
Taxonomic Mycology: The good, the bad, the optimistic

By Harold H. Burdsall, Jr.

For 26 years I have been fortunate enough to be paid to do the sort of work I most enjoy — as a taxonomic mycologist, working for the Forest Service of the U.S. Department of Agriculture. I carry out systematic studies on fungi that cause wood to decay. I carry a hatchet, not a knife, to obtain many of my specimens.

Mine is one of the few mycology positions in systematics (that is, the study and description of the variation in living fungal organisms and the relationships existing between them) that has not been eliminated. At one time there were five systematic mycologists at the University of Michigan. The University of Massachusetts had two. The National Fungus Collection had six. Now the score is 2, 0, and 4.

There are reasons to be optimistic for the future. However, there may be a problem in providing such taxonomically trained mycologists because so few are coming out of the universities today.

What is a taxonomic mycologist? I am referring to a field mycologist who collects specimens from nature, is acquainted with the anatomical characteristics needed for identification, and can then identify specimens using the available keys.

But this is also a person who is well aware of the importance of culture characters and the molecular approaches to the science, and either uses these in addition to morphology (external appearances) or cooperates with colleagues who use these methods. I'm talking about the good old field mycologist who spends time getting rained on, blackfly and mosquito-bitten, poison ivy-irritated,

greenbriar-scratched and yellow-jacket-stung, among other joyful specimen collecting experiences.

Taxonomic mycologists have historically shown a lack of interest in the practical applications of fungi. When C.L. Porter of Purdue University gave his presidential address to the Indiana Academy of Sciences in 1949, he told it this way:

"If a fungus were found to cause a plant disease, it was turned over promptly to the plant pathologist. If a fungus contributed to human ailments it was donated to the medical doctor. A fungus that had no apparent economic importance became the property of the mycologists: an object upon which to gaze, to be written about, and then stored away in dusty boxes, perhaps with mothballs."

Many of those mycologists seem to have thought that working on the taxonomy of fungi of economic importance, such as plant pathogens, somehow lowered the quality and the desirability of the research. Thus, almost by default, plant pathologists, rather than mycologists, worked on the pathogenic fungi. Fortunately, in the past, plant pathologists were heavily exposed to taxonomic mycology, so were able to handle taxonomic problems. I submit that this is not the case today.

Mycologia, the journal of our Mycological Society of America (MSA), may appear to readers of *Mushroom the Journal* to be too oriented toward physiology, biochemistry and genetics, and contain too little on floristics and species description. But mycology is now bigger than treatments of new species as species lists. That narrow view of mycology has been widespread in my contacts with plant

pathologists and others during the last 25 years. In fact, mycology has been for many years considered by many of those who are only marginally associated with it as more of a hobby and art than a science.

Unfortunately, there is some support for this view. Descriptions of new species are necessary, as are interesting and unusual finds. But they are not the end in themselves. Working out species complexes, clarifying relationships in groups and providing monographs that address the biology of the organisms involved are "the reason for being" of taxonomists. We are trying to provide better means of communication and a clearer picture of the relationships and differences among species, genera and families.

The Mycological Society of America has begun to involve itself more broadly. In 1980 the Council reorganized to include councilors representing associated disciplines. We have committees for ecology, medical mycology and phytopathology, and now we interact with the North American Mycological Association, as well.

As I said earlier, I've spent 25 years with a group who, although dealing in "alpha taxonomy," combined that morphological and anatomical work with biosystematic studies to do a better job of delimiting species and elucidating relationships,

How did they do this? They applied many more characters — including biological characters of ecological relationships. They measured optimal temperatures, growth rates, incompatibility reactions. They applied chemical (tests; they measured enzyme production in fungi. This results in a more natural system of taxonomy and indicates more dependable relationships.

(Alpha taxonomy is "herbarium taxonomy," dealing with dried specimens and the microscope, and just maybe a chemical or two. Beta taxonomy is growing things in cultures and using culture characteristics to assist in identification. Mating compatibility studies are an example of Beta taxonomy.)

If taxonomy is to serve its purpose, its findings must be meaningful, and

in order to be meaningful, beta taxonomy must be included in any taxonomic effort today. But taxonomy hasn't progressed far beyond what Porter saw in the 1940s:

"The present taxonomy is chaotic and confusing and must in its present condition retard the progress of the science. An example: the confusing state of the taxonomy and nomenclature in medical mycology. The physician and the botanist speak an entirely different language."

It isn't only the physicians we can't talk to. How many pathologists or physiologists do you know who are still prone to using the "old" names? Have we done our part to involve them in understanding mycology as a science?

We as taxonomic mycologists have not related well with them. We have juggled names. We have done so quite without concern for the user. We've avoided clarifying fungal groups that are of concern to others.

Where I've worked, our research group has heavily emphasized service work: identifications of fungi and providing accurately identified raw materials for other workers. It has given me a chance to consider the interactions of research with service to the users of that research — including the public and non-professionals interested in mycology. It has also impressed upon me the *practicality* of taxonomy.

I credit my practical attitude toward taxonomy for the success in relating to the more applied disciplines. Fortunate to have been "born and raised" (scientifically) in the *applied* atmosphere of a plant pathology department, I became familiar with the more practical orientation and the feeling for how a taxonomic mycologist fits into the biology science "ecosystem."

And so it must be. All the biological sciences, including ecology, physiology, biochemistry, and pathology (both human and plant) depend on the taxonomic mycologist to provide the baseline information: the

name of the organism on which they are working. Without taxonomy, other biological disciplines are lost. It is by use of taxonomy that information is exchanged. It is through taxonomy that extrapolations and predictions can be made regarding the biological attributes of species.

It is the alpha and beta taxonomy (and they must be used in concert) that are absolutely required before the more refined methods can be used.

We must be able to identify genera and species using alpha and beta methods so that we know where to apply methods such as restriction enzymes, DNA hybridization, and isozymes. Let's call these methods of molecular biology *gamma taxonomy*. We need some idea as to how a species fits into the taxonomic scheme before we can apply the advanced techniques.

It is through alpha and beta taxonomy that gamma taxonomy can be so important. This does, however, put an extra responsibility on the part of those taxonomists using the micro-

scope and cultural characteristics, because their identifications are the *basis* on which the studies at the molecular level are based.

Field work and identifications using alpha and beta methods will always be needed. However, it is important that those working in the alpha and beta areas of our research cooperate with those using gamma taxonomic methods. This will lead to the ideal in taxonomic accomplishment.

Down through the years taxonomists have never been those who were financially supported at the higher levels. Jim Trappe, 1988 president of the Mycological Association of America, pointed out in his address just what a small percentage of the United States Department of Defense budget it would take to adequately support his country's mycological research: .00025 percent.

Taxonomists have always had to fight hard for their funding. Many of the early mycologists were not mycologists in today's professional sense of the word, but were rather men of the cloth, such as Rev. Miles Joseph Berkeley, L.D. von Schweinitz, Rev. M.A. Curtis, Abbé Bresadola, and many others.

A number of other scientists well known for their mycology were in fact carrying on their research as a sideline. In fact, many of the exsiccata sets (dried specimens) that are in existence were established as a means of producing a livelihood or supplementing a primary income. Funding for taxonomy has not and will not come easily. I can't imagine a taxonomy bandwagon.

Today fungi are being used in many more ways and in more refined methods. They are beautiful organisms for genetic manipulations and biotechnology. Drug companies are once again taking interest in screening major culture collections for fungi that have antibiotic — and other — properties.

Fungi that were previously considered to be merely saprophytic recyclers of woody debris are now seen as possibilities for degrading toxic wastes or for biological pulping of wood (ending the need to use toxic pulping and bleaching materials).

Ten years ago *Phanerochaete chrysosporium*, the one and only biopulper, was considered to be a savior. By knowing the relationships among the various genera, in this case in the decay fungi, we as taxonomic mycologists were able to suggest other species that might have similar characteristics.

Sure enough: We found that a number of other species in closely related groups are superior in various respects to the isolates originally considered to be the best.

Now, about name changes: They are enormous monkeys on the backs of taxonomists. Name changes should only be made when they are needed, and should be supported with scientific data. I spend a good deal of my time in my interactions with forest pathologists trying to defend name changes that I feel are required — while at the same time trying to explain *why* such name changes were required, and then also why others probably were not.

If we are to have support of those who are paying our way, i.e., those who use our information, then we are going to have to be more considerate of how our research affects them.

The time is right for this to be accomplished. The Mycological Society of America has opened its council to representation from disciplines beyond systematic, has reformatted *Mycologia* to be more attractive to those with interests other than systematics, and has created committees to increase interactions with other societies that use systematic mycology. I

“Name changes are enormous monkeys on our backs”

believe this is the only way we will prosper. I see it happening in a few places and I encourage increased effort in that direction.

In order to get the support of user groups that taxonomists need, it is absolutely mandatory that taxonomists take more time with their work, looking *at the total biology of the organisms relating the species to their natural environment* as well as studying their similarities and differences in the laboratory.

Printed on recycled paper