

Correspondence

March 1, 1955*

TO THE EDITOR:

The research reported by Smith and Rooks in the JOURNAL OF ALLERGY (25: 36-45, 1954) represents a beginning of a kind of inquiry which has been needed for a long time. It is unfortunate, however, that they show only the average hourly pollen concentrations for the first and second halves and for all of the ragweed pollen season. Meteorologically, it is quite doubtful whether the days during their period of record could be sufficiently uniform to justify such an averaging process or to assure the validity of the averages obtained.

On the other hand, aside from these considerations, there is the possibility that the important relationships, which one should like to learn about, between the pollen count extremes and the weather are totally obscured by the averaging process. For example, it would seem appropriate to ask what caused the rise of the counts around 12 midnight to 1 A.M. that appears in Fig. 3 of the paper by Smith and Rooks. It is pertinent to observe that hay fever patients probably respond to specific occurrences. When weather conditions are right to produce sufficiently high pollen concentrations at the breathing level of the patient, such an occurrence takes place. If, therefore, one observes *occasions* rather than *averages*, he is probably better able to relate "cause and effect" at least crudely, since weather may properly be regarded as a continuing series of events suitable for correlation with the individual occasions of high pollen concentration.

In addition to these philosophical considerations, which apply quite broadly to the literature on aeroallergens, it is important to point out and correct Smith and Rooks' misinterpretation of Crawford's work (Pub. Health Rep. 64: 1195, 1949). This is doubly important because the abstract of Crawford's paper (Allergy Abstracts 15: 66, 1950) also gives an erroneous impression of the results. Crawford observed that a *vertical* current of 1.58 cm. per second was sufficient to lift individual pollen grains of *Ambrosia elatior* from rest. Smith and Rooks have mistakenly reported that "... a horizontal air flow of 1.58 cm. per second would be sufficient to overcome the force of gravity and produce airborne pollen . . ." and have given Crawford as reference. Obviously, their subsequent discussion of wind effects is invalidated by this error.

*Editor's Note: The delay in publication is acknowledged to be in part the consequence of a regrettable, but nevertheless to some extent unavoidable, discontinuity attendant upon a change in editors and to the attempt to learn whether any comment on Dr. Dingle's letter was to appear with it.

In the abstract (*loc. cit.*) it is reported that Crawford found the specific gravity of ragweed pollen to be 11.3 and that he *computed* the rate of fall of 0.525 feet per second for ragweed pollen. For the record, Crawford *measured* the vertical air current necessary to refloat ragweed pollen grains and called this the fall rate in still air, that is, 1.58 cm. per second = 0.0525 feet per second (not 0.525), and from this, by means of Stokes' law, he *computed* the specific gravity of 1.3 (not 11.3).

To return to the paper by Smith and Rooks, I should like to add a note concerning the magnitude of the effects of humidity upon pollen fall rates. Since it is possible by means of a few simple calculations to place this discussion on a quantitative basis, this appears to be worth while. Starting with the following assumptions, the basis of which is to be found in the literature cited in each case, the analysis follows directly:

- (1) At 100 per cent relative humidity the water accumulated by each pollen grain weighs 0.65 as much as the dried pollen grain.
(Durham; J. ALLERGY **14**: 455-61, 1943.)
- (2) The dried pollen grain is not appreciably spongelike in structure.
(Crawford, *loc. cit.*)
 - (a) This is further supported by the often-reported observation that pollen grains shrink upon drying and expand again to near-spheres upon moistening. Such shrinkage and expansion do not characterize a sponge.
 - (b) A corollary is that the volume of the moist pollen grain is equal to the sum of that of the dried pollen and that of the water added.

Therefore, a sample of pollen which, when dry, would weigh 1.3 gram and would occupy 1 cm.³ (Crawford) will at 100 per cent relative humidity have added 0.845 gram of water occupying 0.845 cm.³ additional space. The average density of the moist pollen must then be 1.163 gram per cm.³ and the volume of each grain must be increased by a factor of 1.845.

It follows that the diameter of each pollen grain must be increased by a factor of $\sqrt[3]{1.845} = 1.23$ upon moistening. Using these figures to arrive at a comparison between the Stokes' law fall speed of the moist pollen grains and that of the dry pollen grains, one finds that the ratio is 1.35 to one.

Thus, the increase of fall speed due to moistening is about one-third. If we take Crawford's value for the fall speed of dry pollen as 3.15 feet per minute, this gives a fall speed for moist pollen of 4.25 feet per minute. While this represents an appreciable increase, it still does not amount to a rapid fall rate.

Undoubtedly, the most important factor contributing to cleaning of the air at night is the suppression of atmospheric turbulence. This both cuts off the supply of refloats pollen and dust from the ground surface and allows gravitational settling to operate undisturbed upon the air-borne pollen present. This also, incidentally, must contribute substantially to the repollution of

the air in the morning as low level turbulence again becomes active and refloats large numbers of pollen grains resting loosely upon surfaces of all kinds. Smith and Rooks have, for the first time to my knowledge, pointed up the significance of this refloatation process as the means of extending the hay fever season beyond the season of active pollen production. An important process operating to curtail this extension is the natural deterioration with age and exposure of the pollen contents in terms of antigenicity.

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