected plants, and its subsequent testing by the allergist upon pollen victims has yielded an evergrowing mass of information. Throughout the years important data has been collected in all areas of the United States, the Central and South American Republics, England, and other European countries. Two of the most valuable reference volumes upon the hay fever producing plants of the United States are that of Wodehouse (*4*), and Durham (*8*).

Three Seasonal Groups

In the Northeastern area of the United States the dates of pollination of the important hay fever and asthma producing plants permit a sharp division of the pollen victims into three groups. In the first are those whose symptoms occur between mid-March and June first. No weed is a culprit although many tree pollen victims in this group are ready to stigmatize as weeds the real sources of their discomfort, which are the ash, beech, birch, elm, oak, hickory, paper mulberry, and poplar. The pollen of the alder and of the swamp sedges occasionally produces symptoms.

In the second group, the symptoms persist from mid-May to mid-July. English plantain (*Plantago lanceolata*) is a weed of much importance here, with sorrel (*Rumex acetosella*) of lesser importance. Of greater moment than these weeds, however, is the family of grasses—timothy, orchard, oat, rye, redtop, june, bermuda, sweet vernal, velvet. Roses, since insect pollinated, are innocuous unless cut and kept indoors. The term "rose cold" is, therefore, an incorrect designation for the summer type of hay fever.

In the third group of patients the symptoms occur from mid-August to frost, and it is here that the weed asserts its importance. The ragweeds, giant and dwarf (*Ambrosia trifida* and *elatior*), are the chiefs of them all, having the dubious reputation of being the cause of more suffering than all other pollens combined. Not only does the discomfort they produce involve a greater number of victims, but the suffering is more intense in degree and occurs at a time of the year, at the threshold of autumn, when secondary, complicating bronchial and sinus diseases are encouraged to appear. It has been estimated that one-third of all untreated ragweed hay fever sufferers eventually develop bronchial asthma, a much more serious and disabling disease. Of lesser importance than ragweed are cocklebur (*Xanthium*); lambsquarters (*Chenopodium*); pigweed (*Amaranthus*); mugwort (*Artemisia*); American hemp; wild rice (*Zizania*); great reed (*Phragmites*); marsh-elder (*Iva*). Usually goldenrod has on it some adherent ragweed pollen, deposited by wind from adjacent ragweed but, as stated,

goldenrod does not deserve the evil reputation it has. Its pollen, since insect borne, will cause no symptoms unless the blossoms are brought indoors.

The list of weeds which produce allergic discomfort is even greater in other areas of the United States. In the plains States, southwestern States, and the Pacific States, the most troublesome are the chenopods, thistle (*Salsola*), and burning bush (*Kochia*), wormwood and sagebrush (*Artemisia*).

Areas Free of Pollen

Since the distressing allergic symptoms result from actual physical contact of pollen and patient, the surest way for the patient to obtain relief is to escape to an area where the pollen producing plants particularly disturbing to him do not grow. Bermuda, Nova Scotia, the tropics, our own southwest and areas in the Rocky Mountains offer to ragweed sufferers complete freedom from hay fever. Less completely free localities are the southern tip of Florida, California, areas in the heavily wooded sections of the upper Michigan peninsula, of Maine, and of Canada and some parts of the White and of the Adirondack Mountains. The pollen surveys of the New York State Department of Health have established the relative freedom from pollen of numerous Adirondack localities (*1*).

Methods of Destroying the Weeds

Such escapes from pollen, however, are impractical or impossible for the majority of sufferers, who cannot be absent from their work or their families for the long intervals required. For them relief can be expected by attacking the hay fever producing weeds themselves by eradication, a slow, painful, and not very successful process, by manual removal or by cutting at the strategic moment when pollination is imminent.

Far superior are the chemical methods. New York City, according to information from its department of health, and several New Jersey communities conducted in 1946 (*2*) the first centrally directed ragweed control spraying program. By employing a spray of the hormone 2, 4–D, dichlorophenoxyacetic acid, it has been possible greatly to reduce the growth of ragweed within the city limits. In proper dilutions it is reported to be selective in action in that it does not kill desirable grasses, but it is known, of course, to be lethal for vegetables and flowers (*5*, *6*). Persistence in spraying the ragweed areas each year seems essential to prevent a return of the ragweed. Following the example of New York City, other municipalities have adopted this plan of extermination. Until all States in the ragweed zone collaborate in a determined and extensive plan, however, the hay fever victim may be somewhat benefited, but will continue to suffer, since the pollen produced by weeds many miles away can be easily transported to him by air currents.

Individual's Control of Pollen

The patient can conduct a plan of weed pollen control in his immediate environment by the installation in his bedroom or home, and in his place of business, of efficient conditioning units. Such units should filter but not chill the air, since respiratory membranes irritated and congested by pollens seem especially prone to "colds," acute respiratory infections, or sinusitis when suddenly subjected to excessively chilled air. Too, to be most effective, conditioned areas should have as their source of outside air only the conditioning apparatus, and all doors or windows should be kept closed; as little traffic as possible should be permitted into the area, since disturbing quantities of pollen may be imported upon the hair and clothing of those entering.

These measures of escape and avoidance are not altogether successful. Efforts must be made to so condition the pollen sufferer that he may continue to work and live in the pollen-containing atmosphere. This is not the time or place to discuss the therapy of hay fever—but it is pertinent to say that such treatment is based upon an attempt to increase the tolerance of the sensitized cells so that they do not react with such vigor or intensity upon exposure to the disturbing pollen. Minute, gradually increasing amounts of an aqueous extract of the specific pollen excitant are given hypodermically at weekly intervals during the period beginning 3 months before the expected season

and extending through it; or, in selected cases, larger doses administered once monthly throughout the year, though once weekly during the season, are effective (*7*). The use of antihistaminic drugs, of ephedrine, of soothing eye drops, of avoidance of dusts, gases, and chemical fumes contribute to the relief of the patient.

The most important step in the handling of any allergy problem is the attempt to remove the cause. This step can often be readily accomplished by the allergist if the exciting substance, identified by various tests, be an animal dander such as that of the cat or horse, causing asthma; or a food such as egg or chocolate, causing asthma or urticaria. It is impossible to accomplish if the exciting substance cannot be readily removed, being derived from widespread plant sources as in the case of an airborne pollen. Such an exciting cause is effectively reduced only at its point of origin.

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President Names Dr. Keefer Health Adviser to the Secretary

Dr. Chester Scott Keefer of Brookline, Mass., took office August 12, 1953, as special assistant, for health and medical affairs, to the Secretary of Health, Education, and Welfare. His appointment by the President was confirmed by the Senate on July 31.

The position was created in the President's Reorganization Plan No. 1 of 1953 which set up the Department of Health, Education, and Welfare. Dr. Keefer will serve as top staff policy adviser to the Secretary in important external relationships of the Department with national and international bodies concerned with health and medical matters, and will, as needed, coordinate related health and medical programs within the Department.

Dr. Keefer, who received his medical training at Johns Hopkins University, presently is a member of the Executive Committee of the Division of Medical Science of the National Research Council, and chairman of the Council's Committee of Medicine. During World War II he directed United States and Allied procurement of penicillin and streptomycin, and during 1944–46 was medical administrative officer of the Committee on Medical Research of the Office of Scientific Research and Development.

Dr. Keefer has served in key positions at Johns Hopkins Hospital, Billings Hospital at the University of Chicago, and Boston City Hospital, and has served on the faculties of Harvard Medical School and at Peiping Union Medical College. He is director of the Robert Dawson Evans Memorial Hospital. He has arranged to take leave from his position as physician-in-chief at the Massachusetts Memorial Hospital and as Wade Professor of Medicine at the Boston University School of Medicine.

M. Allen Pond, chief of the Division of Engineering Resources, Public Health Service, has been detailed to assist Dr. Keefer.

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