Policy Forum

Crisis in Biosystematics of Arthropods

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THE deteriorating capacity of the U.S. scientific establishment to identify organisms is a serious concern. Plant and animal identifications form the foundation of many areas of biological study, yet financial and organizational support for systematics, the study of biological diversity, is deplorable. E. O. Wilson (*1*) noted that only approximately $38.6 million were devoted to systematics in the United States during fiscal 1985. At this rate, the classification of less than 1% of the species of organisms can be investigated. The need for a U.S. national biological survey has been advanced (*2*), but little action has resulted. Insufficient knowledge of biological diversity may result in flawed environmental impact statements, causing legislators to vacillate on important decisions related to acid rain, habitat destruction, pest management, and other issues. Interest in studying biological diversity is growing, however, with the realization that tropical forests are rapidly being destroyed along with their valuable undiscovered gene pools (*3*).

Expertise in systematics is also invaluable to persons working in agriculture, forestry, and human and veterinary medicine who must be able to identify with certainty the vectors of disease agents and other pests. In Europe, sibling species of anopheline mosquitoes differ not only in their habitats but in their vector competency Millions of dollars can be saved by knowing what species to target for control because vector-associated diseases cause a major portion of illness throughout much of the world.

Two recent events in North America illustrate the importance of identification of arthropod vectors. First was the spread and common occurrence of the tick-transmitted Lyme disease. In the eastern United States, researchers have difficulty distinguishing *Ixodes dammini*, the primary tick vector of Lyme disease, from *I. scapularis*. Lyme disease in North America, first diagnosed in Wisconsin in 1969, caused an epidemic in Connecticut in 1975; it is now found in at least 32 states and on 6 continents. Many biomedical researchers think that if it were not for the acquired immunodeficiency syndrome (AIDS), Lyme disease would be the number 1 new disease facing us today. The second event was the introduction of the dangerous Asian tiger mosquito, *Aedes albopictus*, a potential major vector of several human disease agents, including arboviruses of the California serogroup that are indigenous to the United States (*4*). This mosquito was first recognized here in 1985 in Harris County, Texas. It is now found in 17 southern, eastern, and midwestern states, with the northernmost infestation in downtown Chicago, Illinois (*4*).

Biosystematic services and research on arthropods of medical and veterinary importance worldwide are already declining. Difficulties will surely be exacerbated in the future because of poor financial support and the advanced age of many scientists involved in the research. Formerly, the Centers for Disease Control and the departments of Defense (DOD) and Agriculture (USDA) provided certain adequate taxonomic and biosystematic services and research on these arthropods, but this is not the case today. The National Institutes of Health (NIH) has not had a systematist on its Bethesda campus for a long time and the Smithsonian Institution (SI) does not employ a medical entomologist. Because of tight budgets and other pressures, responsibility for providing biosystematic research and services related to arthropods is falling between the cracks. For example, the largest and best tick collection in the world, containing more type specimens than any other, and currently housed at the SI, will soon be of little practical value. The curator of this collection and his assistant constitute the Acarology Unit; they are currently salaried by NIH, but only until September 1988, when NIH plans to close the unit. This remarkable collection and accompanying library will then be placed in so-called "maintenance-storage," with no specialist employed to identify ticks or to provide information on their biologies or disease-vectorial capacities. There is no other laboratory in the Western world capable of providing such information.

Currently, SI collections of lice and biting midges are maintained in maintenance-storage, and the flea collection is cared for by a nonsalaried scientist. A taxonomist employed by USDA (using SI facilities) spends 25% of his time on medically relevant Diptera such as blackflies, tabanids, and psychodids but must also spend time on 22 other families of flies. The DOD Walter Reed Biosystematics Unit, located at the SI Museum Support Center, studies mosquitoes but has had to drop other projects because of insufficient funding. Scientists competent to work on the systematics of mosquitoes, flies, ticks, chiggers, and other medically important arthropods on a global basis are rare indeed. As experts have retired or moved, they have not been replaced. Unless this trend is reversed, grave problems will be encountered regarding the epidemiology and control of infections, since preventive measures and development of vaccines often depend on detailed knowledge of the habits of the precise arthropod vector.

Can the situation be ameliorated? Why train students in biosystematics when jobs are scarce and research funds meager? The role of biosystematics must be explained to the public and to other scientists because of the need for more experts. The modern biosystematist, and certainly those in training, must use traditional museum techniques and have access to state-of-the-art technology. For example, in Africa, the *Anopheles gambiae* complex of mosquitoes, responsible for an estimated 1 million deaths due to malaria each year, is currently composed of six recognized species. Species determination is possible only by DNA probes or chromosome banding.

Limited budgets and other pressures have forced science administrators to make painful choices. Funding for systematics, however, is inexpensive compared to most types of research. No one denies the need for research and services on AIDS, cancer, and other critical health problems of today. Nevertheless, as a world leader in biomedical research, the United States needs to maintain competence in arthropod-associated disease research as well. Biosystematic investigations of arthropod taxa of medical and veterinary importance form the foundation of such competence.

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