Letter to the Editor:

Further Comments on Spore Release by Drechslera (Helminthosporium) spp. and Other Fungi

Charles M. Leach

Department of Botany and Plant Pathology, Oregon State University, Corvallis 97331.

A recent letter to the editor by Aylor and Day (1) challenged my findings on forcible discharge of conidia by *Drechslera turcica* and other fungi (5). In their first paragraph they state ". . . Leach himself reports direct visual evidence that opposes his indirect observations and opposes his conclusions that violent conidial release triggered by changes in relative humidity is important in *Helminthosporium turcicum*". In my article I find no conflicting evidence nor do I find any data that oppose my conclusions. Aylor and Day state (*personal communication*) that this occurs on pages 1311 and 1312. Their argument appears to be based on the fact that using Meredith's method (8) I was unable to demonstrate violent release but using my method employing the Tyndall effect (light scattering by small particles), I was able to demonstrate the phenomenon. In my opinion, Meredith's procedure for observing violent release of spores leaves much to the imagination and is inadequate for irrefutably demonstrating this phenomenon. Spore release may have occurred when I used Meredith's method, but if it did it was not recognized. By employing a better method utilizing the Tyndall effect, spores easily were seen with the naked eye as they were shot into the air in straight trajectories for the first few millimeters and then floated off in a hapazard manner. Several of my colleagues at D.S.I.R. (Plant Diseases Division, Auckland, N. Z.) witnessed violent spore release by several different fungi, including *D. turcica,* and will attest to its occurrence. Although Meredith used an inadequate method to observe violent release of spores, he was correct in his conclusions.

Another question raised by Aylor and Day concerns the proportion of spores that are violently released from sporulating lesions; i.e., how much does this phenomenon contribute to the daily release of spores in nature. This is a valid concern but it was not the question that I was attempting to answer in this particular study, nor was it possible under the experimental conditions employed to ascertain precisely what percentage of spores remained attached to their conidiophores. In experiments in which I repeated several short cycles of high and low relative humidities, several crops of spores were released indicating that not necessarily all spores are released at any one time. Recently, I proposed (6) on the basis of experimental and other evidence, that the mechanism of violent release of spores involves an exogenous surface electrostatic phenomenon. All my work to date suggests that the percentage of spores released when the relative humidity is lowered probably is dependent on the magnitude of surface voltages. By artificially increasing lesion voltages I have been able to increase the numbers of spores released. Although an electrostatic charge mechanism still has to be proven, if it is correct it would explain why the percentage of spores released may vary from experiment to experiment and from day to day. Surface charges involved in spore release appear to be associated with atmospheric-surface moisture relations and this leads into the large and complex field of atmospheric electricity (2, 4). The relationship of surface charges to changes in atmospheric and surface moisture still is not fully understood.

Throughout Aylor and Day's letter one senses that they believe that violent release of spores is epidemiologically unimportant. Violent release of spores is only one of several modes of spore release by *D. turcica* as I indicated in my article. Wind and rain also play a part, but the relative importance of each form of release can vary from hour to hour and day to day as will be shown in an article recently submitted to Phytopathology (7). All three forms of release have a role in the dispersal of spores, and from an epidemiological viewpoint it is futile to rate one more important than the other except under a specific set of environmental conditions. We should recognize that there are different forms of spore release and then attempt to fully understand the environmental conditions that favor each. Violent release of spores does play an important role in the dispersal of conidia of *D. turcica* in nature and it was extremely common during our 6.5 months of continuous spore trapping in New Zealand (7). However, to put this in perspective, there were also many days during this same study when wind, rain, and violent release all were involved. Characteristic daily patterns of spore release have been shown in airspora studies (3, 9), and many of these are in agreement with what would be expected from a violent release mechanisms triggered by changing relative humidity. In my opinion violent release of spores into the atmosphere is probably a common and widespread phenomenon.

Aylor and Day state that they failed to observe violent release of conidia of *D. maydis* when they lowered the relative humidity from 100% to 5%. Did they use the Tyndall effect to follow spore release? What were the surface electrical potentials of their specimens? How did they humidify their airstream to 100% RH?; this can have a pronounced effect both on the polarity and magnitude of surface voltages. I would expect *D. maydis* to behave very similarly to *D. turcica* and I would be most surprised if it does not liberate its spores violently under the right set of conditions. Violent liberation of spores offers an excellent means of propelling spores through the static boundary layer after which wind then can carry them afar.

In their final sentence Aylor and Day state "Most of the conidial release can probably be understood in terms of action of wind as discussed in earlier papers". Where are

their data supporting such a statement? Wind is an important factor in spore release and dispersal by foliar plant pathogens, but also important are violent release and that caused by rain (7). It is a meaningless exercise to quibble about which is the most important mechanism because all are important in the spread of the spores of plant pathogens.

LITERATURE CITED

1. AYLOR, D. E., and P. R. DAY. 1976. Conidial release in Helminthosporium (letter to the editor). Phytopathology 66:537.
2. CHALMERS, P. H. 1967. Atmospheric electricity. Pergamon, N. Y. 515 p.
3. GREGORY, P. H. 1973. Microbiology of the atmosphere. Wiley, N. Y. 377 p.
4. ISRAËL, H., and H. DOLEZALEK. 1973. Atmospheric electricity. Vol. 2. Field charges and currents. Keter Press, Jerusalem, Israel. 755 p.
5. LEACH, C. M. 1975. Influence of relative humidity and red-infrared radiation on violent spore release by Drechslera turcica and other fungi. Phytopathology 65:1303-1312.
6. LEACH, C. M. 1976. An electrostatic theory to explain violent spore liberation by Drechslera turcica and other fungi. Mycologia 68:63-86.
7. LEACH, C. M., R. A. FULLERTON, and K. YOUNG. 1977. Northern leaf blight of maize in New Zealand. Release and dispersal of conidia of Drechslera turcica. Phytopathology 67: (In press).
8. MEREDITH, D. S. 1965. Violent spore release in Helminthosporium turcicum. Phytopathology 55:1099-1102.
9. SREERAMULU, T., and A. RAMALINGAM. 1966. A 2-year study of the air-spora of a paddy field near Visakhapatnam. Indian J. Agric. Sci. 36:111-132.