INSECT IDENTIFICATION: WHAT IS IT?[1]

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Past presidents have taken liberties to reminisce about the past, complain about the lack of progress, or occasionally offer guide lines for the future of our Society. Our past president John O'Neil has suggested more individual participation and increased communication among our members. In their endeavor to promote entomology as a science and profession, presidents have often framed their remarks with their own area of interest as it relates to entomology. And so it is with this address; my comments will reflect the area of interest with which I am most intimately associated. The younger generation would call this doing "my thing" or doing what I like to do best.

One of the most commonly asked questions in my field of interest is, "What is this specimen?" Man begins as a child full of curiosity about the living organisms he finds around him. Without this natural curiosity he would never accept the challenge of problem-solving. The second most commonly asked question is, "How do I control it or should I control it?" Not only is it wise to know what you are controlling, it is often necessary to know what the organism is before it can be effectively controlled. Records of insect control date back hundreds of years, but it was not until an interest was shown in classifying insects that this discipline began to develop. Since most biological work with living organisms begins with the proper identification, I would like to address my remarks to the field called systematics. According to Becklund, et al. (1969), systematics, in its broadest definition, is concerned with arranging the forms of the organic world into an observable scheme of relationships. The term "taxonomy" may be employed as a synonym for "systematics," but more often taxonomy describes the actual technical aspects of naming and classifying organisms. Both terms are useful and can be used interchangeably.

Biologists may have upwards of 10 million species to work with. Since most of us are entomologists, I would like to confine this discussion to insects and closely related arthropods. Sailer (1969) estimated that there were 3 million species of insects of which only about one-third have been classified. He further projected that at the rate of 8,000 new species named each year, it would require 250 years to complete the naming of our presently estimated insect world. I would like to predict that by the time the mite fauna is as well known taxonomically as the insects, their recorded number will be much closer to that of the insects than we now think. Sailer further estimates that there are only about 250 competent individuals in the United States who can provide authoritative identifications of insects. We have approximately 5,400 U. S. members in the Entomological Society of America which would give us a systematics membership of a little over 4%. The Florida Entomological Society has a

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Florida membership of 298, of which 25 are considered authorities in one or more groups of insects or closely related arthropods. This ratio of 8% or about twice the national average puts Florida in an enviable position, particularly with more emphasis being placed on biological control and environmental manipulation. We must know what parasites and predators are endemic to Florida in order to introduce those exotic parasites and predators for a particular need in a given habitat. It is not the present intent of the Florida Department of Agriculture and Consumer Services, Division of Plant Industry to introduce just any parasite or predator for future biological control work.

How valuable is an identified insect? Federal agencies such as the Atomic Energy Commission, the National Institutes of Health, and the Department of Defense have recognized the need for systematic and ecological investigations of organisms and the need for authoritative identifications. With some exceptions, this need is being met largely by contracting work for the above institutions to Federal and non-Federal agencies, or to private individuals that are paid from 25 cents to $5 per identification. The Florida State Collection of Arthropods now consists of approximately 500,000 pinned, labelled, and identified specimens and thousands of identified slide mounted and alcohol preserved specimens. If a conservative figure of $1 is used for the value of an identified specimen, the Florida State Collection of Arthropods would have a value well over a million dollars. However, the value does not stop at this point. The value as a continuing reference and research collection is as great or even greater than the initial value of identified specimens. Among the more important aspects of taxonomy is the identification of potential disease vectors which is so vital to the health of both military and civilians. Each of our major wars, including the present undeclared war in southeast Asia, has had its share of diseases vectored by arthropods. In regulatory work, programs begin with properly identified specimens. All of the eradication programs in Florida are based on the identification of a new or re-introduced pest. These programs are usually expensive, costing from 1 to 10 million dollars. The stakes are often high in this game of "what is it." The identification must be carefully and accurately done and a good reference collection is one of the most valuable tools of the taxonomist. After the specimen has been keyed to species, it is carefully compared to identified specimens in the collection for variation in size, color, and other morphological characters. Intra and inter-specific variations are sometimes difficult to fit into a key. The specimen for identification may be the exception to the rule and then comes the big decision of what species is involved. Knowing the cost and the problems in eradicating such exotic pests as the Mediterranean Fruit Fly, *Ceratitis capitata* (Wiedemann), much agonizing thought usually precedes the final decision of identification, especially if the specimen is in the immature stage. And so we see that our first important step in the field of entomology is identification of the organism.

Next in importance is knowing the kind of life cycle, food habits, sex ratio, number of generations per year, etc. A case in point is the alfalfa weevil, *Hypera postica* (Gyll.) recently found in Alachua and Gadsden Counties in Florida. According to Schenk (1970), Dr. Carl Blickenstaff, USDA entomologist, has found that the life cycle of the eastern and west-

ern specimens are not the same and, to further complicate the problem, eastern female weevils were crossed with western males only to produce infertile eggs. The reciprocal cross yielded fertile eggs but produced a sex ratio of 1 male to 5.59 females instead of the normal 1:1 ratio. To develop effective controls it is necessary to understand the biology of the insect and its destructive activity, which should partially explain the failure to control or eradicate some pests from large areas. In focusing attention on this phase of entomology, I hope that entomologists in all other related areas will appreciate the special problems faced by the taxonomists.

When the taxonomist goes beyond the point of identification and does a generic revision of a group of insects, he may solve a problem of zoology and/or nomenclature for the taxonomists and create confusion for the general entomologists. To a number of economic entomologists a name is a name is a name whether it be John, George, or Sue, and to change the name merely for scientific accuracy is not justifiable. It is true that some earlier taxonomists have left behind a legacy of dubious names, the interpretation of which baffles contemporary taxonomists. But with the additional new species being added from time to time, it is necessary to reevaluate our knowledge of the arthropod fauna. This is not to say taxonomists are no longer making mistakes or that once the name has been changed it will remain the same forevermore. Changes are made for zoological as well as for nomenclatural reasons. On occasions taxonomists cannot agree on the generic placement of a species, or make a mistake in identification which necessitates a zoological change. Nomenclatural changes are based on the law of priority which requires the use of the oldest proposed name that satisfies certain criteria. The laws governing nomenclatural procedure are established by the International Commission of Zoological Nomenclature. All of their rulings are not necessarily popular even with taxonomists. However we are obliged to follow their decisions until modified or changed.

One classical example of zoological and nomenclatural changes in an insect is the screw-worm, *Cochliomyia hominivorax* (Coquerel). The zoological problem began with Fabricius' description of *Musca macellaria* Fabr. in 1775. Over the last 195 years this insect has been referred to in 4 different genera and by 3 specific names. It was not until the mid-thirties that it was realized that 2 species were involved and the primary and secondary screw-worms were separated, after which the nomenclature was finally resolved in 1965. Some other well known and extensively used names that have had several nomenclatural changes are the corn earworm, tobacco hornworm, tomato hornworm, citrus red mite, citrus rust mite, and the two-spotted mite, just to mention a few. In my own specialty, the phytoseiid mites, there have been some differences of opinion for the past 15 years in the placement of the genera in this family. Due to the press of administrative responsibilities and the death of 2 of the former workers, the differences are polarizing into something that resembles the age old problem of "clumpers" and "splitters." For the benefit of those who are not familiar with the above terminology the "clumper" is often looked upon by the "splitter" as being too conservative in his opinion with taxonomic judgment. The "splitter" on the other hand is looked upon by the "clumper" as being too liberal in his opinion with taxonomic judgment.

There is another problem inherent in the field of insect taxonomy—revisionary work versus routine identifications. In order for the taxonomist to keep abreast or better understand his group of insects, continuous studies should be undertaken, eventually leading to a complete revision of the taxon. This results in better working knowledge of his group for identification and a tool for other workers to use as a reference. With the press of too many routine identifications, the individual fails to provide up-to-date references as well as limits his own knowledge in his interest group. All of this has been said to emphasize the need of a balanced program for the taxonomists. This problem has been with the taxonomists from the beginning and with only about one-third of the insects described it will continue to plague us for many years, particularly with the present trends of limited support for this area of entomology although we have made some strides in Florida in the recent years.

Annual losses caused by insects in the U. S. are estimated to be 3.5 billion dollars. Again, we need to know the species of insect with which we are dealing because the old cliche that "the only good insect is a dead one" is simply not true. Pollination by insects is estimated to be worth over 4 billion dollars annually in the U. S. and this is only one consideration.

In general this paper has been directed toward the classic or orthodox approach to taxonomy or the phylogenetic arrangement of the species. There are some workers who do not consider the phylogenetic approach as being objective in assessing the difference or similarity of characters. Character is interpreted here to mean a property that varies from one kind of organism to another. Some who object to the above approach have turned to numerical taxonomy which assigns numbers to characters (preferably a 100 or more) for computer analysis. The 2 methods, numerical and phylogenetic are subjects that would require considerable time for discussion and are mentioned here only to point out that the role of the taxonomist is not without problems due to the interpretation of speciation by the various workers.

I would like to finish by showing the results of a more recent tool, the scanning electon microscope. It will probably play a major role in future taxonomic work. Dr. Phil Callahan, USDA Insect Attractants Laboratory in Gainesville has taken a picture of the imported fire ant that reveals characters that the taxonomist has not been able to see before. It is suspected that there are at least 2 species involved and with the aid of this new tool, we may be able to help unravel this and many other taxonomic problems. It will probably present new problems as we are able to study insect morphology more critically, and for years to come even the taxonomists may be asking the question, "What is it?"

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