

The continuing saga of imported fire ants: evolution before our eyes

"Ants carry on in the midst of the shifting wreckage created by people, seeming not to care whether humans are present or not, so long as a little piece of minimally disturbed environment is left for them to build a nest, to search for food, and thereby to multiply their kind. According to species, they employ propaganda, deception, skilled surveillance and mass assaults, singly, or in combination to overcome their enemies." Bert Holldobler and Edward Wilson in *Journey to the Ants. A Story of Scientific Exploration*. Belknap Press, Cambridge University, 1994.

The two species of the imported fire ant entered the United States from South America through the Port of Mobile, Alabama in the 1930s. Despite attempts to control them, they have adapted readily to their southeastern environment and rapidly expanded their range. *Solenopsis invicta* has hybridized with the other imported species, *Solenopsis richteri*, and uses roads and other paved surfaces as heat sums to address the major factor limiting further expansion of range, cold intolerance. Another adaption, the appearance of colonies of multiple, unrelated fire ant queens, is the newest and perhaps most important adaption.¹

So far as their effects on habitat are concerned, increased numbers of ants have caused ecologic decimation of some ground nesting species of insects and animals. Ecologic studies have demonstrated that fire ant colonies in the US reach colony sizes and ant densities far greater than those in South America.² This probably results from abundant food sources, their lack of

natural enemies in the US environment and their omnivorousness. In some areas of their North American range, habitat saturation has occurred. As a result, fire ant colonies, which previously consisted of a single queen and genetically related workers (monogyne colonies), now contain 20 to 30 mated, unrelated, egg-laying queens (polygyne colonies). The consequences of this adaptation are obvious to those living in rural and metropolitan infested areas alike: larger mounds, spaced closer together than in previous years. Rather than 100,000 or so ants per monogyne colony, polygyne colonies contain as many as 500,000 ants.

The ultimate outcome of this evolutionary process is unclear. As for now, this means more ants in the outdoor environment protecting their turf against animals and man with a very toxic venom. Moreover, ants appear to be moving nests into occupied homes, a phenomenon previously noted only in times of flood or drought.^{3,4} The increasing population density of fire ants has also been associated with high levels of inbreeding and decreasing genetic diversity. Polygyne colonies now have increased numbers of sterile males and an increased number of unmated queens in colonies.² Since these insects serve no useful purpose, one can only hope that they will breed themselves into oblivion.

In this issue of the *Annals of Allergy, Asthma & Immunology* Chester Stafford, MD, who has been working in this area for a number of years, has provided an accurate, concise, and timely review of the clinical aspects of imported fire ant (IFA)⁵ allergy. I would like to comment further on several areas mentioned.

Donald Hoffman, PhD has systematically and painstakingly characterized the four major protein allergens of IFA venom in a series of studies over the last 10 years.⁶ This important, elegant and painstaking work has facilitated the development of specific assays to characterize the content of venom allergens in the commercial whole body fire ant extracts (IFA-WBE) and as yet unavailable, IFA-venom (IFA-V). Imported fire ant-WBE and IFA-V are useful for diagnostic testing, immunotherapy and the detection of immunological responses consequent to venom exposure and immunotherapy. Dr. Hoffman deserves a great deal of credit for his work in this area.

A comment about immunotherapy with IFA-WBE is also warranted. Our group at Tulane University demonstrated the variability of venom concentrations in various lots of commercial IFA-WBE several years ago.^{7,8} We have seen an occasional patient who has not been protected from anaphylaxis by IFA-WBE immunotherapy. Until extract suppliers assay IFA-WBE to ensure adequate venom concentrations, as they should, or native or recombinant IFA-V preparations become available, we recommend pooling three or more lots of IFA-WBE from different suppliers for use in diagnosis and immunotherapy. This procedure, although costly, increases the probability that the IFA-WBE used will contain adequate quantities of venom allergens.

Of the items in Dr. Stafford's list of questions remaining to be answered about fire ant allergy, the issue of the natural history of IFA allergy is paramount. The data reviewed provide ev-

idence that adults who have experienced anaphylaxis after IFA stings often experience anaphylaxis when again stung. Unfortunately, no such data are available in children, especially young children who are frequently referred for evaluation after systemic allergic reactions. This lack of information should be explained to parents of such children. Many subsequently choose a three year course of immunotherapy because they do not want to be in fear of their child's safety or limit outdoor activities. We have not seen anaphylaxis when after such courses are completed another sting occurs.

With an attack rate of as high as 58% of the population per year in infested areas, it has been surprising to us that anaphylactic reactions after IFA stings are not more common. Perhaps those people most likely to be stung and to develop IFA allergy desensitize themselves yearly on the basis of stings experienced while going about

their usual activities. This "autoimmunotherapy" may be facilitated by the fact that ant venom contains lower concentrations of allergens in the spring than during the summer months.⁹

Fire ants will be an ongoing problem for patients and physicians alike. With the changes taking place in the insects and the technologies to deal with them, regular updates like Dr. Stafford's will continue to be welcome.

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