

Comment on the Letter by Andrivon—Re: Pathogenicity and Virulence

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De Bary is usually considered the father of modern plant pathology, having produced over 60 prominent students (6), and there was a time when many plant pathologists could trace their academic lineage to him (5). The few who could not had to survive in a plant-pathology world dominated by the offspring of De Bary, so they readily learned the lexicon of De Bary's students. However, since the advent of biotechnology, there has been an influx of scientists working in plant pathology who cannot trace their roots to this proud lineage and who are so numerous that they can now submit a paper to a plant pathology journal and have it reviewed solely by their peers. Thus, there are condoned transgressions of classic phytopathological definitions, simply because the followers of the De Bary school of thought are omitted from the review process. I believe, for the sake of effective communication, that we should attempt to stick with the definitions of terms and understanding of concepts that originated deep within our academic family tree. Even if a majority within our society agree that a long-standing term should be modified, we should bear in mind the possibility of confusing future generations with terminology rooted on shifting sands. A change in terminology should be based on consistent argument, should be professionally documented, and should provide a link between past and future.

Disease was a concept long before De Bary put his unifying stamp on plant pathology. However, disease has attributes (such as symptoms) that are described in all major plant pathology texts, so that plant pathologists understand the concept of plant disease and can accommodate slight variants in its definition. I believe that rooted in our family tree is the concept from which most, if not all, other definitions of disease flow. Those lacking this background do not appreciate this underpinning in our definitions. Andrivon's (1) definitions appear to lack this underpinning.

Because Andrivon (1) is overly concerned about a definition for "infectious disease," his definition of a pathogen seems restricted to parasites and ignores the classic examples of a saprophyte causing a disease via toxins (7,8). In Walker (10), we find a simple, more pristine definition of a "pathogen," "an agency which incites disease," which is directly related to disease. Walker's definition covers Andrivon's concern for a definition capable of handling "infectious diseases." Andrivon contends that only infectious diseases fall within the scope of the definitions of virulence, etc. However, saprophytic pathogens also can vary in toxin production (i.e., virulence). Moreover, Andrivon shifts the definition of pathogen depending on what plant is challenged. He contends that *Phytophthora infestans* is a pathogen of potato, but not of pines. However, by the well-accepted definition above, *P. infestans* is a pathogen—period! We can accept that *P. infestans* is pathogenic to potato and nonpathogenic to pine, but this does not change its ability to produce disease; thus, it is a pathogen at all times.

Andrivon gives the impression that Vanderplank (9) originated the term "virulence," whereas, to my knowledge, he was the first

to formally bastardize it. In graduate school, we students were informed that Vanderplank had some good ideas, but his use of virulence was wrong, and all well-trained plant pathologists should use only the original definition for virulence—"the measure of pathogenicity" (11). The Federation of British Plant Pathologists (2) went one step further and formally "condemned" Vanderplank's definition and reaffirmed the original. I believe it is likely that the majority of current plant pathologists would still support Whetzel's (11) original definition, rather than that of Vanderplank and Andrivon.

Although Andrivon (1) has "pathogenicity" in his title, he fails to define it. Whetzel (11) does: "pathogenicity is the ability of an organism [pathogen] to produce disease," which is very close to Andrivon's (1) definition for virulence: "it is able to infect it." It seems that Andrivon (1) has failed to define pathogenicity and then has taken its definition and shifted it to virulence. Whetzel's (11) definitions have been understood and used for a long time; for instance, they have been accepted in many rewrites of *Ainsworth and Bisby's Dictionary of the Fungi* (4). I see no need to change them to satisfy a geneticist's need for paired terminology as discussed by Andrivon (1). If there is a need for terminology for new ideas, then create new terms—do not steal existing terms and bastardize them. Changing established definitions now could lead to future misunderstandings of 60 years of published literature.

This brings us to the term "avirulence." Early studies on the inheritance of pathogenicity in rusts usually referred to "pathogenic" versus "nonpathogenic" (or "immune"). Flor (3) in citing these works created "avirulence" as a synonym for nonpathogenic. When we accept something close to "the ability to cause disease" for pathogenicity and "a measure of pathogenicity" as "virulence," this is not in conflict with Flor's synonym. However, an error in definition may be created if we fine-tune what early rust workers meant by "nonpathogenic." For instance, a "hypersensitive reaction" is a particular resistance response to a pathogen, i.e., a symptom on a diseased plant—to describe this as "avirulent" would create an oxymoron. Clearly, a hypersensitive symptom is a low virulence reaction compared to a more compatible reaction.

How can we plant pathologists save our terminology from bastardization? In reviewing papers, I insist that terminology be used properly, and if an editor disagrees, I send the reference to document the original definition. I strongly encourage others to be equally critical. Hopefully, this will help maintain communication—with our ancestors, ourselves, our offspring, and our non-phytopathological colleagues.

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