

# Coming to Terms with Terms

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We think and communicate with words. In the scientific community, having well-defined, commonly accepted terms is critical to understanding. While communication among scientists is essential to the survival of any discipline, the transmission of ideas and scientific information depends on the meaning of terms we use. Our thinking will be unclear if our understanding of the meaning of terms is not well defined.

Let's take the terms resistant and susceptible as examples. The difficulty in

using these terms is that they have subliminal meanings that were learned before an individual went to school. Many of us take the anthropocentric point of view that a resistant plant (or a plant with resistance) will not suffer yield loss or be damaged by a given pathogen. We are happy because resistance is good and we won't go hungry or be hurt economically. Centurk, a cultivar of hard red winter wheat, and Arthur 71, a cultivar of soft red winter wheat, may be viewed by the grower as having resistance to stem rust. Conversely, Triumph 64 and Blueboy are viewed as susceptible to stem rust. Growers as well as their advisors are justified in this anthropocentric view and do not question why the resistance of the cultivar stands up to the pathogen population present in their location. They only know that Centurk and Arthur 71 do stand up to stem rust and Triumph 64 and Blueboy do not.

In the biological sense, "resistance" of Centurk or Arthur 71 to stem rust is due not to the genes in the wheat hosts alone but also to the genes in the pathogen. Just because a host has genes for "resistance" (biological sense) does not mean the host is resistant (anthropocentric sense). For example, when a host carrying genes conditioning low reaction and a pathogen carrying corresponding genes for high pathogenicity interact, a high-infection type develops (susceptibility). But when this same host and a pathogen carrying corresponding genes for low pathogenicity interact, a low-infection type develops (resistance). Thus, we measure resistance in terms of infection types, but we know that "resistance" is the result of a certain genotype in the host *and* a certain genotype in the pathogen. On the other hand, high-infection type (susceptibility) is due to the genotype of the host *or* the genotype of the pathogen *or* the genotype of both.

The term resistance, therefore, has two different meanings. In speaking of resistance of a variety in the anthropocentric view we refer to the host alone, but in using "resistance" in the biological view we refer to the interaction of the genotypes of host and pathogen. These two views of resistance are not synonymous; their meanings are different and not interchangeable.

In scientific communications where transmission of ideas is paramount, the terms we use must say exactly what we mean. Yet we see numerous examples in scientific literature where the two meanings of resistance are used interchangeably without regard to the meaning conveyed.

As phytopathologists, we subconsciously know what resistance means, but words with covert linguistic meanings must be used with great care in communicating meanings with precision in science and research. We learned the meaning and use of such covert words as children and now as adults we use them with those same subconscious meanings. Thus, consciously we hear resistant and our subconscious says, "That is good; I won't go hungry—I won't get sick." We hear gene for "resistance" and automatically this too means "Good, I won't go hungry." Not so! In no way does it mean that a plant or variety with a gene for "resistance" will have resistance. It may or may not! Whether a plant or variety with a gene for "resistance" is resistant or susceptible depends on the genotype of the pathogen and not on the presence of the gene for "resistance" alone. Can a plant or variety with a gene for "resistance" be called resistant in the absence of the pathogen? There is no disease and no damage. Can we understand what an author means by "a resistant gene"? If we ask what the gene is resistant to, the answer might be "You know what I mean." Perhaps we do, perhaps we don't!

If one accepts the gene-for-gene concept as correct, it becomes clear why we must come to terms with the terms resistant and susceptible. We have come to understand that the host:pathogen relationship is symbiotic, the living together of two dissimilar organisms in intimate association. We accept symbiosis as the sharing of physiological mechanisms by two different species without regard to the relative benefits derived or the final outcome of the association. When the pathogen and host symbionts are associated, the phenotype of the association has been termed aegricorpus. Variability in the degree and kind of association they enter into is termed specificity when based on the gene-for-gene relationship. Current concepts of interorganismal genetics deal with specificity and are based on corresponding gene pairs, that is, a gene pair for pathogenicity in the pathogen corresponds to a gene pair for reaction in the host. The genotype of the corresponding gene pairs interacting in a given environment determines the phenotype of the host:pathogen association (the aegricorpus).

In the cereal rusts, probably the most studied and best understood host:pathogen aegricorpus, the infection type is used to describe the phenotype of the association. The use of infection type avoids some of the ambiguity created by attributing the phenotypic resistance/susceptibility to one of the two symbionts of the aegricorpus and not to the association of the two symbionts.

We know we should be careful in choosing and using words that keep concepts separate and scientific information intelligible, but are we careful enough? Isn't it time we resolve the problem with such words as resistant in the anthropocentric sense and "resistant" in the biological sense?

The first step in resolving this problem is to recognize that we *have* a problem. A starting point in dealing with the problem is for all of us as writers of scientific communications to maintain consistent meanings of the terms we use. While journal editors and reviewers have a certain degree of responsibility for the accuracy of the terminology used in their journals, it is the ultimate responsibility of each individual author to ensure that his or her publication is written in terms that are clear, consistent, and without ambiguity. This requires that each of us has an increased awareness of our responsibility for accurate communication. We must realize that the use of clearly defined, consistent terminology is a service we owe to our colleagues and our discipline.